GOODS MOVEMENT BORDER CROSSING STUDY– PHASE II

REVISED 2018

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GOODS MOVEMENT BORDER CROSSING STUDY–PHASE II

REVISED 2018

A PRODUCT OF THE SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS IN COOPERATION WITH STEERING COMMITTEE PARTNERS:

IMPERIAL COUNTY TRANSPORTATION COMMISSION
SAN DIEGO ASSOCIATION OF GOVERNMENTS
CALIFORNIA DEPARTMENT OF TRANSPORTATION

Revised 2018

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Executive Summary

Introduction

The Southern California Association of Governments (SCAG) conducted the Goods Movement Border-Crossing Study and Analysis, Phase II to assess the mobility of commerce at the California – Baja California border and develop freight planning strategies that address long term trade and transportation infrastructure needs in the border region.

Therefore, the primary purpose of the Goods Movement Border Crossing Study - Phase II effort was to gather and synthetize information on goods movement across the U.S.-Mexico border moving through the San Diego and Imperial Counties international Land Ports of Entry (LPOEs) and to develop future projections of freight flows in order to assist SCAG and regional stakeholders in their assessment of future infrastructure needs and general planning efforts.

Overview of Study Tasks

The study was conducted as a series of tasks that, together, provided a better understanding of the characteristics of the movement of goods across the California – Baja California binational region, forecasted the future volumes of these flows and their impact on the SCAG transportation network and derived recommendations for improving the efficiency with which these flows move. The study was centered on a description of the current situation of border-crossing goods movement in the area, an identification of the emerging trends in goods movement that would affect the future of the movement of these goods, the forecast of border-crossing goods movement under alternative scenarios, the analysis of how these future flows affect highway bottlenecks in the region and the identification of economic development opportunities related to the movement of these goods. A summary of the work performed under each one of these tasks is provided below.

Current Situation

The study began by developing an understanding of the current border-crossing flows of goods by collecting data on the origins and destinations (O-Ds) of goods moving across the California – Baja California border, and the cargo types transported. The targets for this data collection effort[1] were companies located on the Mexican side of the border (both in the greater Tijuana-Rosarito-Ensenada area and in the greater Mexicali area[2]) from a set of representative clusters[3] that generate cargo to be transported to the U.S. side of the border.

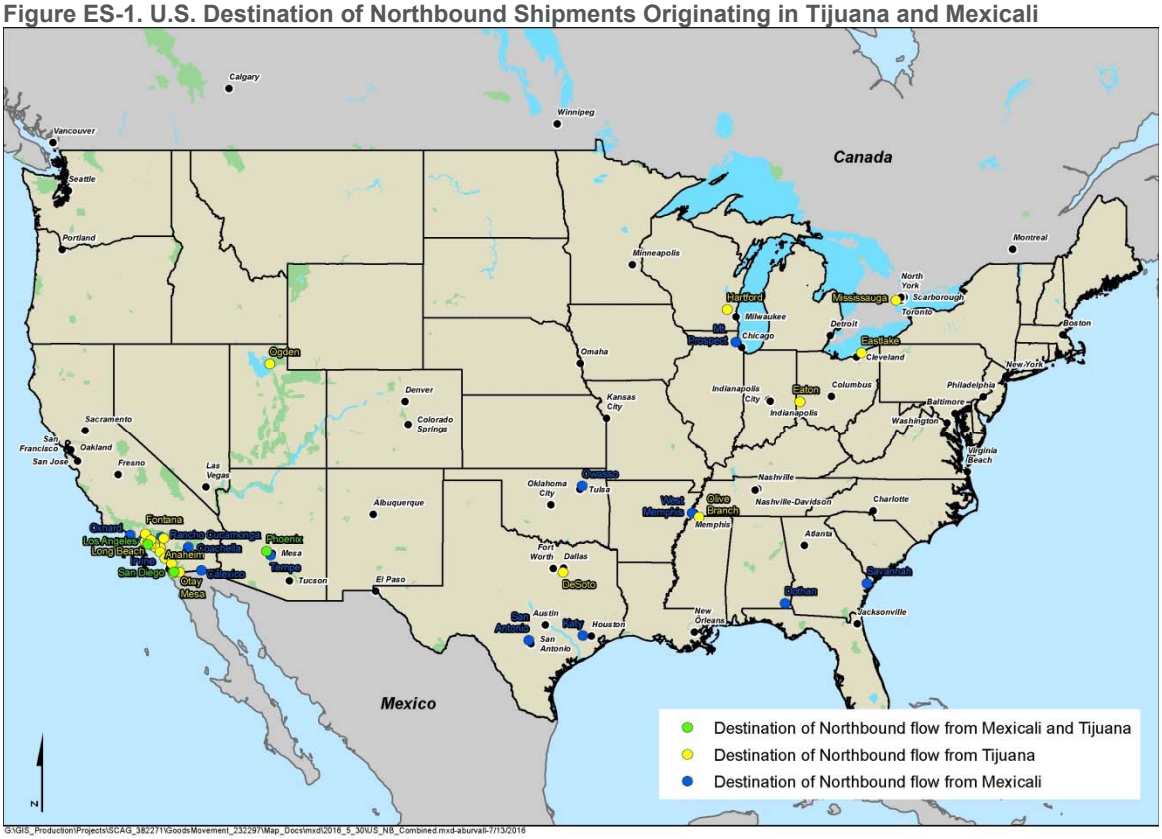
Based on data reported by the companies at an aggregate level, the study found that these companies use inputs and/or raw materials coming primarily from the U.S. (56% of their inbound shipments[4]) in addition to a significant amount of Mexican materials in their production (25% of their inbound shipments). The destinations of the shipments sent by these cargo-generating companies are also primarily located in the

[1] See Chapter 2 (Data Collection Plan & Survey Instruments) of this document for more details on this topic.
[2] Since the focus of this study is on border-crossing movement of goods, the targets were companies located in Mexico that receive and/or ship goods to the U.S.
[3] The clusters analyzed in this study are defined in Chapter 1 (Evaluation of Existing Data Sources) of this document.
[4] Inbound shipments are those that originate elsewhere and have the interviewed company as their destination.

U.S. (72% of their outbound shipments[5]) with fewer shipments sent to Mexico (11% of their outbound shipments) compared to inbound shipments, suggesting that these companies are primarily focused on serving the U.S. consumer market.[6] Furthermore, cargo generating companies stated the preferred transportation mode for cross-border movement of goods in the region is truck.[7]

An analysis of manifest-level data collected from cargo generators in this binational region shows that O-Ds of border-crossing goods movement in the region extend not only to geographies like Northern California and the Pacific Northwest, but also to states in the Central U.S. (including Nebraska, Texas, Illinois, Indiana, Wisconsin), states in the Eastern U.S. (including Georgia, Alabama, North Carolina, South Carolina, Pennsylvania) and Canada. Figure ES-1 and Figure ES-2 illustrate the different origins (for southbound trips) and destinations (for northbound trips) identified by the cargo generating companies. The flows are broken down by border area in Mexico where the trips originate or terminate to provide a sense of the markets served by each border region. [8]

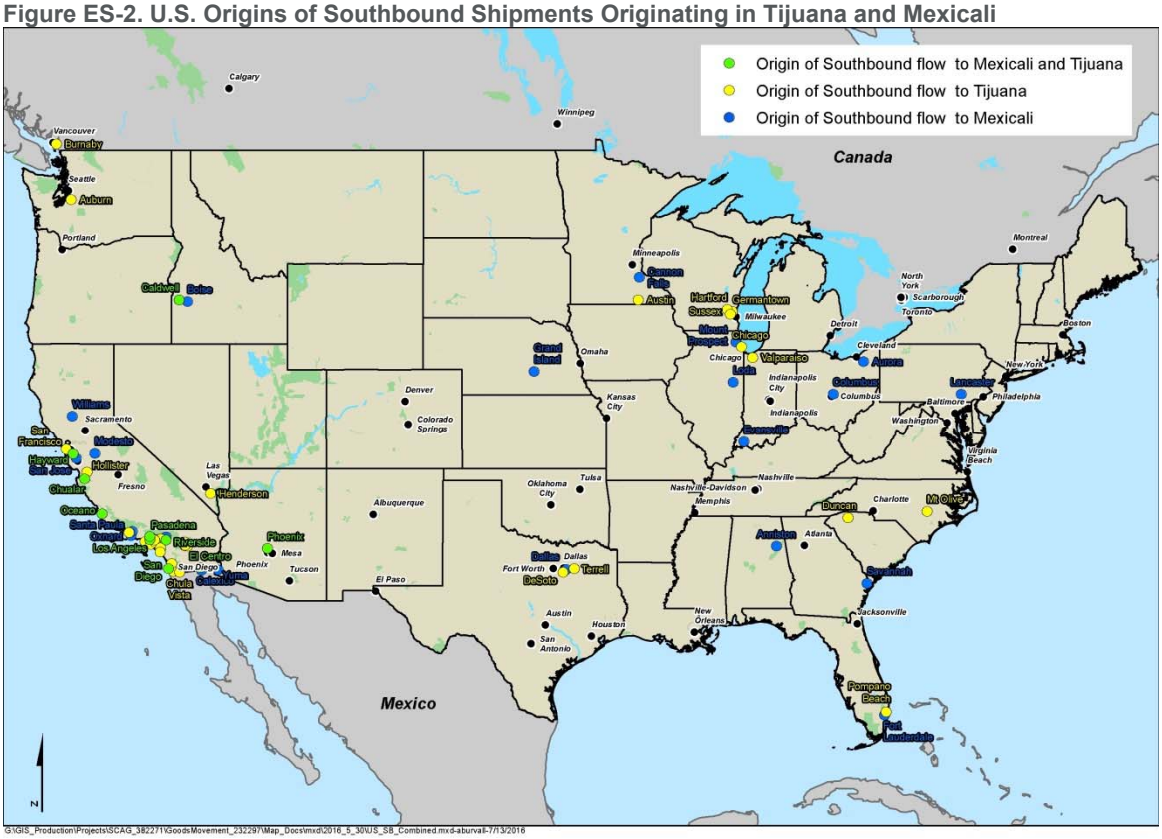
Figure ES-1. U.S. Destination of Northbound Shipments Originating in Tijuana and Mexicali



Source: HDR Analysis of Truck O-D Survey

[5] Outbound shipments are those that originate in the cargo generating company being interviewed and have destination elsewhere.
[6] Other origins of inbound shipments include Asia (14%), Europe (2%) and other/not-reported (3%). Similarly, other destinations of outbound shipments include Asia (7%), Europe (3%), Canada (1%), Latin America excluding Mexico (1%) and other/not-reported (5%).
[7] Trucks alone are estimated to transport approximately 85% of the goods moved across the border in this region. However, interviews were also conducted with rail operators to understand O-D patters and cargo moved by them.
[8] A detailed analysis of the data collected is presented in Chapter 3 (Summary of Truck O-D Data) of this document.

Figure ES-2. U.S. Origins of Southbound Shipments Originating in Tijuana and Mexicali



Source: HDR Analysis of Truck O-D Survey

An assessment of current rail operations shows that the amount of goods moved across the border using this mode is very limited compared to the amount of goods moved by truck, with the majority of rail movement occurring in Imperial County. The study confirmed that the railroad network in the region is only used to move goods across the border between the State of Baja California in Mexico and cities in the U.S., since the railroad on the Mexican side has very limited connectivity with the rest of the Mexican railroad network.

During a previous border crossing study completed in 2012,[9] drayage was found to be an important component of the supply chain for cross-border movements. The current study deepened the understanding of this activity by estimating an economic impact from truck drayage in the binational region of approximately $510.5 million in output, including $253.1 million in value added, and approximately 3,500 jobs.[10] Additionally, information collected through interviews of drayage companies detected that some companies reported performing long-haul "drayage" trips, suggesting that companies engaged in drayage also offer long-haul transportation services.

Emerging Trends

As part of the study, the team conducted a series of interviews with staff and representatives from government agencies, associations, chambers of commerce and private companies to identify emerging

[9] SCAG Goods Movement and Border Crossing Study and Analysis, http://www.freightworks.org/DocumentLibrary/Goods-Movement-Border-Crossing-Study-and-Analysis_Final_6-06-12(1).pdf

[10] Details of the Economic Impact Analysis are provided in Chapter 4 (Summary of Drayage Data and Economic Impacts) of this report.

and future trends in border-crossing goods movement in the region. The main trends identified through these surveys were:

- Growth in the production of high-quality manufacturing products in the region is expected to be strong in the future
- Important components for some industries (i.e., electronics) currently come from Asia and this trend is not expected to change radically in the mid- to long-term
- Trucking will continue to be the preferred transportation mode for border-crossing movements of goods in the region
- Third-party logistics companies (3PLs) have left the Otay Mesa area in recent years due to lower rent and better access to global networks in other regions (not necessarily located along the U.S. – Mexico border)

In addition, the interviewees identified a series of "events" that were used to define different scenarios for the future movement of border-crossing goods in the region that were developed as part of this study. These events were categorized into four groups:

- Infrastructure, related to the physical capacity of the movement of goods in, out and within the binational region;
- Border-crossing operations, related to the processes to move goods across the border;
- Regional production capabilities, linked to the ability of the binational region to produce intermediate and final goods; and,
- Policy, linked to actions by the local governments on both sides of the border to impact the competitiveness of the region with respect to the movement of border-crossing goods.

These events were used to develop the "baseline," "high-volume" and "low-volume" scenarios in terms of forecasted amount of border-crossing goods to be moved, mode of transportation and O-Ds.[11]

Forecasts of Goods Movement

The team developed three forecasts for border-crossing goods movements in the region: baseline, high-volume and low-volume. The forecasts were developed using primarily macro-economic conditions affecting flows of goods across the border that were later adjusted to capture the impact of the events identified as part of the emerging trends stage.

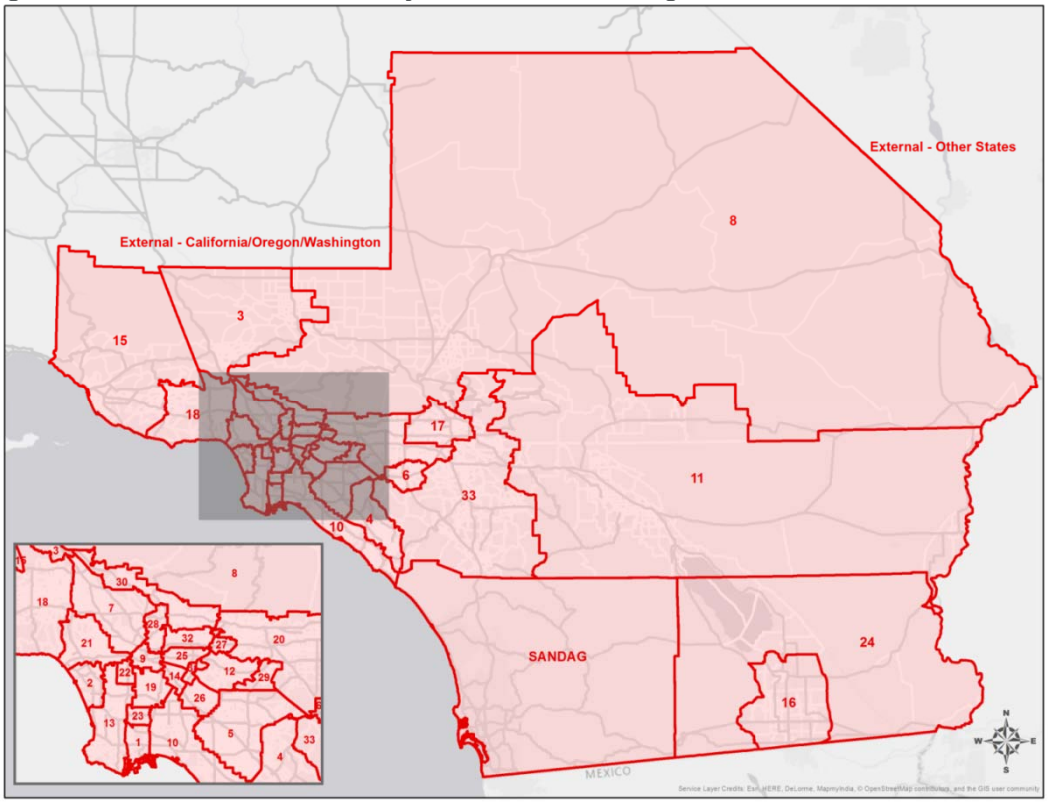
Each scenario's forecast was broken down by transportation mode (truck, rail) and type of generator/attractor (ports, non-ports/inland) and disaggregated into 35 O-D zones (34 within the SCAG and SANDAG region and 1 external zone to capture movement beyond the other zones). A map with the 34 zones in which the SCAG and SANDAG regions are divided is presented in Figure ES-3.

BASELINE SCENARIO FORECAST

The baseline scenario forecast was defined as the forecast of border-crossing goods movement featuring the most-likely future macro-economic conditions and the most-likely occurrence of events as identified in the trends exercise. The baseline scenario features an annual growth rate of 2.9 percent for border-crossing goods moved by truck (in each direction, northbound and southbound) throughout the region between 2015 and 2040. This leads to almost 2.5 million truck crosses in each direction by 2040.

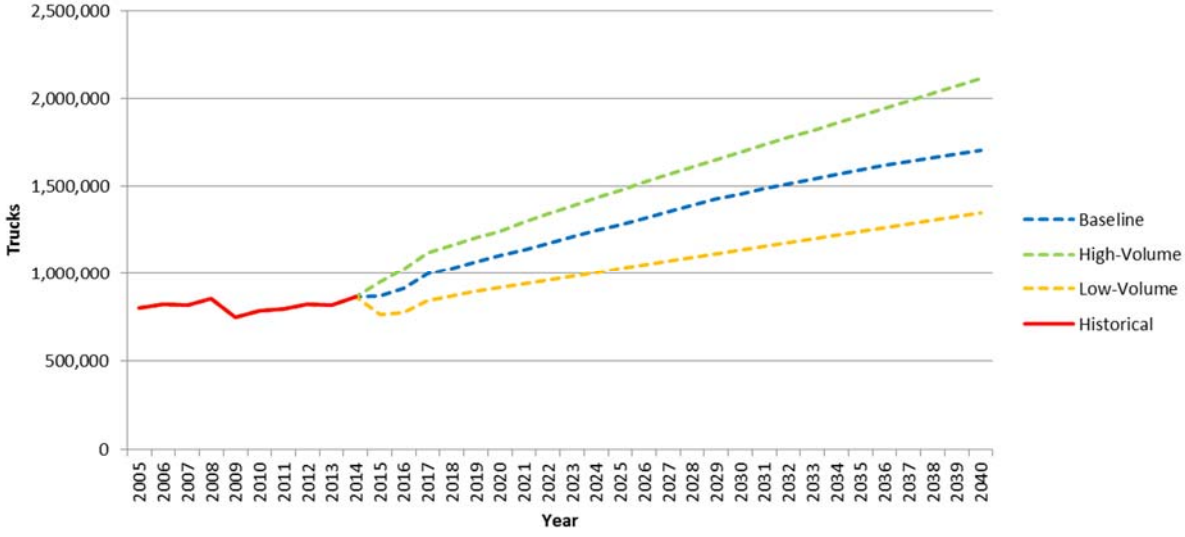
[11] A list of the identified "events" is provided in Chapter 5 (Freight Flow Projections in Baseline Scenario) of this document.

Figure ES-3. O-D Zones Used in Analysis of Border-Crossing Flows



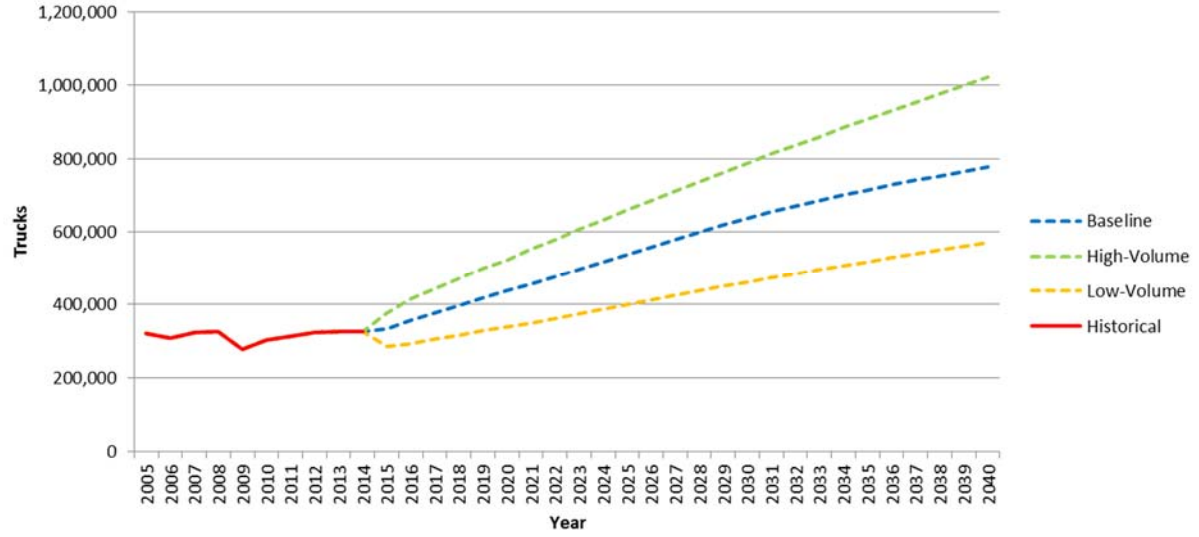
Source: HDR

Figure ES-4. Forecasts of Northbound Truck Volumes in San Diego - Tijuana Border Region Under Different Scenarios



Source: HDR

Figure ES-5. Forecasts of Northbound Truck Volumes in Calexico - Mexicali Border Region Under Different Scenarios



Source: HDR

When these volumes are broken down by geographical area, truck volumes in the San Diego-Tijuana region are expected to grow an annual rate of 2.7 percent, reaching approximately 1.7 million trips in each direction in 2040 while truck flows in the Imperial County-Mexicali region are anticipated to grow at an annual rate of 3.4 percent, reaching more than 760,000 trips in each direction in 2040. A graphical representation of the forecasted northbound truck volumes under each scenario and for each border-crossing region (i.e., San Diego – Tijuana and Calexico – Mexicali) developed as part of this study is presented in Figure ES-4 and Figure ES-5.

Table 1. 2040 Annual Cross Border Truck Flows by Region and Scenario

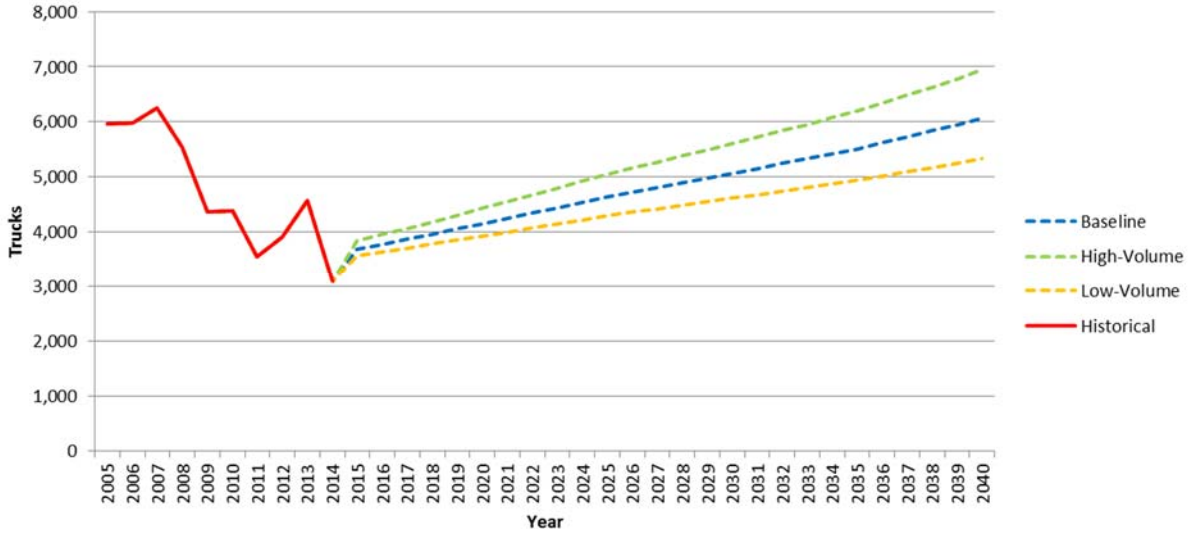
Origin-Destination Pair		2040 Low-Volume Scenario		2040 Baseline Scenario		2040 High-Volume Scenario	
		Annual Trucks	Avg. Daily Trucks	Annual Trucks	Avg. Daily Trucks	Annual Trucks	Avg. Daily Trucks
Mexicali	Imperial County (SCAG)	353,002	1,412	572,944	2,292	886,954	3,548
	From/To/Thru Remaining SCAG Region	363,733	1,455	525,442	2,102	749,065	2,996
	San Diego County	25,006	100	33,904	136	45,567	182
	States East of California	292,828	1,171	420,133	1,681	574,846	2,299
Tijuana	Imperial County (SCAG)	12,487	50	14,556	58	18,725	75
	From/To/Thru Remaining SCAG Region	950,850	3,803	1,170,466	4,682	1,572,474	6,290
	San Diego County	1,082,173	4,329	1,421,812	5,687	2,036,397	8,146
	States East of California	491,230	1,965	638,135	2,553	854,934	3,420
Total Cross Border Truck Trips		**3,571,309**	**14,285**	**4,797,393**	**19,190**	**6,738,961**	**26,956**

Source: HDR

When the aggregate truck flows (i.e., northbound plus southbound) for the year 2040 are allocated to the different O-Ds, the highest flows are between Tijuana and locations within San Diego County with more than 1.4 million annual truck trips. This represents 30% of all cross border truck traffic. The second highest truck flows are between Tijuana and the SCAG region north of San Diego and Imperial Counties with nearly 1.2 million trips. This represents approximately 24% of all cross border traffic. The third highest 2040 baseline volumes (638,000 annual) also cross over at Tijuana and travel from/to states east of California. This major O-D is followed closely by Mexicali from/to Imperial County traffic at 573,000 annual. The results of this allocation for the different scenarios studies are presented in Table 1.

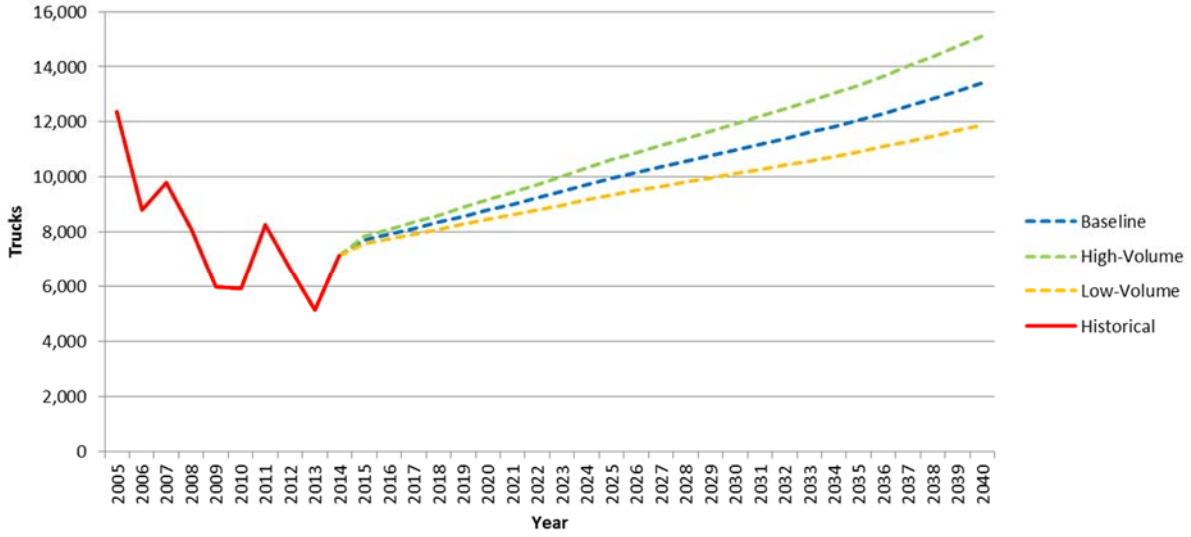
Similarly, the baseline scenario features an annual growth rate of 2.2 percent for border-crossing goods moved by rail (in each direction, northbound and southbound) for the same period of analysis. This results in more than 19,000 railcars crossing in each direction in 2040. Rail volumes in the San Diego-Tijuana region are expected to grow at an annual rate of 2.0 percent, reaching more than 6,000 railcars by 2040 in the northbound direction while rail volumes in the Imperial County-Mexicali region are anticipated to grow at an annual rate of 2.2 percent, reaching more than 13,000 railcars in 2040 in the northbound direction. A graphical representation of the forecasted northbound rail volumes under each scenario and for each border-crossing region (i.e., San Diego – Tijuana and Calexico – Mexicali) developed as part of this study is presented in Figure ES-6 and Figure ES-7.

Figure ES-6. Forecasts of Northbound Rail Volumes in San Diego - Tijuana Border Region Under Different Scenarios



Source: HDR

Figure ES-7. Forecasts of Northbound Rail Volumes in Calexico - Mexicali Border Region Under Different Scenarios



Source: HDR

HIGH-VOLUME SCENARIO FORECAST

The high-volume scenario forecast was defined as the forecast of border-crossing goods movement featuring optimistic future macro-economic conditions and the appearance of events that would increase the movement of goods across the border.[12] The high-volume scenario features an annual growth rate of 3.5 percent for border-crossing goods moved by truck (in each direction, northbound and southbound) throughout the region between 2015 and 2040. This means that more than 3.1 million trucks are anticipated to cross in each direction by 2040. When these volumes are broken down by geographical area, truck volumes in the San Diego-Tijuana region are expected to grow an annual rate of 3.2 percent, reaching more than 2.1 million crossings in 2040 in each direction, while truck flows in the Imperial County-Mexicali region are anticipated to grow at an annual rate of 4.1 percent, reaching approximately 1 million trips in 2040 in each direction.

As in the baseline scenario, the highest aggregate truck forecast flows in 2040 for the high-volume scenario are between Tijuana and locations within San Diego County with just over 2.0 million trips, followed by flows between Tijuana and the remaining SCAG region (excluding Imperial County) with approximately 1.6 million trips. Traffic between Mexicali and Imperial County becomes the third highest O-D in this scenario reaching nearly 890,000 trips in 2040, slightly exceeding the flows between Tijuana and states east of California that feature 850,000 in that same year (see Table 1).

In addition, the high-volume scenario features an annual growth rate of 2.6 percent for border-crossing goods moved by rail (in each direction, northbound and southbound) for the 2015-2040 period of analysis. This results in approximately 22,000 railcars crossing in each direction in 2040. Rail volumes in the San Diego-Tijuana region are expected to grow at an annual rate of 2.4 percent, reaching approximately 7,000 railcars in the northbound direction in 2040, while rail volumes in the Imperial County-Mexicali region are anticipated to grow at an annual rate of 2.7 percent, reaching approximately 15,000 railcars in the northbound direction in 2040.

[12] More details on the high-volume forecast can be found in Chapter 8 (Freight Flow Projections in Alternative Scenarios) of this document.

LOW-VOLUME SCENARIO FORECAST

Finally, the low-volume scenario forecast was defined as the forecast of border-crossing goods movement featuring pessimistic future macro-economic conditions and the appearance of events that would decrease the movement of goods across the border.[13] The low-volume scenario features an annual growth rate of 2.5 percent for border-crossing goods moved by truck (in each direction, northbound and southbound) throughout the region between 2015 and 2040. This means that almost 2.0 million trucks are anticipated to cross in each direction by 2040. When these volumes are broken down by geographical area, truck volumes in the San Diego-Tijuana region are expected to grow an annual rate of 2.3 percent, reaching approximately 1.4 million border-crossing truck trips in each direction, while truck flows in the Imperial County-Mexicali region are anticipated to grow at an annual rate of 2.8 percent, reaching approximately 600,000 truck trips in each direction.

In this scenario, the highest aggregate truck forecast flows in 2040 are between Tijuana and locations within San Diego County with just over 1.0 million trips, followed by flows between Tijuana and the remaining SCAG region (excluding Imperial County) with approximately 950,000 trips. The third highest 2040 low-volume flows cross over at Tijuana and travel from/to states east of California reaching approximately 490,000 truck trips in 2040. The fourth major O-D is Mexicali from/to the remaining SCAG region (excluding Imperial County) with approximately 360,000 trips in that same year (see Table 1).

The low-volume scenario features an annual growth rate of 1.8 percent for border-crossing goods moved by rail (in each direction, northbound and southbound) for the same period of analysis. This results in approximately 17,000 railcars crossing in each direction in 2040. Rail volumes in the San Diego-Tijuana region are expected to grow at an annual rate of 1.6 percent, reaching approximately 5,500 railcars in the northbound direction in 2040, while rail volumes in the Imperial County-Mexicali region are anticipated to grow at an annual rate of 1.8 percent, reaching a little over 11,500 railcars in the northbound direction in 2040.

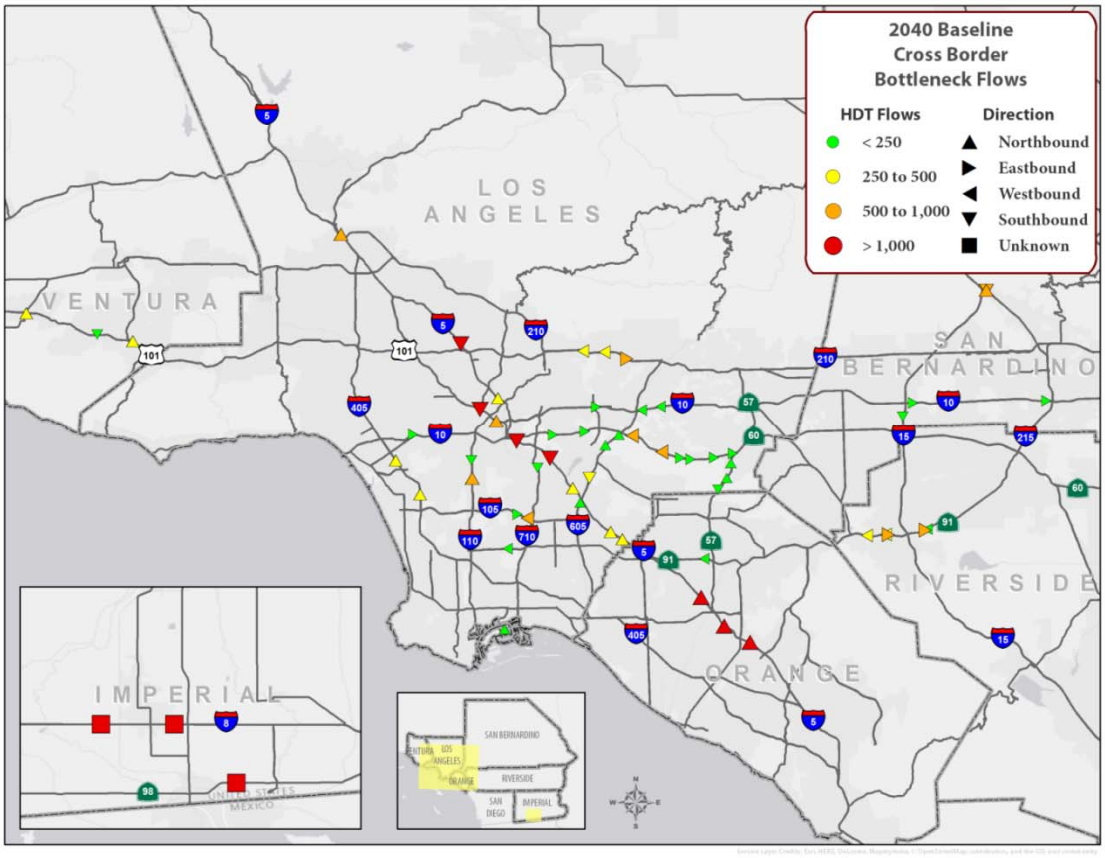
Bottleneck Analysis

The bottleneck analysis conducted as part of this study identified highway corridors where the forecasted volumes of border-crossing goods moved by truck would hit heavy-duty truck “bottlenecks” as identified in the updated version of SCAG’s 2013 Comprehensive Regional Goods Movement Plan and Implementation Strategy. An illustration of the bottlenecks found in this study using the baseline scenario forecasts can be found in Figure ES-8.[14]

Under the three scenarios forecasted, the SCAG bottlenecks on I-5 in Orange and Los Angeles Counties carry the most international trucks. This is to be expected given that outside of San Diego County, the greater Los Angeles Basin and the Tijuana POE O-Ds represent almost a quarter of all cross border truck traffic. Although the extent of the potential congestion impacts on the three Imperial County locations is unknown since they were not quantified in the 2013 study, all truck traffic was assumed to go through to all three locations and therefore become the most impacted bottlenecks in that county.

[13] More details on the low-volume forecast can be found in Chapter 8 (Freight Flow Projections in Alternative Scenarios) of this document.
[14] Similar illustrations for the alternative scenarios can be found in Chapter 9 (Bottleneck Analysis for Alternative Scenarios) of this document.

Figure ES-8. Baseline Scenario Bottlenecks in Year 2040



Source: SMG

Potential mitigation projects to address the bottlenecks affected by border-crossing goods movement include projects on I-5 in South LA County, I-15/I-215, SR-91, US 101/SR 23, I-405, I-710 at the crossing with SR-2, I-10 in SANBAG and I-605.[15]

Opportunities

Opportunities for economic development in the binational area through a literature review of future trends in the Mexican economy, a qualitative analysis of the interviews with agencies and border-crossing goods movement stakeholders, and the analysis of case studies of supply chains in the region.

The literature review on the Mexican economy found that: (i) economic growth in Mexico is expected to remain high in the near future; (ii) Mexico is ideally located to serve as a global manufacturing hub since it straddles major East-West trade lanes and has executed a large number of free trade agreements with developed economies; and, (iii) the industrial base of Baja California is very different than that of the rest of the country and is likely to remain so due to the large degree of integration with the Southern California economy.

The qualitative analysis of interviews and case studies increased awareness about opportunities related to attraction of maquiladora and supplier companies to the binational region from Asia (near-shoring), growth in LPOE capacity to meet future demand for truck crossings, expansion of port capacity on the Mexican

[15] A detailed list of bottlenecks and mitigation projects can be found in Chapter 6 (Bottleneck Analysis for Baseline Scenario) and Chapter 9 (Bottleneck Analysis for Alternative Scenarios) of this document.

side of the border to help relieve congestion at Ports of Los Angeles and Long Beach, development of intermodal capacity in Tijuana to improve the access of automobiles produced in the region to their final destination, development of air cargo to link high-value goods produced in region with consumer markets and promotion of cold storage facilities in Imperial County to better handle agricultural goods crossing through the LPOEs in this county.

The combined assessment of the literature review and the qualitative analysis led to the identification of two key areas of opportunity for the region: (i) growth in high-end manufacturing and, (ii) increased demand for transportation of goods into, out of and within the California – Baja California border region and warehousing/storage services.[16]

Key Study Findings

The wealth of information developed through the different activities completed as part of this study was analyzed and identified the following key findings[17]:

1. Border-crossing traffic flows are large, but are not as significant, in terms of volume, compared to the domestic flows of goods in the region
2. Bottlenecks in the SCAG and SANDAG region are not the result of border-crossing flows but are affected by them
3. The economic impact of drayage in the SCAG and SANDAG region is considerable
4. The main economic development opportunities in the region are linked to the potential for growing high-end manufacturing production and the increase in the offering of transportation modes and warehousing services
5. The movement of goods across the California-Baja California is of national significance

Recommendations

Series of recommendations were developed based on a holistic assessment of the findings and the information developed throughout the study. The final recommendations are presented under strategic considerations that impact border-crossing flows of goods in the region.

Strategic Consideration 1: Truck is anticipated to be main transportation mode in foreseeable future for border-crossing goods in the region

Truck is currently the dominant mode for the movement of border-crossing goods and is anticipated to continue as the dominant mode in the medium-to-long term. The study found that highway bottlenecks in the SCAG region are not created by international flows of goods; however, these flows are affected by the bottlenecks. Also, even though this study did not focus on the analysis of the LPOEs in the region, other efforts have shown that congestion exists in these facilities. Therefore, in order to achieve a more efficient movement of border-crossing goods across the entire chain (i.e., from origin to destination), both the bottlenecks at the LPOEs and the highway networks need to be removed.

Specific recommendations identified as part of this strategic consideration include:

[16] More details on the specific opportunities identified are provided in Chapter 7 (Development Opportunities in Baseline Scenario) of this document.
[17] A more detailed description of the study findings is provided in Chapter 10 (Findings and Recommendations) of this document.

RECOMMENDATION 1: PRIORITIZE INVESTMENT IN PROJECTS TO REMOVE HIGHWAY BOTTLENECKS IDENTIFIED IN BOTTLENECK ANALYSIS

The study identified a series of projects already listed in SCAG's 2016-2040 Regional Transportation Plan /Sustainable Community Strategies (RTP/SCS) that would help alleviate the main bottlenecks through which border-crossing goods movements need to move through under the different scenarios forecasted. Some of the identified projects are already under construction while others are in the different planning stages.[18] In the case of projects under construction, it is important to secure funding for their completion and ensure they will be completed on schedule. On the other hand, in the case of projects currently in the different stages of planning and design, it is important to ensure all planning studies are completed within schedule and that sources of funding are identified so they can transition smoothly to the construction stage.

RECOMMENDATION 2: INVEST IN AUGMENTING LPOE CAPACITY

The State Route 11/Otay Mesa East Port of Entry (POE) Project is anticipated to provide fast, predictable, and secure crossings via tolled approach roads that connect directly to a new state-of-the-art POE serving both personal and commercial vehicles. Similarly, there is a project to expand truck and auto inspection lanes at the existing LPOE in Calexico East. These two projects should be given a high priority in terms of local support and funding in order to ensure the bottlenecks at the LPOEs are ameliorated.

RECOMMENDATION 3: PROMOTE CONSTRUCTION OF COLD STORAGE FACILITIES IN IMPERIAL COUNTY TO IMPROVE QUALITY OF AGRICULTURAL GOODS MOVED BY TRUCK

A recommendation specific to Imperial County relates to the construction of cold storage facilities. The important amount of drayage in the area and the delays due to border-crossing inspections at the LPOEs can compromise the freshness of agricultural products, in particular during the peak-period of international trade. Therefore, the construction of cold storage facilities constitutes a solution to preserving the quality and freshness of the agricultural products that cross the U.S.-Mexico border. In these facilities, products can be consolidated after drayage and/or inspection to preserve their freshness before being transported to their final destination (usually via long-haul truck). In addition to improving the quality of the imports, this activity could generate an important economic impact in the region by creating value added activities and jobs.

Strategic Consideration 2: Cali-Baja is competing with other border regions to attract and retain companies that want to be closer to final consumer markets but with ease of access to global networks

The attractiveness of the U.S. – Mexico border to companies producing goods for consumers in the U.S. market is undeniable. However, the Cali-Baja region is not the only border region competing to host these companies. In order for the Cali-Baja region to remain competitive vis-à-vis other border regions, it needs to promote modal diversification and generate redundancies in the transportation networks that serve these border-crossing goods movements.

RECOMMENDATION 4: PROMOTE MODAL DIVERSIFICATION IN REGION TO LEVERAGE THE REGION'S STRATEGIC LOCATION

The overwhelming majority of border-crossing goods in the region move by truck, with rail playing a very small role. Cargo producers and owners prefer redundancy in the transportation networks of the places where they operate and therefore the addition of rail and air cargo facilities would improve the prospects of Cali-Baja to attract them. Specific initiatives that would diversify the supply of transportation alternatives in the region include the development of an intermodal terminal in Tijuana to transport automobiles, the rehabilitation of the Desert Line and improving rail connectivity of El Centro with points to the east of the

[18] The comprehensive list of projects is provided in Chapter 10 (Findings and Recommendations) of this document.

U.S. and the development of the Holtville Cargo Airport to transport high-value, low volume goods. The implementation of these specific initiatives requires the confluence of private and public interests. As such, the role of the public agencies in the region could be that of facilitating discussions and generating consensus on the importance of these initiatives.

Strategic Consideration 3: Performance and level of integration of supply chains in the region is directly linked to characteristics of border-crossing processes

The movement of goods across the border in the region is undoubtedly sensitive to border-crossing wait times at the LPOEs. Technological advances can be applied to different stages of the border-crossing process to expedite it.

RECOMMENDATION 5: PROMOTE USE OF STREAMLINED PROCESSES AND STATE-OF-THE-ART TECHNOLOGICAL ADVANCES

There are several streamlined processes and state-of-the art technologies that can be applied to the freight border-crossing experience that would reduce wait times at LPOEs and allow for a larger degree of integration of the supply chains on both sides of the border. Some specific improvements include the use of non-intrusive inspection methods for cargo, the electronic transmission of data of cargo prior to arriving at LPOE and the use of pre-inspection at point of origin (for example, maquiladora plant) combined with the use of GPS tracking of trucks between the origin and the LPOE. The implementation of the proposed improvements at a border-wide scale requires the agreement and buy-in from several stakeholders and may not occur in the short-term. However, Cali-Baja authorities could request CBP and other agencies the implementation of pilot programs at the local level that can eventually be transformed into a permanent component of the border-crossing process.

Strategic Consideration 4: A large number of agencies and stakeholders on both sides of the border are involved in the movement of goods

The list of government agencies involved in the movement of goods across the border is long. In addition to the agencies, there are direct and indirect private stakeholders that are also involved in the movement of the goods. There are several initiatives implemented by individual agencies and stakeholders that do not realize their maximum potential due to a lack of coordination with other initiatives being deployed by other agencies or stakeholders.

RECOMMENDATION 6: PROMOTE HIGHER LEVELS OF COORDINATION BETWEEN AGENCIES AND STAKEHOLDERS TO ACHIEVE EFFICIENT SHIPMENT OF GOODS ACROSS THE BORDER

Agencies in the Cali-Baja region could lead a group similar to a binational supply-chain council where discussions between all the relevant agencies and stakeholders take place. Those discussions should be aimed at achieving the efficient movement of goods across the binational region and to coordinate the implementation of different programs available in the region and their integration with border-crossing procedures.

Strategic Consideration 5: The State of Baja California is aggressively trying to attract producers and their suppliers to the region

The government of Baja California is investing in attracting manufacturing companies to the region as a way to strengthen its production base. The state is doing promotional and pushing for better tax conditions for maquiladoras on Mexican side.

RECOMMENDATION 7: HARMONIZE POLICIES ON BOTH SIDES OF THE BORDER TO MAKE THE ARGUMENT MORE APPEALING

The attractiveness of the region as a whole could be enhanced by introducing policies on the U.S. side of the border that reinforce or complement the policies introduced on the Mexican side. An initial list of policies could be developed in consultation with staff from the State of Baja California. This list could be adapted/expanded as the binational region assesses their effectiveness in attracting new companies.

Strategic Consideration 6: Supply chains are constantly evolving, looking for ways to minimize cost and/or reach markets faster

Supply chains in the region show changes over short periods of time. This study analyzed representative supply chains in the area, but local agencies should continue to learn about them to understand their evolution in future years.

RECOMMENDATION 8: CONTINUE FUNDING GOODS MOVEMENT STUDIES TO BETTER UNDERSTAND THEIR CHARACTERISTICS

Global trade and transportation costs driven by oil prices and other macro variables can significantly affect the way goods move across the border.

It is important to continue studying the movement of goods across the border to identify the new requirements imposed by production processes and times to market on supply chains. Furthermore, the integration of the findings and recommendations stemming from studies that analyze different perspectives on border-crossing goods movement will shed a brighter light on the future of domestic and international movement of goods as well as on the policy options to make their transportation more efficient.

Chapter 1: Evaluation of Existing Data Sources

Introduction

In order to assess the mobility of commerce at the California – Baja California border and to develop freight planning strategies that address long term trade and transportation infrastructure needs in the border region, the Southern California Association of Governments (SCAG) conducted the Goods Movement Border-Crossing Study and Analysis – Phase II.

The objective of this report was to evaluate existing data sources for freight transportation using the land ports-of-entry (LPOEs) in Imperial and San Diego Counties. In particular, this effort endeavored to shed light on the goods categories and clusters that have recently generated freight movements across the border, as well as the location and type of firms involved in the trading of these goods. Using this information and the available shipment-level data collected during Phase I of this study, an assessment of the representativeness of this sample data was made, identifying those clusters whose proportion in the sample is not adequate compared to the population-level data. This assessment fed directly into the Data Survey Plan conducted as part of this study with the goal of developing a data collection plan that resulted in a representative sample of origin-destination (O-D) pairs.

Overview and Methodology

Existing data sources and their quality were evaluated in order to create an overview of the state of freight transportation in the California – Baja California border region. The first step consisted of identifying the types of goods that have been recently transported across the border through the different LPOEs in the region. To do this, information was gathered from the Bureau of Transportation Statistic's (BTS) Transborder Freight data on the value of different commodities traded through the six LPOEs in Southern

California. The data was collected separately for imports and exports, and for trucks and rail, for the years 2007 through 2013.

The different commodities identified in the BTS database for a specific transportation mode (i.e., truck or rail) were aggregated into clusters of economic activity using the categories created by the U.S. Cluster Mapping Project, an initiative supported by the U.S. Department of Commerce[19]. The clusters used in the aggregation were those identified by the project to be relevant to the State of California. The aggregation consisted of a "matching" exercise where each commodity category from BTS was assigned to a cluster based on the characteristics of the commodity and the definition of the 'cluster' it was paired with.

The result of this aggregation was a list of the value of goods moved across the border, in each direction and by transportation mode, for each one of the clusters. This constitutes, from a methodological perspective, the population of border-crossing goods movement this study analyzed.

However, since the information from the Phase I surveys was collected on a "per-shipment" basis[20] (and not based on value of the shipment), additional transformations were performed to compare the population information with the sample information from the surveys. In particular, the aggregated values of goods transported by each cluster were transformed into kilograms using data on value per weight for each commodity type, direction of flow and transportation mode.

Finally, the number of kilograms of goods moved by each cluster was used as a proxy to determine the appropriate share that each cluster should have in the sample of shipments collected during Phase I. These appropriate shares were then compared to the actual sample shipments to determine those clusters that were either under- or over-represented in the Phase I shipment data. Recommendations based on this comparison were made for their inclusion in the Data Survey Plan considered under Phase II of this study.

Goods Recently Transported Through LPOEs in the Region

To begin, data from the BTS Transborder Freight Data was extracted in order to understand the types of goods that are transported across the border through the land LPOEs in Southern California. Data was collected for commodities transported via truck and rail. Key variables used in the search include:

- Trade Type – divided into Total, Exports and Imports
- Mode – Truck and Rail
- Trader – USA
- Partner – Mexico
- Port of Entry – Andrade, Calexico, Calexico East, San Ysidro, Otay Mesa, and Tecate
- Commodity Description – list of commodities traded (see Table 68 in Chapter Appendix)
- Annual Trade Value – in actual U.S. Dollars between 2007 and 2013

Therefore, this database provided the value of traded commodities in the California – Baja California region, by commodity classification and by mode of transportation, that use land LPOEs in the region.

In order to analyze the most recent trends in goods movement through the border, the analysis focused on the composition of goods traded during 2013. The value of total imports via truck from Mexico through the

[19] The U.S. Cluster Mapping Project is led by Professor Michael E. Porter at the Institute for Strategy and Competitiveness, Harvard Business School. This initiative is funded by the Economic Development Administration of the U.S. Department of Commerce.
[20] Since the majority of the interviewees during Phase I relied almost exclusively on trucks to move goods across the border, a shipment was defined as the amount of goods transported in a one-way truck-trip.

Southern California land LPOEs exceeded $30 billion in that year. The value of total exports via truck that use the Southern California land LPOEs into Mexico was approximately $19 billion in that same year. The total value of goods traded via rail through the land LPOEs in Southern California was significantly lower than the total value of goods traded via truck. The amount for rail is approximately $229 million, compared to nearly $50 billion for trucks.

The top ten commodities imported by truck using the LPOEs in the region over the past 3 years are presented in Table 2 while the top ten commodities exported by truck during that same period are presented in Table 3 (both tables show value of goods in millions of USD).

Table 2. Top Ten Commodities Imported By Truck Through Southern California's LPOEs (in millions of USD)

Commodity Description	2011	2012	2013
Electrical machinery and equipment and parts thereof; Sound recorders and reproducers	13,088	13,447	13,563
Optical; photographic; cinematographic; measuring; checking; precision; medical instruments	2,740	3,038	3,063
Vehicles; other than railway or tramway rolling stock; and parts and accessories thereof	2,260	2,575	2,902
Nuclear reactors; boilers; machinery and mechanical appliances; parts thereof	2,050	2,168	2,059
Special classification provisions	1,138	1,211	1,350
Edible vegetables and certain roots and tubers	1,016	842	991
Furniture; Bedding; mattress supports; cushions and similar stuffed furnishings; Lighting fittings	635	766	845
Plastics and articles thereof	560	611	701
Miscellaneous articles of base metal	432	435	510
Aircraft; spacecraft; and parts thereof	222	407	456
All other commodities	3,996	4,241	4,244
Grand Total	**28,137**	**29,741**	**30,684**

Source: BTS

Table 3. Top Ten Commodities Exported By Truck Through Southern California's LPOEs (in millions of USD)

Commodity Description	2011	2012	2013
Electrical machinery and equipment and parts thereof; Sound recorders and reproducers	4,064	4,267	4,758
Nuclear reactors; boilers; machinery and mechanical appliances; parts thereof	2,488	2,614	2,688
Plastics and articles thereof	1,737	1,804	1,886
Vehicles; other than railway or tramway rolling stock; and parts and accessories thereof	1,190	1,396	1,349
Optical; photographic; cinematographic; measuring; checking; precision; medical instruments	640	754	767
Articles of iron or steel	538	641	665
Paper and paperboard; Articles of paper pulp; of paper or of paperboard	563	593	618
Aluminum and articles thereof	373	426	514
Iron and steel	292	312	306
Rubber and articles thereof	261	283	290
All other commodities	4,816	4,894	4,982
Grand Total	**16,962**	**17,985**	**18,822**

Source: BTS

As the previous two tables demonstrate, the ranking of top traded goods across the six LPOEs in the region has been very stable over the past few years. Furthermore, the values of both imported and exported goods grew over the three-year period. It is also worth noting that the commodity described as "Electrical machinery and equipment and parts thereof; Sound recorders and reproducers" represents almost half of the value of goods imported by truck into the U.S. while the same commodity represents approximately 25 percent of the value of the goods exported by the U.S. via truck.

The number of commodities traded by rail in the region is significantly smaller compared to those traded by truck. The top five commodities imported by rail using the LPOEs in the region over the past 3 years are presented in Table 4 and the top five commodities exported by rail during that same period are presented in Table 5. Both tables display the value of goods traded in millions of USD.

Table 4. Top Five Commodities Imported By Rail Through Southern California's LPOEs (in millions of USD)

Commodity Description	2011	2012	2013
Animal or vegetable fats and oils and their cleavage products; Prepared edible fats; Animal waxes	9.3	15.8	17.9
Articles of stone; plaster; cement; asbestos; mica or similar materials	2.9	4.7	5.6
Iron and steel	13.0	8.0	5.4
Special classification provisions	0.3	0.2	0.6
Oil seeds and oleaginous fruits; Miscellaneous grains; Seeds and fruit; Industrial plants	-	0.7	0.3
All other commodities	10.8	6.2	0.3
Grand Total	**36.3**	**35.6**	**30.1**

Source: BTS

Table 5. Top Five Commodities Exported By Rail Through Southern California's LPOEs (in millions of USD)

Commodity Description	2011	2012	2013
Mineral fuels; mineral oils and products of their distillation; Bituminous substances; Mineral waxes	206.0	185.9	184.4
Animal or vegetable fats and oils and their cleavage products; Prepared edible fats; Animal waxes	36.2	52.0	47.7
Paper and paperboard; Articles of paper pulp; of paper or of paperboard	30.2	24.8	35.0
Cereals	101.8	63.6	31.2
Plastics and articles thereof	15.6	112.3	27.6
All other commodities	135.2	157.7	73.8
Grand Total	**524.8**	**596.3**	**399.7**

Source: BTS

The information on goods traded by rail shows more irregular patterns compared to those of goods traded by truck. In particular, two important observations must be made: (i) both the values of imported and exported goods declined significantly in 2013; and, (ii) the values (and therefore the ranking) of goods is not consistent across the different years.

Identification of Clusters

The commodities identified in the BTS database were aggregated into clusters of economic activity using the categories created by the U.S. Cluster Mapping Project, an initiative supported by the Economic Development Administration of the U.S. Department of Commerce[21]. The aggregation was made separately

[21] http://www.clustermapping.us

for every specific transportation mode (i.e., truck and rail) to maintain parity with the data collection efforts developed during Phase I of this study.

In particular, the definition of each cluster was analyzed to determine their specific composition (in terms of finished products and raw materials used). Based on this definition, the list of different commodities from the BTS database was paired to specific clusters based on their common characteristics.

Table 69 through

Table 72 in the Chapter Appendix provide a detailed breakdown of the value of traded goods in actual U.S. Dollars for imports into the U.S. and exports to Mexico, by cluster, for the 2007 – 2013 period. The top five clusters traded by truck (in terms of value of traded goods in the region) are presented in Table 6.

Table 6. Top Five Clusters Traded by Truck in the Region, by Type of Trade, 2013 (in millions of USD)

Cluster	Value of Imports in 2013	Cluster	Value of Exports in 2013
Lighting and Electrical Equipment	13,565	Lighting and Electrical Equipment	4,815
Medical Devices	3,063	Heavy Machinery	2,688
Automotive	2,913	Plastics	2,220
Heavy Machinery	2,059	Metal Manufacturing	2,068
Aerospace Vehicles and Defense	1,807	Automotive	1,350
All other clusters	7,277	All other clusters	5,681

Source: HDR Analysis using BTS data

Commodities moved by truck associated to the 'Lighting and Electrical Equipment' cluster (which includes electrical machinery and equipment and parts thereof) account for approximately half the amount of total imports value and one-fourth the amount of total exports value, therefore making it the most traded cluster between both countries with a total trade value in excess of $18 billion.

The top five traded clusters by rail (in terms of value of traded goods in the region) are presented in Table 7.

Table 7. Top Five Clusters Traded by Rail in the Region, by Type of Trade, 2013 (in millions of USD)

Cluster	Value of Imports in 2013	Cluster	Value of Exports in 2013
Processed Food	18.2	Chemical Products	191.6
Construction Materials	5.6	Processed Food	92.0
Metal Manufacturing	5.4	Agricultural Products	36.6
Aerospace Vehicles and Defense	0.6	Publishing and Printing	36.3
Agricultural Products	0.3	Plastics	27.7
All other clusters	0.0	All other clusters	15.6

Source: HDR Analysis using BTS data

In the case of goods transported by rail the most traded clusters (in terms of total trade value in the region) are chemical products, processed food, and agricultural products. The value of the trade in these clusters, however, is significantly smaller compared to the value of trade in the top clusters of the goods moved by truck.

Transformations Required to Compare Data

In order to determine if the amount of data collected during Phase I of the study was a representative sample of the movement of goods through the border in the region, the information on traded goods by cluster had to be transformed into a physical measure that allowed comparison to the shipment-based data collected through the surveys. To do this, information on the ratio of value to weight was collected from BTS and the appropriate transformations were made to the value of traded goods by cluster. The factors used to transform US dollars to kilograms varied depending on the transportation mode used as well as by the year and the direction of trade. A detailed list of the value-to-weight ratios used is presented in Table 75 through Table 78 in the Chapter Appendix.

The share of the different clusters in the trade of goods by truck (based on their estimated traded weight) in 2013 is presented in Table 8 by direction of trade. Notice not all of the clusters with high percentages in Table 8 are listed in the top five clusters from Table 6. This is a result of the value-for-weight nature of some of the clusters such as medical devices, where small shipments can have a large trading value. The shares presented in Table 8, however, are considered to represent accurately the composition of the shipments that currently cross the border. Additionally, they are presented in units that are similar to those of the information captured through the surveys performed during Phase I of this study, thus allowing direct comparison with available survey data.

Table 8. Share of Clusters in Import and Export of Goods Traded by Truck (Based on Weight), 2013

Cluster Description	Percentage of Total Imports in 2013	Percentage of Total Exports in 2013
Aerospace Vehicles and Defense	5.4%	0.5%
Agricultural Products	23.9%	12.9%
Apparel	0.6%	0.5%
Automotive	9.1%	4.6%
Biopharmaceuticals	0.1%	0.2%
Chemical Products	1.4%	6.9%
Construction Materials	9.8%	7.3%
Entertainment	0.0%	0.0%
Fishing and Fishing Products	0.2%	0.2%
Footwear	0.1%	0.0%
Forest Products	1.3%	5.7%
Furniture	4.0%	1.1%
Heavy Machinery	2.6%	3.7%
Information Technology	0.0%	0.1%
Jewelry and Precious Metals	0.0%	0.0%
Leather and Related Products	0.1%	0.1%
Lighting and Electrical Equipment	9.4%	3.6%
Medical Devices	2.5%	0.7%
Metal Manufacturing	9.5%	20.3%
Plastics	5.5%	14.2%
Processed Food	11.4%	9.8%
Publishing and Printing	1.6%	5.3%
Sporting, Recreational and Children's Goods	1.0%	1.0%
Textiles	0.6%	1.2%
Tobacco	0.0%	0.0%
Transportation and Logistics	0.0%	0.0%

Source: HDR Analysis using BTS data

In the previous list, the clusters of agricultural products, metal manufacturing, processed food, plastics and construction material have important shares in the total trade of goods across the border. Notice these shares are relevant on both directions of goods movement (i.e., import and export).

The estimated share of trade goods transported by rail for each cluster during 2013 is presented in Table 9. Notice the clusters with the highest importance are construction materials, chemical products, processed foods and agricultural products. With the exception of the processed foods cluster, their importance is only based on one-directional flows (either import or export).

Table 9. Share of Clusters in Import and Export of Goods Traded by Rail (Based on Weight), 2013

Cluster Description	Percentage of Total Imports in 2013	Percentage of Total Exports in 2013
Aerospace Vehicles and Defense	1.0%	0.0%
Agricultural Products	1.2%	21.6%
Apparel	0.0%	0.0%
Automotive	0.0%	0.0%
Biopharmaceuticals	0.0%	0.0%
Chemical Products	0.0%	45.7%
Construction Materials	68.2%	0.9%
Entertainment	0.0%	0.0%
Fishing and Fishing Products	0.0%	0.0%
Footwear	0.0%	0.0%
Forest Products	0.0%	0.0%
Furniture	0.0%	0.0%
Heavy Machinery	0.0%	0.0%
Information Technology	0.0%	0.0%
Jewelry and Precious Metals	0.0%	0.0%
Leather and Related Products	0.0%	0.0%
Lighting and Electrical Equipment	0.0%	0.1%
Medical Devices	0.0%	0.0%
Metal Manufacturing	8.8%	0.3%
Plastics	0.0%	1.6%
Processed Food	20.8%	15.7%
Publishing and Printing	0.0%	14.1%
Sporting, Recreational and Children's Goods	0.0%	0.0%
Textiles	0.0%	0.0%
Tobacco	0.0%	0.0%
Transportation and Logistics	0.0%	0.0%

Source: HDR Analysis using BTS data

Furthermore, these clusters can be further aggregated by the time-sensitivity and the per-kilogram value of the goods that comprise them. In particular, the ratio of value to weight presented in Table 73 and Table 74 in the Chapter Appendix was used as a proxy for per-kilogram value.

Table 10. Aggregation of Clusters by Time Sensitivity and Per-Kilogram Value of Goods

Time Sensitivity / Per-Kilogram Value	Low	High / Luxury Item
Low (Non-Perishable)	Construction Materials Forest Products Chemical Products Metal Manufacturing Publishing & Printing Plastics	Jewelry and Precious Metals Lighting and Electrical Equipment* Medical Devices Footwear Entertainment

	Transportation & Logistics Furniture Sporting, Recreational & Children's Goods Textiles Automotive Aerospace Vehicles & Defense Fishing & Fishing Products Information Technology Biopharmaceuticals Apparel Leather and Related Products Heavy Machinery	
High (Perishable)	Agricultural Products Processed Food	Tobacco

** In the case of rail, this cluster would be classified into the low per-unit value category*
Source: HDR Analysis

Using the classification introduced in Table 10, the share of different cluster groups on imports and exports for goods that crossed the border via truck is displayed in Table 11 using data from 2013. Similarly, the share of different cluster groups in 2013 that used rail to cross the border, by direction of trade, is presented in Table 12.

Table 11. Share of Cluster Groups of Border-Crossing Goods Moved by Truck, by Direction of Flow, 2013

IMPORTS				EXPORTS		
Time Sensitivity / Per-Kilogram Value	**Low**	**High / Luxury**		**Time Sensitivity / Per- Kilogram Value**	**Low**	**High / Luxury**
Low	52.7%	12.0%		**Low**	72.9%	4.3%
High	35.3%	0.0%		**High**	22.8%	0.0%

Source: HDR Analysis using BTS data

Table 12. Share of Cluster Groups of Border-Crossing Goods Moved by Rail, by Direction of Flow, 2013

IMPORTS				EXPORTS		
Time Sensitivity / Per-Kilogram Value	**Low**	**High / Luxury**		**Time Sensitivity / Per- Kilogram Value**	**Low**	**High / Luxury**
Low	77.9%	0.0%		**Low**	62.6%	0.1%
High	22.1%	0.0%		**High**	37.3%	0.0%

Source: HDR Analysis using BTS data

As the previous tables suggest, the majority of border-crossing goods movements are generated by clusters with low time sensitivity and low per-kilogram values. However, in the case of goods that cross the border using truck, the share of goods movement generated by clusters with low time sensitivity but high per-kilogram value is significant in the case of merchandise imported into the U.S.

Analysis of Survey Data Collected During Phase I

Data collected in 2011 during Phase I of this study consisted of shipments of goods from 63 companies engaged in goods movement across the border. Information was collected at the shipment level on origin and destination (using zip codes), components of the supply network (facility types involved in the

transportation of the goods) and transportation modes used to transport the goods across the border. Of the 63 firms surveyed, 43 (68 percent) were classified as manufacturing companies, 19 (30 percent) as logistics intermediaries and 1 (2 percent) as a producer of agricultural goods. The firms participating in this survey were firms based in the Mexicali – Calexico border area given the focus of Phase I on studying movement of goods through Imperial County's LPOEs.

Furthermore, shipment-level data collected during Phase I contained information on the type of commodities being transported as well as the direction of movement (northbound or southbound). Using this information, shipments for which an origin-destination pair was recorded were aggregated into clusters using the definitions created by the U.S. Cluster Mapping Project. This ensured consistency between the data extracted from BTS and the data collected in Phase I and allowed their future comparison. The results of this aggregation for goods are presented in Table 13 for the case of goods imported by truck and in Table 14 for the case of goods exported by truck.

Table 13. Share of Imported Goods Moved by Truck in Phase I Data, by Cluster

Cluster Description	Count	Percentage
Aerospace Vehicle and Defense	6	1.3%
Agricultural Products	27	6.0%
Chemical Products	13	2.9%
Construction Materials	19	4.2%
Furniture	8	1.8%
Lighting and Electrical Equipment	75	16.6%
Medical Devices	40	8.8%
Metal Manufacturing	55	12.1%
Plastics	34	7.5%
Processed Food	15	3.3%
Publishing and Printing	34	7.5%
Textiles	18	4.0%
Other Clusters / Mixed Cargo	109	24.1%
Total	**453**	**100.0%**

Source: Phase I of the 2012 SCAG Border Study Company Interviews

Table 14. Share of Exported Goods Moved by Truck in Phase I Data, by Cluster

Cluster Description	Count	Percentage
Agricultural Products	7	2.3%
Automotive	4	1.3%
Construction Materials	16	5.2%
Furniture	8	2.6%
Lighting and Electrical Equipment	62	20.2%
Medical Devices	32	10.4%
Metal Manufacturing	49	16.0%
Plastics	27	8.8%
Processed Food	13	4.2%
Publishing and Printing	13	4.2%
Textiles	11	3.6%
Other Clusters / Mixed Cargo	65	21.2%
Total	**307**	**100.0%**

Source: Phase I of the 2012 SCAG Border Study Company Interviews

Notice the number of goods traded that belong to "other clusters / mixed cargo" is significant in the Phase I shipment data for both directions of goods movement (more than one in every five shipments in the case of exports and almost one in every four shipments in the case of imports). It was not possible to attribute mixed cargo to any cluster due to the lack of information provided in the company interviews regarding the type of commodities included in these shipments.

Using the classification introduced in Table 10, the shipment data collected during the Phase I surveys of goods moved by truck constitutes the shares of cluster groups presented in Table 15. In general, the surveys show a significant amount of low time sensitivity, high per-kilogram value clusters. This is the result of an important number of shipments being reported as transporting goods classified under the "Lighting and Electrical Equipment" and the "Medical Devices" clusters.

Table 15. Share of Cluster Groups of Border-Crossing Goods Moved by Truck, by Direction of Flow, Phase I Surveys

IMPORTS*				EXPORTS*		
Time Sensitivity / Per-Kilogram Value	Low	High / Luxury		Time Sensitivity / Per- Kilogram Value	Low	High / Luxury
Low	41.3%	25.4%		**Low**	41.7%	30.6%
High	9.3%	0.0%		**High**	6.5%	0.0%

** Excludes percentages associated to "Other Clusters / Mixed Cargo" category.*
Source: HDR Analysis using data from Phase I of the 2012 SCAG Border Study Company Interviews

Comparison of Analyzed Data Sources with Phase I Sample

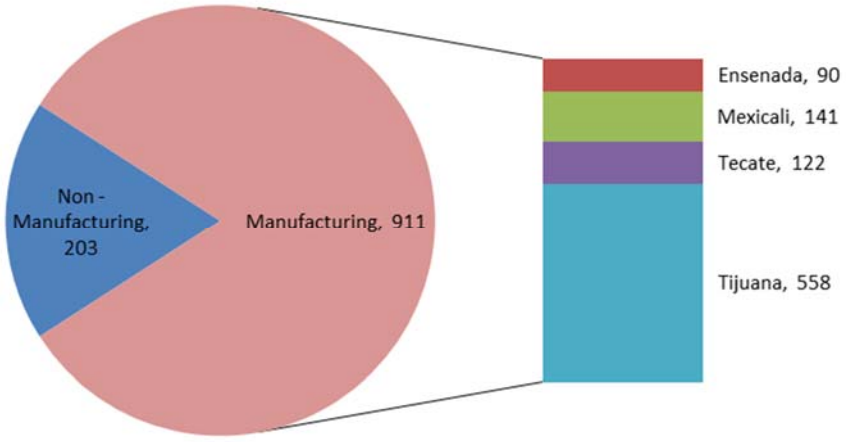
Finally, a comparison between data from population-based sources (such as BTS and Mexico's *Instituto Nacional de Estadística, Geografía e Informática*, INEGI) and the sample collected during Phase I of this study was performed to determine how well the sample data represented the population data. This comparison was done along two dimensions: (i) the type and geographical location of firms from which the Phase I sample was collected; and, (ii) the category of goods captured in the O-D sample.

The composition of firm types used for the collection of data during Phase I was compared to information from the *Programa de la Industria Manufacturera, Maquiladora y de Servicios de Exportación* (IMMEX) compiled by Mexico's INEGI. This database records information on the number of manufacturing and non-manufacturing exporting firms established in Mexico, the sources of their revenues (domestic or foreign) and the origin of their inputs (domestic or foreign). Therefore, this dataset provides an indirect way to validate the type of firms that generate significant amounts of movement of goods across the border.

INEGI's data shows that for 2013, approximately 82 percent of the firms participating in the IMMEX program in Baja California are manufacturing firms, while the remaining 18 percent are non-manufacturing firms[22]. Furthermore, there is a high concentration of manufacturing firms in Tijuana (more than 60 percent of the manufacturing firms in the state), with the remaining activity located in Mexicali, Tecate and Ensenada (see Figure 9).

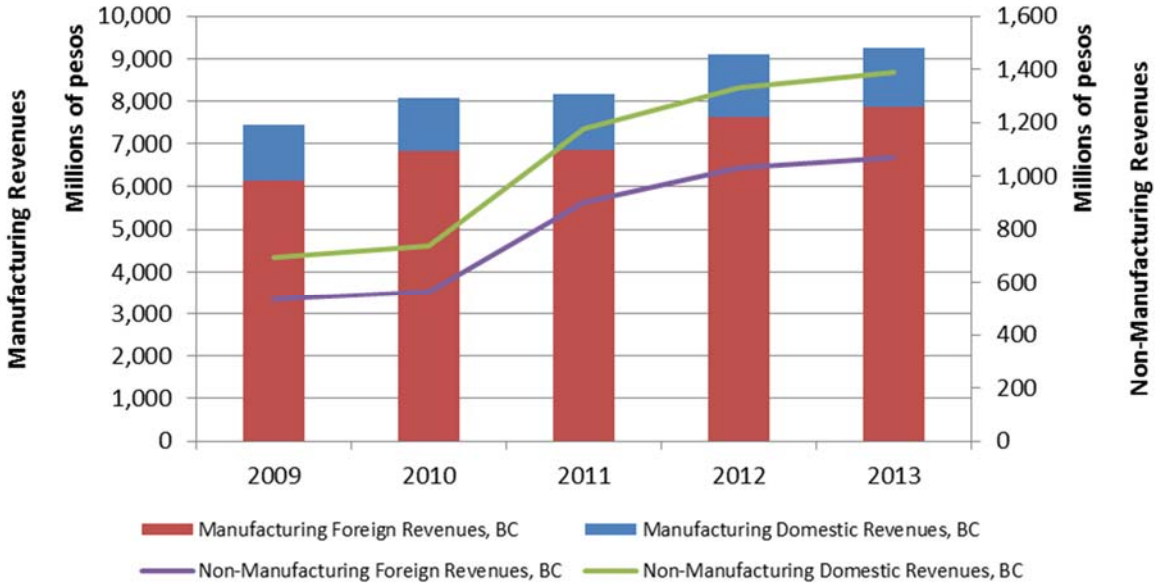
[22] Firms classified as non-manufacturing include those performing the following activities: agriculture, mining (excluding mining of oil and gas), wholesale of agricultural and forest raw materials, warehousing, waste management and services in support of businesses.

Figure 9. Number of Baja California-Based Firms Engaged in International Trade in 2013, by Type



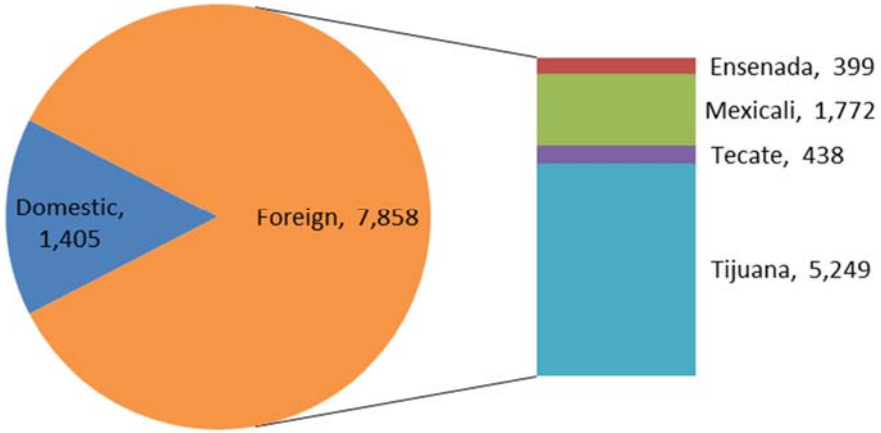
Source: INEGI

Figure 10. Source of Revenues for Firms Established in Baja California in 2013, by Type of Firm (in millions of pesos)



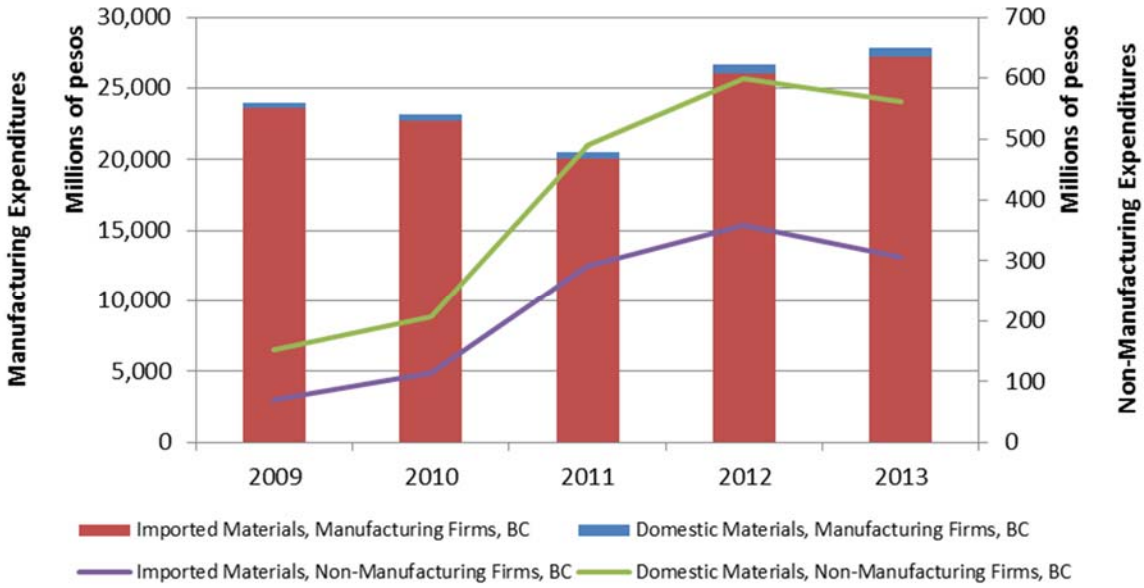
Source: INEGI

Figure 11. Location of Manufacturing Firms Generating Foreign Revenues in 2013 (in number of firms)



Source: INEGI

Figure 12. Source of Inputs for Firms Established in Baja Californa in 2013, by Type of Firm (in millions of pesos)

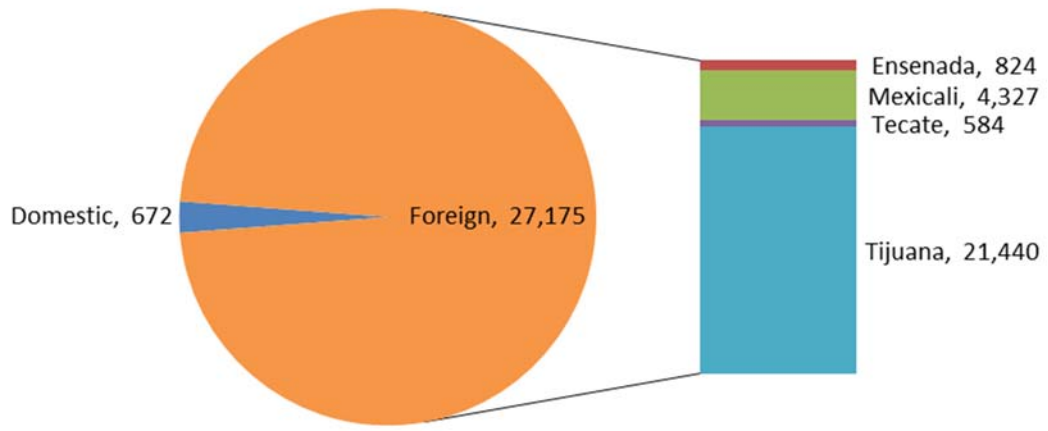


Source: INEGI

Furthermore, data collected by INEGI on the sources of revenues collected and the source of inputs used by manufacturing firms established in Baja California validated the importance of firms established in Tijuana for the movement of goods in the California – Baja California region. The sources of revenue for Baja California-based manufacturing and non-manufacturing firms are presented in Figure 10 while the geographic distribution foreign revenues generated by manufacturing firms based in Baja California is displayed in Figure 11. It is clear from Figure 10 that foreign revenues represent an important share of

revenues for manufacturing firms established in Baja California and therefore these types of firms generate considerable cross-border goods movements. Figure 11 shows that more than two-thirds of the foreign revenues produced by manufacturing firms are from establishments located in Tijuana.

Figure 13. Location of Manufacturing Firms Consuming Foreign Inputs in 2013 (in number of firms)



Source: INEGI

Regarding the sources of inputs used by manufacturing and non-manufacturing firms based in Baja California, Figure 12 shows imported materials used by manufacturing firms are a strong generator of goods movement in the region. Similar to the case of foreign revenues, Figure 13 shows that more than two-thirds of the foreign inputs used by manufacturing firms in the State of Baja California correspond to firms located in Tijuana.

A comparison between the survey data collected in 2011 and INEGI's data with respect to trade-oriented firms established in Baja California leads to two conclusions: (i) data collected during Phase I under-represented the share of manufacturing firms (68 percent in the Phase I sample vs. 82 percent in INEGI's population data); and, most importantly, (ii) data collected during Phase I did not have enough geographical diversity to represent the distribution of manufacturing firms in the California – Baja California border region. None of these observations, however, should come as a surprise, since Phase I of this study was focused on goods movement that used LPOEs in Imperial County, therefore minimizing the importance of goods moved in the San Diego – Tijuana border area.

Secondly, a comparison between categories of goods captured during the Phase I interviews was performed by contrasting the sample information with that collected from BTS and presented in the Identification of Clusters section in this document. In particular, each shipment was assigned to a particular cluster (as defined by the U.S. Cluster Mapping Project) based on the goods reported to be transported in it. The percentage that each cluster represents of the total goods movement by truck for the population-level data (i.e., BTS data) and the sample-level data (i.e., Phase I data) is presented in Table 16 by direction of movement. Since data collected during Phase I corresponds almost exclusively to goods moved by truck, a similar table for goods transported by rail cannot be created.

Table 16. Comparison of BTS and Phase I Data for Goods Moved by Truck

Cluster Description	Percentage of Imports - BTS	Percentage of Imports – Phase I	Percentage of Exports – BTS	Percentage of Exports – Phase I
Aerospace Vehicle and Defense	5.4%	1.3%	0.5%	0.0%
Agricultural Products	23.9%	6.0%	12.9%	2.3%
Apparel	0.6%	0.0%	0.5%	0.0%
Automotive	9.1%	0.0%	4.6%	1.3%
Biopharmaceuticals	0.1%	0.0%	0.2%	0.0%
Chemical Products	1.4%	2.9%	6.9%	0.0%
Construction Materials	9.8%	4.2%	7.3%	5.2%
Entertainment	0.0%	0.0%	0.0%	0.0%
Fishing and Fishing Products	0.2%	0.0%	0.2%	0.0%
Footwear	0.1%	0.0%	0.0%	0.0%
Forest Products	1.3%	0.0%	5.7%	0.0%
Furniture	4.0%	1.8%	1.1%	2.6%
Heavy Machinery	2.6%	0.0%	3.7%	0.0%
Information Technology	0.0%	0.0%	0.1%	0.0%
Jewelry and Precious Metals	0.0%	0.0%	0.0%	0.0%
Leather and Related Products	0.1%	0.0%	0.1%	0.0%
Lighting and Electrical Equipment	9.4%	16.6%	3.6%	20.2%
Medical Devices	2.5%	8.8%	0.7%	10.4%
Metal Manufacturing	9.5%	12.1%	20.3%	16.0%
Plastics	5.5%	7.5%	14.2%	8.8%
Processed Food	11.4%	3.3%	9.8%	4.2%
Publishing and Printing	1.6%	7.5%	5.3%	4.2%
Sporting, Recreational and Children's Goods	1.0%	0.0%	1.0%	0.0%
Textiles	0.6%	4.0%	1.2%	3.6%
Tobacco	0.0%	0.0%	0.0%	0.0%
Transportation and Logistics	0.0%	0.0%	0.0%	0.0%
Other Clusters / Mixed Cargo	0.0%	24.1%	0.0%	21.2%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: HDR Analysis of BTS data and Phase I of the 2012 SCAG Border Study Company Interviews

Furthermore, a comparison of the share of the different cluster groups shows that the proportion of low time-sensitive, high value-per-kilogram clusters in the Phase I sample (i.e., for goods moved by truck) is almost as high as that of low time-sensitive, low value-per-kilogram clusters. The population data, however, shows that the movement of goods generated by low time-sensitivity clusters occurs predominantly in the low value-per-kilogram segment. Similarly, the sample data shows percentages of the high time-sensitivity, low value-per-kilogram clusters between 7 and 10 percent, whereas the population data points to roughly a fourth to a third of all border-crossing movements being generated by this segment. A direct comparison of these segments is presented in Table 17.

Table 17. Comparison Between Data Source of Share of Cluster Groups of Border-Crossing Goods Moved by Truck, by Direction of Flow

	IMPORTS				EXPORTS			
	Low		High		Low		High	
Time Sensitivity / Per-Unit Value	BTS	Phase I	BTS	Phase I	BTS	Phase I	BTS	Phase I
Low	52.7%	41.3%	12.0%	25.4%	72.9%	41.7%	4.3%	30.6%
High	35.3%	9.3%	0.0%	0.0%	22.8%	6.5%	0.0%	0.0%

Source: HDR Analysis of BTS data and Phase I of the 2012 SCAG Border Study Company Interviews

Recommendations for Development of Data Survey Plan

Based on information from Table 16, the sample shipments of border-crossing goods moved via truck collected during Phase I of this study have proportionally more observations than the population data on the clusters of medical devices and lighting and electrical equipment. At the same time, the sample shipments lack information on the agricultural products, processed food and construction materials clusters in order to adequately represent the proportions observed in the population data.

Therefore, it was recommended that during Phase II of this study more O-D pairs of truck-transported shipments of agricultural products, processed food, and construction materials clusters were collected at the expense of O-D pairs from shipments moved by truck containing commodities classified under the lighting and electrical equipment as well as medical devices clusters. Furthermore, since the shipments secured during Phase I were collected only for firms in the Mexicali – Calexico area, it was recommended that during Phase II firms located in the Tijuana area become the main target of the surveys.

In the case of rail shipments, it is recommended that the Phase II data collection efforts focus on obtaining O-D data from shipments of goods belonging to the construction materials and processed food clusters in the case of imported goods. In the case of exported goods by rail, O-D data on shipments of goods classified under the chemical products, agricultural products, processed foods and publishing and printing clusters should be the primary focus.

Chapter 2: Data Collection Plan & Survey Instruments

Introduction

Understanding the current (and expected future) trade flows across the California-Baja California border is critical not only for planning appropriate transportation infrastructure, but also for supporting the growth of a competitive region that takes advantage of binational, economic synergies. While some existing data sets of origin-destination (O-D) information is available – from secondary sources such as the Bureau of Transportation Statistic's Transborder Freight data, the US Department of Commerce, and Mexico's INEGI as well as from the previous Phase I of the 2012 SCAG Border Crossing Study and Analysis – a broader and more detailed set of O-D data was needed to better reflect Baja California's market, while providing greater insights into regional and global trade flows as well as the logistical planning that companies are using.

In order to accomplish this, five separate survey/interview instruments were developed for use in the Phase II effort. Four of these survey/interviews were geared to collecting O-D data while the remaining one collected anticipated trends in binational trade and supply chain logistics in the region. The four O-D surveys not only secured data from cargo generators that use truck as their border-crossing transportation mode (as was done in Phase I), but also from generators using rail, from the drayage/trucking firms that move those goods across regional borders as well as the suppliers and customers of those cargo generators.

This multi-questionnaire approach allowed for better analysis of current and anticipated supply chains and the relationship between firms up and down the value chain with cargo-generating companies, and definition for the economic role of drayage/trucking firms in cross border trade in the California-Baja California region.

Overview of O-D Surveys

The four survey/interviews used for this effort were:

- **Cargo Generator O-D Survey**: Geared primarily to manufacturing, agricultural, and wholesale/retail companies located in Baja California, this survey/interview format collected a range of general operating information, as well as detailed O-D information for inbound and outbound shipments per company, covering several months (in order to avoid potential seasonal effects). A number of companies were interviewed, allocated between different industries and different cities of Baja California. As found during Phase I of this study, these cargo generators were expected to use truck as their primary mode for border-crossing goods movement. The Cargo Generator O-D Survey was a first step toward identifying common or major suppliers that were serving a range of companies in Baja California, as well as common or major end-users/consumers of the products being shipped through the LPOEs (part of the two-step interview process described in more detail below);
- **Major Supplier/Major Customer Survey:** Based on results from the Cargo Generator O-D Survey, a "second step" of surveying occured to secure a better understanding of the broader supply chains. First, a list of dozens of specific major Supplier Companies (i.e.: those that are selling and shipping goods/materials into Baja California), as well as dozens of major Customer Companies (i.e.: those that are purchasing and/or consuming goods/materials from Baja California), were compiled using data from the Cargo Generator survey. Then, working with SCAG and project stakeholders, a prioritized target list of Suppliers and Customers was created. Interviews covered standard practices, trends, O-D for specific shipments that were identified in the Cargo Generator Survey, and overall supply chain activities related to Baja California. This

additional survey, while more general than the Cargo Generator data, provided broader industry perspectives and trends missing from Phase I of this project.

- **Rail O-D survey:** The primary targets for these interviews were the railroad companies which transport goods across the U.S. and Mexico borders in California and Baja California. In particular, Admicarga / Baja California Railroad and San Diego / Imperial Valley Railroad were interviewed to capture goods crossing at the San Ysidro/Tijuana border, while Ferromex and Union Pacific were targeted for goods crossing at the Calexico / Mexicali West border. The volume of goods moved at the Calexico/Mexicali border and the San Diego/Tijuana border varies, and therefore sample sizes requested from these railroads may vary. A representative sample size of shipment data that included the primary commodities crossing the border on 2 typical days during a typical week was requested from each railroad company. The information requested included both northbound and southbound shipments.
- **Drayage/Trucking Firm Survey:** Lastly, in order to gain more insights into the practices and economic impacts of Drayage companies operating in Baja California, a survey/interview was applied firms – split between large, medium, and smaller drayage trucking firms that were identified via the Cargo Generator surveys and through regional stakeholder communications. Specific issues that were addressed included general trends and customer categories, volumes, seasonality of shipments, local and medium-distance O/D points for customers, and employment by these firms.

Another important consideration that was part of the Phase II approach related to the type of goods shipped across the U.S.-Mexico border. Initial trade data was analyzed to help identify categories of goods and industry clusters that are currently influencing trade across the California-Baja California border. Major product categories included agricultural, metal, food, construction, plastics, electrical/electronics, and automotive goods. Survey recruitment remembered the relative strength of these traded goods to ensure that eventual results were fairly weighted and representative of overall exports and imports.

Table 18. Share of Selected Clusters in Import and Export of Goods Traded by Truck (Based on Weight), 2013

Cluster Description	Percentage of Total Imports in 2013	Percentage of Total Exports in 2013
Agricultural Products	23.9%	12.9%
Automotive	9.1%	4.6%
Chemical Products	1.4%	6.9%
Construction Materials	9.8%	7.3%
Lighting and Electrical Equipment	9.4%	3.6%
Metal Manufacturing	9.5%	20.3%
Plastics	5.5%	14.2%
Processed Food	11.4%	9.8%
Publishing and Printing	1.6%	5.3%

Source: HDR Analysis using BTS data

Table 19. Share of Selected Clusters in Import and Export of Goods Traded by Rail (Based on Weight), 2013

Cluster Description	Percentage of Total Imports in 2013	Percentage of Total Exports in 2013
Agricultural Products	1.2%	21.6%

Chemical Products	0.0%	45.7%
Construction Materials	68.2%	0.9%
Metal Manufacturing	8.8%	0.3%
Processed Food	20.8%	15.7%
Publishing and Printing	0.0%	14.1%

Source: HDR Analysis using BTS data

O-D Survey Allocation

While there was a focus for Phase II on international trade flows through the Mexicali-Imperial County region, the integrated nature of the Tijuana Metropolitan region and Ensenada in terms of transportation, ports, and the economy could not be overlooked. Both the population and the economy of Mexicali are substantial, but the Tijuana Metropolitan region (comprised of Tijuana, Tecate and Rosarito) has over three-times the IMMEX (maquiladora manufacturing) industry, and nearly twice the population. Ensenada is also important, given the large agricultural and seafood industries centered around and south of the city, not to mention the growing amount of containerized cargo flowing through its seaport and into Baja California's manufacturing firms.

Table 20. Selected Socioeconomic Indicators for Baja California Geographies

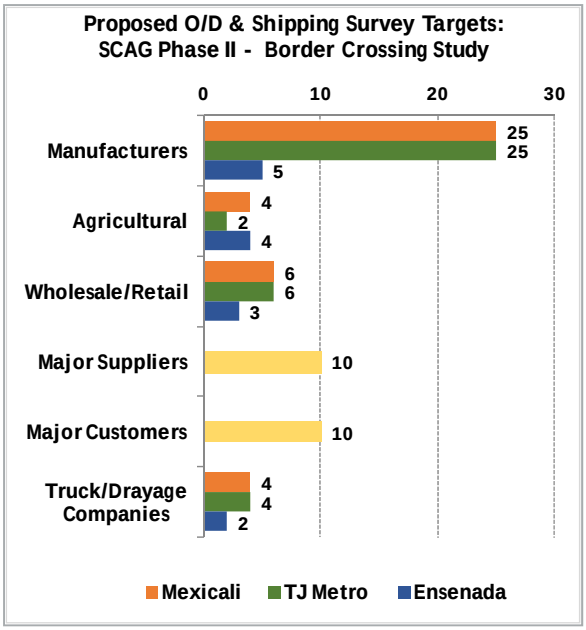
Geography	IMMEX Firms (Mar. 2014)	IMMEX Employment (Mar. 2014)	Non-IMMEX Employment (estimate)	Population (estimate)
Mexicali	137	53,100	358,900	936,826
Tijuana Metropolitan Region (Tijuana, Tecate & Rosarito)	682	185,430	584,730	1,751,430
Ensenada	88	18,660	186,640	466,814

Source: INEGI

As such, the O-D surveys for Phase II envision apportioning targets for both the Cargo Generator and the Drayage/Trucking surveys to companies throughout Baja California – including not just Mexicali, but also the Tijuana Metropolitan region, and Ensenada. Initial proposed target allocations are shown in the figure in next page.

Note that targets for the Major Suppliers and Major Customers surveys are not based on regions, but rather were based on frequently mentioned firms mentioned during the Cargo Generator surveys, and are limited to 10 each.

In the case of O-D for goods moved by rail, the existence of only four companies operating in the area dictates the geographical allocation of the data collection efforts.



O-D Schedule & Sample Targets

Sample types of companies that were targeted include the following:

- **Cargo Generator - Manufacturing Firms:** Carefusion, COTO Technology, Tetra Pak Plastic Mexico, Foxconn, Furukawa Mexico, Goodrich Aerospace Mexico, Honeywell Aerospace de Mexico, Hyundai, Kenworth Mexicana, Kyocera, Medtronic, Robert Bosch Tools de Mexico, Panasonic Electric Works Mexicana, Plantronics, Breg Mexico, Samsung, Skyworks, Toyota, etc.;
- **Cargo Generator - Agricultural/Food Firms:** Agricola Colonet, Acuacultura Integral de Baja California, Sabritas, Jumex Mexicali, BIMBO, F&G Produce & Logistic, Estrella, Fruvemex Mexicali, Agrovizion Integradora, Monica Produce, Productor Agricola Industrial del Noroeste, etc.;
- **Cargo Generator - Wholesale/Retail Firms:** Coppel, Calimax, Comercial Mexicana, Exel del Norte, FAMSA, Smart & Final, Costco, Elektra, Home Depot, etc.;
- **Drayage/Trucking Firms:** Black Eagle Trucking Mexico, Comandos Shuttle, Gutierrez Trucking, Ramirez Express, E & E Transport, Fletes Esquer, Southwest Mex Distributors, Transportes Castores de Baja California, Transportes Pitic, Transmex, etc.;

O-D Survey Validation, Collection & Delivery

Each Draft Questionnaire was applied to 1-2 “pilot” companies from their respective business category (Cargo Generator, Drayage/Trucking, Major Supplier/Customer, Rail Operator) that were recruited to support this effort, in order to verify that wording and requested data result in meaningful information. Input from these sample companies were incorporated into a Final Questionnaire for application in the field.

Surveys were conducted during one or multiple meetings by trained, bilingual personnel using tablet and/or paper formats, via a face-to-face interview. Recruited participants were high-level executives at targeted companies that have direct management and/or control over supply chain decisions and/or the facility. In the case of the Cargo Generator O-D survey, interviews included several top onsite executives (GM, Purchasing, Logistics) as possible as well as phone interviews with offsite personnel at US- or Mexico-based headquarters where possible and necessary; Drayage/Trucking surveys were conducted onsite with regional managers/owners; Major Supplier/Customer surveys included face-to-face or phone interviews

with individuals that have regional responsibility for sales or sourcing from Baja California or Mexico when possible; and Rail surveys were to be conducted onsite and will involve personnel in charge of operations where feasible.

Recruited survey targets were provided bilingual, introductory information about the project, as well as a Questionnaire in advance (in order to facilitate the collection of detailed information prior to the actual interview). Collected information was compiled via a secure, cloud-based platform, with a report listing targets, participants to-date, and progress toward the goals.

Border-Crossing Trade & Supply Network Trends Survey

The primary targets for these interviews were individuals with keen knowledge of the binational cross border trade and supply networks of goods crossing the U.S. and Mexico border through Southern California's Ports of Entry. These included individuals who participated in public-private partnerships between the Government and the local business associations:

a) Baja California: Federal, State and Local officials responsible for economic development, Economic Development Councils, Industrial Business associations, Chairs of the Industrial Clusters and the main manufacturing (maquiladora) plants that belong to these clusters.
b) California: Regional and Local Government officials responsible for economic development in San Diego and Imperial Counties, Economic Development Corporations of San Diego and Imperial Counties, the Regional Chamber of Commerce, and U.S. firms with maquiladora plants in Baja California.

Each of the above targets can provide useful information on the future trade scenarios including: government policies of retention and attraction of investments, emerging trends in logistics (with an emphasis on border-crossing logistics) and potential changes to regional and local supply networks.

The goal of this effort was to gather the expert's perspectives regarding the following issues:

a) Integration of the California-Baja California Border Region.
b) How Border Security affects binational trade in the region.
c) Expectations regarding improvements of Border Infrastructure (in particular LPOEs).
d) Improvement of Mexico's export capacity.
e) Evolution of inventory management systems.
f) Emergence of near-shoring in the Baja California-Southern California region
g) Perspectives for tourism in the region.
h) Emergence of renewable energy projects in the border region.
i) Expectations regarding improvements of rail line infrastructure in the region.
j) Government policies for promotion of foreign investment in Baja California.

These surveys were applied at the interviewee's offices during in-person interviews. Data obtained was considered confidential, and no proprietary or identifying information was linked to the actual survey data to ensure privacy of the participants.

Recruitment of participants was done through the following steps:

a) Request the assistance of business associations and public-private partnerships in Baja California and San Diego/Imperial counties to identify prospects for recruitment and to provide the contact information. This information was used to contact the appropriate individuals and to schedule the interviews.

b) Request that SCAG provide a letter to each of these individuals (either from the Government sector or the private sector) to request a meeting where the survey will be conducted. The letter provided a brief explanation of the project and the scope of the required data collection effort, mentioning the information collected is confidential.

Pilot tests of the bilingual survey instrument were performed. These “pilot” tests also served as training for the survey personnel, to ensure that questionnaires were understood and applied correctly in each circumstance.

After these pilot tests, feedback will be provided to SCAG about the pilot test and the bilingual survey instrument as well as any modifications considered appropriate for the subsequent interviews.

A survey instrument was developed in English and later translated into Spanish, so it could be used for interviews in Baja California.

In order to ensure accuracy of the data, whenever possible data was recorded via an electronic version of the questionnaire on an interviewer’s lap-top. If this was not possible, the information was recorded manually and entered into the survey database.

Data entry was reviewed by 2 staff members to ensure information was recorded correctly. A copy of the survey instruments that were recorded manually were provided to SCAG.

Results were compiled in a standard Excel spreadsheet database format to allow for analysis of all survey results. A written survey question guide was also developed, outlining all questions and possible answers, as well as coding methodology for any responses.

Chapter 3: Summary of Truck O-D Data

This chapter describes the information captured through interviews with cargo generators in the region that use truck as their primary mode of transportation. Even though these companies had agreed to share manifest-level information of their representative border-crossing flows, confidentiality concerns limited the amount of information that was provided. In order to complement the shipment-level data needed to conduct Phase II of the Goods Movement Study, information was mined from a commercial database containing manifest-level data of border-crossing shipments through the Southern California – Baja California Land Ports of Entry (LPOEs).

Overview and Methodology

Data collected from cargo generator companies were collected between December 2014 and June 2015 for a total of fifty-three (53) companies. The interviewees are located in the Tijuana, Mexicali, and Ensenada regions of Mexico (see Figure 14 below).

The data was collected using the “cargo generator survey” instrument. 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;
- Name of representative suppliers and customers;
- Locations of primary customers;

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

- 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/Vendor Managed Inventory agreement;
- Percentage of shipments by 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.

The data compiled was evaluated to create an overview of cross-border shipping activity in the Imperial County and San Diego County region. Averages and percentages were computed through a weighted average method.

The first sections of this report summarize the data collected from Parts A, B and C of the cargo generator survey, which captured information about characteristics of border-crossing goods movement at the firm level (i.e., aggregate level). The last section summarizes the data regarding individual shipments provided by the interviewed companies. In analyzing the shipment-level data collected in the final part of the cargo generator survey, similar data made available by Panjiva, a database provider[23] was also leveraged. The complete cargo generator survey with each individual question is provided in the Appendix section. Responses to qualitative questions are also presented in the Chapter Appendix.

Analysis of Truck O-D Data Collected During Phase II

As mentioned previously, data were collected between December 2014 and June 2015 through interviews with cargo generators engaged in goods movement across the border. The data was collected under a confidentiality agreement with the interviewees, and therefore this chapter presents results in a way that minimizes the risk of identifying any specific companies and/or shipments.

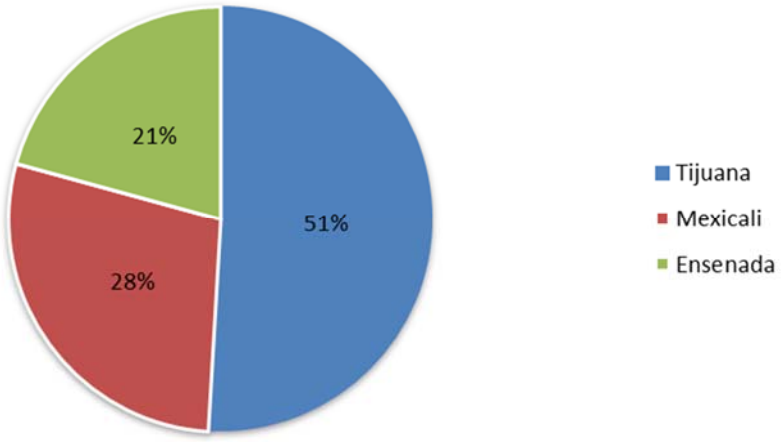
PART A: Company-Level (Aggregate) Information

This section summarizes information at the company-level about location, industry classification and current number of employees at each interviewed firm.

CHARACTERISTICS OF FIRMS INTERVIEWED

Of the 53 companies surveyed, 27 (51 percent) were located in Tijuana, 15 (28 percent) were located in Mexicali, and 11 (21 percent) were located in Ensenada (see Figure 1).

Figure 14: Location of Companies/Interviewees

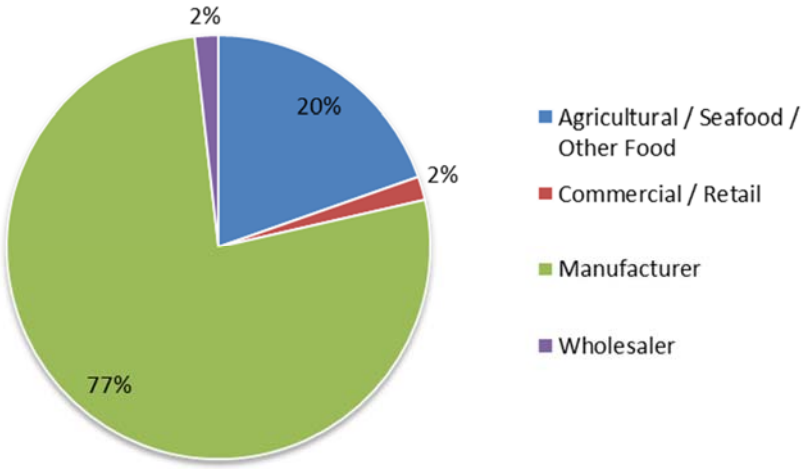


[23] The data collected by Panjiva on border-crossing shipments was not commercially available when the data collection for this study began and therefore was not identified as a potential source of information in Chapter 2 that described the data collection plan.

Source: HDR Analysis of Truck O-D Survey

The companies interviewed were predominantly manufacturers (see Figure 15). Additionally, ten (20 percent) were agricultural, seafood, or other food companies. One company (2 percent) was a wholesaler and another company (2 percent) was a commercial / retailer company.[24]

Figure 15: Interviewees by Cargo Generator Type

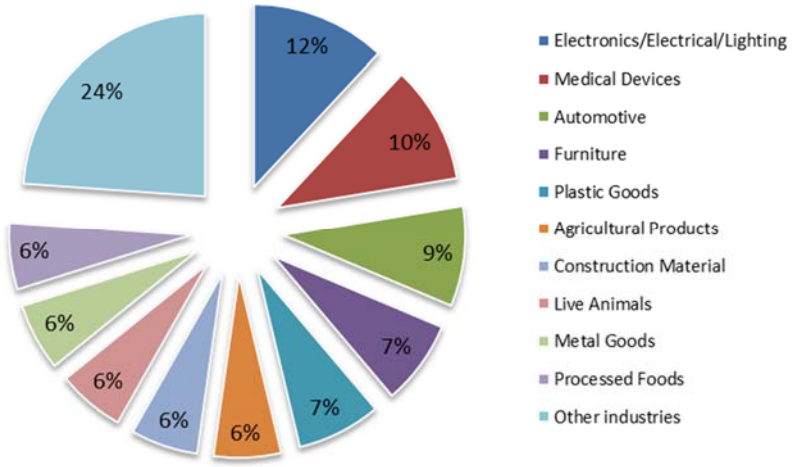


Source: HDR Analysis of Truck O-D Survey

Companies were also asked to select one category as their primary industry sectors. The most prevalent sectors were electronics/electrical/lighting (12 percent), medical devices (10 percent), and automotive (9 percent). Figure 16 presents a full breakdown of the responses and the Chapter Chapter 3 Appendix has additional information on tabular format.

[24] Note that manufacturing is the major driver of border-crossing shipments and therefore constituted the focus of cargo-generator interviewees. Agricultural companies have well-known “spikes” that affect border-crossing infrastructure and therefore represented the second-largest category of interviewees.

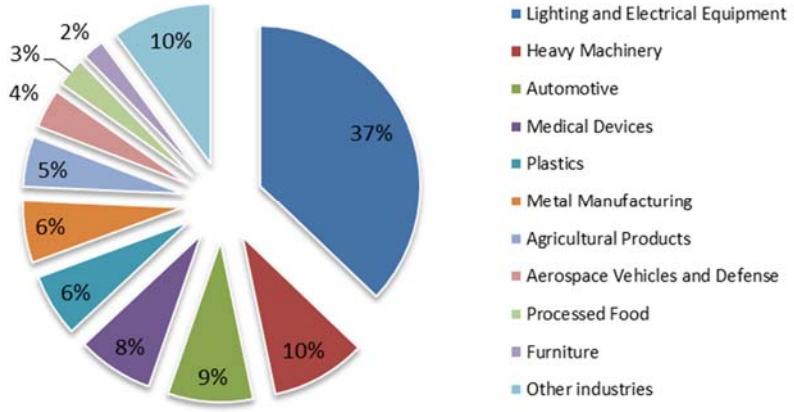
Figure 16. Interviewees by Cargo Generating Industry



Source: HDR Analysis of Truck O-D Survey

The sample of companies interviewed as part of this effort comprises those industries that generate the largest amount of trade through the California – Baja California border. These trade-generating industries are presented in Figure 17.

Figure 17. Industries Generating Largest Border-Crossing Trade in Region (in Percentage of Traded Value)



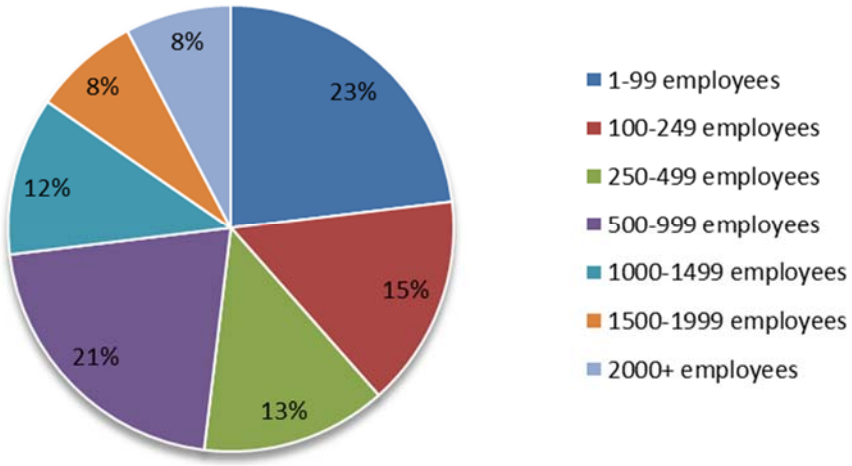
Source: HDR Analysis of Transborder Data from BTS

CURRENT EMPLOYMENT GENERATED BY CROSS-BORDER SHIPPING ACTIVITY

The study also collected data on the number of employees at the surveyed firms. One company (located in Ensenada) did not indicate its number of employees. Therefore, summary statistics are calculated based on the remaining 52 companies. As can be seen in Figure 18, the companies surveyed were distributed among a range of sizes. Just over half had fewer than 500 workers, with twelve (23 percent) having fewer

than 100 workers, eight (15 percent) having 100-249 workers, and seven (13 percent) having 250-499 workers. Among firms with 500 or more workers, eleven (21 percent of all firms) had 500-999 employees, six (12 percent) had 1000-1499 employees, four (8 percent) had 1500-1999 employees, and four (8 percent) had more than 2000 employees.

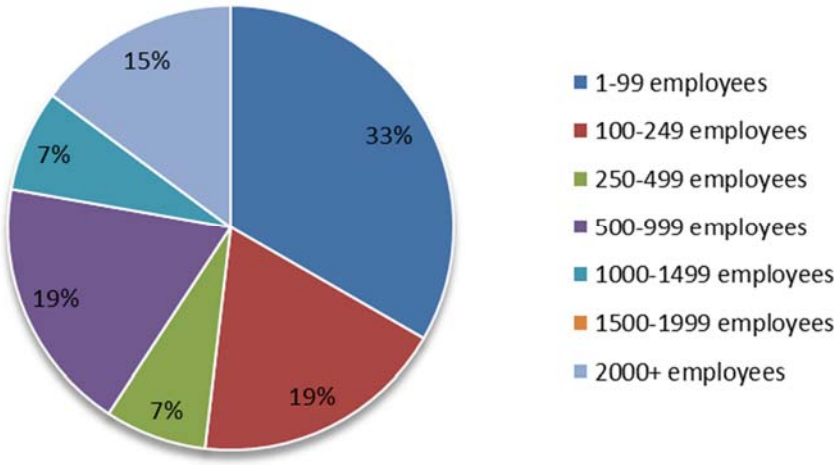
Figure 18: Number of employees at interviewed companies (aggregate)



Source: HDR Analysis of Truck O-D Survey

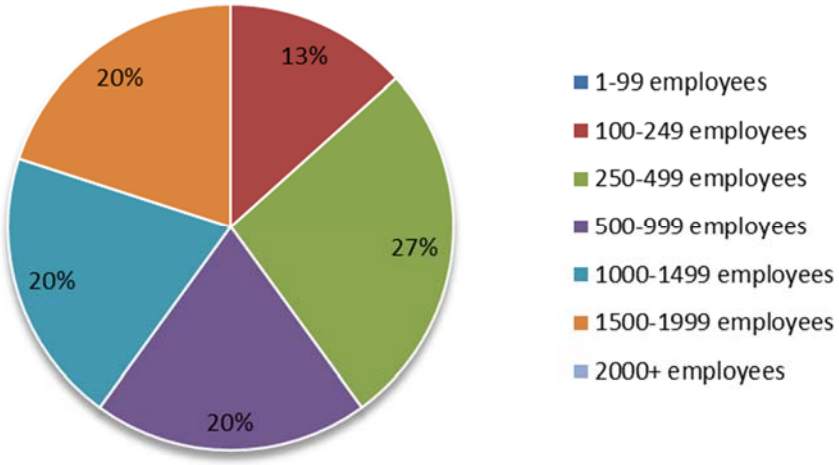
Based on the sample of firms surveyed, Tijuana had the highest concentration of both the smallest and largest firms. Of the twenty-seven firms located in Tijuana, twelve (33 percent) had fewer than 100 employees. However, all four firms with more than 2,000 employees were also located in Tijuana (see Figure 19). In contrast, the Mexicali region held a range of mid-sized companies, with all fifteen of those surveyed having more than 99 employees but fewer than 2,000 (see Figure 20). Of the remaining ten firms located in Ensenada, three had fewer than 100 employees and three had 500-999 employees. The 100-249, 250-499, 1000-1499, and 1500-1999 employee categories each contained a single firm located in Ensenada (see Figure 21).

Figure 19: Number of employees at interviewed companies (Tijuana)



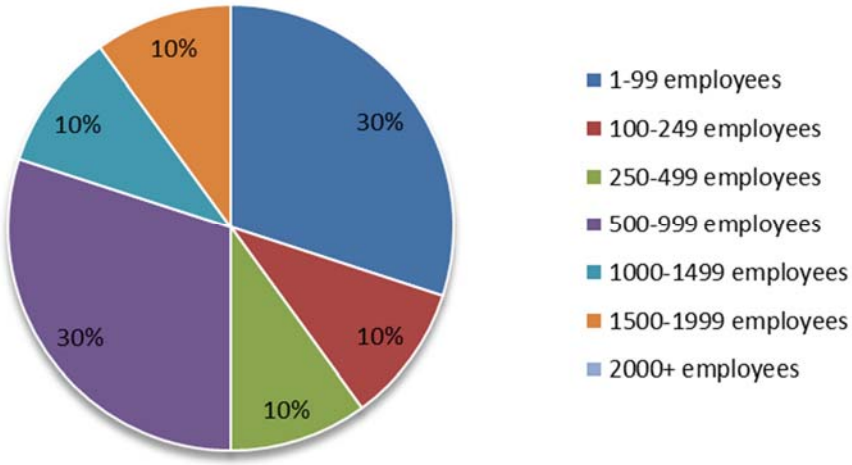
Source: HDR Analysis of Truck O-D Survey

Figure 20: Number of employees at interviewed companies (Mexicali)



Source: HDR Analysis of Truck O-D Survey

Figure 21: Number of employees at interviewed companies (Ensenada)



Source: HDR Analysis of Truck O-D Survey

PART B: Company-Level (Aggregate) Supply Chain Characteristics

This section captured the self-reported most common origins and destinations to which companies ship their goods to or receive their goods from.

COMPANY-LEVEL (AGGREGATE) ORIGIN AND DESTINATION LOCATIONS

The surveyed firms self-reported breakdowns of the percentages of their monthly shipments which originated from and were destined for selected locations. Table 21 through Table 28 summarize the survey results by using an average of the percentages reported to each origin and destination location weighted by the number of monthly shipments reported to be performed by each company. Therefore, these results illustrate the relative importance of the selected shipping routes, and the percentages correspond to the weighted proportions of goods shipments which travel to and from particular locations. Some companies did not allocate all 100 percent among the locations provided on the survey, so not all of the percentages sum to 100.

As can be seen in Table 21, a significant proportion of companies' inbound shipments (i.e., those shipments used as input in the interviewed company's production process) originate in the U.S. but outside of California[25]. The regions of Baja California in Mexico, Los Angeles and Asia also account for a high percentage.

Table 21: Origins of Inbound Shipments (All Destination Locations in Mexico)

Origin	Percentage of inbound shipments
U.S. – Other than California	28.9%
Mexico – Baja California	23.2%
U.S. – California – Los Angeles (L.A./Orange/Ventura/Santa Barbara)	18.6%

[25] Inbound shipments are those that originate elsewhere and have the interviewed company as their destination (regardless of where the company is located). In the case of this study, all interviewed companies were located in Mexico.

Asia	14.3%
U.S. – California – San Diego/Imperial	4.8%
U.S. – Rest of California	2.6%
Mexico – Other than Baja California	2.1%
Europe	1.9%
U.S. – California – Inland Empire (San Bernardino/Riverside)	0.9%
Other	0.8%
Latin America (non-Mexico)	0.0%
Canada	0.0%

Source: HDR Analysis of Truck O-D Survey

For companies located in Tijuana, higher percentages of their inbound shipments come from the U.S. but outside of California, Los Angeles and Asia (see Table 22). This suggests their supply chains are, in fact, binational.

Table 22: Origins of Inbound Shipments (Tijuana)

Origin	Percentage of inbound shipments
U.S. – Other than California	40.7%
U.S. – California – Los Angeles (L.A./Orange/Ventura/Santa Barbara)	23.6%
Asia	11.2%
Mexico – Baja California	9.1%
U.S. – California – San Diego/Imperial	7.7%
U.S. – Rest of California	2.4%
Europe	2.3%
Mexico – Other than Baja California	0.6%
U.S. – California – Inland Empire (San Bernardino/Riverside)	0.4%
Other	0.1%
Latin America (non-Mexico)	0.0%
Canada	0.0%

Source: HDR Analysis of Truck O-D Survey

For companies located in Mexicali, higher proportions of inbound shipments were sourced from Baja California in Mexico (see Table 23). This suggests the geographical extent of the supply chains for these companies extends further into Baja California compared to the cargo generator companies located in Tijuana.

Table 23: Origins of Inbound Shipments (Mexicali)

Origin	Percentage of inbound shipments
Mexico – Baja California	50.0%
Asia	20.5%
U.S. – Other than California	10.7%
U.S. – California – Los Angeles (L.A./Orange/Ventura/Santa Barbara)	8.7%
U.S. – Rest of California	3.2%
Other	2.2%
U.S. – California – Inland Empire (San Bernardino/Riverside)	1.9%
Mexico – Other than Baja California	1.4%
Europe	1.1%
U.S. – California – San Diego/Imperial	0.3%

Latin America (non-Mexico)	0.0%
Canada	0.0%

Source: HDR Analysis of Truck O-D Survey

For companies in Ensenada, the bulk of inbound shipments originated in Baja California or elsewhere in Mexico (see Table 24), suggesting a strong Mexican component in their supply chains.

Table 24: Origins of Inbound Shipments (Ensenada)

Origin	Average percentage of inbound shipments
Mexico – Other than Baja California	24.8%
Mexico – Baja California	21.6%
U.S. – California – Los Angeles (L.A./Orange/Ventura/Santa Barbara)	20.9%
Asia	12.0%
U.S. – Other than California	4.7%
Europe	2.2%
Other	1.2%
U.S. – Rest of California	0.5%
U.S. – California – San Diego/Imperial	0.0%
Latin America (non-Mexico)	0.0%
Canada	0.0%
U.S. – California – Inland Empire (San Bernardino/Riverside)	0.0%

Source: HDR Analysis of Truck O-D Survey

A large percentage of companies' outbound shipments were destined for U.S. states outside of California[26]. However, shipments headed for the Los Angeles and San Diego regions registered significant percentages of movements, (see Table 25).

Table 25: Destinations of Outbound Shipments (All Origin Locations)

Destination	Percentage of outbound shipments
U.S. – Other than California	37.3%
U.S. – California – Los Angeles (L.A./Orange/Ventura/Santa Barbara)	14.6%
U.S. – California – San Diego/Imperial	13.5%
Asia	6.8%
Mexico – Other than Baja California	6.1%
U.S. – Rest of California	6.1%
Mexico – Baja California	4.7%
Europe	3.0%
Latin America (non-Mexico)	1.1%
Canada	1.1%
U.S. – California – Inland Empire (San Bernardino/Riverside)	0.9%
Other	0.1%

Source: HDR Analysis of Truck O-D Survey

Companies in Tijuana sent a somewhat higher percentage of their outbound shipments to U.S. states outside of California (see Table 26). However, the regions of Los Angeles and San Diego also receive a

[26] Outbound flows are those that have an origin in the cargo generating company and a destination elsewhere.

significant share of the shipments, suggesting an important level of integration of supply chains at the regional level.

Table 26: Destinations of Outbound Shipments (Tijuana)

Destination	Percentage of outbound shipments
U.S. – Other than California	45.5%
U.S. – California – Los Angeles (L.A./Orange/Ventura/Santa Barbara)	16.4%
U.S. – California – San Diego/Imperial	14.0%
Asia	8.8%
Europe	4.0%
U.S. – Rest of California	1.6%
Latin America (non-Mexico)	1.3%
Mexico – Baja California	0.6%
Mexico – Other than Baja California	0.3%
U.S. – California – Inland Empire (San Bernardino/Riverside)	0.2%
Other	0.1%
Canada	0.0%

Source: HDR Analysis of Truck O-D Survey

In contrast, companies in Mexicali sent fewer of their shipments to the San Diego and Los Angeles regions, and more to the rest of California, Mexico and elsewhere in the United States. This suggests that the supply chains for these companies are more integrated at the national level on both countries (as opposed to the bi-national level in the region).

Table 27: Destinations of Outbound Shipments (Mexicali)

Destination	Percentage of outbound shipments
U.S. – Other than California	23.5%
Mexico – Other than Baja California	21.4%
U.S. – Rest of California	18.0%
Mexico – Baja California	14.6%
U.S. – California – San Diego/Imperial	9.2%
U.S. – California – Los Angeles (L.A./Orange/Ventura/Santa Barbara)	4.7%
U.S. – California – Inland Empire (San Bernardino/Riverside)	2.5%
Canada	2.0%
Asia	2.0%
Europe	1.0%
Latin America (non-Mexico)	0.7%
Other	0.2%

Source: HDR Analysis of Truck O-D Survey

For companies in Ensenada, Los Angeles was the most common destination for outbound shipments, followed by San Diego. This information, combined with the analysis of inbound flows, suggests that the supply chains for these companies are truly binational, though primarily operate in the Baja California – Southern California region.

Table 28: Destinations of Outbound Shipments (Ensenada)

Destination	Percentage of outbound shipments

U.S. – California – Los Angeles (L.A./Orange/Ventura/Santa Barbara)	39.1%
U.S. – California – San Diego/Imperial	27.5%
U.S. – Other than California	11.3%
Canada	7.6%
Asia	7.0%
Mexico – Baja California	4.5%
Europe	2.4%
U.S. – California – Inland Empire (San Bernardino/Riverside)	1.2%
U.S. – Rest of California	0.0%
Mexico – Other than Baja California	0.0%
Latin America (non-Mexico)	0.0%
Other	0.0%

Source: HDR Analysis of Truck O-D Survey

PART C: Company-Level (Aggregate) Information on Volumes & Transportation Mode Used

This section summarizes the self-reported information on most-commonly used border-crossing facility as well as the most-commonly transportation mode used by the interviewed companies.

FACILITY OF ENTRY TO AND EXIT FROM BAJA CALIFORNIA

Forty-four companies self-reported estimates of the percentages of their shipments which entered Baja California through given transportation facilities. As with the origin-destination data, these responses are aggregated through a weighted average process where the weights are the self-reported amount of shipments dispatched by each company in a typical month. Also, as in the case of Part B, some companies did not allocate all 100 percent among the facilities and modes provided on the survey, so not all of the percentages sum to 100.

Among shipments originating outside Baja California, the Otay Mesa Land Port of Entry was the most common facility of entry, followed by the Calexico East Land Port of Entry and the Port of Ensenada.

Table 29: Cross-Border Facility of Entry to Baja California

Transportation Facility	Percentage of inbound shipments
Otay Mesa LPOE (Mesa de Otay)	54%
Calexico East LPOE (Mexicali II)	20%
Ensenada Sea Port	9%
From Original Supplier in Baja California (not including VMI/local storage)	4%
Other Port or Transportation Facility	2%
Mexicali Airport	1%
Tecate LPOE	1%
Tijuana Airport	<1%

Source: HDR Analysis of Truck O-D Survey

Forty-eight companies provided estimates of the percentages of their shipments which exited Baja California through given transportation facilities. Table 30 presents averages of these percentages. The Otay Mesa Land Port of Entry was the most common facility of exit followed by the Calexico East Land Port of Entry. In comparison with inbound shipments, outbound shipments were significantly less likely to remain within Baja California. On average, companies indicated that only one percent of their outbound shipments were destined for a customer in Baja California.

Table 30: Facility of Exit from Baja California

Transportation Facility	Percentage of outbound shipments
Otay Mesa LPOE (Mesa de Otay)	57%
Calexico East LPOE (Mexicali II)	22%
Other Port or Transportation Facility	3%
Mexicali Airport	2%
Tecate LPOE	2%
Ensenada Sea Port	1%
Tijuana Airport	1%
To Customer in Baja California (not including VMI/local storage)	1%

Source: HDR Analysis of Truck O-D Survey

TRANSPORT MODES

Forty-six companies provided estimates of the percentage of their inbound shipments (to Baja California) which used selected modes of transport. As can be seen in Table 31, the surveyed companies indicated that a significant majority of their inbound shipments were transported solely by truck.

Table 31: Mode of Transport, Inbound Shipments

Transportation Facility	Percentage of outbound shipments
Truck Only	84%
Truck-Seaport	6%
Truck-Rail	3%
Truck-Air	2%

Source: HDR Analysis of Truck O-D Survey

Fifty companies provided estimates of the percentage of their outbound shipments which used selected modes of transport. As with inbound shipments, the bulk of outbound shipments were transported by truck only.

Table 32: Mode of Transport, Outbound Shipments

Transportation Facility	Percentage of outbound shipments
Truck Only	83%
Truck-Seaport	6%
Truck-Rail	3%
Truck-Air	2%

Source: HDR Analysis of Truck O-D Survey

PART D: Shipment-Level Data

The final portion of the survey asked companies to submit information on representative border-crossing shipments. Details were obtained from 43 companies for a total of 205 northbound shipments and 174 southbound shipments. The team then retrieved similar information on shipment-level data from a database maintained by Panjiva, an information provider. These data included 1,531 northbound and 1,684 southbound shipments made by 39 different companies. The two sources combined provide a sample of 1,736 northbound shipments and 1,858 southbound shipments from 63 companies. While some companies were represented in both the survey data and the Panjiva data, care was takien to avoid duplicating individual shipments in the combined sample[27].

[27] Companies for which Panjiva data was collected were chosen based on the fact that they provided either very limited or no data at all on individual shipments as part of the cargo generator surveys.

Goods in the Automotive cluster represented the largest fraction of both northbound and southbound shipments (see Table 33 and Table 34). Significant numbers of shipments in both directions also fell into the Lighting and Electrical Equipment cluster and the Plastics cluster. Note that the samples collected as part of this effort capture the industries that trade the largest volumes of goods across the border in terms of weight, as shown in the column on the right of the tables.

Table 33: Goods Transported in Sampled Shipments, Northbound

	Number of Shipments	Percentage of Northbound Shipments	Percentage in Northbound Total Trade (by Weight)
Automotive	313	18%	9%
Lighting and Electrical Equipment	182	10%	9%
Plastics	150	9%	6%
Information Technology	134	8%	<1%
Sporting, Recreational and Children's Goods	134	8%	1%
Metal Manufacturing	131	8%	10%
Agricultural Products	115	7%	24%
Aerospace Vehicles and Defense	114	7%	5%
Construction Materials	85	5%	10%
Heavy Machinery	62	4%	3%
Biopharmaceuticals	55	3%	<1%
Apparel	37	2%	1%
Publishing and Printing	19	1%	2%
Fishing and Fishing Products	12	1%	<1%
Forest Products	12	1%	1%
Chemical Products	5	<1%	1%
Entertainment	2	<1%	<1%
Textiles	2	<1%	1%
Processed Food	1	<1%	11%
Other/Unspecified	173	10%	N/A

Source: HDR Analysis of Truck O-D Survey

Table 34: Goods Transported in Sampled Shipments, Southbound

	Number of Shipments	Percentage of Southbound Shipments	Percentage in Southbound Total Trade (by Weight)
Automotive	327	18%	5%
Plastics	279	15%	14%
Lighting and Electrical Equipment	256	14%	4%
Metal Manufacturing	189	10%	20%
Chemical Products	138	7%	7%
Agricultural Products	133	7%	13%
Processed Food	92	5%	10%
Publishing and Printing	92	5%	5%
Information Technology	65	3%	<1%
Forest Products	43	2%	6%
Textiles	33	2%	1%
Sporting, Recreational and Children's Goods	30	2%	1%
Construction Materials	20	1%	7%
Heavy Machinery	15	1%	4%

	Number of Shipments	Percentage of Southbound Shipments	Percentage in Southbound Total Trade (by Weight)
Entertainment	5	<1%	<1%
Aerospace Vehicles and Defense	4	<1%	<1%
Apparel	1	<1%	<1%
Fishing and Fishing Products	1	<1%	<1%
Leather and Related Products	1	<1%	<1%
Other/Unspecified	134	7%	N/A

Source: HDR Analysis of Truck O-D Survey

ORIGIN AND DESTINATION LOCATIONS

The 92154 zip code, just north of the border in San Diego, was the most common destination for northbound shipments and the most common origin for southbound shipments. The top destination locations for northbound shipments and the top origin locations for southbound shipments were all in California (see Table 35 and Table 36 as well as the maps presented in the Chapter Chapter 3 Appendix).

Table 35: Top Destination Zip Codes, Northbound Shipments

Zip Code	Number of Shipments	Percentage of northbound shipments
92154	233	13%
92121	110	6%
92231	95	5%
90220	80	5%
92064	64	4%
92123	63	4%

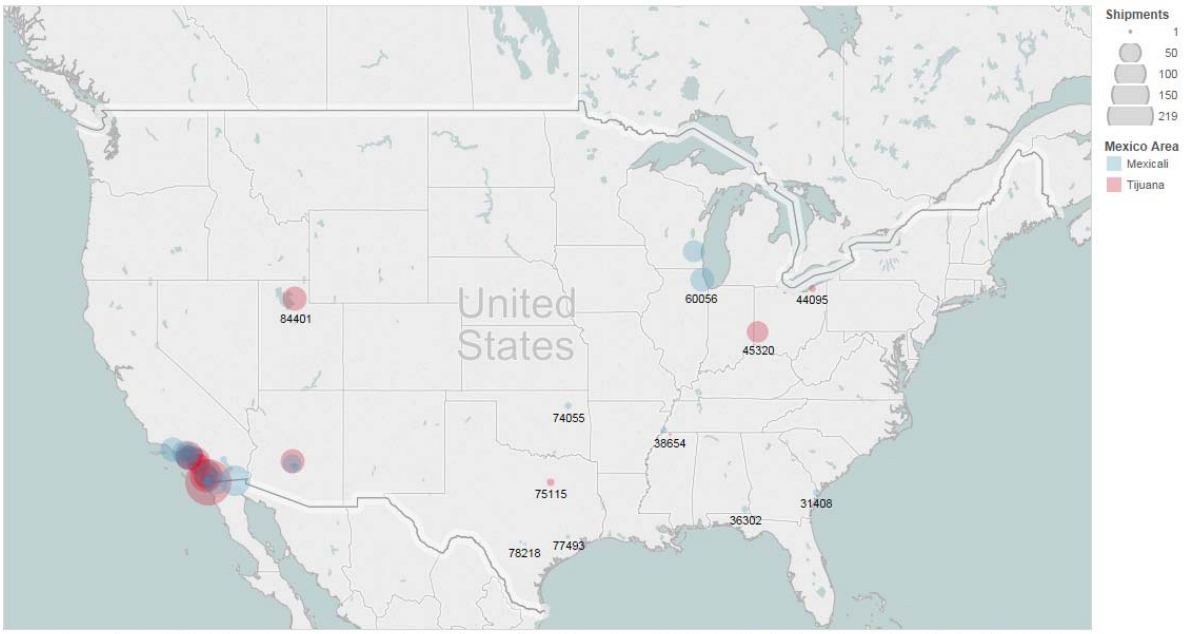
Source: HDR Analysis of Truck O-D Survey

Table 36: Top Origin Zip Codes, Southbound Shipments

Zip Code	Number of Shipments	Percentage of southbound shipments
92154	179	10%
92121	112	6%
92064	86	5%
92231	83	4%
90220	68	4%

Source: HDR Analysis of Truck O-D Survey

Figure 22. U.S. Destination of Northbound Shipments

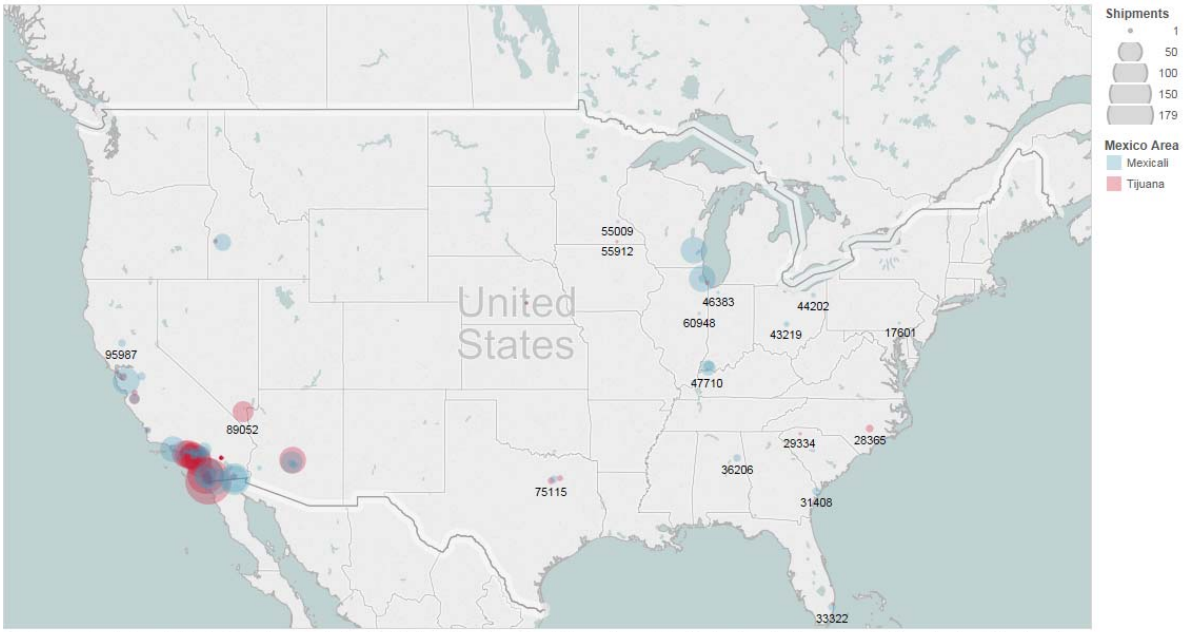


Source: HDR Analysis of Truck O-D Survey

Maps representing all U.S. origins (for southbound movements) and all U.S. destinations (for northbound movements) and are presented in Figure 22 and Figure 23. Note that in these maps the color of the circle represents the border region in Mexico where the shipment originated (for northbound trips) or ended (for southbound trips) and the size of the circle represents the number of shipments linked to each origin or destination[28]. Additional maps are presented in the Chapter Appendix.

[28] For the purpose of simplification, the border regions in Mexico were categorized as Tijuana (including Tijuana, Ensenada, Tecate and Rosarito) and Mexicali.

Figure 23. U.S. Origin of Southbound Shipments

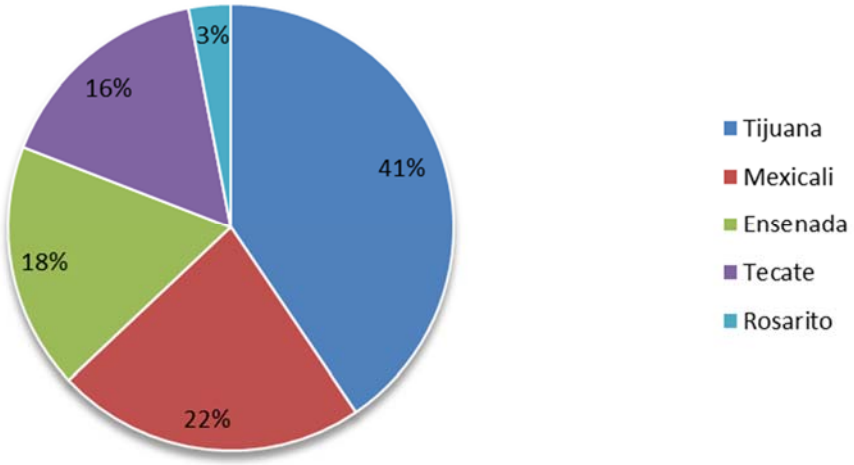


Map based on Longitude and Latitude. Color shows details about Mexico Area. Size shows Count. The marks are labeled by Location. Details are shown for Flow. The view is filtered on Flow and Mexico Area. The Flow filter keeps Southbound. The Mexico Area filter keeps Mexicali and Tijuana.

Source: HDR Analysis of Truck O-D Survey

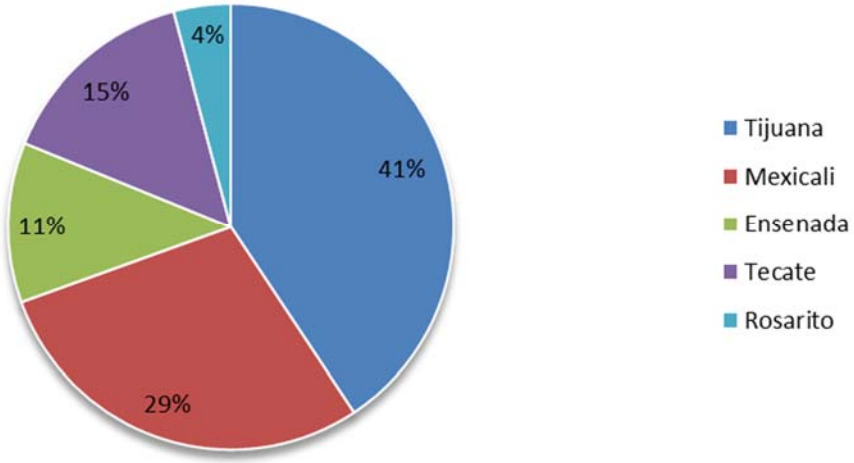
A more detailed analysis of the Mexican cities of origin for northbound shipments and destination cities in Mexico for southbound shipments shows that Tijuana was the most common city for origins and destinations for the aggregate sample, followed by Mexicali (see Figure 24 and Figure 25 below as well as additional maps and tables in the Chapter Chapter 3 Appendix).

Figure 24: Mexican City of Origin, Northbound Shipments



Source: HDR Analysis of Truck O-D Survey

Figure 25: Mexican Destination City, Southbound Shipments



Source: HDR Analysis of Truck O-D Survey

ORIGIN AND DESTINATION FACILITIES

The survey inquired about the type of facilities where shipments were being picked-up from or dropped-off at. Eighty-four percent of northbound shipments originated from a *maquiladora,* of which 76 percent were destined for a warehouse (see Table 37).

Table 37: Origin and Destination of Shipments by Type of Facility, Northbound

To (→) /From (↓)	Airport	Farm	Mfg/ Maqui-ladora	Other (Whole-saler)	Rail Yard	Retail	Seaport	Ware-house/ DC	Total
Farm	<1%	<1%	0%	0%	<1%	0%	0%	7%	8%
Mfg/Maquiladora	<1%	0%	6%	1%	0%	0%	<1%	76%	84%
Warehouse/Dc	0%	0%	0%	0%	0%	1%	0%	8%	9%
Total	1%	<1%	6%	1%	<1%	1%	<1%	91%	100%

Source: HDR Analysis of Truck O-D Survey

Among southbound shipments, warehouses were the most common origin facility, and *maquiladoras* were the most common destination.

Table 38: Origin and Destination of Shipments by Type of Facility, Southbound

To (→) /From (↓)	Farm	Mfg/ Maquiladora	Warehouse/DC	Total
Mfg/Maquiladora	0%	22%	4%	25%
Seaport	0%	<1%	3%	3%
Warehouse/DC	11%	52%	9%	72%
Total	11%	73%	15%	100%

Source: HDR Analysis of Truck O-D Survey

LAND PORT OF ENTRY

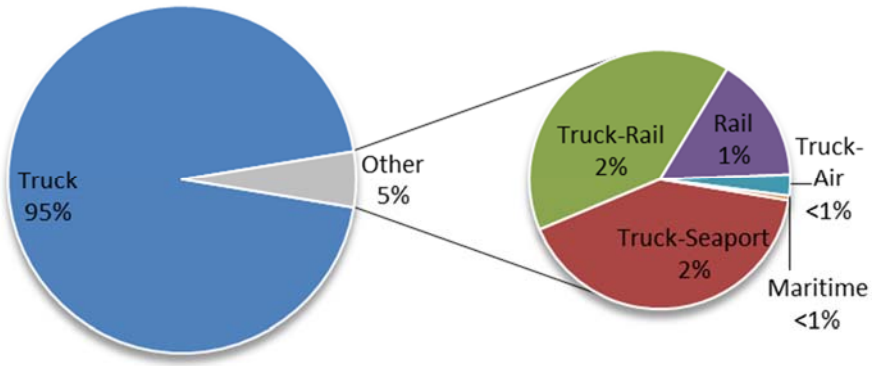
Among all shipments in both directions, the Otay Mesa Land Port of Entry (LPOE) was the most common border crossing location with 61 percent of the total sample using this border crossing. The remaining 39 percent was split between the Calexico LPOE (25 percent) and the Tecate LPOE (14 percent).

When the analysis focuses only on the LPOE used by northbound shipments, 66 percent of them used Otay Mesa to cross the border, while 21 percent used Calexico and the remaining 13 percent used Tecate. For southbound shipments, on the other hand, the use of Otay Mesa decreases slightly to 56 percent while the use of Calexico and Tecate increases slightly (to 29 percent and 15 percent respectively).

TRANSPORT MODES

Regarding the transportation mode used by border-crossing shipments, overall truck was by far the most common mode of transport (see Figure 26).

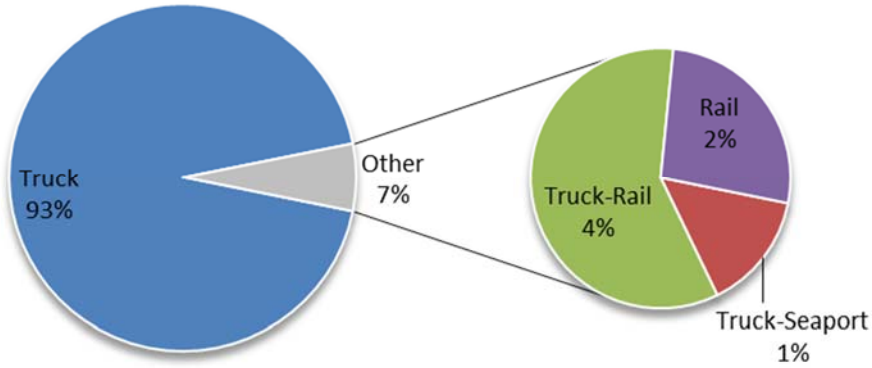
Figure 26: Transport Modes, Aggregate



Source: HDR Analysis of Truck O-D Survey

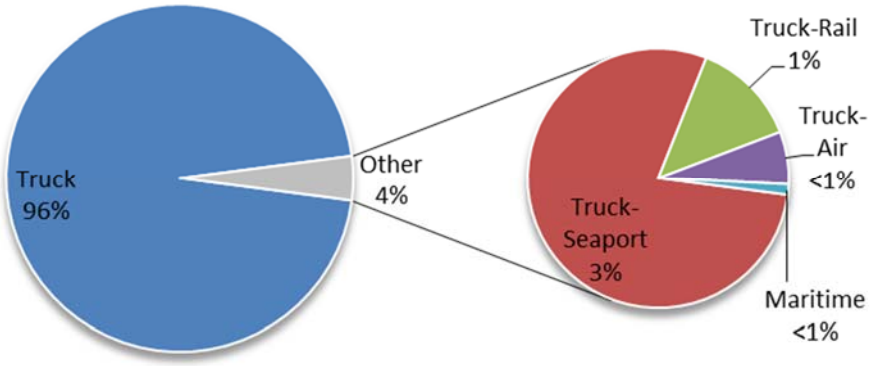
For trips that do not use truck exclusively as their transportation mode, northbound shipments were more likely to use rail, while southbound shipments were more likely to transit through a seaport (see Figure 27 and Figure 28).

Figure 27: Transport Modes, Northbound Shipments



Source: HDR Analysis of Truck O-D Survey

Figure 28: Transport Modes, Southbound Shipments



Source: HDR Analysis of Truck O-D Survey

Chapter 4: Summary of Drayage Data and Economic Impacts

Introduction

The objective of this chapter is to evaluate the information captured through the interviews with drayage operators in the region (including the collection of sample shipment data). In particular, this effort shed light on the true origins and destinations for the goods that move across the border using drayage. Using this information, an analysis of the drayage activity in the Imperial County and San Diego County region was conducted. This analysis provided a quantitative assessment of the following: primary origin and destination for cross-border drayage trips (identified by zip-code), type of location where the cross-border drayage is performed in the U.S. (classified by structure type such as warehouse, empty lot, industrial park and distribution center), cross-border drayage volumes (identified by goods type and aggregated by clusters), aggregate value of cargo transported by cross-border drayage, and current employment generated by drayage activities. Results derived from the drayage survey data in Phase II are compared to the available shipment-level and truck-intercept data collected during Phase I of this study.

Additionally, information derived from the interviews with companies specializing in drayage was assessed to estimate the economic impacts of this activity in the region through an Economic Impact Analysis (EIA).

Overview and Methodology

To gather information on the true origins and destinations for the goods that move across the border, the a critical survey focused on international shipments, regional supply chains, and the volume of goods managed by companies that cross the border was developed. Companies specializing in drayage were interviewed. Throughout the process, companies were informed that the interviews were intended to assist SCAG and the San Diego Association of Governments (SANDAG) with short and long-term Southern California/Baja California transportation infrastructure planning including regional border crossings (Otay Mesa East, Calexico), seaports (Los Angeles, Long Beach, San Diego), Southern California freeways, and Binational Rail operations. All company data are confidential and were anonymized during the data entry process to de-link responses from individual company information. Only aggregated information from multiple companies is provided in this report and no individual company details have been released[29].

Data were collected between December and June 2015 for a total of twelve (12) companies. Eight of those companies were located in Tijuana, 3 in Mexicali and 1 in Ensenada.[30]

The survey is divided into two parts. Part A focuses on company and general shipping information. Interviewees self-reported information on the following topics (meant to represent company-wide averages):

- 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;

[29] Companies were also notified that Crossborder Group was willing to sign a non-disclosure agreement if desired.
[30] This allocation is meant to capture the fact that, based on BTS border-crossing data, between 70 and 75 percent of the northbound border-crossing trips for trucks are performed through the Tijuana – San Diego border region and the remaining 25 to 30 percent are performed through the Mexicali – Calexico border region.

- 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.

On the other hand, Part B focuses on supply chain questions such as shipping routes and transport modes. Interviewees self-reported information on the following topics (meant to represent company-wide, aggregate data):

- 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) movements;
- 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).

The survey data compiled through the interviews was evaluated in order to create an overview of the state of drayage activity in the Imperial County and San Diego County region. Averages and percentages were computed through a weighted average method. The complete survey with each individual question is provided in the Chapter Chapter 4 Appendix.

Analysis of Drayage Survey Data Collected During Phase II

As mentioned in the previous section, data collected between December and June 2015 during Phase II of the study consisted of information about the drayage of goods from 12 companies engaged in goods movement across the border. Of the 12 firms surveyed, 8 were located in Tijuana, 3 in Mexicali and 1 in Ensenada. The firms participating in this survey were firms based in the Calexico – Mexicali and San Diego – Tijuana border area given the focus on studying movement of goods through Imperial County and San Diego County's Ports of Entry (LPOEs).

Part A: Company-Level Information

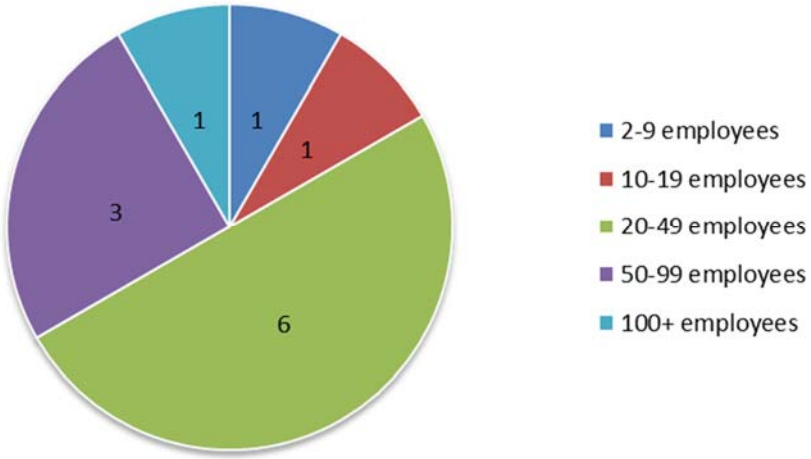
The companies interviewed were asked to self-report company-wide information on size of the company's truck fleet, number of employees working at each firm, number of border-crossing shipments performed on recent months, the share that each commodity represents of drayage movements for each company and the approximate average value of drayage cargo (see the Chapter Chapter 4 Appendix for the survey instrument used to collect this information).

With the exception of one firm (10-24 trucks), all firms surveyed had a fleet that consisted of at least 25 trucks.

CURRENT EMPLOYMENT GENERATED BY DRAYAGE ACTIVITIES

Representatives collected information on the number of employees for each company surveyed. Of the 12 firms interviewed, 2 currently employ less than 20 workers, 6 currently employ 20-49 workers, 3 currently employ 50-99 workers, and 1 employs more than 100 workers. Figure 29 below present a more detailed breakdown of current employment at drayage specialized companies (expressed in number of companies within each range of employment).

Figure 29: Number of Employees at Drayage-Specialized Companies (Number of Companies, Aggregate)



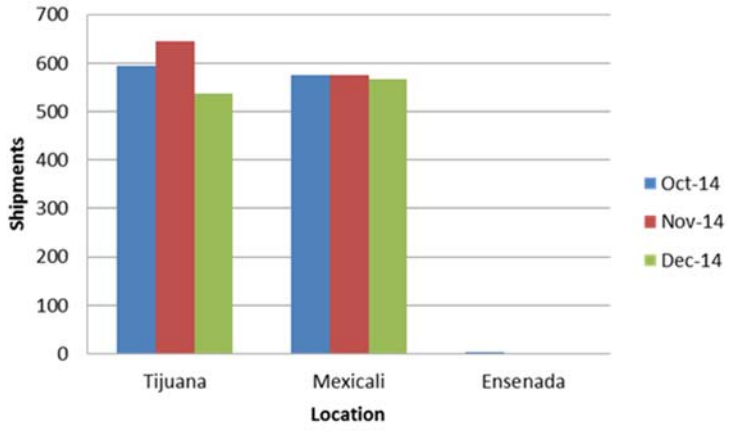
Source: HDR Analysis of Drayage Survey

Of the 8 companies located in Tijuana, 5 companies employed between 20-49 employees, 2 employed 50-99 employees and 1 had more than 100 employees. Similarly, of the 3 firms interviewed in Mexicali, 1 employed 2-9 workers, 1 employed 20-49 workers, and 1 employed 50-99 workers. For Ensenada, the firm surveyed employed 10-19 workers.

AVERAGE DRAYAGE SHIPMENTS PER MONTH

Companies were asked to estimate the approximate number of border-crossing drayage shipments they handled over the months of October, November and December of 2014 by direction of movement. The interviewed companies located in Tijuana self-reported that they sent, on average, 593 northbound drayage shipments per month during that period. Those companies located in Mexicali reported they sent, on average, 573 northbound drayage shipments per month while the company located in Ensenada sent, on average, only about 2 drayage trips per month during that three-month span. These numbers are presented in Figure 30.

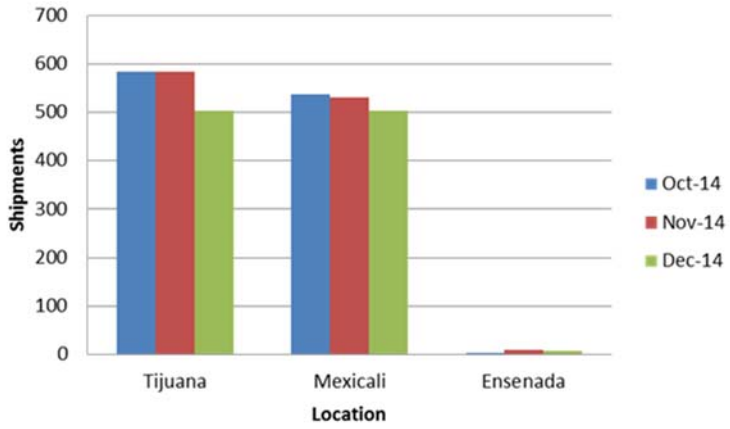
Figure 30. Average Drayage Shipments by Location and Month, Northbound



Source: HDR Analysis of Drayage Survey

The number of southbound drayage shipments was reported to be slightly lower compared to those of northbound drayage shipments as presented in Figure 31. Companies located in Tijuana reported to have sent 557 monthly southbound drayage shipments on average during the three-month period, while companies located in Mexicali reported sending, on average, 524 southbound drayage shipments per month. The company in Ensenada reported sending 7 shipments per month, on average, on southbound movements.

Figure 31. Average Drayage Shipments by Location and Month, Southbound



Source: HDR Analysis of Drayage Survey

VALUE OF CARGO TRANSPORTED BY CROSS-BORDER DRAYAGE

Companies were requested to provide the approximate total dollar value of goods for which they provide drayage services during a typical month. Of the 12 firms surveyed, 5 provided a total value, 6 did not have any information on the total value of goods, and 1 indicated a wide range as the total value varies, depending on the client. The 5 companies that provided a total value are all based in Tijuana. On average, the approximate total dollar value of cargo transported by cross-border drayage by selected companies based in Tijuana during a typical month is $12.46 million (with an average value per shipment of $21,084).

SHARE BY COMMODITY OF CROSS-BORDER DRAYAGE SHIPMENTS

Interviewed companies self-reported the company-wide percentage that different commodity cluster's shipments represent of the total cross-border drayage shipments handled by each company. This information was then aggregated using a weighted average by location and presented below, where the weights were the self-reported number of weekly shipments moved by each company. As Table 39 suggests, for northbound flows originating in Tijuana, the clusters of lighting and electrical equipment, plastics, medical devices, automotive, metal manufacturing and other consumer goods have important shares in the total of drayed shipments handled by the companies interviewed. These clusters represent over three-fourths of drayed shipments. These shares also appear to be relevant for southbound flows.

Table 39: Share of Drayage Shipments in Phase II Data for Companies Located in Tijuana

Cluster Description	Northbound Percentage	Southbound Percentage
Aerospace Vehicle and Defense	0.5%	0.0%
Agricultural Products	0.4%	0.4%
Automotive	13.3%	13.5%
Chemical Products	0.3%	0.4%

Cluster Description	Northbound Percentage	Southbound Percentage
Construction Materials	1.5%	1.2%
Forest / Paper Products	1.6%	4.1%
Furniture	0.6%	0.2%
Lighting and Electrical Equipment	16.8%	14.9%
Live Animals	0.0%	0.0%
Machinery	1.4%	0.6%
Medical Devices	14.4%	17.1%
Metal Manufacturing	11.3%	14.2%
Plastics	16.5%	14.6%
Processed Food	1.0%	0.2%
Sports & Recreation	0.0%	0.2%
Textiles / Apparel / Leather	0.9%	0.6%
Other Consumer Goods	9.2%	10.4%
Other	10.2%	7.4%
Do Not Know	0.0%	0.0%
Total	**100.0%**	**100.0%**

Source: HDR Analysis of Drayage Survey

Table 40: Share of Drayage Shipments in Phase II Data for Companies Located in Mexicali

Cluster Description	Northbound Percentage	Southbound Percentage
Aerospace Vehicle and Defense	1.3%	1.4%
Agricultural Products	0.0%	0.0%
Automotive	0.0%	1.4%
Chemical Products	0.0%	0.8%
Construction Materials	0.0%	0.0%
Forest / Paper Products	0.0%	0.8%
Furniture	0.0%	0.0%
Lighting and Electrical Equipment	46.7%	43.9%
Live Animals	0.0%	0.0%
Machinery	0.0%	0.0%
Medical Devices	0.0%	0.0%
Metal Manufacturing	0.7%	2.0%
Plastics	4.4%	5.8%
Processed Food	0.0%	0.0%
Sports & Recreation	0.0%	0.0%
Textiles / Apparel / Leather	0.0%	0.0%
Other Consumer Goods	37.6%	35.1%
Other	9.3%	8.8%
Do Not Know	0.0%	0.0%
Total	**100.0%**	**100.0%**

Source: HDR Analysis of Drayage Survey

Table 40 above indicates the self-reported weighted share of drayage shipments by commodity cluster for interviewed companies located in Mexicali. The clusters of lighting and electrical equipment, other consumer goods and other goods have important shares in drayed shipments across the border. Notice that these shares are relevant on both directions of goods movement (e.g., northbound and southbound).

Table 41: Share of Drayage Shipments in Phase II Data for Selected Companies Located in Ensenada

Cluster Description	Northbound Percentage	Southbound Percentage
Aerospace Vehicle and Defense	0.0%	0.0%
Agricultural Products	90.0%	0.0%
Automotive	0.0%	90.0%
Chemical Products	0.0%	0.0%
Construction Materials	0.0%	0.0%
Forest / Paper Products	0.0%	0.0%
Furniture	0.0%	0.0%
Lighting and Electrical Equipment	0.0%	0.0%
Live Animals	0.0%	0.0%
Machinery	0.0%	0.0%
Medical Devices	0.0%	0.0%
Metal Manufacturing	0.0%	0.0%
Plastics	0.0%	0.0%
Processed Food	0.0%	0.0%
Sports & Recreation	0.0%	0.0%
Textiles / Apparel / Leather	0.0%	0.0%
Other Consumer Goods	0.0%	0.0%
Other	10.0%	10.0%
Do Not Know	0.0%	0.0%
Total	**100.0%**	**100.0%**

Source: HDR Analysis of Drayage Survey

Agricultural products represent the largest share of northbound drayage shipments for the company based in Ensenada.[31] The importance of this cluster is only based on one-directional flow and a very small number of average monthly northbound drayage shipments. As can be seen on Table 41, based on the drayage survey data, there is no southbound drayage shipments of agricultural products. The relevant cluster is automotive, with a 90 percent share.

TYPE OF CONTAINER USED FOR CROSS-BORDER DRAYAGE SHIPMENTS

Table 42 below shows the main container types to transport drayage loads as self-reported by the interviewed companies. These types include: semi-trailers, intermodal containers, flatbeds and tankers.

Table 42: Container Types Used for Drayage Loads

Container Type	Example
Semi-Trailer	
Intermodal Container	

[31] Even though the movement of goods between Ensenada and the U.S. side of the border is not technically drayage, this company reported making a very small number of such short-haul trips that are considered internally drayage trips.

Flatbed	
Tanker	

Source: HDR's Drayage Survey

FAST PROGRAM

Certain programs are aimed at facilitating cross-border surface freight flows. The Free and Secure Trade (FAST) is a commercial clearance program for known low-risk shipment entering the U.S. from Canada and Mexico. It allows for expedited processing for commercial carriers who have completed background checks and fulfill certain eligibility requirements. FAST requires that every link in the supply chain, from manufacturer to carrier to driver to importer is certified under C-TPAT.[32]

Out of the 12 firms surveyed, 11 indicated that a share of drayage loads are shipped via the FAST program.[33] Out of the companies that use the FAST program, the percentage of drayage loads shipped via this program ranges between 75 percent and 100 percent, with the exception of one company that uses the program for only 20 percent of its shipments.

Part B: Company-Level Shipping Routes and Small Sample of Shipments

The companies interviewed were also asked to self-report company-level information on the type of location where the cross-border drayage is performed and to submit a small sample of drayage shipments for analysis of origins and destinations.

TYPE OF LOCATION WHERE CROSS-BORDER DRAYAGE IS PERFORMED

The tables below indicate the company-wide weighted averages, by type of location, where cross-border drayage is performed as reported by the interviewed companies.[34] As can be seen in Table 43, for companies located in Tijuana, the majority of cross-border drayage for northbound pickup sites is performed in Mexican-based manufactures (50.5 percent) and Mexican-based warehouses (28.4 percent). Drop-off sites for cross-border drayage on northbound trips consist primarily of U.S.-based warehouses (52.0 percent) and U.S.-based manufactures (31.0 percent). Southbound pickup sites are mainly located in U.S.-based warehouses (55.8 percent), followed by sea ports (15.1 percent) and U.S.-based manufactures (11.6 percent). Drop-off sites on southbound trips are primarily located in Mexican-based manufactures (43.5 percent) and Mexican-based warehouses (31.5 percent).

Table 43: Share of Location Type where Drayage Is Performed for Selected Companies Located in Tijuana

Location Type	Northbound Pickup Site	Northbound Drop Off Site	Southbound Pickup Site	Southbound Drop Off Site
Truck/Container Parking Lot	7.9%	8.8%	9.3%	8.8%
US-based Warehouse/3PL/Broker	0.4%	52.0%	55.8%	0.0%

[32] Customs-Trade Partnership Against Terrorism (C-TPAT) is a voluntary government-private sector partnership in which companies involved in commerce destined for the U.S. demonstrate that they have implemented enhanced security measures within their facilities and day-to-day operations to prevent terrorists and weapons of mass effect from infiltrating the supply chain.
Source: Goods Movement Border Crossing Study and Analysis, Final Report, SCAG. June 2012.

[33] The company not registered under the FAST program self-reported having the fewest number of drayage trips from all the firms interviewed.

[34] The percentages shown in the tables below correspond to weighted averages of the percentages indicated by each company, where the weight corresponds to the self-reported number of drayage shipments handled by each company on a typical week.

MX-based Warehouse/3PL/Broker	28.4%	0.0%	0.0%	33.5%
US-based Manufacturer	0.0%	31.0%	11.6%	0.0%
MX-based Manufacturer	50.5%	0.0%	0.0%	43.5%
Sea Port	7.7%	4.7%	15.1%	8.1%
Rail Yard	4.7%	3.2%	6.1%	5.0%
Airport	0.0%	0.0%	1.8%	0.0%
Other	0.4%	0.4%	0.4%	1.1%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: HDR Analysis of Drayage Survey

For firms located in Mexicali, northbound pickup sites where drayage is performed are located in two types of facilities: Mexican-based manufactures (66.7 percent) and truck and container parking lots (33.3 percent). [35] The shares by type of facilities are the same for northbound drop off sites Southbound pickup sites consist of three main location facilities: U.S.-based manufactures (44.4 percent), U.S.-based warehouses (27.8 percent) and Mexican-based manufactures (27.8 percent). Lastly, the shares by type of facilities are the same for southbound drop off sites as they are for southbound pickup sites. For Ensenada, drayage would appear to be entirely performed in U.S.-based manufactures but in reality the shares reported correspond to those of the one interviewed company.[36]

Table 44: Share of Location Type where Drayage Is Performed for Selected Companies Located in Mexicali

Location Type	Northbound Pickup Site	Northbound Drop Off Site	Southbound Pickup Site	Southbound Drop Off Site
Truck/Container Parking Lot	33.3%	33.3%	0.0%	0.0%
US-based Warehouse/3PL/Broker	0.0%	0.0%	27.8%	27.8%
MX-based Warehouse/3PL/Broker	0.0%	0.0%	0.0%	0.0%
US-based Manufacturer	0.0%	0.0%	44.4%	44.4%
MX-based Manufacturer	66.7%	66.7%	27.8%	27.8%
Sea Port	0.0%	0.0%	0.0%	0.0%
Rail Yard	0.0%	0.0%	0.0%	0.0%
Airport	0.0%	0.0%	0.0%	0.0%
Other	0.0%	0.0%	0.0%	0.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: HDR Analysis of Drayage Survey

Table 45: Share of Location Type where Drayage Is Performed for Selected Companies Located in Ensenada

Location Type	Northbound Pickup Site	Northbound Drop Off Site	Southbound Pickup Site	Southbound Drop Off Site
Truck/Container Parking Lot	0.0%	0.0%	0.0%	0.0%
US-based Warehouse/3PL/Broker	0.0%	0.0%	0.0%	0.0%
MX-based Warehouse/3PL/Broker	0.0%	0.0%	0.0%	0.0%
US-based Manufacturer	100.0%	100.0%	100.0%	100.0%
MX-based Manufacturer	0.0%	0.0%	0.0%	0.0%
Sea Port	0.0%	0.0%	0.0%	0.0%

[35] As described by the companies interviewed, these correspond primarily to parking lots of manufacturing firms which are somewhat detached (though adjacent) to the main facility. In previous studies these locations had been classified under "manufacturer."

[36] For northbound flows, drayage loads are picked up in Mexico (i.e. Baja California) and are dropped off in U.S. (i.e., California); however in some cases, companies interviewed reported "US-based Manufacturer" as a pickup site. Our understanding is that the companies interviewed reported the location of the parent company where drayage is performed, which is in the U.S., despite the fact that the pickup site is actually in Mexico. The reasoning is similar for southbound flows where companies interviewed report "US-based Manufacturer" as a drop-off site.

Rail Yard	0.0%	0.0%	0.0%	0.0%
Airport	0.0%	0.0%	0.0%	0.0%
Other	0.0%	0.0%	0.0%	0.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: HDR Analysis of Drayage Survey

PICK-UP AND DROP-OFF LOCATIONS OF CROSS-BORDER DRAYAGE TRIPS

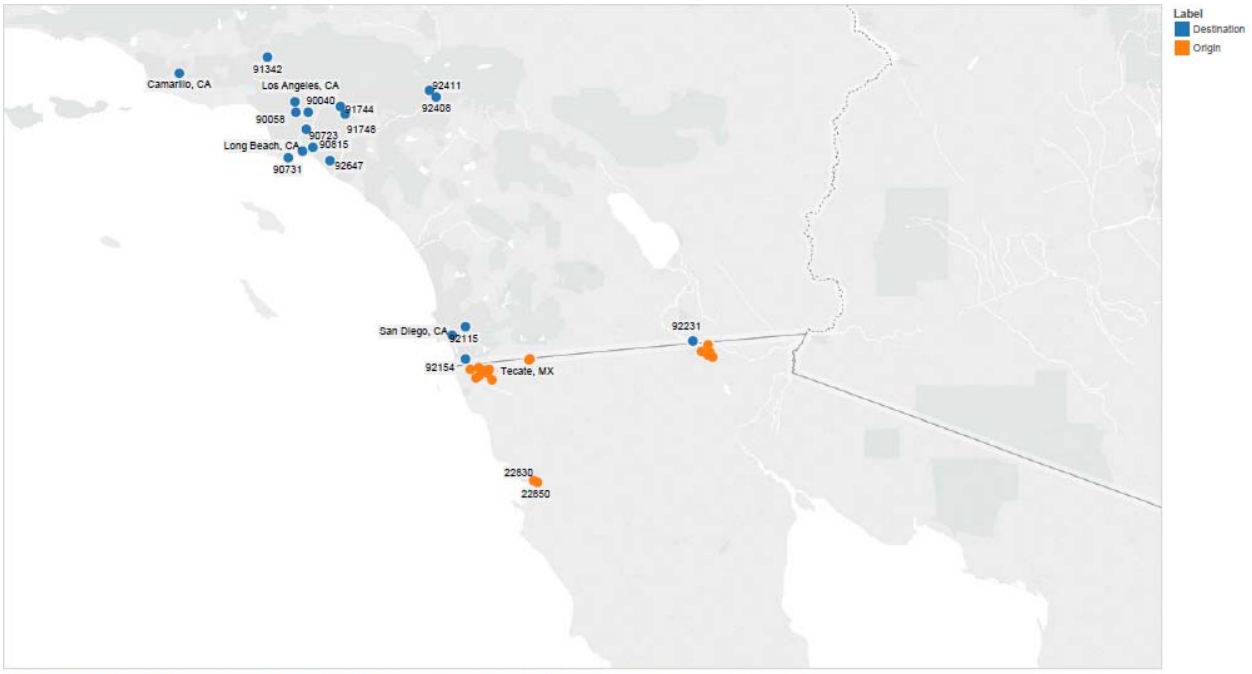
Companies were asked to provide 10 representative pairs of zip codes for pick-up and drop-off locations of drayage for each direction of movement (i.e., 10 for northbound and 10 for southbound shipments). The total number of zip-code pairs reported was 44 for northbound drayage shipments and 40 for southbound drayage shipments. Locations were either provided by zip code, by city, or by state.

The maps below indicate the locations where drayage trucks pick-up and drop-off containers/loads for typical northbound and southbound border crossing trips. A complete table with a list of pickup and drop-off location for northbound and southbound flows is provided in the Chapter Chapter 4 Appendix section. As can be seen from maps below, drayage movements occur primarily along the California-Baja California border[37]. Northbound drayage movements typically begin in Baja California, Mexico on a site close to the border and finish close to the border in California, whereas southbound drayage movements begin in California on a location close to the border and conclude in Baja California, Mexico, in a location also close to the border.

Furthermore, drayage shipment-level data contained information on the number of shipments (weekly and monthly), type of commodities being transported as well as the direction of movement (northbound and southbound). Using this information, companies were aggregated into 3 *zones* based on their location. The results for this aggregation for goods are presented in the tables below[38].

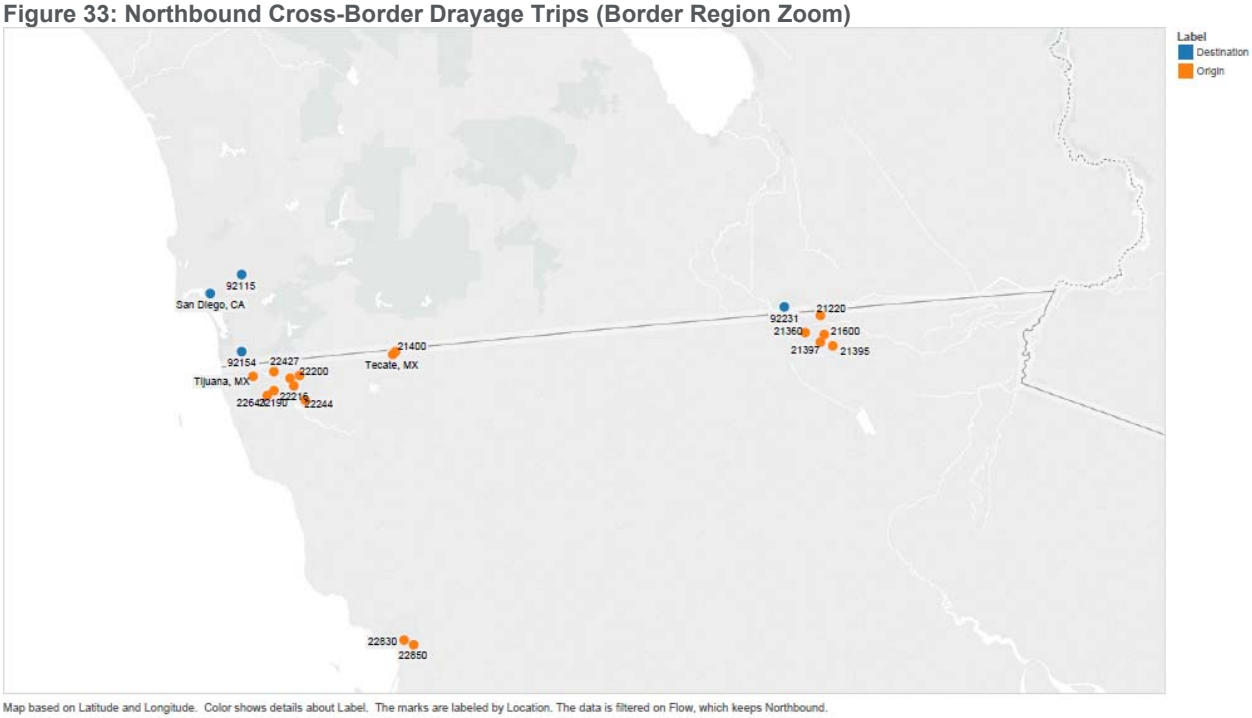
Figure 32: Northbound Cross-Border Drayage Trips (Southern California Zoom)

[37] For northbound shipments, in some cases, companies indicated the presence of long-haul drayage movements that begin in Baja California, Mexico and conclude in locations such as Wisconsin, Georgia, and Mississippi in the U.S. A map that indicates long-haul drayage movements (drop-off sites in the U.S.) in addition to movements that occur primarily along the California-Baja California Border is presented in the Chapter 4 Appendix section.
[38] Note that percentages in tables and charts below may not equal 100 percent due to rounding.



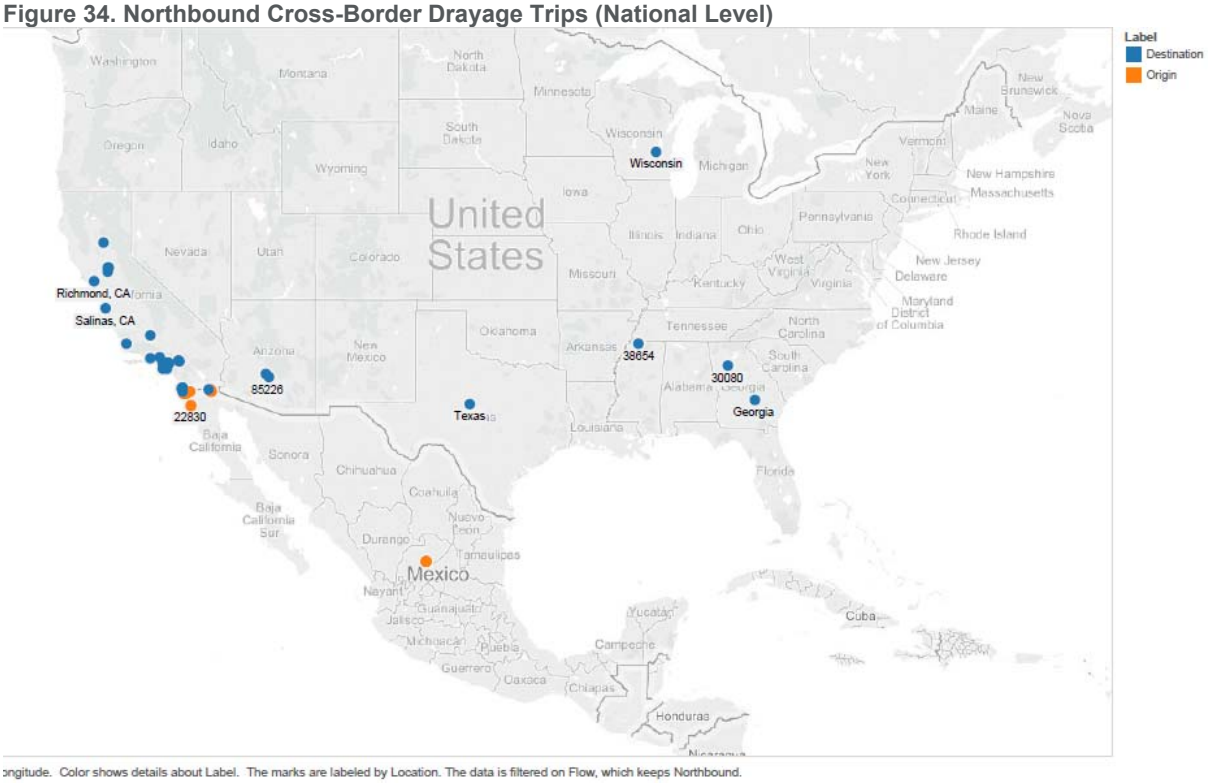
Source: HDR Analysis of Drayage Survey

Figure 33: Northbound Cross-Border Drayage Trips (Border Region Zoom)



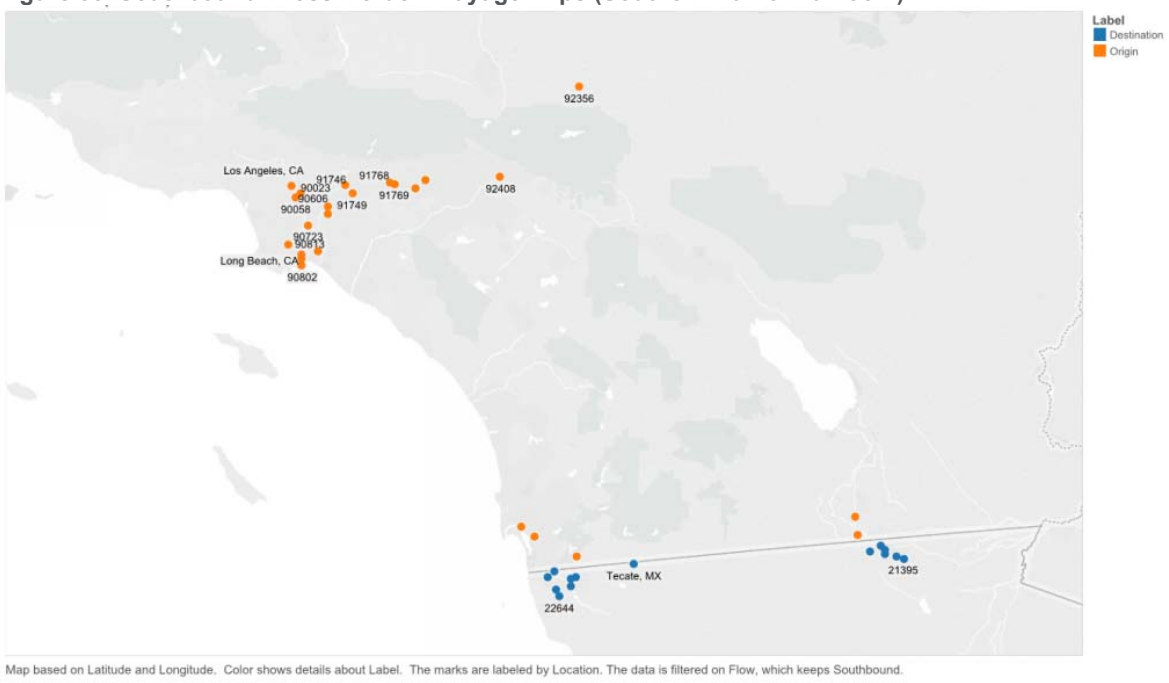
Source: HDR Analysis of Drayage Survey

Figure 34. Northbound Cross-Border Drayage Trips (National Level)



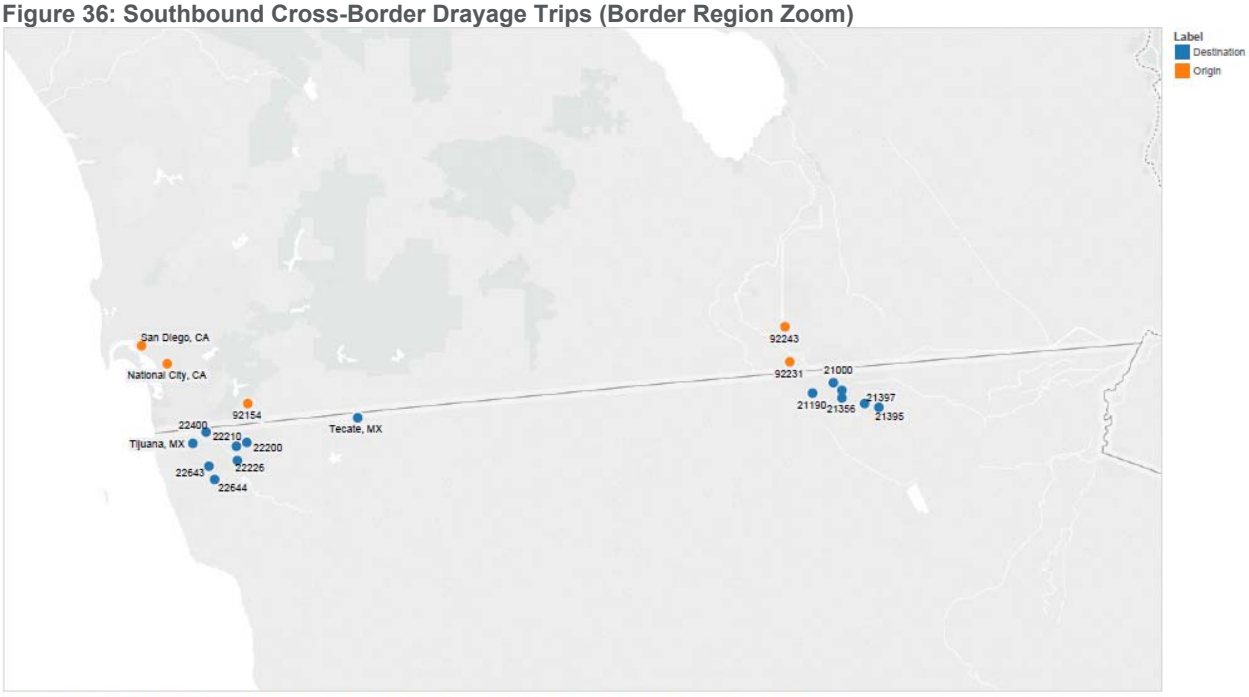
Source: HDR Analysis of Drayage Survey

Figure 35. Southbound Cross-Border Drayage Trips (Southern California Zoom)



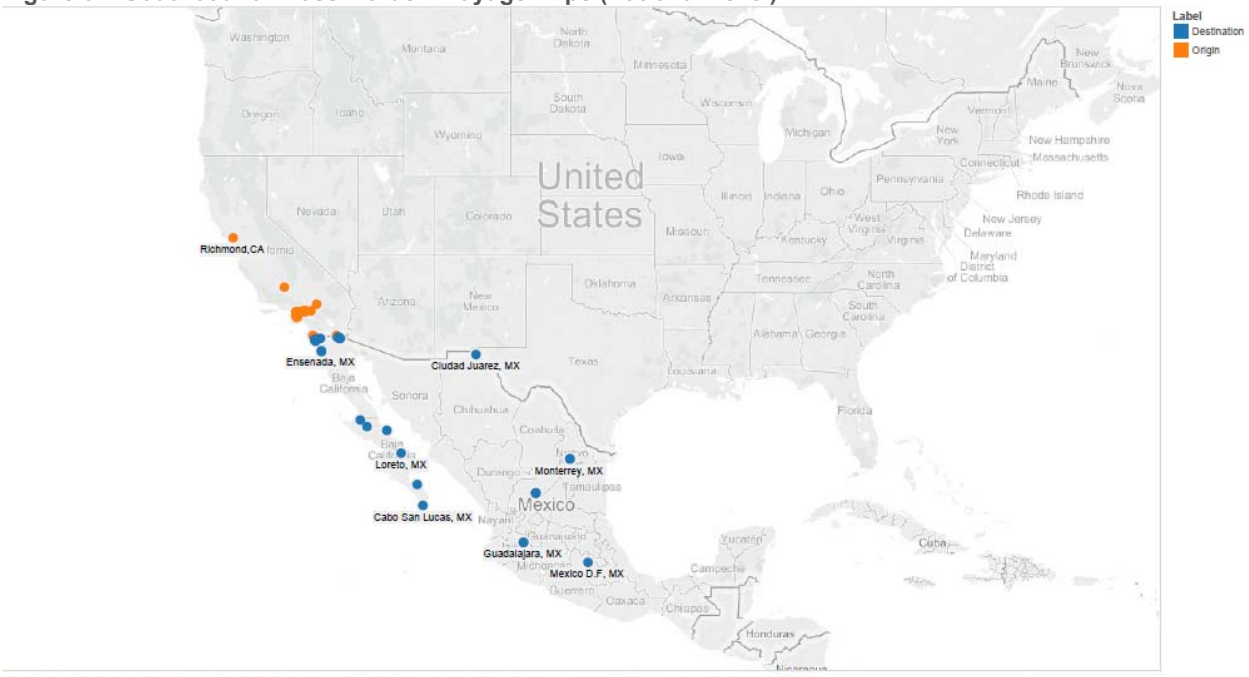
Source: HDR Analysis of Drayage Survey

Figure 36: Southbound Cross-Border Drayage Trips (Border Region Zoom)



Source: HDR Analysis of Drayage Survey

Figure 37: Southbound Cross-Border Drayage Trips (National Level)



Source: HDR Analysis of Drayage Survey

Comparison of Analyzed Drayage Data with Phase I Results

Phase I of the goods movement border crossing study presented results from the Origin – Destination (O-D) surveys for northbound shipments only. A summary of total flows was provided first, followed by estimates disaggregated by mode, by commodity, and where available, by origin and destination. The O-D survey conducted during Phase I of the report was designed to provide a better understanding of how and where goods are shipped as estimates derived from the U.S. Department of Transportation, Bureau of Transportation Statistics, Transborder Surface Freight Data do not have any information on the origin and destination (O-D) of imported goods. Data on O-D pairs were collected from the following sources:

- Shipment information provided by manufacturing companies and custom brokers; and
- Truck information obtained via intercept surveys at the Calexico Port of Entry (POE).

However, unlike Phase II of the study, a specific survey related solely to drayage activities was not considered to be a key element of the study. However, during Phase I, it was noticed that drayage is a common element of the logistic chains in the region, notably for northbound trips. Overall, the results of Phase I of the study show that approximately 60 percent of northbound shipments were drayage related whereas less than 50 percent of shipments were drayage related in the opposite direction (see Table 47). Overall, Phase I found that 55.4 percent of shipments were drayage loads. Drayage continues to remain prominent in the transportation of goods across the border, as can be seen from results derived from the drayage survey in Phase II of the study.

The table below shows the preferred equipment to transport goods across the border. Phase II, found that on average, the majority of loa ds are shipped via semi-trailers (64 percent) compared to only 15 percent in Phase I, where the preferred equipment, based on sample data, was the truck with box (56 percent). In Phase II, this equipment accounted for 3 percent at most. A significant amount of the difference in the findings of the two phases can be traced to the fact that during Phase I the survey did not specialize in collecting data from drayage companies as did the survey during Phase II. The Phase I data was collected from companies that generate border-crossing flows whereas the Phase II data presented here was collected exclusively from drayage companies, for which semi-trailers are known to be their main type of equipment.

Additionally, Phase II found that, for northbound flows, the primary origin of goods movement is manufacturing firms. Similarly, the main destination facility for these flows is warehouses. For southbound flows, manufacturing firms and warehouses are the main types of originating facilities while manufacturing firms are the primary destination. These findings are consistent with those from Phase I.

Table 46: Equipment Used to Transport Goods Across the Border, Aggregate Shipments

Container Type	Phase I	Phase II
Semi-Trailer	15%	64%
Intermodal Container	6%	18%
Flatbed	10%	13%
Tanker	1%	2%
Other[39]	68%	3%
Total	**100%**	**100%**

Source: HDR Analysis of Phase I and Phase II surveys

Table 47: Use of Drayage Shipments, by Direction of Trade Flow

[39] Other consists of: truck with box, van, and pickup truck.

Drayage	Northbound Percentage	Southbound Percentage	Aggregate Percentage
Yes	59.6%	48.5%	55.4%
No	38.4%	51.5%	44.4%
N/A	2.0%	0.0%	0.2%
Total	**100.0%**	**100.0%**	**100.0%**

Source: Goods Movement Border Crossing Study and Analysis, Final Report, SCAG. June 2012.

Economic Impact Analysis (EIA)

In addition to the O-D survey, the contribution of the drayage industry to the regional economy was assessed using the IMPLAN® system, an input-output based regional economic assessment modeling system owned by the IMPLAN Group LLC.[40]

Types of Effect

Traditionally, economic impact analysis involves the estimation of three types of effect, commonly referred to as direct effect, indirect effect and induced effect:

- **Direct effect** – Refers to the economic activity occurring as a result of direct spending or hiring by businesses or agencies located in the study area (e.g., number of people employed in the drayage industry);
- **Indirect effect** – Refers to the economic activity resulting from purchases by local firms who are the suppliers to the directly affected businesses or agencies (e.g., spending by suppliers of drayage firms); and
- **Induced effect** – Represents the increase in economic activity, over and above the direct and indirect effects, associated with increased labor income that accrue to workers (of drayage firms and all their suppliers, in this case) and is spent on household goods and services purchased from businesses within the impact area.

The total economic impact is simply the sum of these direct, indirect and induced effects. Note that the indirect and induced effects are sometimes referred to as multiplier effects since they can make the total economic impact substantially larger than the direct effect alone.

Impact Metrics

Typically, economic impacts are measured in terms of industry output, value added, employment, and tax revenue (at the federal and state/local levels). While output is the broadest measure of economic activity and refers to the total volume of sales, value added is the value a company adds to a product or service. It is measured as the difference between the amount a company spends to acquire it and its value at the time it is sold to other users. Therefore, value added can be thought of as a measure of the contribution to the gross domestic product (GDP) made by an establishment or an industry. The total value added within a region is equivalent to the gross regional product and includes employee compensation, proprietary income, other property type income (e.g., rents received on property) and indirect business taxes (e.g., sales tax).

With respect to employment, two impact metrics are calculated: labor income and jobs. Labor income includes employee compensation and proprietary income. Employee compensation, in turn, consists of wage and salary payments as well as benefits (health, retirement, etc.) and employer paid payroll taxes (employer side of social security, unemployment taxes, etc.). Proprietary income consists of payments received by self-employed individuals (such as doctors and lawyers) and unincorporated business owners.

[40] For more information on the IMPLAN® system, visit http://www.implan.com/.

The job impact measures the number of jobs created for a full year. These impacts should not be interpreted as full-time equivalent (FTE) as they reflect the mix of full- and part-time jobs that is typical for each industry. And, strictly speaking, they should not be interpreted as permanent jobs either, but rather as job-years. A job-year can be defined as one person employed for one year, whether part-time or full-time.

Economic Modeling

The IMPLAN® system consists of a software package and data files that are updated every year. The data files include transaction information (intra-regional and import/export) on 517 private industry sectors (corresponding to four- and five-digit North American Industry Classification System [NAICS] codes) and data on more than 20 different economic variables, including employment, output and value added. For this study, the IMPLAN® system was populated with the most recent data available (2013) for the area comprising Imperial County and San Diego County.

The first step in the economic impact analysis was to determine the direct effect (in terms of spending or employment). The number of employees in the drayage industry in the impact area is not available directly from the IMPLAN® database, and therefore was derived using the following calculations:

6. The total number of employees in the truck transportation industry (IMPLAN® sector 335; NAICS code 484) in the impact area was obtained from the IMPLAN® study area data;
7. The total number of firms in the truck transportation industry and in the drayage industry was obtained from ReferenceUSA®; and
8. The average number of employees in the truck transportation industry was then applied to the number of firms in the drayage industry.

The estimated number of employees in the drayage industry in the impact area and the inputs used to derive that estimate are shown in Table 48 below.[41]

Table 48: Estimation of the Number of Employees in the Drayage Industry

Variable	Value
Total employment in truck transportation	11,672
Number of firms in truck transportation	967
Average number of employees per firm in truck transportation	12
Number of drayage companies	159
Estimate of the number of employees in the drayage industry	**1,919**

Sources: IMPLAN® and ReferenceUSA.

This estimate of the number of employees in the drayage industry was then used as an input to the truck transportation industry in the IMPLAN® model[42] to estimate the corresponding direct output effect, which was, in turn, used to calculate the indirect and induced effects on the regional economy. Since the original IMPLAN® data were reported for the year 2013, the analysis results were ultimately adjusted for inflation to be expressed in 2015 dollars.

Analysis Results

Overall, when accounting for the multiplier effect, the total contribution of the drayage industry to regional employment in 2013 is estimated at 3,496 jobs (or 0.2 percent of regional employment). These employees

[41] Even though a breakdown of these effects between the San Diego and Imperial Counties was out of the scope of this study, a high-level calculation based on the number of jobs in the truck transportation sector in each county adjusted for the relative difference in output multiplier for that particular sector results in an allocation of 90% of the impacts to San Diego County and the remaining 10% of the impacts to Imperial County.
[42] It is assumed that the drayage industry has a spending pattern similar to that of the truck transportation industry.

earned a combined $104.2 million in labor income and generated about $510.5 million in output, including $253.1 million in value added. Federal, state and local tax revenues generated by the drayage industry totaled $58.0 million.

The direct employment effect (1,919 jobs in the drayage industry) represented 56 percent of the total employment effect, while the indirect and induced employment effects represented 24 percent and 21 percent of the total respectively.

A summary of the impact results associated with the drayage industry is provided in Table 49 below. The results are broken down by impact metric (output, value added, labor income, employment and taxes) and by type of effect (direct, indirect, induced and total).

Table 49: Contribution of the Drayage Industry to the Imperial County and San Diego County Economy (2013)

Impact Metric	Direct	Indirect	Induced	Total
Output	$284.0	$124.8	$101.8	$510.5
Value Added	$115.8	$74.8	$62.4	$253.1
Labor Income	$104.2	$47.0	$34.9	$186.2
Employment	1,919	834	743	3,496
Taxes	-	-	-	$58.0
Federal Taxes	-	-	-	$37.2
State/Local Taxes	-	-	-	$20.8

Notes: All dollar amounts are expressed in millions of 2015 dollars. State and local tax impacts are combined and cannot be separated within IMPLAN®. Totals may not add due to rounding.

A complete tax impact report (by tax and institution) is provided in the Chapter Appendix on page 4-229.

Chapter 5: Freight Flow Projections in Baseline Scenario

Introduction

The objective of this chapter is to present and evaluate the baseline forecast of future cross-border freight flows in the region. Projections of freight flows were derived through a time-series analysis of historic cross-border freight flows, with data collected from publicly-available sources and used in a statistical model to forecast overall border crossings in the study area based on socioeconomic variables that affect this type of traffic[43].

Cross-border freight volumes were primarily distributed across multiple transportation modes (truck or rail) and by direction of flow (import/northbound or export/southbound). The baseline projections of aggregate flows by mode and direction were developed for the 2015 – 2040 period, in compliance with the requirement of SCAG's 2016 – 2040 Regional Transportation Plan / Sustainable Communities Strategy. Additionally, baseline projections for aggregate drayage flows were evaluated. Aggregate projections of freight flows were then refined using information from the origin destination surveys to assign specific freight flow estimates to different geographies across the study area. This disaggregation was performed for the forecast of freight flows transported by truck (including drayage). On the United States side, the disaggregation was made at the subregional level[44] using well-defined geographies that maintain consistency with previous analyses of infrastructure capacity performed by SCAG such as the Statewide Goods Movement Action Plan and the Multi-County Goods Movement Action Plan.

This report presents the results of the baseline border-crossing freight forecasts. It begins with, an overview of the forecasting analysis and definition of the baseline scenario, followed by a discussion of the methodology used and the resulting projections.

Overview

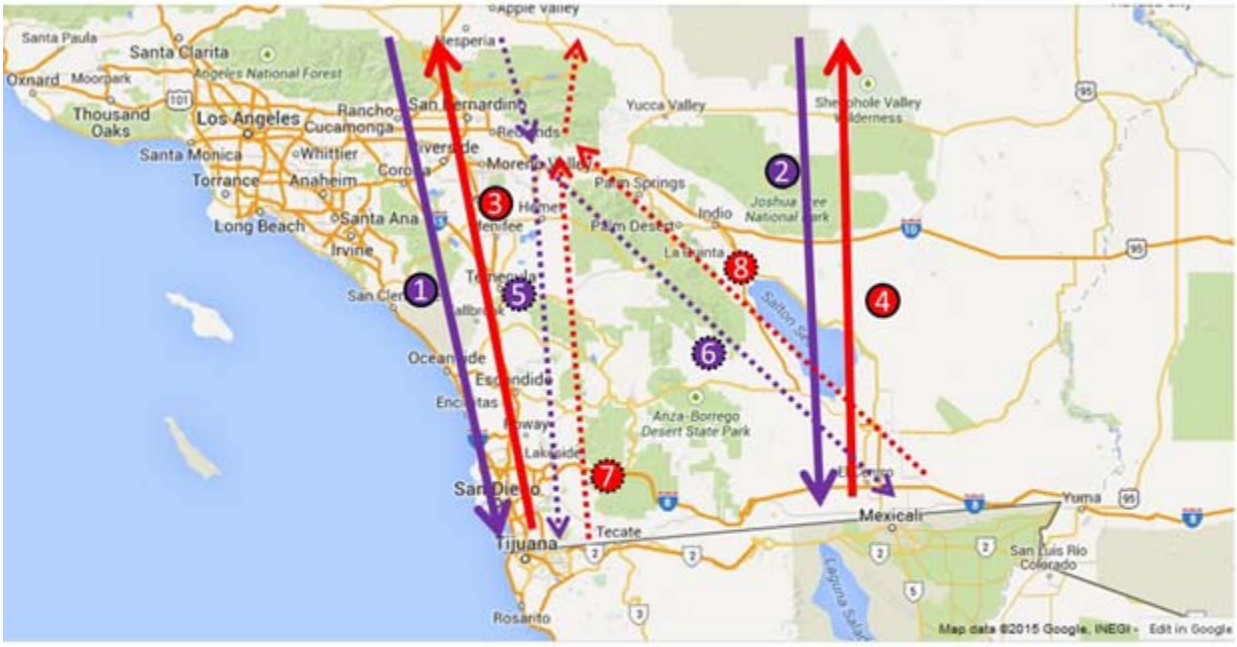
A forecasting model that projects the aggregate level of goods movements between four (4) main Origin-Destination (O-D) zones in the study area was developed. These zones were: (a) Tijuana and Tecate (border crossing points with the San Diego Association of Governments (SANDAG) region), (b) Mexicali (as the border-crossing point with Imperial County), (c) San Pedro Bay Ports (location for waterborne international trade with the SANDAG and SCAG regions), and (d) Other domestic (U.S.) locations different from the San Pedro Bay ports.

The addition of an intermediate/relay zone (close to the Riverside/San Bernardino area) where warehousing activities are concentrated in the SCAG region results in a series of movements depicted in Figure 38 and

[43] Please refer to Overview section for further information.
[44] These subregions are referred as "SuperZones".

Figure 39, which capture the different types of interactions between the four main O-D zones and the warehousing/relay zone. For simplicity, these movements have been categorized as "inland-related" movements (that capture the movement of goods that do not begin or end in the San Pedro Bay ports) and "seaport-related" movements (those that begin or end in the San Pedro Bay ports). The forecasting model projects the aggregate level of goods movement between the main four zones by transportation mode, by direction, and by goods category (or cluster). Furthermore, the model includes the estimation of the shares of these movements that are conducted using drayage[45].

Figure 38: Inland-Related Flows for SCAG Goods Movement Study



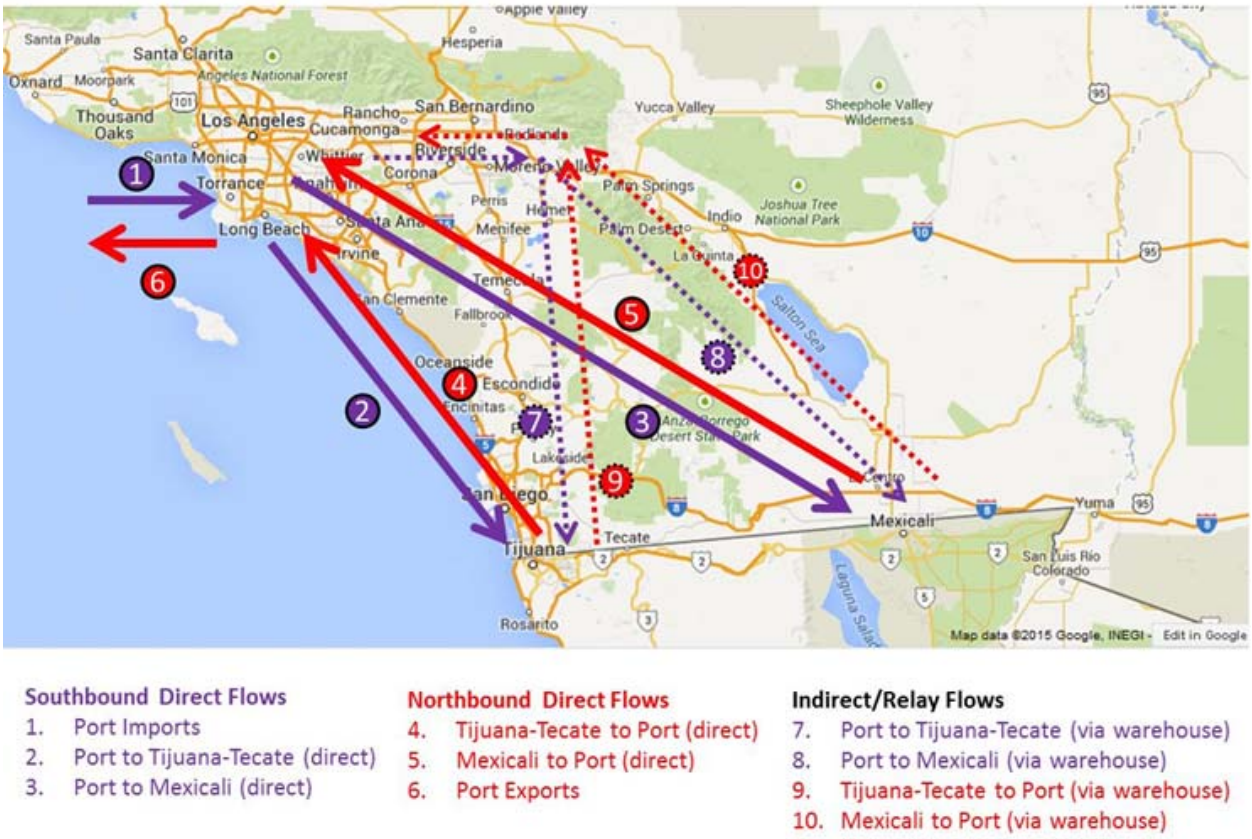
Southbound Direct Flows
1. Exports to Tijuana-Tecate (direct)
2. Exports to Mexicali (direct)

Northbound Direct Flows
3. Imports through Tijuana-Tecate (direct)
4. Imports through Mexicali (direct)

Indirect/Relay Flows
5. Exports to Tijuana-Tecate (via warehouse)
6. Exports to Mexicali (via warehouse)
7. Import through Tijuana-Tecate (via warehouse)
8. Import through Mexicali (via warehouse)

[45] We used information from the cargo generator surveys to disaggregate the estimated volumes into specific O-D pairs and data from the drayage surveys to estimate the share of volume that uses this particular transportation method.

Figure 39: Seaport-Related Flows for SCAG Goods Movement Study



Southbound Direct Flows
1. Port Imports
2. Port to Tijuana-Tecate (direct)
3. Port to Mexicali (direct)

Northbound Direct Flows
4. Tijuana-Tecate to Port (direct)
5. Mexicali to Port (direct)
6. Port Exports

Indirect/Relay Flows
7. Port to Tijuana-Tecate (via warehouse)
8. Port to Mexicali (via warehouse)
9. Tijuana-Tecate to Port (via warehouse)
10. Mexicali to Port (via warehouse)

The study of goods movement in the binational area includes the analysis of flows at a Port of Entry (POE) level based on both geography and entry/exit mode. In particular, the study defines the following as the relevant POEs: San Diego – Tijuana[46] Land POEs (including Tijuana – Tecate), Calexico – Mexicali[47] Land POE, and the seaports of Los Angeles, Long Beach, and San Diego. Additionally, the total movement of goods between the U.S. and Mexico that use the transportation network in the SCAG or SANDAG regions (i.e., international trade flows) is divided into the following modal categories: inland-truck, inland-rail, port-truck, and port-rail.

Definition of Baseline Scenario

[46] San Diego – Tijuana can also be referred to as San Diego County.
[47] Calexico – Mexicali can also be referred to as Imperial County.

The model generates projections of international goods movement for a set of pre-defined scenarios.[48] The definition of the scenarios is based on two primary considerations:

- Forecast of nationwide socio-economic conditions that impact the volume of goods crossing the border (in terms of the forecasted values of the U.S. Index of Industrial Production and of U.S. Retail Sales, which were found to be the main drivers of goods movement across the border using an econometric analysis); and
- Expectations regarding the future development of local and regional border-crossing events that directly affect the flow of cross-border goods, such as the development of border infrastructure projects and policies affecting international trade in the California – Baja California region.

Each scenario is, therefore, the combination of an expected socio-economic profile at the "macro" level and the anticipated development of a series of "micro" events in the California-Baja California region. This chapter focuses on the description and results of the baseline scenario, defined at a very high level as the scenario that reflects the most-likely future "macro" conditions (in terms of the forecasted values of the U.S. Index of Industrial Production and of U.S. Retail Sales) and the most-likely progression of "micro" events (such as infrastructure projects, border-crossing operations, regional production capabilities and international trade policies in the California – Baja California region). A more detailed description of the socio-economic conditions and the border-crossing events that define this baseline scenario is provided below.

Aggregate Socio-Economic Conditions ("Macro" Component)

An analysis of historical border-crossing flows in the study area found that the U.S. Index of Industrial Production (IIP) and the dollar value of U.S. Retail Sales are good predictors of the number of aggregate, northbound border-crossing trucks in the region.[49] Therefore, these two indicators were used to define the baseline scenario from a socio-economic conditions perspective.

Multiple data sources were used to determine the future value of each one of the two socio-economic variables identified to affect border-crossing truck volumes in the region. The future values of these indicators define the baseline for the "macro" component in the future. The data sources used are listed in Table 50. They include both official (public) sources, as well as commercially available data.

Table 50: Data Sources Used in Traffic Growth Model

Variable Name	Historical Data Source(s)	Forecast Source(s)
U.S. Retail Sales	U.S. Department of Commerce (Census Bureau)	California Finance Department; California Department of Transportation, Economic Analysis Branch; and HDR Analysis
U.S. Index of Industrial Production	U.S Federal Reserve	Moody's Analytics

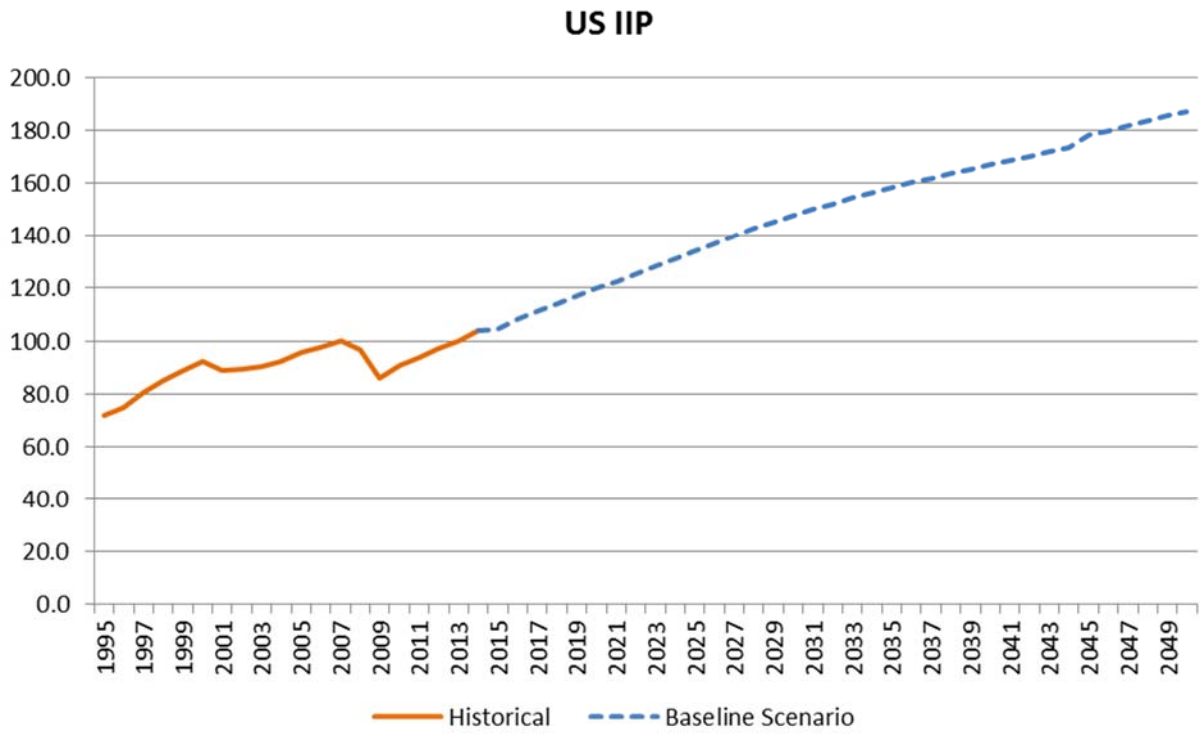
Source: HDR

However, these sources had to be screened to eliminate overly-optimistic forecasts that predicted a strong economic recovery in the U.S. in the near future. Therefore, the border-crossing volumes transported by

[48] In addition to the baseline scenario presented in this chapter, two other alternatives are considered in this study: high-volume scenario and low-volume scenario. For information on the high and low-volume scenarios, please refer to Chapter 8 of this report.
[49] See the Econometric Analysis Section in this report for more information on this relation.

truck presented in this study are considered to be conservative.[50] A graphical representation of the historical and future values for these two variables, which represent the baseline scenario for the "macro" components, is presented below.

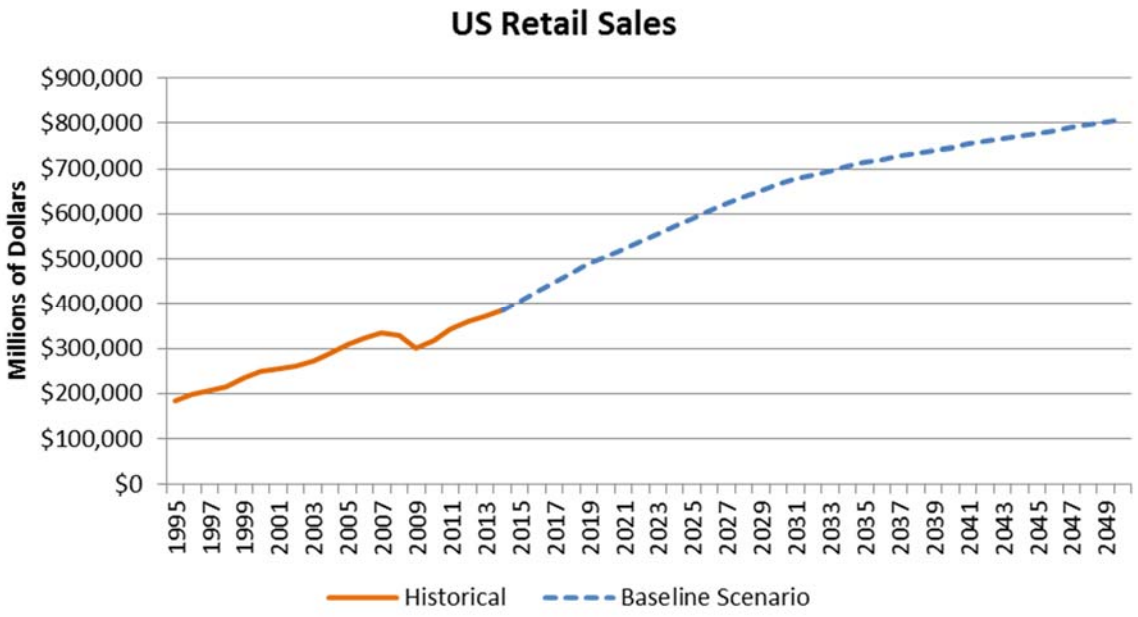
Figure 40: U.S. Index of Industrial Production (IIP) Projections in Baseline Scenario



Source: HDR Analysis of data collected[51].

Figure 41: U.S. Retail Sales Baseline Projections in Baseline Scenario

[50] Note that for this study, historical data for U.S. Retail Sales and the U.S. Index of Industrial Production was used for values until 2014 and the forecasted values for these inputs from 2015 until 2040.
[51] Please refer to Table 50 for a list of the data sources used.



Source: HDR Analysis of data collected[52].

In the baseline scenario, the U.S. IIP is anticipated to grow at an average annual rate of 1.6 percent between 2015 and 2050 and U.S. Retail Sales are anticipated to grow at an average annual rate of 2.1 percent during that same period.[53] These forecasted growth rates represent a conservative outlook on the future of the U.S. economy since the historical annual growth rates observed for these same indicators during the 1995-2014 period are 2.0 percent for U.S. IIP and 4.0 percent for U.S. Retail Sales.[54]

The baseline forecasts presented above become the explanatory variables in the development of a socio-economic based (i.e., "macro-based") forecast for the number of trucks crossing the border in the baseline scenario. This is done by combining the appropriate forecasted input variable with the coefficients resulting from an econometric analysis of historical border-crossing data that captures the impact of socio-economic changes on border crossing volumes[55].

Regional Border-Crossing Events ("Micro" Component)

After forecasting the baseline number of trucks crossing the border scenario using the "macro" components, the baseline scenario is further refined by adding relevant "micro" components. These "micro" components were found to be important to goods movement across the California – Baja California border region through an analysis of the responses to the economic trends surveys conducted as part of this study.

These "micro" components became the foundation for the development of "micro-based" adjustment factors to the "macro-based" forecasts described in the previous section. The "micro-based" set of adjustment factors are derived using information on the anticipated progress/development of certain border-crossing

[52] Please refer to Table 50 for a list of data sources.
[53] See the Chapter 5 Appendix for a table with the historical values and the forecasts for these two variables under the different scenarios considered in this study.
[54] The conservative nature of these projections is directly related to the uncertainty surrounding the performance of the global economy over the medium-to-long term due to sustained low oil prices and the slowdown of growth in China, which could have a significant impact on the performance of the U.S. economy.
[55] The econometric analysis produces the "structural parameters" (or coefficients) for the U.S. Index of Industrial Production and the U.S. Retails Sales that are used in the forecast of northbound border-crossing trucks and is described in the Chapter 5 Appendix of this report.

events found to be relevant to the flow of goods across the border region. These "micro-based" factors modify the "macro-based" forecasts by increasing or decreasing the "macro-based" baseline number of trucks that are anticipated to cross the border.

In order to develop the "micro-based" adjustment factors, it is necessary to first define the baseline scenario with respect to these "micro" events. This definition was made using the following logic:

- Identification of individual events that define the "micro" characteristics of different scenarios;
- Classification of those events into "impact categories" based on how they affect the movement of goods across the border;
- Assessment of likelihood of occurrence of each event in the baseline scenario; and
- Assessment of impact on key border-crossing characteristics of each event included in the baseline scenario.

IDENTIFICATION OF EVENTS THAT DEFINE THE SCENARIOS

The information used to identify the events (or "characteristics") that define the different scenarios from a "micro" perspective is derived from an analysis of the economic trends surveys collected as part of this study and the information collected via interviews with companies that have large supply-networks in the region.

The events identified from those two sources were aggregated into four broad categories: 1) infrastructure; 2) border-crossing operations and processes; 3) regional production capability (including near-shoring); and, 4) policy. The list of events identified during the interviews and the surveys and their placement into the four different categories is presented in Table 51 .

Table 51. List of "Micro" Events Identified Through the Interview and Survey Processes

Category	Event
Infrastructure	• Expansion of the port of Ensenada • Construction of an intermodal facility in Tijuana • Construction of cold-storage facilities in Imperial County • Reconstruction of the Desert Line (railroad) • Congestion at the ports of Los Angeles/Long Beach • Modernization of short-line between Tijuana and Tecate, including expansion of freight yards in San Ysidro and Tijuana (railroad) • Expansion of capacity at the Land Ports of Entry (LPOEs) in San Luis Rio Colorado • Construction of Otay Mesa East LPOE • Repurposing of Hotville airport to handle freight
Border-Crossing Operations	• Higher efficiency in LPOEs in California compared to those in Arizona • Introduction of pre-inspection & other technology-based operational improvements at California LPOEs
Regional Production Capability[56]	• Relocation of cargo-generating companies from China to Tijuana and Mexicali due to quality concerns (particularly furniture cluster) • Relocation of suppliers of large maquiladoras to Tijuana and Mexicali • Manufacturing activities in Tijuana and Mexicali involve larger share of high-volume activities

[56] Even though interviewees did not specifically identify the performance of current and future trade agreements (such as the TPP) in their responses, the events listed under this category correspond to direct manifestations of the performance of these trade agreements. As a result, trade agreements were not explicitly analyzed in this study.

Policy	• Baja California State policy to retain and expand maquiladoras in region • Baja California State policy to promote relocation (to the area) of companies supplying to maquiladoras • Mexico's Federal policy to promote domestic suppliers to maquiladoras • Mexico's Federal fiscal incentives policy towards maquiladoras

Source: HDR Analysis of Economic Trends Survey and Interviews with Companies

IMPACT OF INDIVIDUAL EVENTS ON KEY CHARACTERISTICS OF BORDER-CROSSING FLOWS

Each of the events listed in Table 51 was analyzed and classified into different "impact categories" based on the anticipated impact each event could have on three key elements of border-crossing flows: 1) O-D patterns; 2) modal distribution; and 3) mix of border-crossing cargo (or cluster mix)[57]. The resulting classification of events is presented in Table 52.

Table 52. Anticipated Impacts of "Micro" Events on Border-Crossing Flows

Category	Event	Changes in O-D patterns	Modal shares	Cluster trade mix
Infrastructure	Expansion of the port of Ensenada	X		X
	Construction of an intermodal facility in Tijuana	X	X	X
	Construction of cold-storage facilities in Imperial County	X		X
	Reconstruction of the Desert Line (railroad)	X	X	X
	Congestion at the ports of Los Angeles/Long Beach	X		
	Modernization of short-line between Tijuana and Tecate, including expansion of freight yards in San Ysidro and Tijuana (railroad)	X	X	X
	Expansion of capacity at the Land Ports of Entry (LPOEs) in San Luis Rio Colorado	X		X
	Construction of Otay Mesa East LPOE	X		
	Repurposing of Hotville airport to handle freight	X	X	X
Border-Crossing Operations	Higher efficiency in LPOEs in California compared to those in Arizona	X		
	Introduction of pre-inspection & other technology-based operational improvements at California LPOEs	X		X
Regional Production Capability	Relocation of cargo-generating companies from China to Tijuana and Mexicali due to quality concerns (particularly furniture cluster)	X		X
	Relocation of suppliers of large maquiladoras to Tijuana and Mexicali	X		X

[57] These three elements were identified by the study team to be critical elements in assessing the use of the regional transportation network and therefore are included in the border-crossing volume forecasting model developed for this study.

Category	Event	Changes in O-D patterns	Modal shares	Cluster trade mix
	Manufacturing activities in Tijuana and Mexicali involve larger share of high-volume activities	X		X
Policy	Baja California State policy to retain and expand maquiladoras in region	X		X
	Baja California State policy to promote relocation (to the area) of companies supplying to maquiladoras	X		X
	Mexico's Federal policy to promote domestic suppliers to maquiladoras	X		
	Mexico's Federal fiscal incentives policy towards maquiladoras	X		

Source: HDR Analysis of Economic Trends Survey and Interviews with Companies

EVENTS THAT DEFINE BASELINE SCENARIO

An analysis of the events and impacts listed in Table 52 was conducted in order to assess the likelihood of those events occurring with a high degree of certainty in the baseline scenario. As a result of this analysis, only the following events were included in the baseline scenario:

- Construction of Otay Mesa East LPOE
- Congestion at the ports of Los Angeles/Long Beach (LA/LB)

The construction of the Otay Mesa East LPOE was included due to the progress-to-date reported by SANDAG that indicates the project will be built and operational in the next few years. The congestion at the ports of LA/LB was assessed to be an almost-certain event by the project team due to the current volumes observed and the future forecasts of volumes handled by the port (in particular containers).

IMPACT OF EVENTS INCLUDED IN BASELINE SCENARIO

An analysis of these two events shows that it is unlikely that they will change significantly the observed O-D patterns, modal distributions and cluster mix of traded goods. The construction of the Otay Mesa East LPOE will cause a "shift" on the entry-point for truck-transported goods by a couple of miles east (compared to the current situation at Otay Mesa) and will generate a small amount of induced truck-based trade volumes through the San Diego region due to the anticipated reduced wait times at this new facility. On the other hand, congestion at the ports of Los Angeles/Long Beach in the baseline case is not anticipated to be severe enough to divert cargo to other ports in the region or to alternative maritime routes.[58]

Methodology and Forecast Results

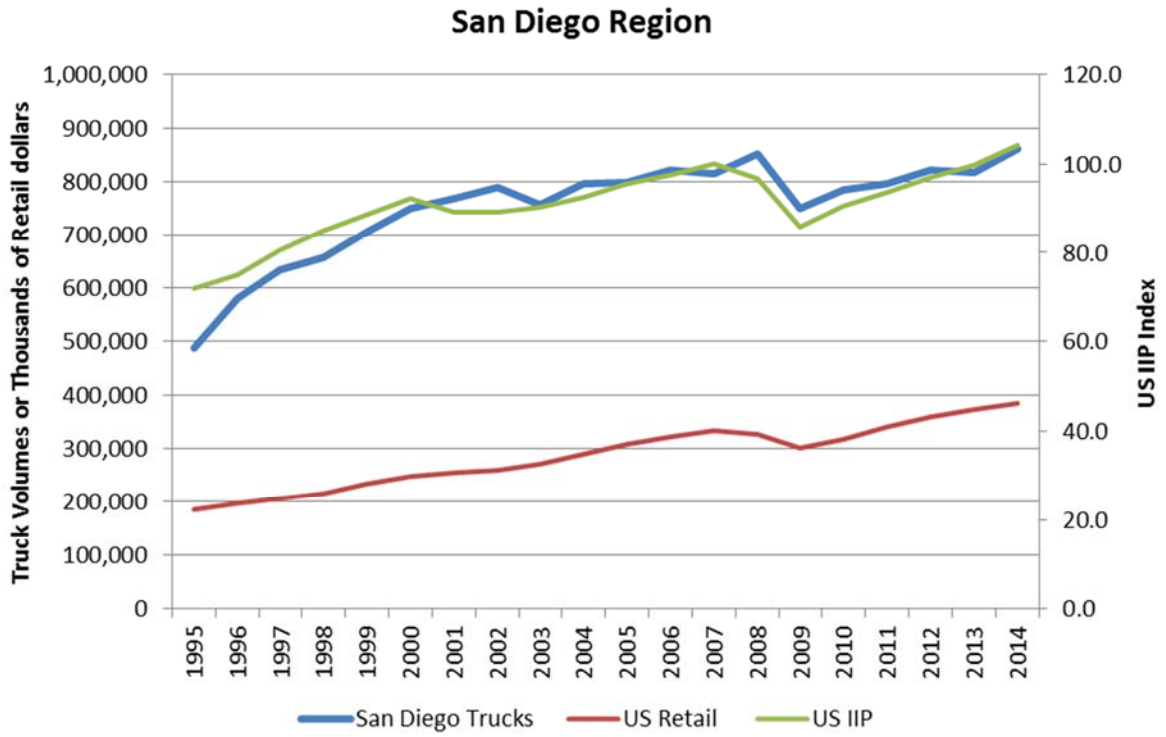
The methodology to forecast border-crossing goods movement flows consists of two main steps: (i) estimation of goods movement flows in each border-region area by direction and mode; and, (ii) breakdown of those aggregate forecasts into movements linked to port operations and movements not linked to port operations. The first step is conducted using an econometric analysis that relies on high-level socio-economic inputs while the second step consists of an accounting exercise that uses shipment-level data to perform the appropriate flow allocations.

Econometric Analysis

[58] Refer to the Methodology and Forecast Results section for additional information on O-D patterns, modal shares and cluster shares.

The first step in the econometric analysis consisted on identifying variables that help explain the behavior of border-crossing truck volumes in the border region. To do this, a high-level statistical analysis was conducted between the historical values of northbound border-crossing truck volumes and two measures of economic activity: annual total value of retail sales in the U.S. and the annual index of industrial production in the U.S.[59] The analysis showed a strong correlation between the variables at a regional level, providing support for the use of these variables in the forecast. A graphical representation of the historical correlation is presented in Figure 42 and Figure 43 for each one of the different border areas.

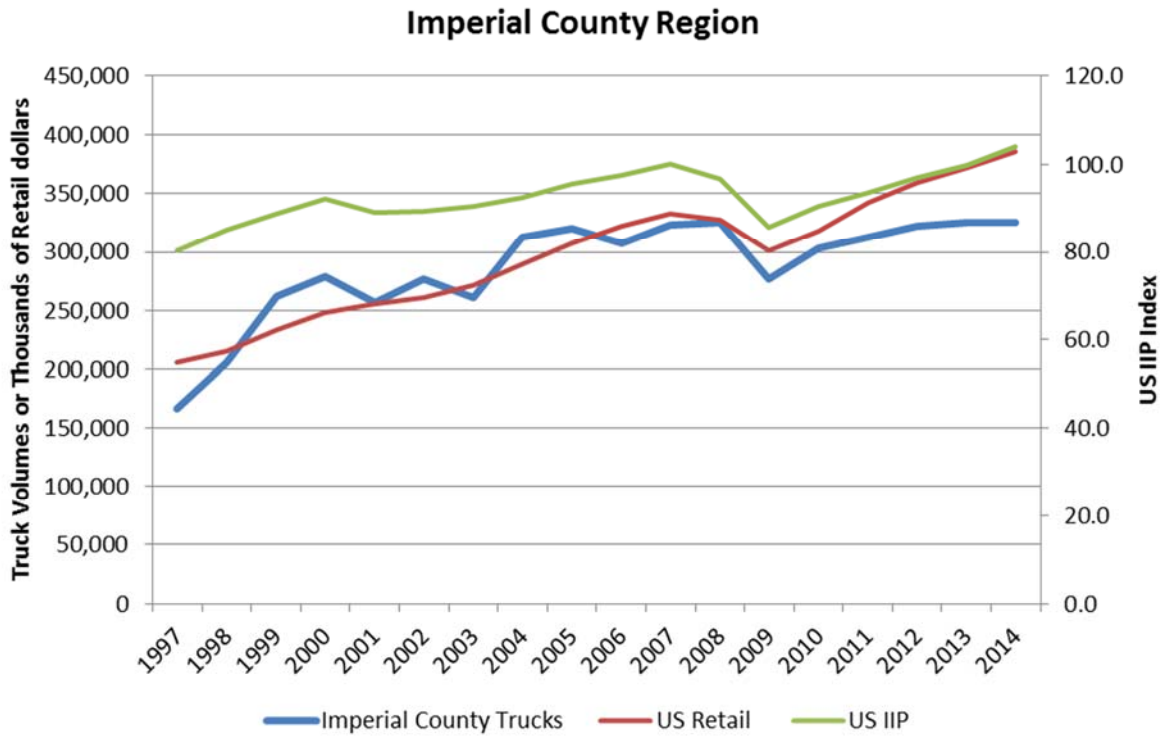
Figure 42. Graphical Representation of Historical Correlations in San Diego Region



Source: HDR Analysis of data collected.

[59] A traffic and revenue analysis conducted by HDR for the new Otay Mesa East LPOE in the San Diego-Tijuana border region found these variables explain the historical volumes of northbound border-crossing trucks from a socio-economic perspective.

Figure 43. Graphical Representation of Historical Correlations in Imperial County Region



Source: HDR Analysis of data collected.

As a result, the econometric analysis used in this study to estimate the future number of truck border-crossings consisted on finding the relation between northbound border-crossing truck movements in each specific region analyzed (San Diego – Tijuana and Calexico – Mexicali) and the annual total value of retail sales in the U.S. and the annual index of industrial production in the U.S. In particular, the econometric procedure estimated the structural relations (i.e., value of coefficients) existing between the explanatory variables and the number of border-crossing trips by truck in the northbound direction for each region using historical data.[60]

The structural relations found through the econometric analysis were combined with projections of future values for the explanatory variables to produce the forecasted number of northbound border-crossing trips by truck in each region. The future values of explanatory variables were collected from several sources[61] and subjected to a risk-analysis process to identify low, high and medium forecasted values that were used to develop the different forecasts. In particular, the medium forecasts of the explanatory variables were used to generate the baseline scenario forecasts described in this memorandum.

Truck and Rail Projections

This section presents the results of the forecasting exercise in four different subsections, each one of them related to a specific combination of mode used to cross the border and flow-generator (inland vs. port). As such, the four methodologies and results presented are:

- Inland-truck forecasts
- Inland-rail forecasts

[60] The results of the econometric regression are presented in the Chapter 5 Appendix of this report.
[61] See Table 50 for a list of sources.

- Port-truck forecasts
- Port-rail forecasts

A final subsection consists of the estimation of drayage flows for truck border-crossing movements. Drayage movements were found to be important in the supply chains in the California – Baja California border region and therefore require to be quantified as part of this study.

The methodology used to generate the freight forecasts varies for each of the different border-crossing modes analyzed (truck and rail) but relies on two principles: (i) forecasting aggregate, mode-wide movements by direction of flow for each of the two border-crossing regions analyzed (San Diego – Tijuana and Calexico – Mexicali, separately); and, (ii) disaggregate each border region's aggregate volumes into border-crossing movements generated by the ports in the San Pedro Bay area (identified in this study as "port flows") and border-crossing movements not generated by the ports (identified as "inland flows").

From the perspective of forecasting aggregate flows for a specific mode (truck or rail), the methodologies vary slightly due to the differing availability of data and the ability to identify structural parameters linking border-crossing movements to socio-economic indicators. In the case of trucks, an aggregate forecast of northbound truck border-crossing movements at each border region was created using the structural factors found through the econometric analysis and forecasted "macro" conditions and "micro" adjustment factors.[62] In the case of rail, an aggregate forecast of northbound rail border-crossing movements in each border region was developed using historical data combined with forecasts of future freight growth rates in the region produced by the Freight Analysis Framework version 3 (FAF3) data set. For both truck and rail, aggregate northbound flows for each mode and border region were assumed to be equal to aggregate southbound flows, due primarily to a lack of reliable data to quantify southbound flows but also to the fact that an imbalance of these flows would not be sustainable in the long-run.

Mode-wide forecasts were separated into inland flows versus port flows at each border region using available data on port throughput whose origin or destination is in the Tijuana or Mexicali areas. This data was used to generate port-based flow forecasts for each mode, which were then subtracted from the aggregate forecasts described in the previous paragraph to estimate the corresponding inland flows.

INLAND-TRUCK PROJECTIONS

Inland-truck projections capture truck-based movements originating in Mexico and crossing the border through the Southern California (SoCal) Land POEs to a destination in the U.S. other than the San Pedro Bay ports (in the northbound direction) as well as movements that originate in the U.S. (other than the San Pedro Bay ports) and cross the border through the SoCal Land POEs to a destination in Mexico (in the southbound direction).

The analysis is conducted for northbound and southbound flows of goods for the San Diego – Tijuana region (including LPOEs at Otay Mesa and Tecate) and the Calexico – Mexicali region (including the LPOE at Calexico East). The historical number of northbound trucks crossing the border was collected from the Bureau of Transportation Statistic's (BTS) Crossing/Entry data from 1995 to 2014 for the LPOEs at Otay Mesa, Tecate and Calexico East. Additionally, goods movement flows (in tonnage) were collected by commodity and mode for inland entries and exits in the relevant border area from the FAF3 database (FAF3 data was collected for the years 2007 and 2012). The forecasts developed for this study begin in 2015 and span until 2040. For analytical purposes, commodities were matched into 27 clusters identified previously[63].

[62] See the section on Definition of Baseline Scenario in this report for details on forecasted "macro" conditions and "micro" adjustment factors.
[63] For more information, refer to Chapter 1 and the U.S. Cluster mapping website: http://clustermapping.us/cluster

Southbound flows of goods are not consistently recorded and therefore, on an annual basis, the historical and forecasted number of trucks crossing the border in the southbound direction was assumed to be identical to those crossing on the northbound direction. However, the cluster shares of these two movements do differ in this study as data from FAF3 is available for both directions. Using freight volumes (historical and forecasts), the number of trucks crossing the border were derived via land for each year and by cluster. Note that because the cluster shares are provided in tonnage in the FAF3 database, they were adjusted using an average density of tons per truck in each cluster to estimate the cluster shares in terms of number of trucks[64].

In an attempt to correct the shortcomings of publicly available border-crossing forecasts[65], An econometric model was developed to forecast the total number of northbound truck border crossings through the San Diego – Tijuana and Calexico – Mexicali regions in future years. The model is similar to that used in the SR-11 Investment Grade Traffic and Revenue Study for SANDAG, which uses regional socioeconomic explanatory variables to explain the number of trucks crossing the border through the estimation of structural relations between them.[66]

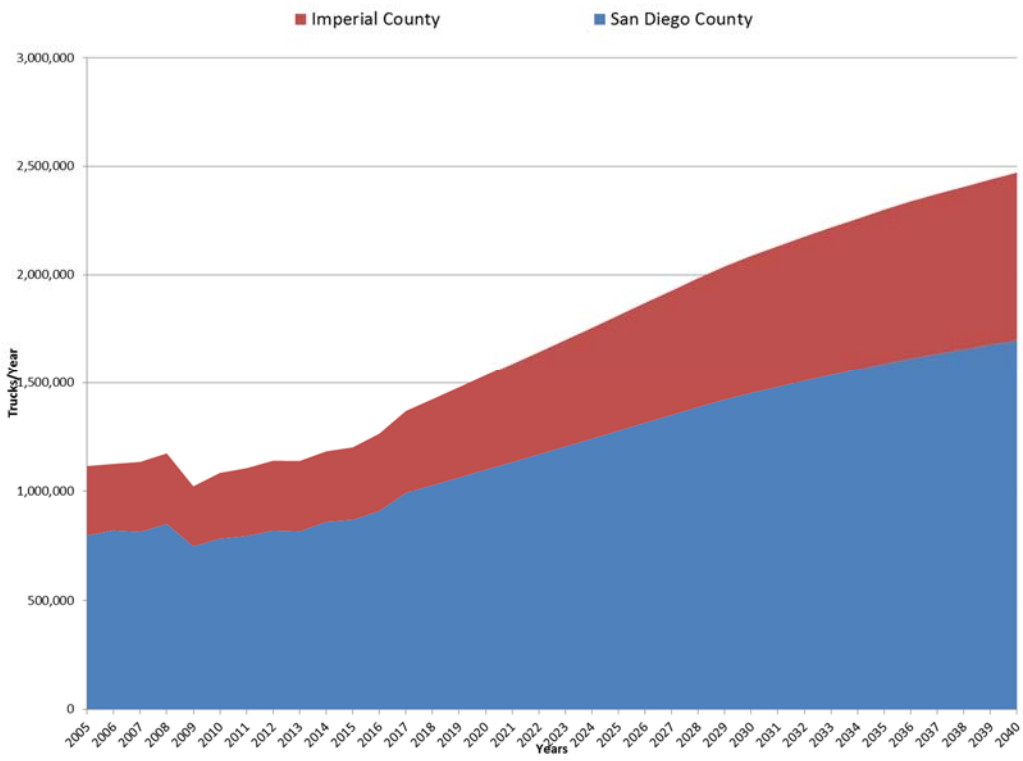
To generate the number of northbound and southbound crossings by inland-truck, several computations were required:

- Derive annual forecasts of aggregate truck volumes crossing at the Southern California (SoCal) Land POEs in each direction and for each one of the relevant study regions of San Diego County and Imperial County[67] using the structural relations estimated in this study. Notice that forecasted southbound aggregate flows will equal forecasted northbound aggregate flows for any future year.
- By definition, the aggregate truck volumes forecasted in each region can be broken down into the four types of flows described in the Overview section of this report.
    - Northbound forecasted truck volumes at each region can be divided into: (a) trips that originate in Mexico and are destined to locations in the U.S. excluding the San Pedro Bay ports; (b) trips that originate in Mexico, enter the U.S. and are then exported to a foreign country through the San Pedro Bay Ports.
    - Southbound forecasted truck flows at each region can be divided into: (c) trips that originate in the U.S., excluding the San Pedro Bay Ports, that are destined for Mexico; (d) trips that originate in a foreign country, enter the U.S. through the San Pedro Bay ports and are then transported into Mexico.
- The forecast of inland-truck volumes corresponds to flows (a) and (c), with (a) representing northbound inland-truck flows and (c) representing southbound inland-truck flows. Hence, it is necessary to exclude truck forecasts that are related to the San Pedro Bay Ports from the aggregate forecasts generated in the fist bullet point.
- A forecast for the number of trucks in scenarios (b) and (d)[68] was developed. These volumes are subtracted from the total truck volumes for each corresponding direction and in each region that were generated through the econometric model. This subtraction allows the estimation of inland-truck projections.

[64] The source for the parameters used in this adjustment is the SANDAG Motor Carrier study.
[65] Since FAF data was deemed to be inaccurate to predict future border-crossing truck trips (forecasts are rather exponential), the econometric approach described in this section was used in this study.
[66] See the Econometric Analysis section of this report for a description of how the structural coefficients were estimated.
[67] Also called the San Diego – Tijuana and Calexico – Mexicali regions, respectively.
[68] See Port-Truck Projections subsection in this report.

Figure 44 shows the baseline inland-truck volumes projections for Imperial County and San Diego County for northbound flows[69]. For northbound flows, inland-truck volumes are projected to grow at a faster pace in Imperial County than in San Diego County throughout the forecasting period (overall growth of 96 percent and 132 percent for San Diego County and Imperial County, respectively). However, the total number of truck border crossings is considerably higher in San Diego County (almost 1.7 million forecasted in 2040 for San Diego County as opposed to more than 770 thousand forecasted in Imperial County for that same year).[70]

Figure 44: Forecasted Inland-Truck Volumes – Northbound, Baseline Scenario



Source: SCAG Forecasting Model

INLAND-RAIL PROJECTIONS

These projections capture rail-based movements that originate in Mexico and cross the border through the SoCal Land POEs to a destination other than the San Pedro Bay ports in the U.S. (northbound flows) as well as movements that originate in the U.S. (other than the San Pedro Bay ports) and cross the border through the SoCal Land POEs to a destination in Mexico (southbound flows).

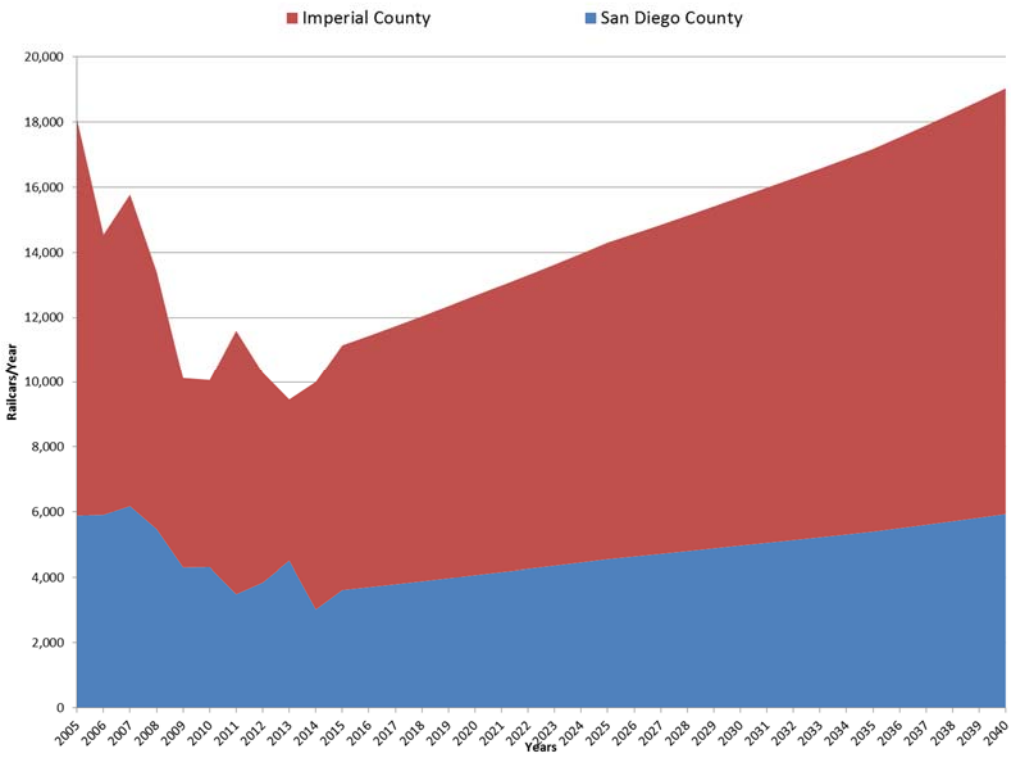
The analysis and forecasting methodology is fairly similar to that conducted for inland-truck projections with one exception: an econometric model approach is not used since border-crossing rail movements are relatively small in the area[71]. Rather, FAF3 was used data to indirectly derive the future number of border-crossing rail movements between 2015 and 2040. To do this, the projected annual growth rates of border-

[69] As mentioned before, southbound volumes are assumed to be identical to northbound volumes.
[70] These forecasts are also presented in the Chapter 5 Appendix in a tabular format.
[71] The large majority of the land movements of goods across the border are performed using truck and therefore more consideration was given in this study to the forecast methodology of truck border-crossings.

crossing rail volumes (measured in tons) from the FAF3 database[72] was calculated and these growth rates were applied to the historical (observed) number of railcars that cross the border.

Figure 45 shows baseline scenario inland-rail border-crossing projections (in terms of the number of railcars crossing the border) for Imperial County and San Diego County for northbound flows[73]. For northbound flows, Imperial County was found to have a highest growth rate in border-crossing inland-rail volumes between 2015 and 2040 compared to San Diego (overall growth rates of 64 percent and 74 percent for San Diego County and Imperial County respectively).

Figure 45: Forecasted Inland-Rail Volumes – Northbound, Baseline Scenario



Source: SCAG Forecasting Model

PORT-TRUCK PROJECTIONS

The port-truck projections capture the expected movement of goods that represent U.S. imports through the San Pedro Bay ports (that is, originate in a foreign country and travel to the U.S. by ocean) and then cross through the SoCal Land POEs by truck to a destination in Mexico; similarly, it includes the movement of goods representing U.S. exports through the San Pedro Bay ports (with a destination in a foreign country using ocean carriers) that originate in Mexico and cross through the SoCal land POEs by truck. The following reports were used to generate forecasts: *Port Imports and Exports Container Base Case Historical and Forecast Data: San Pedro Cargo Forecast*, The Tioga Group, Inc., December 2007; *San Pedro Bay Container Forecast Update*, The Tioga Group, Inc., July 2009; and *Ports Imports and Exports Non-*

[72] The analysis was made looking only at goods transported via rail.
[73] As in the case of truck flows, southbound volumes are assumed to be identical to northbound volumes on an annual basis.

Containerized Base Case Historical and Forecast Data: San Pedro Bay Cargo Forecast, The Tioga Group, Inc., December 2007.[74]

In order to estimate port-truck volumes for the baseline scenario throughout the period of analysis, several assumptions were made in order to break down container and non-container volumes by mode, ports of entry and direction. In particular, values for the following variables were assumed to be constant throughout the forecast period and equal to their historical (observed) values:

- San Diego Modal Share (Truck/Rail);
- Imperial County Modal Share (Truck/Rail);
- Share of Port Imports Headed to Mexico (Southbound);
- Share of Port Exports Coming from Mexico (Northbound);
- Share of Containers Headed to San Diego (Truck/Rail); and
- Share of Containers Headed to Imperial County (Truck/Rail).

As in the case of inland-truck and inland-rail projections, the analysis is conducted for northbound and southbound flows for San Diego – Tijuana and Calexico – Mexicali. The first step in the estimation was to identify the volume of port imports (headed to Mexico) and port exports (with an origin in Mexico) of containerized and non-containerized cargo. The truck modal share value was then applied to obtain the number of trucks heading to/coming from Mexico. The total number of trucks heading to/coming from Mexico is then assigned to either San Diego – Tijuana or Calexico – Mexicali based on the share of containers transported by truck to San Diego County and Imperial County respectively.

Volumes are then broken down by clusters. For southbound flows, historical data from Datamyne Query from PIERS was used to determine the share of each cluster. These shares were calculated by dividing each cluster's TEU volume by the total TEU volume in 2014 for San Diego – Tijuana (including Otay Mesa, San Ysidro, and Tecate) and Calexico – Mexicali (including Andrade, Calexico, and Calexico East). However, since the historical data from Datamyne Query is not broken down by mode, an assumption was made that the cluster shares for truck and rail are identical. Additionally, these shares are assumed to remain constant in the baseline scenario throughout the period of analysis. For northbound flows, cluster shares were estimated using the FAF3 database. Since FAF3 data does not further disaggregate the composition of truck volumes, the same cluster shares as those used for inland-truck entries were assumed to be applicable to port-truck movements.

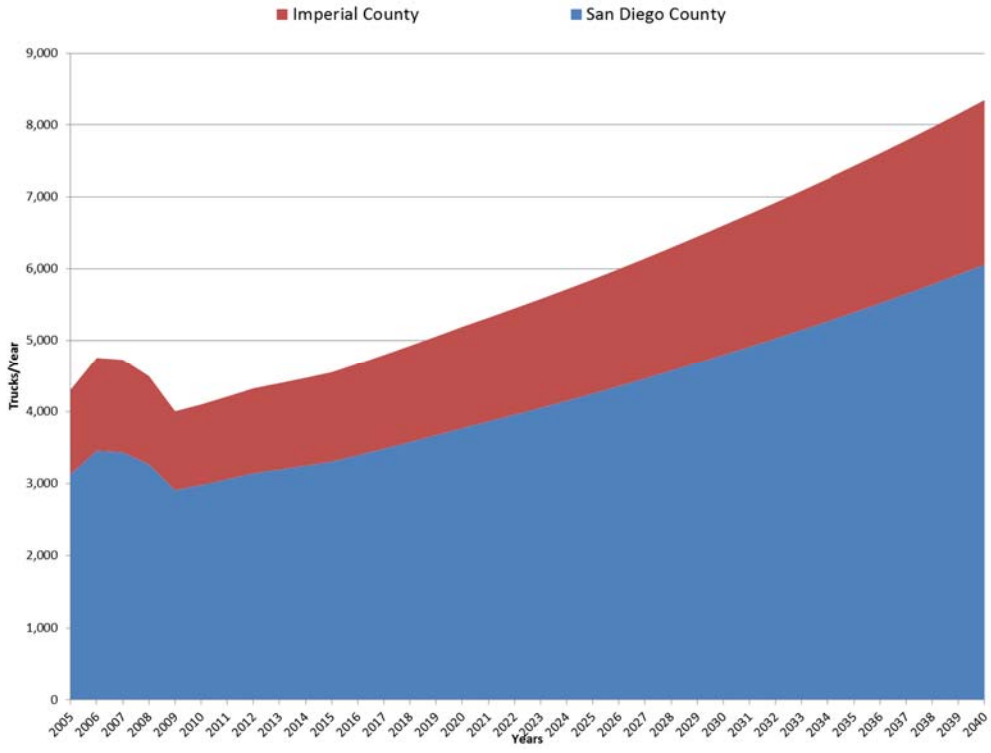
To develop the baseline scenario forecast for port-truck movements of containerized cargo, the two reports on the San Pedro Bay Cargo Forecasts that analyze containers were used. In particular, the historical number of TEUs from the 2009 Update were used as a starting point, while average growth rates derived from the original 2007 report and 2009 Update were used to forecast TEU volumes until 2040.

Non-containerized cargo forecasts, historical and forecasted data in metric tons with compound annual growth rates (CAGR) for dry bulk, liquid bulk, and general cargo were taken from San Pedro Bay Cargo Forecast 2007 report. The 2007 report was used instead of the 2009 report, since the latter report does not provide revised numbers. The 2007 report provides tonnage numbers for the baseline scenario and then projects future volumes using two growth rates: high growth and low growth. For consistency purposes, tons per truck conversion factors were used to transform tonnage numbers into truckloads for each

[74] The Port of LA/LB was undergoing a process to update its future volume forecasts at the time this analysis was conducted. However, the updated forecasts had not been produced at the time this chapter was written.

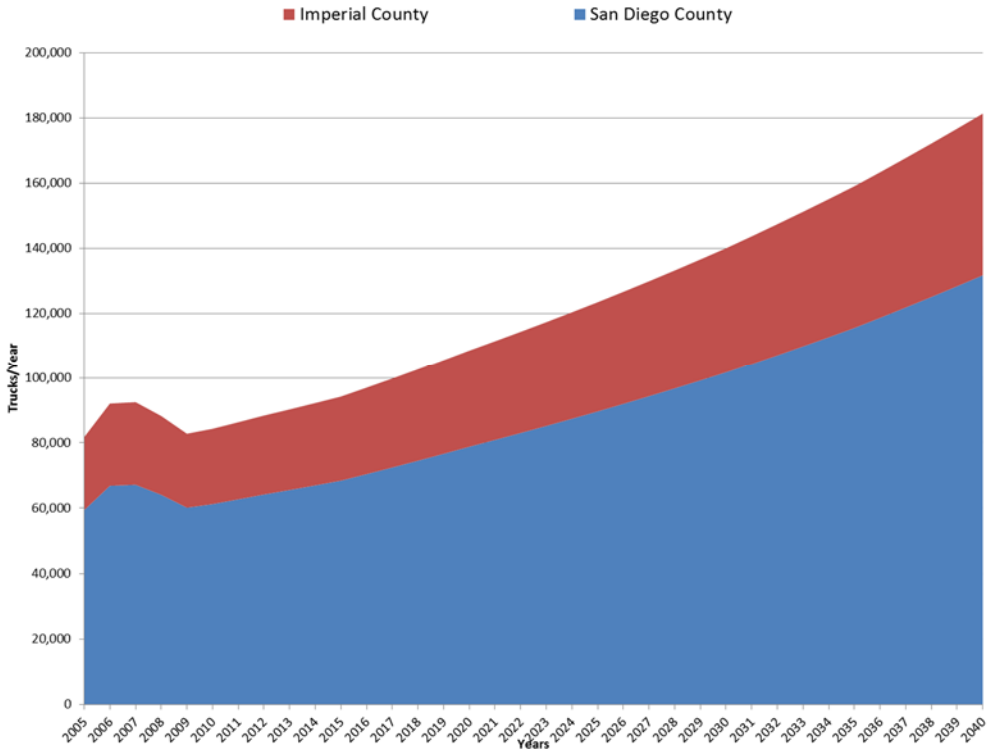
scenario. Containerized and non-containerized cargo forecasts were then added at each year of the analysis to generate aggregate port-truck volumes.

Figure 46: Forecasted Port-Truck Volumes – Northbound, Baseline Scenario



Source: SCAG Forecasting Model

Figure 47: Forecasted Port-Truck Volumes – Southbound, Baseline Scenario



Source: SCAG Forecasting Model

Figure 46 and Figure 47 show baseline port-truck volumes projections for northbound and southbound flows, respectively, for Imperial County and San Diego County. Northbound, approximately 8,300 trucks are forecasted to cross the border in 2040 compared to approximately 4,500 trucks in 2014. Southbound movements are much more prominent than northbound movements. More than 181,000 trucks are forecasted to cross in 2040, compared to approximately 92,000 trucks in 2014.

PORT-RAIL PROJECTIONS

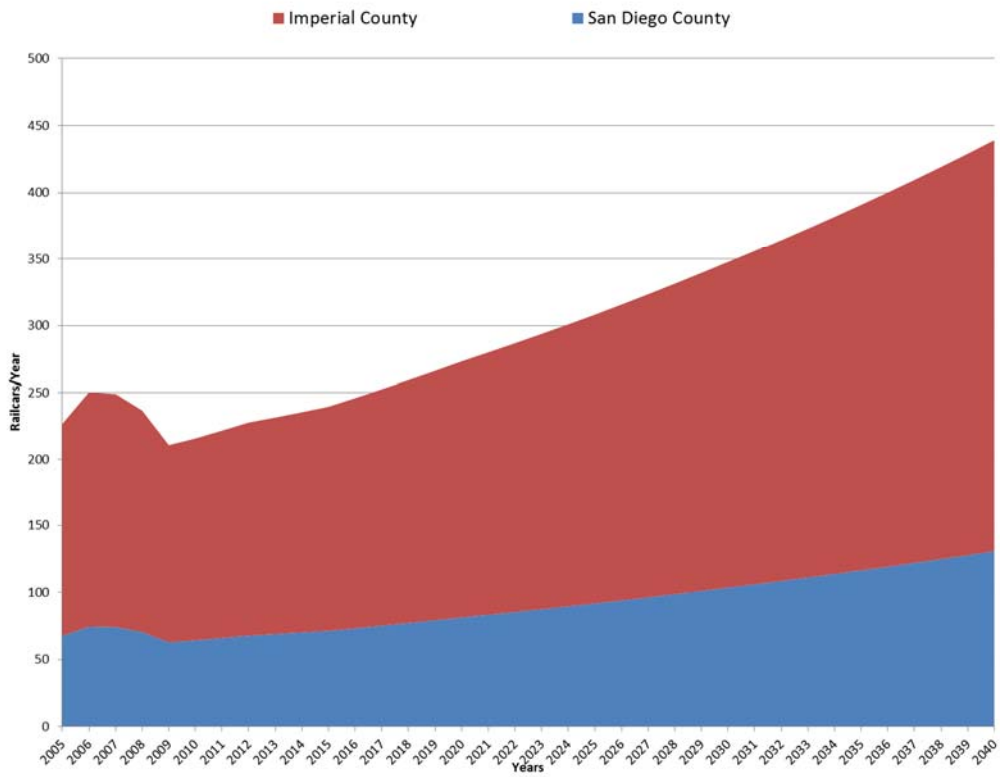
The port-rail projections capture movements of goods that represent U.S. imports through the San Pedro Bay ports (that is, originate in a foreign country) and then cross through the SoCal Land POEs by rail to a destination in Mexico, as well as movements of goods that represent U.S. exports through the San Pedro Bay ports (that is, with a destination in a foreign country) that originate in Mexico and cross through the SoCal Land POEs by rail. The analysis is identical to port-truck projections.[75]

Figure 48 and Figure 49 show baseline scenario port-rail volumes projections for northbound and southbound flows, respectively, for Imperial County and San Diego County. Northbound, almost 440 railcars are forecasted to cross the border in 2040, compared to approximately 235 railcars in 2014. As presented in Figure 48 the majority of northbound rail movements originate in Imperial County. The same is true for southbound flows, except that southbound volumes are much greater than northbound volumes.

[75] Notice that this category of movements may include a truck component or short drayage to an intermodal facility as part of the overall border-crossing trip. However, these flows are categorized under port-rail since the goods enter the U.S. through a port and leave the U.S. via rail (for southbound flows) or vice versa (for northbound flows).

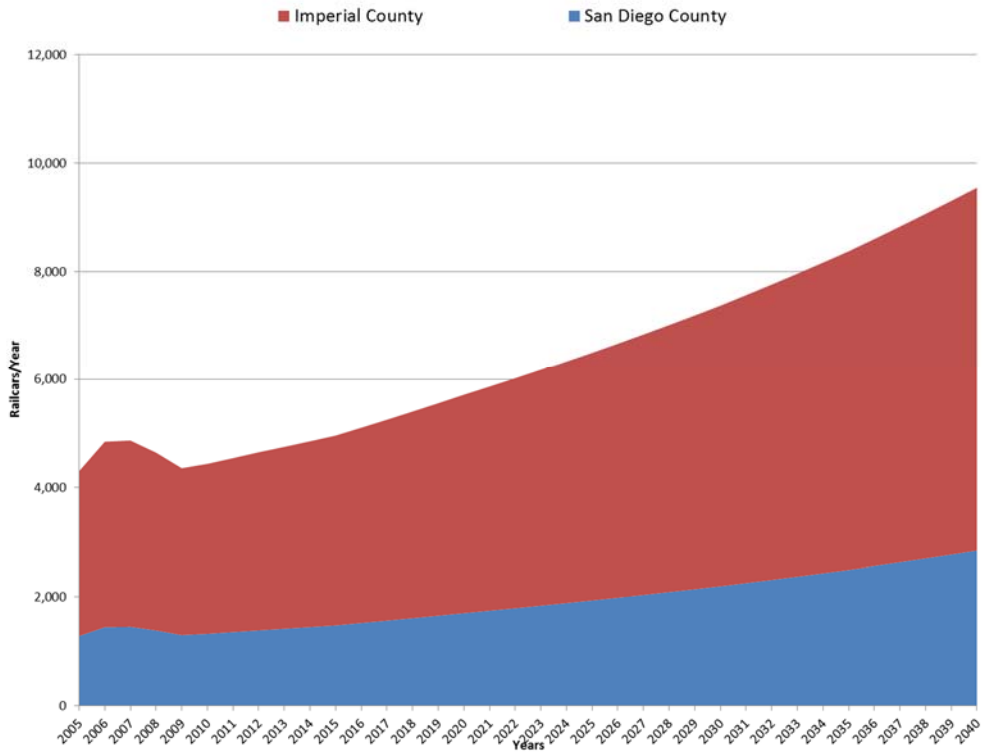
Approximately 9,500 railcars are forecasted to cross the border in 2040 at both Imperial County and San Diego County, compared to approximately 4,850 railcars in 2014.

Figure 48: Forecasted Port-Rail Volumes – Northbound, Baseline Scenario



Source: SCAG Forecasting Model

Figure 49: Forecasted Port-Rail Volumes – Southbound, Baseline Scenario



Source: SCAG Forecasting Model

DRAYAGE PROJECTIONS

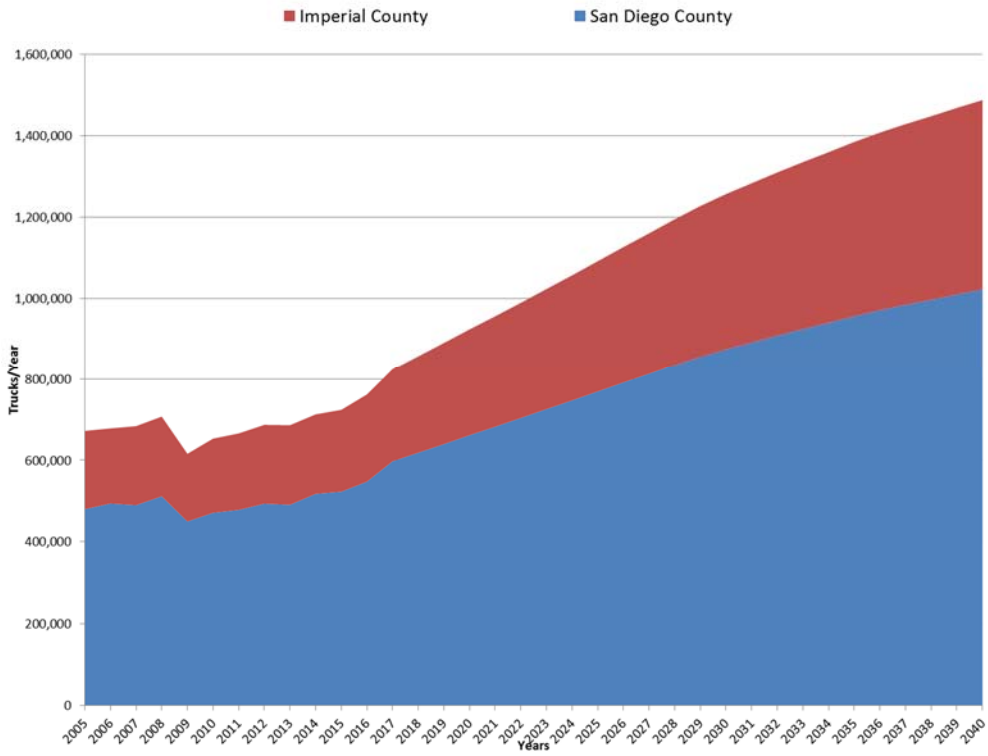
Drayage is defined as the transport of goods over a short distance, often as part of a longer overall move. In the context of this study, drayage is used to denote the transportation of goods from a location close to a POE on one side of the border to a location close to the POE on the other side of the border by truck. Phase I of the study found that drayage is a common element of the transportation procedures in the region. It was found that it is more prominent on northbound trips, with approximately 60 percent of the goods moved across the Calexico-Mexicali border being drayage shipments. For southbound flows, drayage accounted for approximately 49 percent of shipments. During Phase II of this study, drayage companies on both the San Diego-Tijuana and the Calexico-Mexicali border regions were interviewed and it was found that conditions that foster border-crossing drayage trips have not changed significantly on the years between the two phases. Therefore, we used the share of drayage trips found during Phase I and the total truck volumes forecasted in Phase II to extrapolate truck volumes that are drayage-related.[76]

Figure 50 and Figure 51 show baseline scenario drayage projections for northbound and southbound flows that cross through Imperial County and San Diego County.[77] For northbound flows, aggregate drayage volumes in both border areas are projected to approximately double in 2040 compared to 2014 volumes (more than 710,000 trucks in 2014 and almost 1,490,000 trucks in 2040).

[76] Phase I identified the share of drayage only for the Calexico-Mexicali border region. Since Phase II did not involve truck intercept surveys to calculate a similar drayage share for the San Diego-Tijuana region, the team made the reasonable assumption that the shares for this border region are similar to those of Calexico-Mexicali. This assumption was tested by using a risk-analysis process that generated a different percentage share for each one of the different scenarios analyzed in this study.

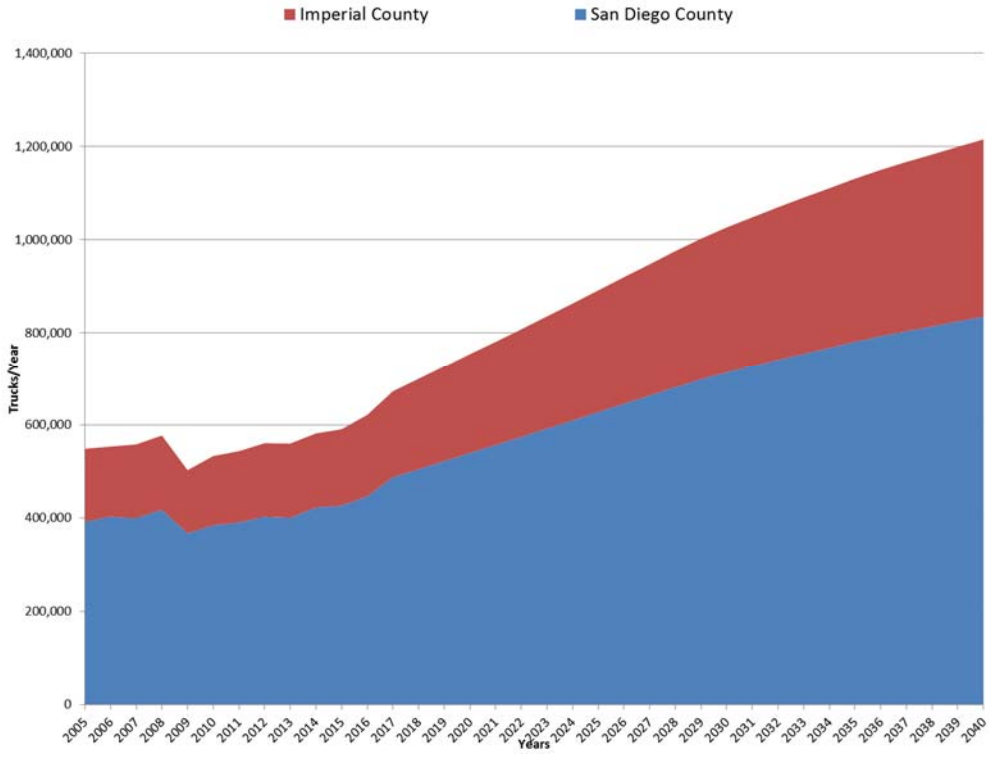
[77] Based on perspectives from the border-crossing transportation in the region collected through the surveys with transportation companies, these projections rely on the assumption that the percentage share of drayage for the baseline case does not change through time.

Figure 50: Forecasted Drayage Volumes – Northbound, Baseline Scenario



Source: SCAG Forecasting Model

Figure 51: Forecasted Drayage Volumes – Southbound, Baseline Scenario



Source: SCAG Forecasting Model

For southbound flows, aggregate drayage volumes in both border areas are also projected to more than double in 2040 compared to 2014 volumes (more than 580,000 trucks in 2014 and more than 1,200,000 trucks in 2040).

Disaggregation of Truck Projections

The projections of freight flows by truck were disaggregated using information captured through interviews with cargo generators in the region (primarily producers of agricultural goods, food products and manufacturing companies) that primarily transport their goods by truck[78] and Panjiva data[79]. Truck projections were disaggregated into 33 subregions, or "SuperZones" (referenced previously in the report) into which the SCAG region is divided plus 1 SuperZone for the San Diego region covering all the SANDAG geography.[80] A map that shows the SuperZones locations is included in the Chapter Chapter 5 Appendix.

Baseline Projections by Origin – Destination (O-D) Pair

The data retrieved from the cargo generator survey and Panjiva included the origin and destination of shipments reported by zip code. The zip codes were used to assign shipments to SuperZones in the SCAG region. If a single zip code overlapped multiple SuperZones, shipments to and from that zip code were divided among the SuperZones in proportion to the percentage of that zip code lying within each Super Zone. Zip codes outside the SCAG region were assigned to either the SANDAG SuperZone or to an "external" zone based on the specific shipment data.[81]

For northbound flows, goods originate in Tijuana or Mexicali in Mexico and are destined to i) one of the 33 SCAG Super Zones, ii) the SANDAG region, or iii) the rest of the U.S. (i.e., the external zone). For southbound flows, goods originate in the i) 33 SCAG Super Zones, ii) the SANDAG region, or iii) the rest of the U.S. and are destined to Tijuana or Mexicali in Mexico. Surveys of cargo generators and Panjiva data were used to generate estimates of the percentage of truck volumes for each O-D pair. Using these percentage shares, aggregate truck volumes[82] were disaggregated and assigned to each O-D pair.

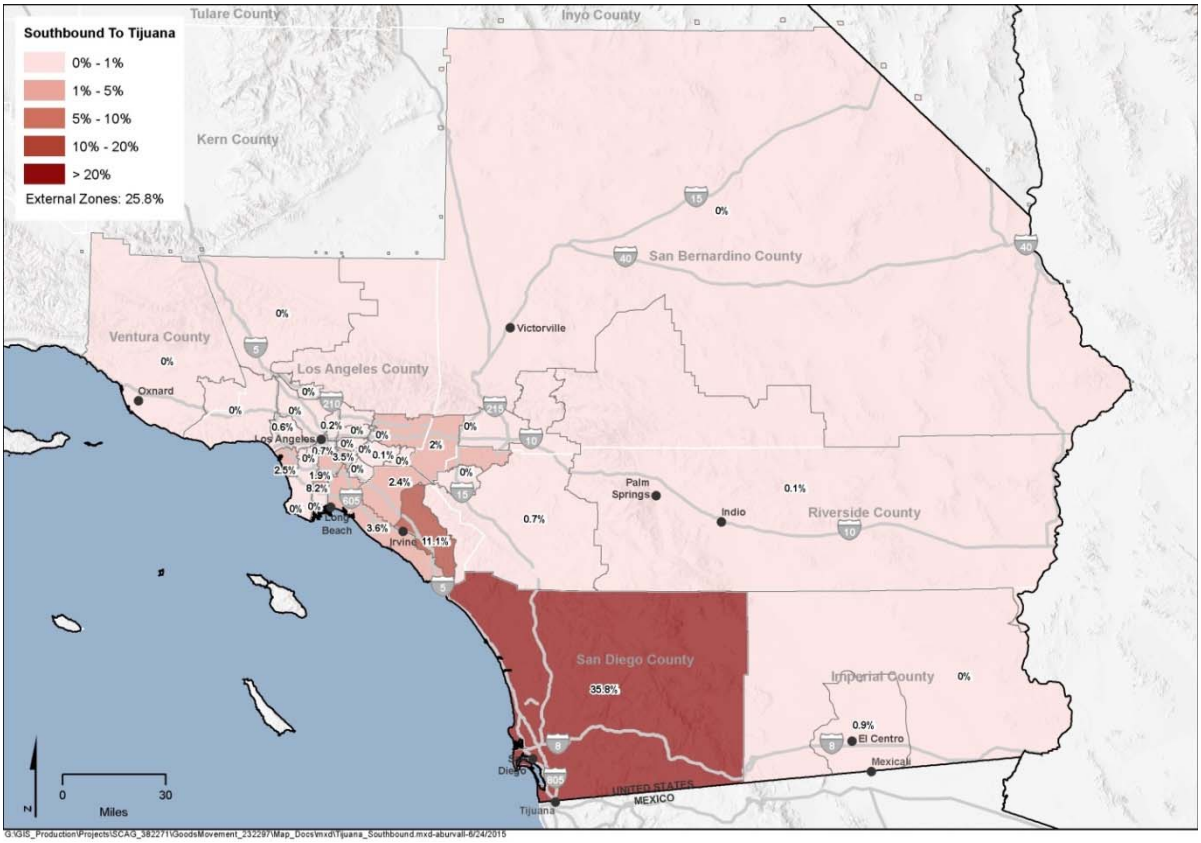
Figure 52 below shows a map of origin truck percentages for the baseline scenario for southbound flows to Tijuana[83]. Note that, by definition, the baseline scenario assumes these percentages remain constant throughout the period of analysis. A key finding is that the majority of southbound truck shipments (35.85 percent) originate in the SANDAG region. Similarly, 25.78 percent of truck shipments originate in the rest of the U.S. (external zone)[84]. Using these percentages, matrices that derive truck volumes for each O-D pair for the baseline scenario were produced. O-D matrices with truck volumes (Table 87) and additional maps are provided in the Chapter 5 Appendix.

Furthermore, data collected through the surveys was used to identify the percentage share of truck shipments that correspond to each commodity cluster. These percentages, derived from sample data, were

[78] Please refer to Chapter 3 of this report for more information.
[79] Panjiva is a private company that maintains and updates a database with information on the movement of goods, by company, at the shipment-level. For more information, please refer to Chapter 3.
[80] A table in the Chapter Chapter 5 Appendix provides information on the 33 SuperZones identified in the SCAG area, including county or counties in which it is located, a major city or zone that is representative of the Super Zone, and latitude and longitude for the centroid of the SuperZone. Note that many of the SuperZones are irregularly shaped.
[81] The "external" zone comprises of the rest of the U.S.
[82] Note that aggregate truck volumes consist of inland-truck and port-truck volumes combined.
[83] Please refer to the Chapter Appendix section for additional maps and tables.
[84] This is not represented in the figure since there is no specific geography for this zone.

compared to the population data reported by the Bureau of Transportation Statistics (BTS) and adjustments were made (when applicable) to ensure the study's sample and results were representative.

Figure 52: O-D Pairs Truck Percentages – Southbound to Tijuana



Source: HDR

Chapter 6: Bottleneck Analysis for Baseline Scenario

Introduction

The objective of this chapter was to conduct a review of regional Heavy Duty Truck (HDT) high-priority bottlenecks identified as part of the Southern California Association of Governments (SCAG) 2013 Comprehensive Regional Goods Movement Plan and Implementation Strategy[85]. This analysis identified 48 HDT bottlenecks using reviews of regional corridor studies, stakeholder outreach, and a quantitative analysis of traffic congestion. In 2015, a "refresh" analysis identified an additional 12 potential HDT bottlenecks.

To perform the bottleneck analysis for the baseline scenario, forecast volumes of cross-border flows produced for the baseline scenario were used and assigned to travel corridors to identify potential impacts on these bottlenecks.[86] Also, potential infrastructure projects were identified from the SCAG Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) that could mitigate HDT high-priority bottleneck impacts.

Overview or Bottlenecks

The basis for the bottleneck analysis are the 60 high-priority SCAG region truck bottlenecks from the 2013 study and the recently completed "refresh" analysis. The original Strategy produced a list of 48 high-priority bottlenecks, which were identified using a comprehensive quantitative exercise using 2008 modeling and traffic data, a review of existing studies such as Corridor System Management Plans, and stakeholder input.

In 2015, SCAG refreshed the list of HDT bottlenecks to account for any changes that may have occurred following the "Great Recession" (officially ended in 2009 though financial markets did not return to previous highs until 2013 and the unemployment rate did not return to January 2008 levels until the late summer of 2015. SCAG also identified 12 potential new bottlenecks that had emerged since the 2013 study due to increased traffic congestion. This resulted in a list of 60 HDT high-priority bottlenecks.

Figure 53 is a map showing the locations of the "refreshed" HDT bottlenecks, and Table 53 is a table listing the bottlenecks and associated delays (where quantified). Forty-one of these bottlenecks are in Los Angeles County, eight are in the Inland Empire Counties of Riverside and San Bernardino, five in Orange County, and three each in Ventura and Imperial Counties. The three Imperial County locations are not described as truck bottlenecks, but were identified by stakeholders as being key goods movement projects that would improve freight system efficiencies.

[85] http://www.freightworks.org/DocumentLibrary/CRGMPIS_Summary_Report_Final.pdf
[86] The forecasted truck volumes in the baseline scenario are reported in Chapter 5 of this document.

Figure 53. SCAG Regional High Priority HDT Bottlenecks

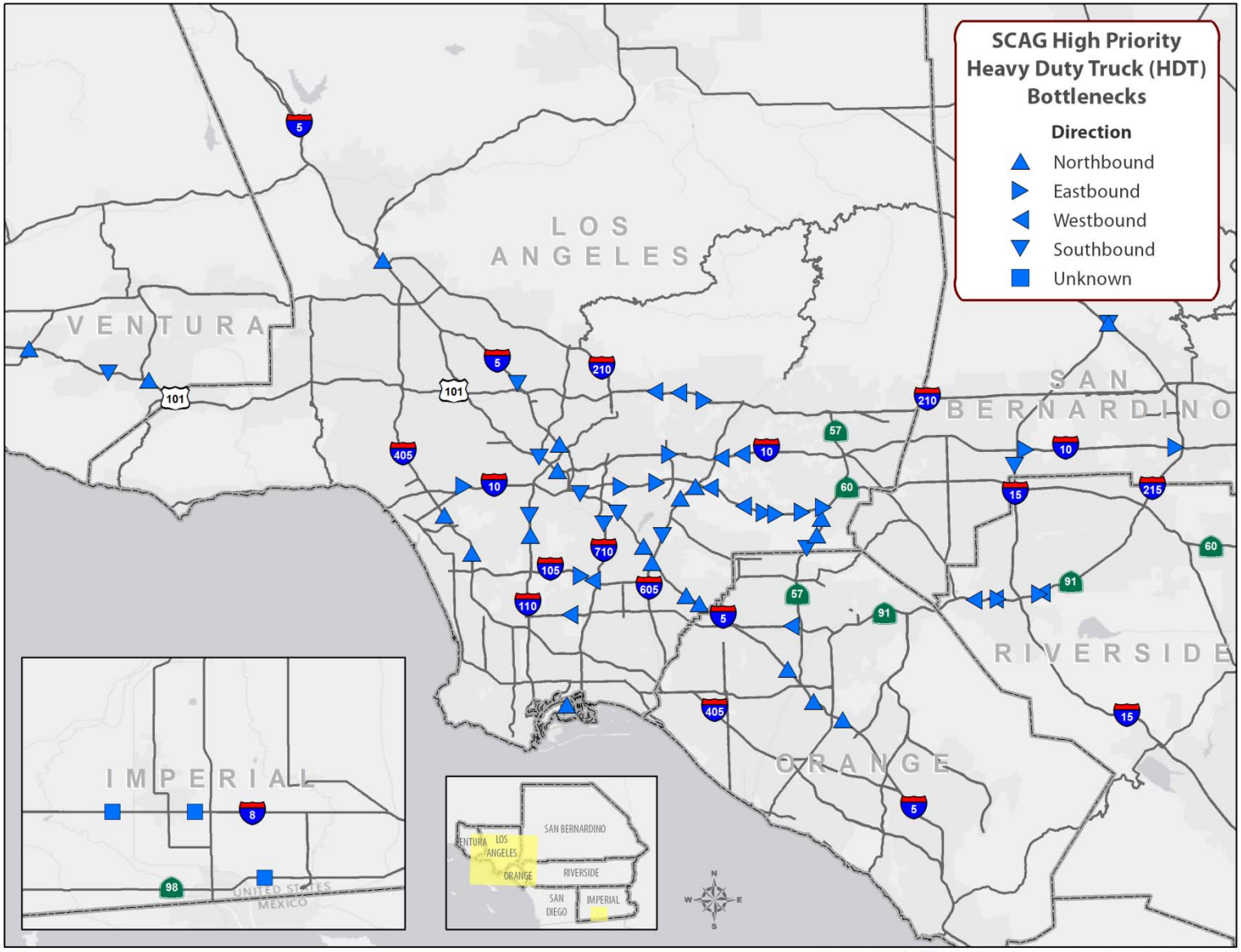


Table 53. List of SCAG Regional Truck Bottlenecks

Source	Route	Dir	Absolute Postmile	County	2012 Estimated Total Truck Annual Vehicle-Hours of Delay	2012 Estimated Heavy Duty Truck (HDT) Annual Vehicle-Hours of Delay
2012 Comprehensive Regional Goods Movement Plan and Implementation Strategy	605	SB	13.8	LA	108,000	41,000
	5	NB	117.8	LA	101,800	39,500
	405	NB	46.5	LA	92,800	34,400
	101	SB	4.1	LA	61,000	15,300
	5	NB	124.9	LA	85,500	31,500
	605	NB	17.5	LA	79,300	39,900
	60	EB	18.3	LA	61,700	21,700
	110	NB	16.1	LA	72,400	20,300
	10	EB	25.6	LA	37,000	14,900
	91	WB	3.9	LA	50,300	19,000
	60	EB	21.6	LA	52,000	24,500
	110	SB	17.8	LA	55,900	19,700
	60	EB	19.3	LA	52,900	26,800
	10	WB	32.0	LA	79,300	33,100
	405	NB	50.8	LA	65,300	21,600
	60	EB	5.1	LA	37,800	10,400
	60	EB	8.2	LA	37,500	13,200
	91	WB	42.7	LA	40,000	16,400
	101	NB	132.4	LA	57,600	14,300
	5	SB	128.5	LA	33,500	13,400
	5	NB	101.5	ORA	28,300	11,100
	605	NB	19.2	LA	50,900	25,600
	5	SB	132.3	LA	33,900	18,800
	210	WB	31.0	LA	34,700	17,700
	60	WB	13.0	LA	58,500	22,700
	91	WB	40.9	RIV	22,400	8,200
	5	NB	160.8	LA	17,600	10,900
	10	WB	30.1	LA	59,000	20,700
	10	EB	6.6	LA	26,000	5,100
	105	WB	12.9	LA	71,400	33,500
	5	NB	119.2	LA	47,700	18,300
	60	WB	16.4	LA	53,300	20,700
	710	SB	17.5	LA	28,800	15,800
	91	WB	23.6	ORA	14,600	4,400
Corridor System Mgmt Plan (CSMP)	5	SB	144.3	LA	Not Estimated	
	10	EB	70.5	SBD		
	57	SB	12.3	ORA		
	91	WB	46.9	RIV		
	210	WB	28.8	LA		
Stakeholder Identified	Forrester Road			IMP	Not bottlenecks: Prioritized, key planned goods movement project locations	
	8	Imperial Interchange		IMP		
	98	(or Jasper Rd)		IMP		
	215	NB/SB	NA	SBD	Not Estimated	
	10	EB	57.5	SBD		
	101	NB	53.2	VEN		
	101	NB	42.1	VEN		
	57	NB	24.4	LA		
	710	NB	0.5	LA		
Potential New Bottlenecks Identified in 2012 by SCAG Analysis	5	NB	137.7	LA	21,400	13,000
	57	NB	15.2	LA	36,100	19,900
	60	EB	23.5	LA	33,300	16,900
	105	EB	11.9	LA	24,000	8,300
	210	EB	33.4	LA	24,700	12,900
	605	NB	11.4	LA	34,500	14,500
	5	NB	104.6	ORA	14,500	6,000
	5	NB	108.7	ORA	13,400	3,200
	91	EB	42.9	RIV	11,200	5,200
	91	EB	46.6	RIV	9,800	4,600
	15	SB	107.7	SBD	16,700	10,200
	101	SB	45.7	VEN	3,800	1,900

Methodology

The SCAG HDT Regional Travel Demand Model (RTDM) has more than 4,400 traffic analysis zones (TAZs), which results in more than 19 million potential origin-destination (O-D) combinations. Clearly, assessing potential impacts caused by changes in cross border traffic would be impossible without the use of a detailed modeling analysis, which was beyond the scope of this analysis.

To facilitate the analysis, the TAZs were aggregated into 34 "SuperZones". The cross border truck O-D forecast matrix for the baseline scenario in year 2040 is comprised of these 34 zones. Table 54 shows the baseline scenario forecast matrix for year 2040 while results for the baseline scenario base year of 2015 are presented in the Chapter 6 Appendix of this memorandum. Annual cross border truck volumes were converted to average daily volumes by dividing the annual flows by 250 days to arrive at an average annual flow.

Table 54. 2040 Baseline Forecast Scenario (Illustrative)

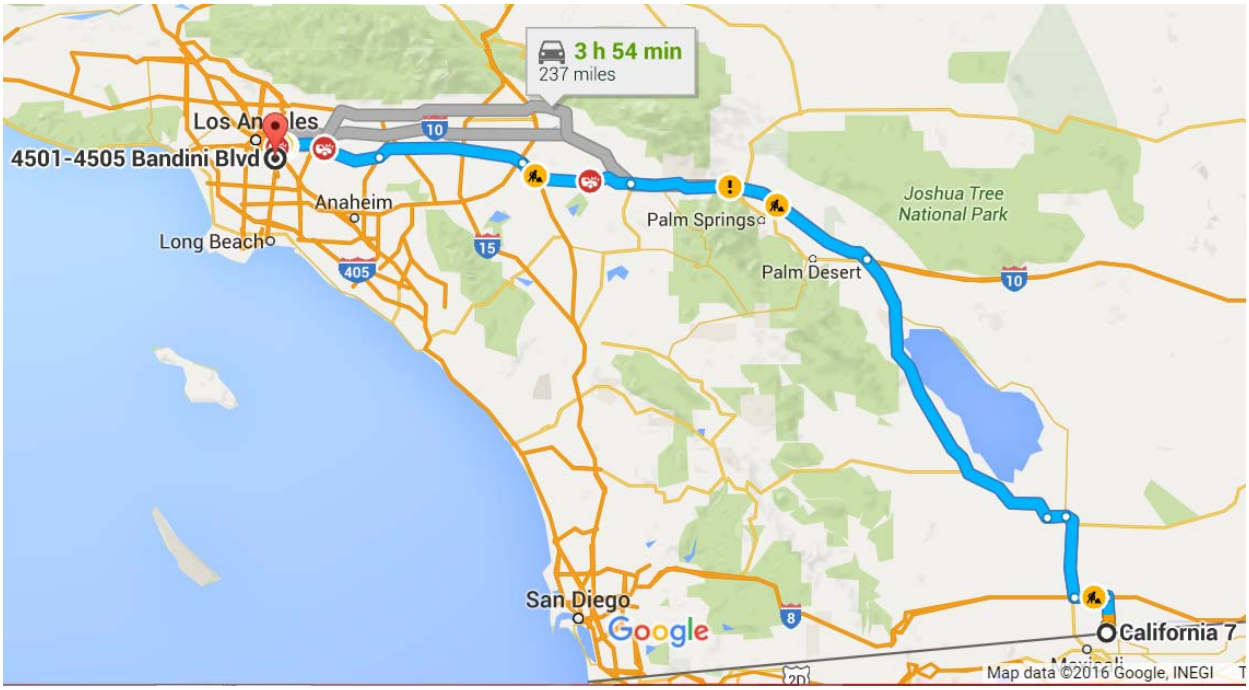
BASELINE - 2040

	NORTHBOUND																															
ORIGIN / DESTINATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	#	25	26	#	28	29	#	#	#	33	External	SANDAG
Tijuana	8,221	88,541	0	92,902	17,181	0	816	0	33,031	#####	0	0	0	48,661	0	0	2,714	0	5,602	0	0	0	25,519	0	129	0	0	0	0	#	#	0	0	342,264	840,140
Mexicali	0	0	0	0	0	0	0	0	496	496	2,478	0	31,757	0	#####	424,213	0	0	1,759	0	#####	719	0	0	0	0	0	0	0	0	0	0	0	46,682	496

	SOUTHBOUND																															
DESTINATION / ORIGIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	#	25	26	#	28	29	#	#	#	33	External	SANDAG
Tijuana	0	39,936	0	179,382	38,313	0	0	0	10,637	57,926	1,095	##	0	56,669	439	14,556	483	0	30,235	31,650	9,916	0	133,530	0	0	249	0	3,639	171	0	0	0	11,593	418,326	581,672
Mexicali	0	0	0	0	1,701	0	0	0	0	0	0	0	0	0	45,500	148,731	####	0	0	1,300	2,897	0	0	0	8,960	0	0	4,346	0	0	0	0	0	507,187	33,409

The SuperZones structure is shown in the map in Figure 56. This zonal structure was based on an analysis of the bottleneck locations, geography, and estimated travel patterns for cross border trucks. For example, zones 8, 11 and 24 are very large. Any trips projected between those zones and Mexicali, for example, do not pass over any SCAG region bottlenecks, so those O-Ds can be can be eliminated from further analysis. In contrast, there are many bottlenecks and travel options for trucks in Los Angeles County, which are represented by smaller SuperZones.

Figure 54. Illustrative Google Maps Shortest Path Evaluation



Source: SMG

To assess how travel between O-Ds can impact truck bottlenecks, likely routes for each O-D pair were identified. This was done by using Google Maps to identify shortest travel time paths and any alternatives for major O-D pairs, illustrated in Figure 54. The development a detailed truck travel demand model for this engagement was beyond the scope of this project, so in areas where there are multiple potential routes, bottlenecks on all alternatives were flagged as being equally likely to be impacted. For example, a truck traveling between downtown Los Angeles (Zone 9) and Mexicali (Zone 16) can take I-10 or SR-60, both of which have truck bottlenecks. All flows in this case would be assigned to both routes as potential alternatives. This approach will overstate the impact on bottlenecks since the evaluation double counts flows on bottlenecks that have other alternative routes available.

To assign truck travel between O-D pairs to specific bottlenecks, a matrix was developed in a Microsoft Excel workbook that shows each O-D pair under analysis and each bottleneck (illustrated in Figure 55). A bottleneck (shown in the columns) was flagged with a "1" if that bottleneck lies in the path between the O-D pair (shown in the rows). A truck traveling between Mexicali in Zone 16 and the City of Downey in Zone 14 would potentially travel through bottleneck number "31", which is on I-5 northbound at Rosecrans Avenue in the City of Norwalk. Therefore, the truck O-D volumes between those two Super Zones are assigned to that bottleneck. Trips between other O-D pairs may also be assigned that bottleneck location, so the total truck demand at that specific bottleneck would be the summation of all the assigned truck demand.

Figure 55. O-D Pairs and Bottlenecks Analysis Workbook

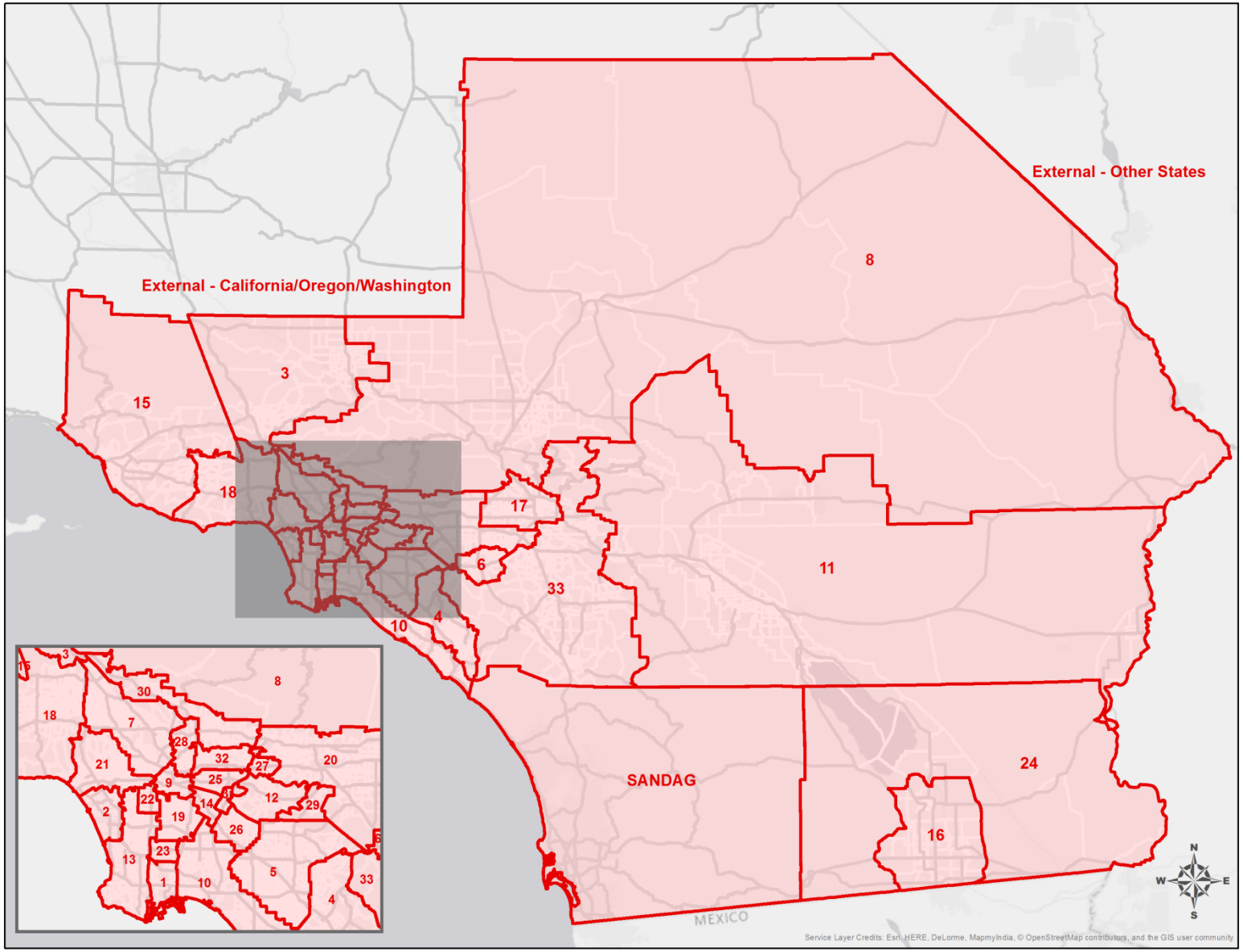
B	C	D	E	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN
Origin	**O_Zone**	**Destination**	**Dest_Zone**	BN_ID: 26	BN_ID: 27	BN_ID: 28	BN_ID: 29	BN_ID: 30	BN_ID: 31	BN_ID: 32	BN_ID: 33	BN_ID: 34	BN_ID: 35
Downtown Los Angeles	9	Mexicali	16	0	0	0	0	0	0	0	0	0	0
Downtown Los Angeles	9	Tijuana	10	0	0	0	0	0	0	0	1	0	0
Mexicali	16	Indio	11	0	0	0	0	0	0	0	0	0	0
Mexicali	16	Whittier	12	0	0	1	0	0	0	1	0	0	0
Mexicali	16	Torrance	13	0	0	0	0	1	0	1	0	0	0
Mexicali	16	Downey	14	0	0	0	0	0	1	0	0	1	0
Mexicali	16	Oxnard	15	0	1	0	0	0	0	0	0	0	0
Mexicali	16	Imperial County	16	0	0	0	0	0	0	0	0	0	0
Mexicali	16	San Bernardino	17	0	0	0	0	0	0	0	0	0	0
Mexicali	16	Simi Valley	18	0	0	0	0	0	0	0	0	0	0
Mexicali	16	South Gate	19	0	0	0	0	1	0	0	0	0	0
Mexicali	16	Inglewood	2	0	0	0	0	1	0	1	0	0	0
Mexicali	16	Los Angeles	20	0	0	0	0	0	0	0	0	0	0
Mexicali	16	Santa Monica	21	0	0	0	0	0	0	1	0	0	0
Mexicali	16	Florence	22	0	0	0	0	0	0	1	0	1	0
Mexicali	16	Carson	23	0	0	0	0	0	0	0	0	0	0
Mexicali	16	Calipatria	24	0	0	0	0	0	0	0	0	0	0
Mexicali	16	Whittier	25	0	0	1	0	0	0	1	0	0	0
Mexicali	16	Norwalk	26	0	0	0	0	0	1	0	0	1	0
Mexicali	16	West Puente Valley	27	0	0	1	0	0	0	0	0	0	0
Mexicali	16	East Los Angeles	28	0	0	1	0	0	0	0	0	0	0

Source: SMG

"External" flows in the O-D matrices were split into flows that travel between states east of California (which potentially do not impact any regional bottlenecks since most destinations east of California would involve travel along I-8) and flows that travel to northern California, Oregon, or Washington State (which would potentially impact SCAG region bottlenecks). Four percent of northbound external trips go to northern California/Oregon/Washington, and 26% of southbound external trips travel from California/Oregon/Washington.

Using these percentages, the "northern" external flows were allocated to SuperZone 3, the northernmost zone in the SCAG region through which trips to northern California, Oregon and Washington would likely travel through along I-5. Trips allocated to states east of California would potentially impact key truck project locations in Imperial County (e.g., Imperial Avenue interchange on I-8), but would not impact HDT bottlenecks in other parts of the SCAG region.

Figure 56. Cross border SuperZones



Bottleneck Analysis for Baseline Scenario

Based on a review of the cross-border forecast O-D matrices, most future cross border impacts on HDT bottlenecks will occur on a limited number of major roadways. The 2040 Baseline model projects nearly 4.8 million annual (nearly 19,200 per day) international truck trips with approximately 68% of those trips coming through San Diego County Ports-of-Entry (POEs) and the remainder crossing at Mexicali.

Before discussing the more specific bottleneck impacts, a review of the overall forecast results can provide insight on what impacts could occur on Southern California roadways. For discussion purposes, the truck O-D annual volumes from the SuperZones (Figure 56 above) were aggregated into very high-level, generalized travel regions as follows:

- Imperial County in the SCAG Region
- Remaining SCAG Region (Including trips traveling through the SCAG region to Northern California and the states of Oregon and Washington)
- San Diego County
- States East of California.

Figure 57 summarizes the bi-directional volumes between these regions and the two POEs in the 2040 baseline scenario and Table 3 presents the same information in a table.

Figure 57. 2040 Baseline Annual Cross Border Truck Flows by POE and Region

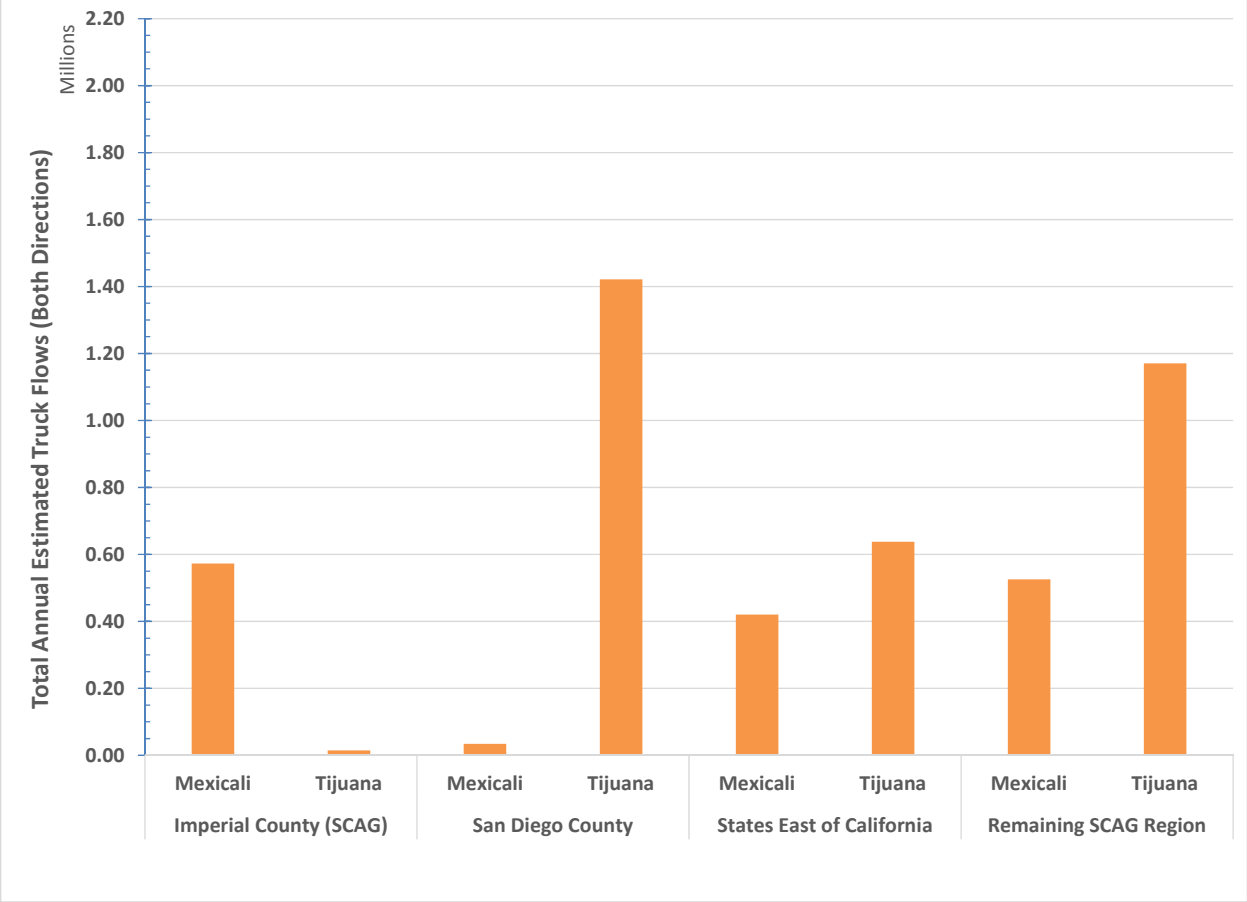


Table 3. 2040 Baseline Annual Cross Border Truck Flows by POE and Region

Origin-Destination Pair		2040 Baseline Scenario Cross Border Truck Flows		
		Annual Trucks	Average Daily Trucks	Percent of Total
Mexicali	Imperial County (SCAG)	572,944	2,292	12%
	From/To/Thru Remaining SCAG Region	525,442	2,102	11%
	San Diego County	33,904	136	1%
	States East of California	420,133	1,681	9%
Tijuana	Imperial County (SCAG)	14,556	58	0%
	From/To/Thru Remaining SCAG Region	1,170,466	4,682	24%
	San Diego County	1,421,812	5,687	30%
	States East of California	638,135	2,553	13%
Total Cross Border Truck Trips		**4,797,393**	**19,190**	**100%**

The highest flows are between Tijuana and locations within San Diego County with more than 1.4 million annual truck trips (or just under 5,700 average daily). This represents 30% of all cross border truck traffic.

The second highest truck flows are between Tijuana and the SCAG region north of San Diego and Imperial Counties with nearly 1.2 million trips (or nearly 4,700 daily). This represents approximately 24% of all cross border traffic.

The third highest 2040 Baseline volumes (638,000 annual or over 2,500 daily) also cross over at Tijuana and travel from/to states east of California. This major O-D is followed closely by Mexicali from/to Imperial County traffic at 573,000 annual (2,300 daily).

These findings indicate that potential congestion impacts would be realized on roadways in San Diego County (e.g., I-15, I-805, I-5, SR-905, and SR-125) since more than two-thirds of all international truck traffic travels through that county.

Around 4,700 average daily trucks or 26% of all cross border traffic is between Tijuana from/to the SCAG region north of San Diego County, or to destinations north of the SCAG region. This implies that interregional routes connecting San Diego County to the SCAG region are likely going to be the most impacted under the two alternative scenarios (e.g., I-5 and I-15).

Cross-border volumes between Mexicali and the SCAG region (outside of Imperial County) were significantly smaller with only around 11% of all truck traffic (525,000 annual or 2,100 average daily trips) moving between those O-Ds. This traffic would likely impact highways in the Inland Empire counties of Riverside and San Bernardino (e.g., I-10, I-15, I-210, I-215, SR-60, SR-91). Cross border truck trips that originate or end in Imperial County (SuperZones 16 and 24) may potentially impact the key freight project locations that were identified by stakeholders at the I-8/Imperial Highway interchange, along Forrester Road, or along the SR-98/Jasper Road corridor , but would not impact truck bottlenecks in the remaining SCAG counties.

Results of Bottleneck Analysis

Table 55 summarizes the cross border truck flows over each bottleneck. Note that the Low and High Volume scenarios results are shown, but these will be discussed in more detail in the following section. For comparison purposes, estimated 2014 bi-directional Average Annual Daily Traffic (AADT) from the Caltrans truck volumes is provided along with the 2015 Cross border Base Year flows.

Figure 58 is a map showing the 2040 Baseline cross border flows for all bottlenecks. Note that the map does not show the total truck volumes over these locations, but only the cross border flows. The triangles represent the directionality of the bottleneck and the color-coding in Table 55 corresponds to the color-coding on the map (e.g., red for volumes greater than 1,000 average daily trucks).

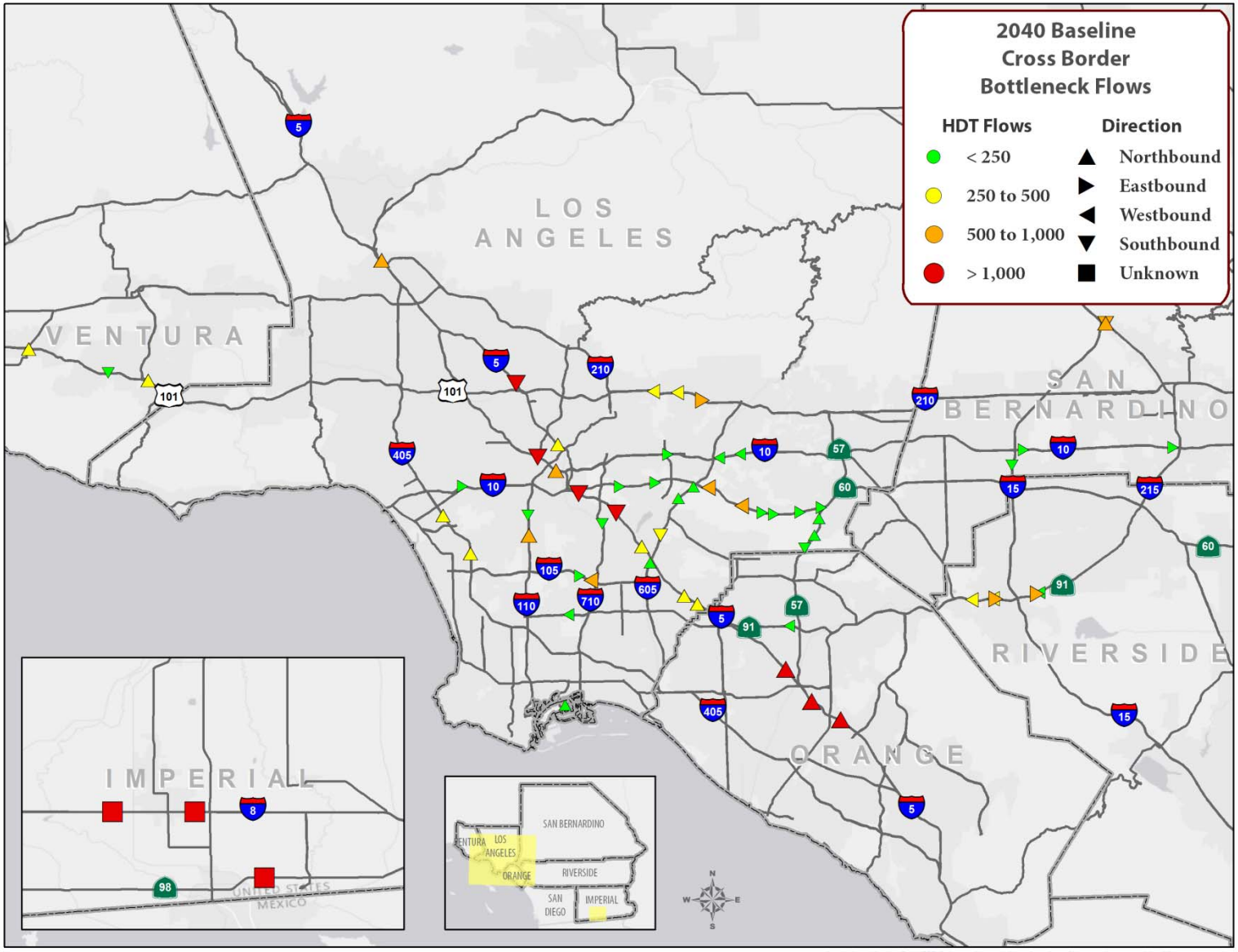
Although the extent of the potential congestion impacts on the three Imperial County locations is unknown since they were not quantified in the 2013 study, all truck traffic through that county has been allocated to all three locations so they report the same reported value. Clearly, this greatly exaggerates the actual number of trucks that will flow over those Imperial County locations.

It is clear that the SCAG bottlenecks on I-5 in Orange and Los Angeles Counties carry the most international trucks. This is to be expected given the previous discussion that outside of San Diego County, the greater Los Angeles Basin and the Tijuana POE O-Ds represent 24% of all cross border truck traffic.

Table 55. Cross-Border Truck Flows through SCAG Region Bottlenecks

Cross Border Bottleneck Code	Route	Dir	Absolute Postmile	County	2014 Estimated 4+Axle HDT AADT	Assigned Cross Border Truck Flows			
						2015 Base Year	2040 Low Volume Scenario	2040 Baseline Scenario	2040 High Volume Scenario
BN_ID: 44_?	Forrester Road			IMP					
BN_ID: 45_?	8	Imperial Ave		IMP	n/a	1,928	2,919	4,454	6,580
BN_ID: 46_?	98	(or Jasper Rd)		IMP					
BN_ID: 21_NB	5	NB	101.5	ORA	5,900	1,167	1,815	2,410	3,297
BN_ID: 55_NB	5	NB	104.6	ORA	7,100				
BN_ID: 56_NB	5	NB	108.7	ORA	7,300				
BN_ID: 20_SB	5	SB	128.5	LA	6,700	807	1,277	1,655	2,237
BN_ID: 23_SB	5	SB	132.3	LA	7,700	598	940	1,255	1,719
BN_ID: 04_SB	101	SB	4.1	LA	3,100	567	891	1,198	1,645
BN_ID: 35_SB	5	SB	144.3	LA	10,000	541	848	1,146	1,579
BN_ID: 57_EB	91	EB	42.9	RIV	7,800	403	657	902	1,249
BN_ID: 58_EB	91	EB	46.6	RIV	7,700				
BN_ID: 40_NB/SB	215	N/SB	n/a	SBD	2,600	443	673	827	1,086
BN_ID: 25_WB	60	WB	13.0	LA	11,000	328	517	759	1,073
BN_ID: 32_WB	60	WB	16.4	LA	11,000	328			
BN_ID: 53_EB	210	EB	33.4	LA	8,800	319	521	738	1,036
BN_ID: 08_NB	110	NB	16.1	LA	4,600	284	440	652	932
BN_ID: 19_NB	101	NB	132.4	LA	3,300	298	459	643	893
BN_ID: 30_WB	105	WB	12.9	LA	7,300	260	412	511	667
BN_ID: 27_NB	5	NB	160.8	LA	12,800	224	345	506	714
BN_ID: 24_WB	210	WB	31.0	LA	10,900	197	308	455	645
BN_ID: 39_WB	210	WB	28.8	LA	8,200				
BN_ID: 42_NB	101	NB	53.2	VEN	2,900	191	299	444	633
BN_ID: 43_NB	101	NB	42.1	VEN	3,400				
BN_ID: 18_WB	91	WB	42.7	LA	7,500	236	366	440	573
BN_ID: 26_WB	91	WB	40.9	RIV	7,800				
BN_ID: 49_NB	5	NB	137.7	LA	9,600	225	345	422	548
BN_ID: 02_NB	5	NB	117.8	LA	6,100	222	339	414	541
BN_ID: 05_NB	5	NB	124.9	LA	6,700				
BN_ID: 31_NB	5	NB	119.2	LA	6,200				
BN_ID: 01_SB	605	SB	13.8	LA	12,600	205	330	389	503
BN_ID: 03_NB	405	NB	46.5	LA	2,600	190	295	354	461
BN_ID: 15_NB	405	NB	50.8	LA	4,000				
BN_ID: 09_EB	10	EB	25.6	LA	4,100	106	182	247	332
BN_ID: 36_EB	10	EB	70.5	SBD	12,000	117	192	240	315
BN_ID: 41_EB	10	EB	57.5	SBD	15,300				
BN_ID: 59_SB	15	SB	107.7	SBD	11,100				
BN_ID: 07_EB	60	EB	18.3	LA	10,800	103	176	238	319
BN_ID: 11_EB	60	EB	21.6	LA	13,900				
BN_ID: 13_EB	60	EB	19.3	LA	12,000				
BN_ID: 51_EB	60	EB	23.5	LA	15,500				
BN_ID: 10_WB	91	WB	3.9	LA	9,100	110	178	229	300
BN_ID: 29_EB	10	EB	6.6	LA	1,600	113	181	213	274
BN_ID: 52_EB	105	EB	11.9	LA	5,200	112	180	211	272
BN_ID: 60_SB	101	SB	45.7	VEN	3,300	79	136	184	247
BN_ID: 33_SB	710	SB	17.5	LA	4,800	88	141	164	212
BN_ID: 37_SB	57	SB	12.3	ORA	7,100	75	120	140	180
BN_ID: 14_WB	10	WB	32.0	LA	6,800	68	109	127	164
BN_ID: 28_WB	10	WB	30.1	LA	5,800				
BN_ID: 12_SB	110	SB	17.8	LA	3,000	49	79	94	121
BN_ID: 16_EB	60	EB	5.1	LA	4,700	33	56	73	97
BN_ID: 17_EB	60	EB	8.2	LA	7,900				
BN_ID: 34_WB	91	WB	23.6	ORA	7,500	38	59	72	93
BN_ID: 06_NB	605	NB	17.5	LA	13,100	8	13	16	21
BN_ID: 54_NB	605	NB	11.4	LA	14,000				
BN_ID: 22_NB	605	NB	19.2	LA	13,100	7	11	14	18
BN_ID: 47_NB	57	NB	24.4	LA	5,800	1	2	2	3
BN_ID: 50_NB	57	NB	15.2	LA	3,900				
BN_ID: 38_WB	91	WB	46.9	RIV	7,700	0	0	0	0
BN_ID: 48_NB	710	NB	0.5	LA	11,700	0	0	0	0

Figure 58. 2040 Baseline Cross border Truck Bottleneck Daily Flow



In Orange County each of the three I-5 northbound bottleneck carries more than 2,400 cross border trucks in the Baseline. In the 2015 Base Year, cross border truck traffic makes a significant portion of HDT AADT when compared against Caltrans 2014 truck volumes on all I-5 bottlenecks.

In Los Angeles County, I-5 southbound is impacted near downtown Los Angeles with these bottlenecks all carrying in excess of 1,000 daily international trucks. US-101 southbound near downtown Los Angeles is also heavily impacted.

Potential Mitigation Projects

Table 56 lists projects from the SCAG 2016 Regional Transportation Plan (RTP)/Sustainable Community Strategies (SCS) that are currently under construction or that are planned/programmed that could potentially mitigate truck bottlenecks on these corridors.

Table 56. SCAG RTP/SCS Projects to Mitigate HDT Bottlenecks in 2040 Baseline

Status	Route		Project Description
Construction	I-5	HOV/ Mixed Flow/ Interchange	I-5 South LA County projects - $1.6 billion over the next 5 years I-5 between Orange County line and I-605. Improvements include HOV lanes, mixed flow lanes, interchange modifications, pedestrian overcrossings, and frontage road modifications, includes I-5 Carmenita Rd IC. Shoemaker bridge widening just opened to traffic
Planning/ Environmental / Design	I-5	HOV/ Mixed Flow	I-5: Add 2 MF lanes from SR-73 to El Toro Rd and extend 2nd HOV lane from El Toro to Alicia Pkwy with operational improvements, split into 3 projects – all undergoing environmental phase.

Chapter 7: Development Opportunities in Baseline Scenario

Introduction

The objective of this chapter is to identify opportunities for economic development on the region as a result of the baseline forecasts and bottlenecks identified as part of this study.[87] In particular, this memorandum explores the specific sectors in the California – Baja California binational region that are more likely to show significant grow as part of the Baseline Scenario and the specific opportunities that this growth would generate in related economic sectors and/or services.

Methodology

In order to identify opportunities for development in the binational region, a qualitative analysis was conducted using two main sources of information: (i) a literature review of the future trends in the Mexican economy (and in the Baja California economy), and, (ii) the results of interviews with agencies and border-crossing goods movement stakeholders on both sides of the border. Each one of these sources of information was analyzed separately. After the analyses were conducted for each source, the findings were compared to derive harmonized conclusions which are summarized in the final section of this chapter.

Trends in the Mexican Economy

A mix of quantitative and qualitative analysis of the current situation was performed and anticipated trends of the Mexican economy in the context of international trade and production capability were identified. The three major trends of the Mexican economy identified in this analysis are:

9. Economic growth in Mexico is expected to remain high due to:
    a. Its young, growing population;
    b. Productivity growth is high in Mexico and is likely to stay high as long as infrastructure investment and economic reforms like energy deregulation are sustained; and,
    c. Competitiveness of manufacturing in Mexico is supported by low wages, productivity growth and proximity to the US.
10. Mexico is ideally located to serve as a global manufacturing hub since it straddles major East-West trade lanes and has executed a large number of free trade agreements with developed economies;
11. Like other geographically large and diverse economies, economic activity is not homogeneous. The industrial base of Baja California is very different than that of the Golden Triangle region and likely to remain so due to the large degree of integration with the Southern California economy.

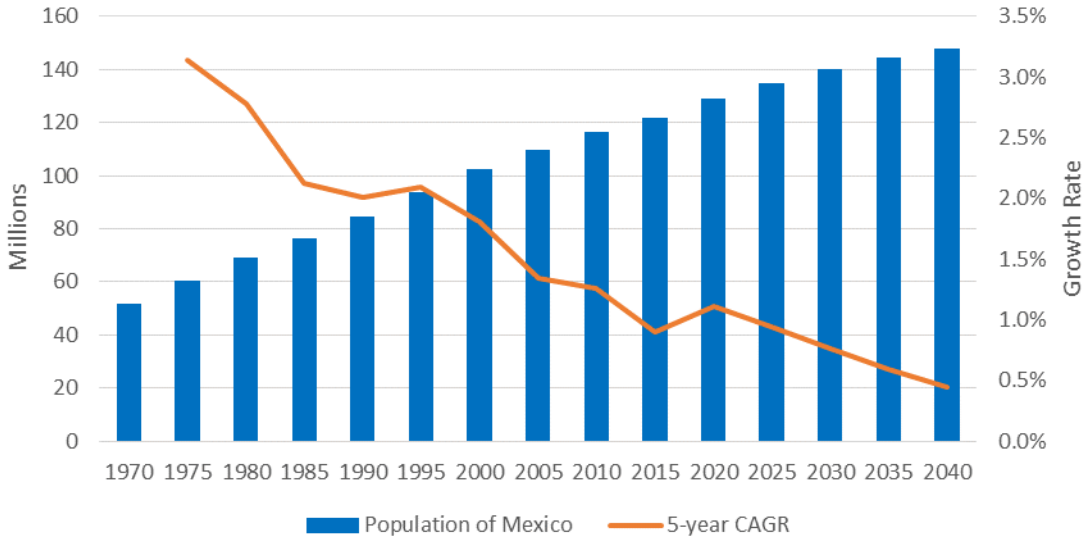
A brief description of each of the three trends is provided in the next subsections.

Economic Growth and Labor Productivity

Economic growth in Mexico is expected to remain high because of population and productivity (output per capita) growth. Mexico's population is currently estimated to be 122 million and is growing at an annual average rate of 1.3% and is projected to slow to a 0.4% pace by 2035 (see Figure 59).

[87] See Chapter 5 of this report for the Baseline Scenario Forecasts and Chapter 6 for the Bottlenecks identified on the Baseline Scenario.

Figure 59. Mexico Population and 5 Year Compounded Annual Growth Rates



Source: US Census Bureau

At the same time, Mexican productivity has been growing at a 1.9% pace since 2009, which reversed a declining trend (see Figure 60). Over the last 10 years Mexico has engaged in a number of structural reforms, such as electronic customs filing and more recently deregulation of the energy sector, as well as significant increases in infrastructure investments.

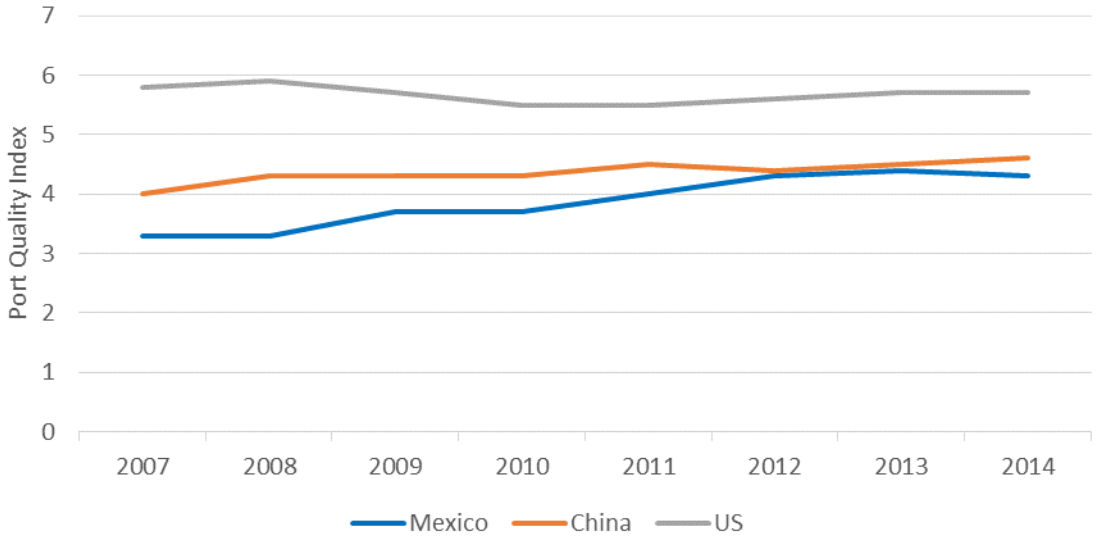
Figure 60. Mexico Labor Productivity Trends

Source: Trading Economics

Infrastructure investments in Mexico have been made in several sectors, including transportation. Moreover, the funding sources in this area are diverse, including Federal, State and the private sector through a successful Public-Private Partnership (P3) program. An example of infrastructure investment involving the public and private sectors (mostly via foreign direct investment) is in the ports subsector.

These investments have resulted in an improvement in the port quality index published by the World Bank. This data indicates that Mexico has been closing the gap to China and the US over the last 10 years (see Figure 61).

Figure 61. Port Quality Index (1= extremely underdeveloped to 7 = efficient by international standards)



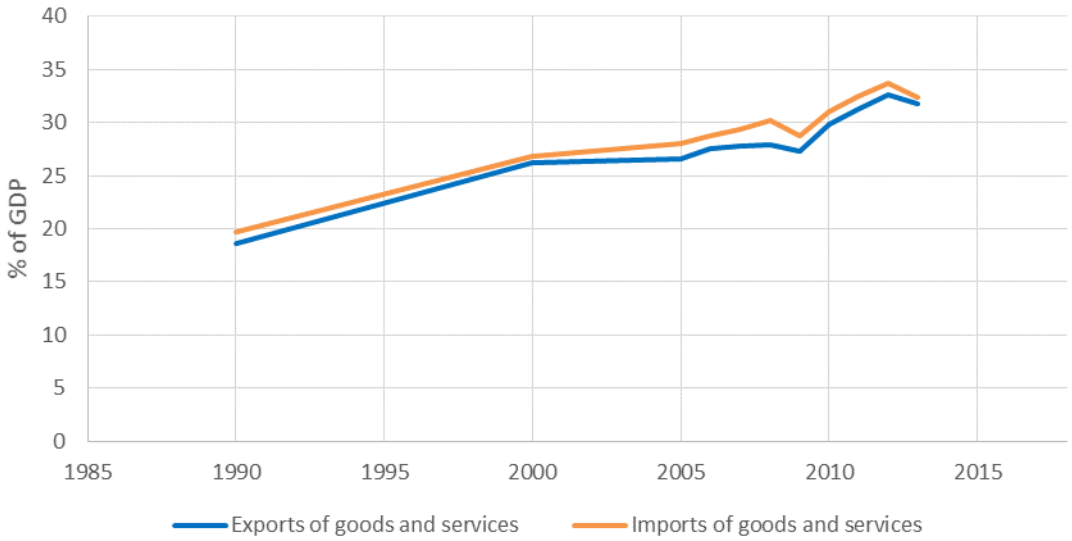
Source: World Bank

Expert opinion suggests that, provided Mexico sustains economic reforms and infrastructure investment, the productivity growth of 1.9% and population growth of 1.2% over the next ten years indicates the country would be able to sustain a real GDP growth rate above 3.0%.

Mexico as a Potential Global Manufacturing Hub

By investing in transportation infrastructure and, in particular in ports, Mexico is leveraging its geographic location as an intermediate link between large production and consumption markets such as East Asia and the U.S. In particular, investments in port infrastructure have been identified as the driver of the recent increase in the share of international trade in Mexico's GDP (see Figure 62).

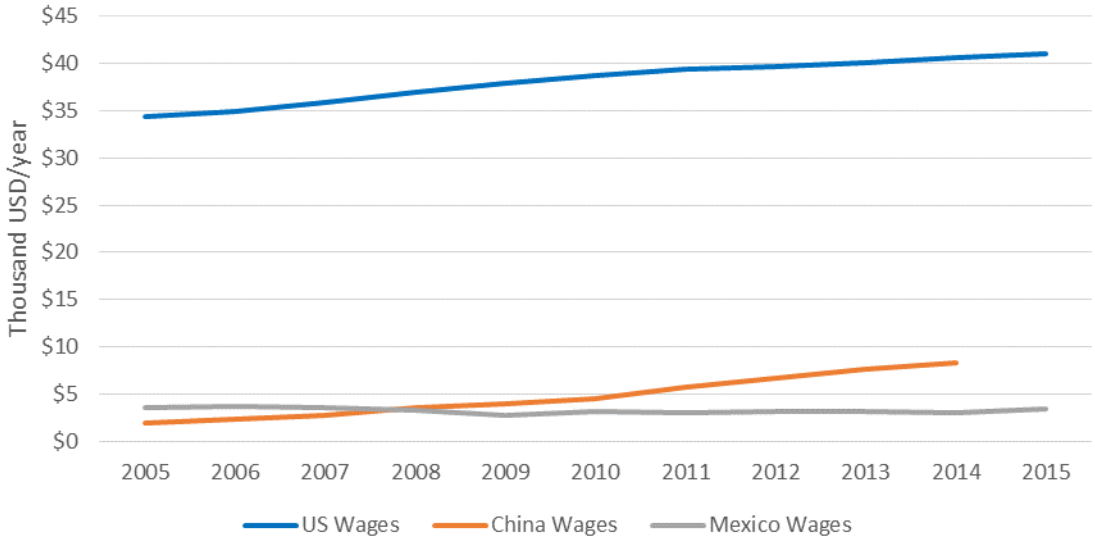
Figure 62. Trade Share of Mexico GDP



Source: World Bank

In particular, the contribution of trade to Mexico's GDP did not increase during the period from China's ascension to the World Trade Organization until the Global Financial Crisis of 2008-2009, largely due to Mexican labor being more expensive. However since 2008, Chinese wages denominated in U.S. dollars, have been higher than Mexican wages (see Figure 63). This is largely due to foreign exchange trends (the U.S. dollar devalued against the Chinese Renminbi and revalued against the Mexican Peso). In addition to Mexico's proximity to the U.S., this has improved the competitiveness of manufacturing in Mexico relative to China.

Figure 63. Manufacturing Wages in China, Mexico and US



Source: UN ILO, INEGI, Moffatt & Nichol

Furthermore, Mexico has signed trade agreements (FTAs) with countries in three continents and therefore is positioned as a gateway to a potential market of over one billion consumers and 60% of world´s GDP.[88]

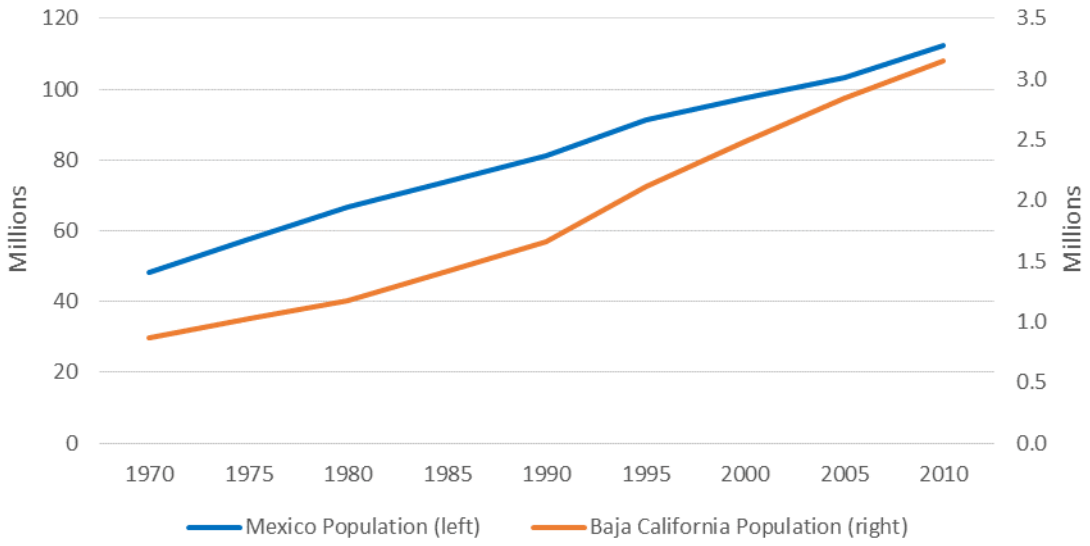
Mexico has a network of 10 FTAs with 45 countries, 32 Reciprocal Investment Promotion and Protection Agreements (RIPPAs) with 33 countries, 9 trade agreements (Economic Complementation and Partial Scope Agreements) within the framework of the Latin American Integration Association (ALADI) and is a member of the Trans-Pacific Partnership Agreement (TPP).[89]

In addition, Mexico is an active member in multilateral and regional organisms and forums such as the World Trade Organization (WTO), the Asia-Pacific Economic Cooperation (APEC), the Organization for Economic Cooperation and Development (OECD) and the ALADI.

Uniqueness of Regional Economies, Particularly Baja California

The economic outlook for Baja California is more positive than for the entire country of Mexico. Baja California's population has been growing faster as compared to Mexico as a whole, driven by employment opportunities in the region (see Figure 64). Additionally, Baja California's state GDP has also grown faster than Mexico as a whole (see Figure 65).

Figure 64. Mexico and Baja California Population

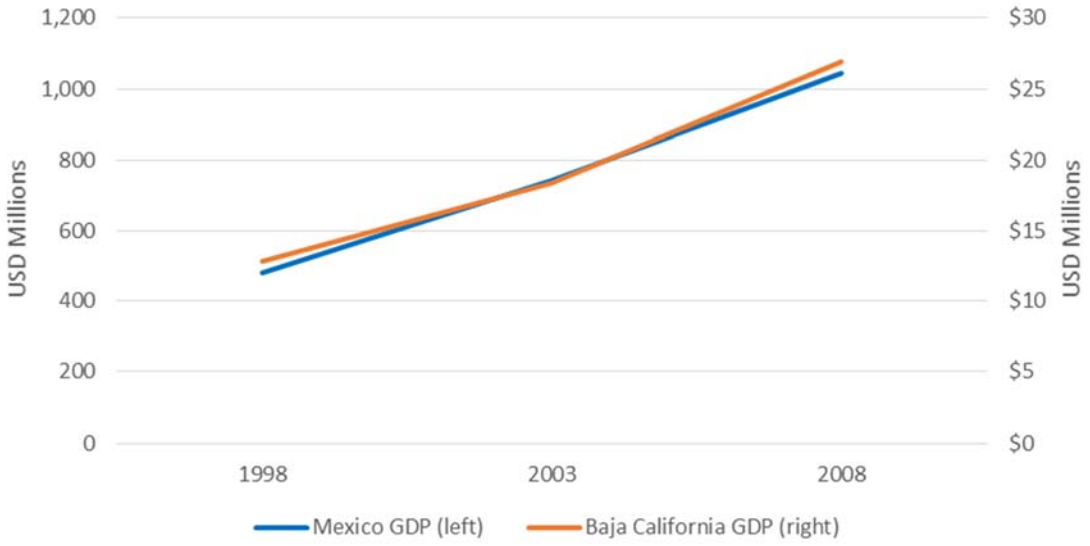


Source: INEGI

It is worth noting that Baja California is more economically integrated with the southern Californian economy than with other production and consumption regions in Mexico, including the hub of manufacturing in the Golden Triangle region (the region of Mexico between Mexico City, Monterey and Guadalajara). The Golden Triangle has been a case study in terms of the significant growth on manufacturing production and economic activity in a region in Mexico as well as the strengthening of international supply-chains linked to these activities.

[88] Source: Promexico, http://www.promexico.gob.mx/en/mx/tratados-comerciales
[89] A list of the countries with whom Mexico has trade agreements can be found at: http://www.gob.mx/se/acciones-y-programas/comercio-exterior-paises-con-tratados-y-acuerdos-firmados-con-mexico

Figure 65. Mexico and Baja California GDP



Source: INEGI

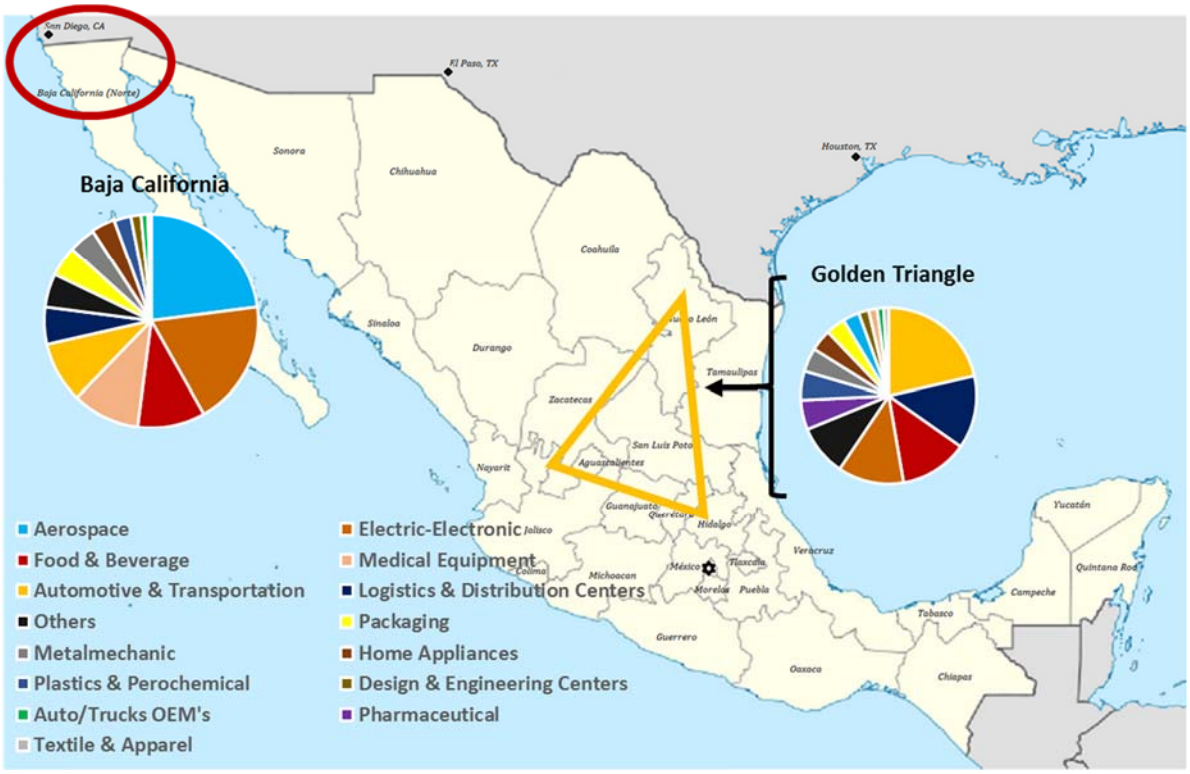
Due to its integration with the U.S., it is not surprising that the industrial composition of the Baja California economy is different than that of the Golden Triangle (see Figure 66 and Figure 67). Baja California has a higher concentration of aerospace electric/electronic equipment/appliances and medical equipment companies, and a lower concentration of textile & apparel, packaging and food & beverage companies, compared to the Golden Triangle. This is in part due to Baja California being situated just south of the U.S.-Mexico border. With good connectivity to the U.S. markets, Baja California has been able to attract more of the high-end manufacturers. The greater concentration of high-end manufacturing activity indicates higher productivity growth and wages, which should continue to help Baja California's population and economy grow faster as compared to Mexico as a whole.

Opportunities Resulting from Mexican Economic Trends

Baja California economic growth is expected to remain high due to population and productivity growth, provided infrastructure investment and economic reforms like energy deregulation are sustained. The proximity to U.S. markets, increased labor productivity, lower manufacturing wages and the existence of significant high-end manufacturing activities in the Baja California – California region make it a likely candidate for future sustained growth on these high-end manufacturing sectors.

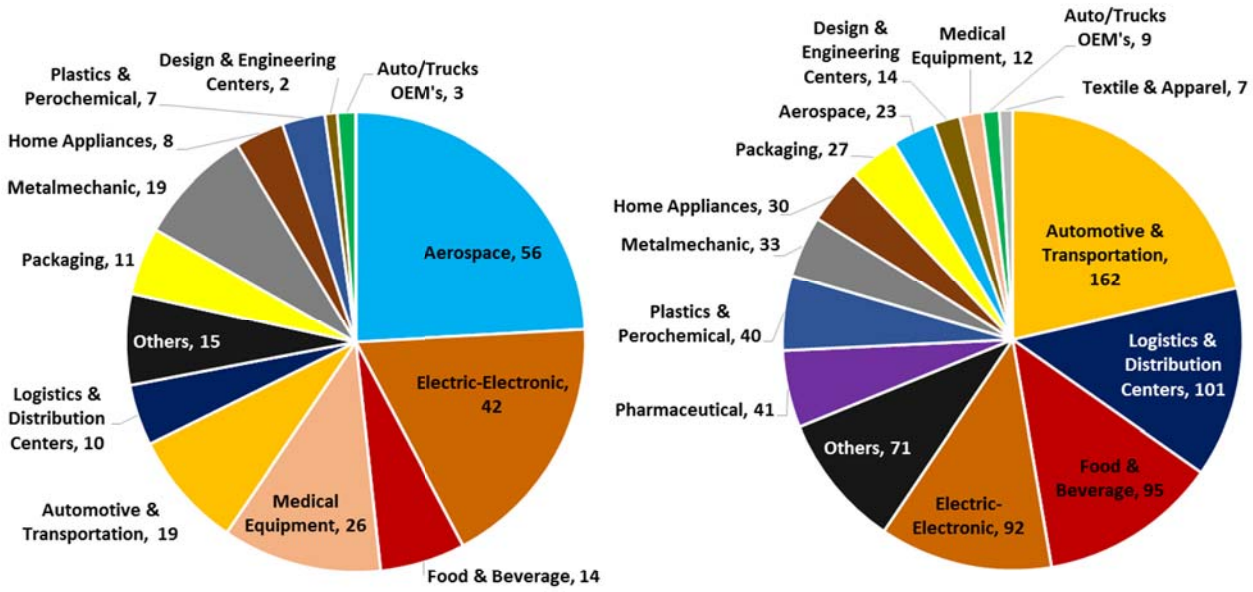
This, in turn, is anticipated to expand the base of high-paid manufacturing jobs (compared to other manufacturing regions in Mexico) and, through multiplying effects, generate important economic impacts in the binational region. In addition, the opportunity to grow high-end manufacturing will translate in an increase in the border-crossing flows of goods, generating the need for an increase in transportation and warehousing services throughout the region.

Figure 66. Industrial Composition in Baja California and the Golden Triangle



Source: Colliers, Moffatt & Nichol

Figure 67. Number of Firms in Each Subsector in Baja California (Left) and the Golden Triangle (Right)



Source: Colliers, Moffatt & Nichol

Regional Economic Trends and Supply Chain Interviews

A set of targeted economic trends and supply chain interviews were to assess the current state of border-crossing goods movement in the region and to identify opportunities to generate economic development. These opportunities were framed under the perspective of border-crossing movements of goods in the California – Baja California region.

Twenty nine economic trend interviews that targeted, on both sides of the border, local agencies and their economic development staff, business associations and industry clusters, and large cargo-generating companies with significant border-crossing goods movement were conductedM.[90]

The opportunities for economic development in the region and their impacts on the goods movement in the California – Baja California region identified by the interviewees are presented in the table below. Notice these opportunities may attract and/or retain companies to the region, thus increasing output, value added and jobs in study area.

Table 57. Opportunities Identified in Economic Trends Interviews and Their Impacts

Opportunity	Anticipated Impact on Goods Movement
Attraction of maquiladora and supplier companies to binational region from Asia (near-shoring)	Develop and strengthen supply chains and increase manufacturing production in the binational region
Increase LPOE capacity for truck crossings	Make binational region more competitive with respect to other regions in international goods movement by truck
Increase capacity for moving goods across the border via railroad	Increase number of transportation options and resiliency of network for companies based in the area to connect with suppliers and customers
Expand port capacity on the Mexican side of the border	Increase capacity in region to receive raw material from Asia
Develop intermodal capacity in Tijuana	Allows certain industries/clusters (primarily automobile) to reach customers in U.S. market with lower transportation costs
Increase use of cold storage facilities in Imperial County	Improve preservation of agricultural goods that cross the border

Source: HDR and LaSalle Solutions' Analysis of Economic Trends Surveys

Similarly, eight interviews with companies whose supply chains are closely linked to the movement of border-crossing goods across the California – Baja California border were conducted. The companies were classified under three categories:

(i) Manufacturing companies: to capture supply chains for cargo-generators of port-related goods;
(ii) Logistics and transportation companies: to capture the perspective of companies moving goods across the border that either begin or end at the San Pedro Bay ports; and,
(iii) Real estate companies: to represent the warehousing component of the local supply chains.[91]

The main opportunities identified as part of these interviews and their potential impact on goods movement are listed below. As in the previous case, these opportunities could impact output, value added and jobs in the region.

[90] A list of the interviewees is provided in the Chapter Appendix.
[91] Due to confidentiality reasons, the names of the companies interviewed as part of the supply-chain survey are not listed in this report.

Table 58. Opportunities Identified in Supply Chain Surveys

Opportunity	Anticipated Impact on Goods Movement
Increase capacity for moving goods from border to ports via railroad	Increase number of transportation options and resiliency of network for companies based in the area to connect with ports
Expand port capacity on the Mexican side of the border	Have alternative ports in the region to address congestion issues at port of LA/LB
Develop air cargo capacity in region	Allows certain industries/clusters with high value and low weight (primarily medical devices and electronics) to reach customers in U.S. market much faster
Improve access to global networks	Allows increase in number of 3PLs and other transportation companies in the region

Source: Moffatt & Nichol and HDR's Analysis of Supply-Chain Interviews

Summary of Opportunities Identified in the Region

The closeness and high degree of integration of the California – Baja California region with the U.S. markets, a highly productive labor force and the relatively low manufacturing wages on the Mexican side of the border indicate that high-end manufacturing is a key area of opportunity for this binational region. Specific subsectors of opportunity include aerospace, automobile and medical equipment.

In addition, other manufacturing subsectors such as furniture and suppliers of the automobile cluster could also feature high growth rates in the future due the potential of near-shoring (i.e., companies currently producing in Asia but considering moving their operations to the California – Baja California region).

The potential growth of the manufacturing sector would generate more jobs, output and value added in the region. Furthermore, these additional jobs would likely pay wages above those for the average manufacturing job due to the high-end nature of the production that would create them.

Additionally, the potential increase in manufacturing activity would generate not only an increase in the demand for raw materials that need to be transported into the region but also an increase on the supply of finished goods that need to leave the region to reach their final consumers. Therefore, another key opportunity for the region is related to the transportation of goods into, out of and within the California – Baja California border region. Specific opportunities in this area include:

- Development of intermodal capacity in the region
    - In particular, development of an intermodal terminal in Tijuana to transport automobiles produced in the Toyota plant in Tijuana to the U.S. market
- Increase capacity for moving goods across the border via railroad
    - The Desert Line and the rail connectivity of El Centro with points to the east would provide a transportation alternative for goods produced in the region with a final destination in the U.S. market
- Develop air cargo capacity in region
    - The development of the Holtville Cargo Airport could help transport high-value, low volume goods (such as medical devices and electronics) out of the region and into their final destinations across the U.S. markets
- Increase LPOE capacity for truck crossings

- The construction of the Otay Mesa East LPOE would relieve border-crossing truck congestion for the San Diego – Tijuana border region[92]

A complement to the opportunities for transportation services in the region is the provision of warehousing and storage services. The construction of distribution centers both in the immediate border region and in the Inland Empire would be needed to allow the potential expansion in manufacturing activities described in this chapter.

Finally, an opportunity that is specific to Imperial County and linked to the border-crossing movement of agricultural goods consists of the construction of cold storage facilities. These facilities would capitalize on the need to improve the quality of the border-crossing movement of these goods especially during peak season, when long delays at the border due to inspections can increase the probability of damage to perishable goods.

[92] The development of the new Otay Mesa East LPOE is well underway at the time of the creation of this report but it is still listed as an opportunity for the region.

Chapter 8: Freight Flow Projections in Alternative Scenarios

Introduction

The objective of this chapter is to present and evaluate the alternative forecasts of future cross-border freight flows in the region. Baseline projections of freight flows were derived through a time-series analysis of historic cross-border freight flows, with data collected from publicly-available sources and a statistical model developed to forecast overall border crossings in the study area based on socioeconomic variables that affect this type of traffic. Cross-border freight volumes were primarily divided by transportation mode (truck and rail) and by direction of flow (import and export)[93]. Two alternative freight scenarios based on different key characteristics such as low growth and high growth were developed. Aggregate projections of freight flows for both alternatives were also refined by using information from the origin-destination (O-D) surveys to assign specific freight flow estimates to different geographies in the U.S. This disaggregation was performed using subregions ("Super Zones") in which SCAG is divided.

This report highlights the results of the alternative scenarios projection analysis, but first, an overview of the forecasting analysis and complete definitions of the alternative scenarios are provided[94].

Overview

A forecasting model that projects the aggregate level of goods movements between four (4) Origin-Destination (O-D) geographies was developed. These geographies consist of the following: (a) Tijuana and Tecate (border crossing points with the San Diego Association of Governments (SANDAG) region), (b) Mexicali (as the border-crossing point with Imperial County), (c) San Pedro Bay ports (location for waterborne international trade with the SANDAG and SCAG regions), and (d) Other domestic (U.S.) locations different from the San Pedro Bay ports.[95]

Movements have been categorized as "inland-related" movements (that capture the movement of goods that do not begin or end in the San Pedro Bay ports) and "port-related" movements (those that begin or end in the San Pedro Bay seaports). The forecasting model projects the aggregate level of goods movement between these four geographies by transportation mode, by direction, and by goods category (or cluster). Furthermore, the model estimates the shares of these movements that are conducted using drayage[96].

The aggregation of Ports of Entry (POE) in the study area includes the following: San Diego – Tijuana[97] land POEs (including Tijuana – Tecate), Calexico – Mexicali[98] land POE, Port of Los Angeles/Long Beach and Port of San Diego. The total movement of goods between the U.S. and Mexico that use the transportation network in the SCAG or SANDAG area for each one of the alternative scenarios defined (i.e.,

[93] Please refer to Chapter 5 for more information.
[94] This chapter presents some events that define our two alternative scenarios and are thus likely to generate smaller or larger-than anticipated border-crossing freight flows in the region. These events were derived based on the analysis of economic trends surveys collected as part of this study.
[95] The actual forecasts are produced at a more detailed level of geography called SuperZone, as described later in this document.
[96] We will use information from the cargo generator surveys to disaggregate the estimated volumes into specific O-D pairs and data from the drayage surveys to estimate the share of volume that U.S.es this particular transportation method.
[97] San Diego – Tijuana can also be referred as San Diego County.
[98] Calexico – Mexicali can also be referred as Imperial County.

high-volume and low-volume) is further broken down into the following categories: inland-truck, inland-rail, port-truck, and port-rail.

Definition of Alternative Scenarios

The model generates projections of international goods movement for a set of pre-defined scenarios. The definition of scenarios is based on two primary considerations:

- Forecast of socio-economic conditions that impact the volume of goods crossing the border (in terms of the forecasted values of the U.S. Index of Industrial Production and the U.S. Retail Sales, which were found to be the main drivers of goods movement across the border); and,
- Expectations regarding the future development of regional border-crossing events that directly affect the flow of cross-border goods, such as the development of border infrastructure projects and policies affecting international trade in the California – Baja California region

Each scenario is, therefore, the combination of an expected socio-economic profile at the "macro" level and the anticipated development of a series of "micro" events in the California-Baja California region. The alternative scenarios are defined as follows:

- High-volume scenario: comprised of higher growth in the "macro" variables[99] compared to the baseline scenario and the evolution of certain border-crossing "micro" events[100] in the California – Baja California region that individually result in the generation a larger movement of goods across the border compared to the baseline scenario; and,
- Low-volume scenario: comprised of lower growth in the "macro" variables compared to the baseline scenario and the evolution of border-crossing "micro" events in the California – Baja California region that individually result in the generation of a smaller movement of goods across the border compared to the baseline scenario.

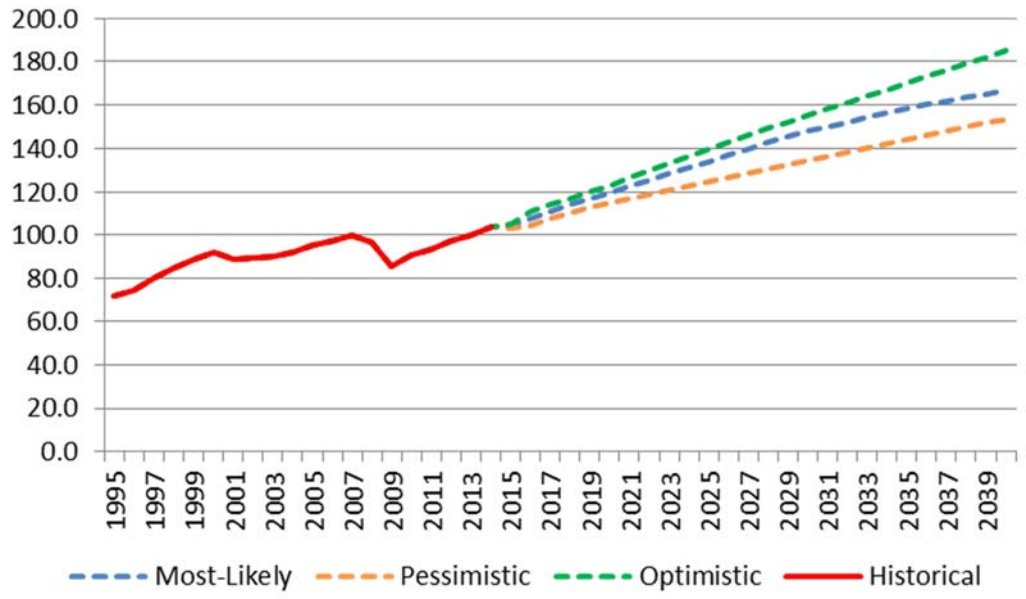
A more detailed description of the socio-economic conditions and the border-crossing events that affect the amount of goods crossing the border is provided below, along with a clearer identification of how these elements combine to form each one of the scenarios considered in this study.

Socio-Economic Conditions ("Macro" Component)

As described in Chapter 5, the U.S. Index of Industrial Production and the U.S. Retail Sales were found to be good predictors of the number of aggregate, northbound border-crossing trucks in the region. Therefore, these two variables were used to define the baseline, high-volume and low-volume scenarios of cross-border truck volumes from a socio-economic conditions perspective. A graphical representation of the forecasted high, medium and low values for these two variables is presented in the figures below. Notice that the most-likely forecasts for these variables were used to define the baseline scenario, while the optimistic and pessimistic projections are used to define the high-volume and low-volume scenarios, respectively.

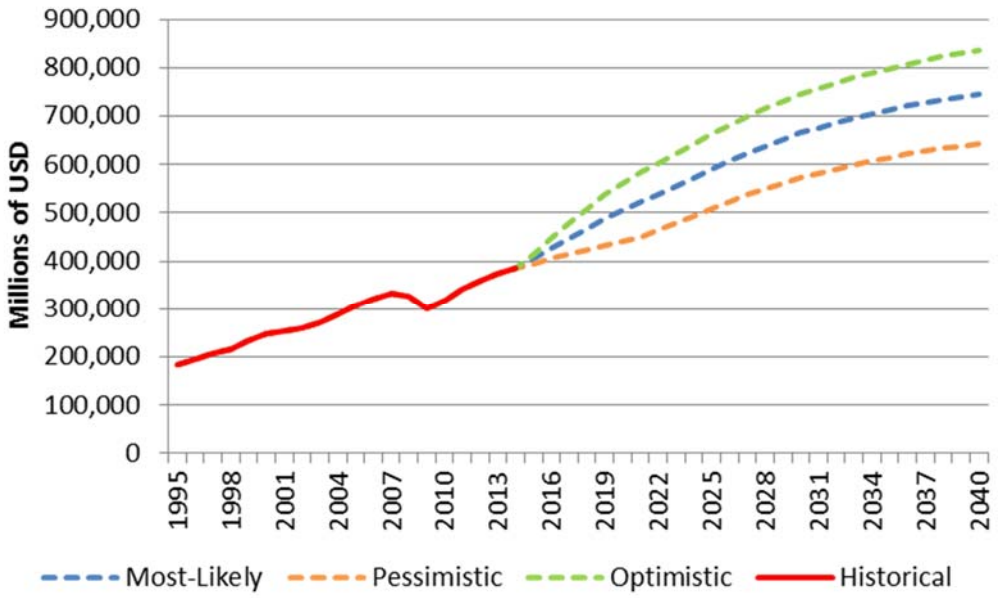
Figure 68: U.S. Index of Industrial Production (IIP) Historical Value and Projections

[99] In terms of the forecasted values of U.S. Index of Industrial Production and the U.S. Retail Sales.
[100] "Micro" events are categorized into infrastructure projects, border-crossing operations, regional production capabilities and international trade policies.



Source: HDR Analysis of data collected[101].

Figure 69:U.S. Retail Sales Historical Values and Projections



Source: HDR Analysis of data collected[102].

In the case of the optimistic forecast for these variables, the growth of the U.S. economy is stronger than anticipated and therefore both the U.S. IIP and the U.S. Retail Sales are above their most-likely forecasts. This, in turn, means the high-volume scenario will feature border-crossing truck volumes above those

[101] See the Appendix in Chapter 5 for a table with the historical and forecasted values.
[102] See the Appendix in Chapter 5 for a table with the historical and forecasted values.

forecasted in the baseline scenario.[103] On the contrary, in the pessimistic forecasts for these variables, the growth of the U.S. economy is weaker than anticipated and therefore both the U.S. IIP and the U.S. Retail Sales are below their most-likely forecasted values. This, in turn, means the low-volume scenario will include border-crossing truck volumes below those forecasted in the baseline scenario.

Finally, the forecasted values of the U.S. IIP and the U.S. Retail Sales become the explanatory variables in the development of socio-economic based (i.e., "macro-based") forecasts for the number of trucks crossing the border in the baseline, high-volume and low-volume scenarios. This is achieved by combining the appropriate forecast of the input variables with the coefficients resulting from the econometric analysis of historical border-crossing data[104].

Regional Border-Crossing Events ("Micro" Component)

After defining each scenario using the "macro" components, each scenario is further refined by adding relevant "micro" components. These "micro" components were found to be important to goods movement across the California – Baja California border region through an analysis of the responses to the economic trends surveys conducted.

Furthermore, these "micro" components become the foundation for the development of "micro-based" adjustment factors to the "macro-based" forecasts described in the previous section. The "micro-based" set of adjustment factors are derived using information on the anticipated progress of certain border-crossing events found out to be relevant to the flow of goods across the border region. These "micro-based" factors modify the "macro-based" forecasts by increasing (in the case of the high-volume scenario) or decreasing (in the case of the low-volume scenario) the "macro-based" forecasts.

In order to develop the "micro-based" adjustment factors, it is necessary to first define each scenario in terms of these "micro" events. As such, the definition of the different scenarios in terms of the border-crossing events was made using the following logic:

- Identification of individual events that define the "micro" characteristics of the different scenarios;
- Classification of those events into "impact categories" based on how they affect the movement of goods across the border;
- Assessment of likelihood and impact of each event in each alternative scenario (i.e., high-volume and low-volume); and,
- Assessment of impact on border-crossing key characteristics of each event included in each one of the alternative scenario.

IDENTIFICATION OF EVENTS THAT DEFINE THE SCENARIOS

The information used to identify the events (or "characteristics") that define the alternative scenarios from a "micro" perspective is derived from an analysis of the economic trends surveys collected as part of this study and the information collected via the interview of companies with large supply-networks in the region.

The events identified through those two information sources were aggregated into four broad categories: 1) infrastructure; 2) border-crossing operations and processes; 3) regional production capability (including near-shoring); and, 4) policy. Specific events considered in the scenario definition, classified by category, are presented below:

[103] This results from the fact that the relation between the two variables and the number of trucks crossing the border was found to be positive.
[104] The econometric analysis produces the "structural parameters" (or coefficients) for the U.S. Index of Industrial Production and the U.S. Retails Sales that are used in the forecast of northbound border-crossing trucks.

Table 59: List of "Micro" Events Identified Through the Interview Process

Category	Event
Infrastructure	• Expansion of the port of Ensenada • Construction of an intermodal facility in Tijuana • Construction of cold-storage facilities in Imperial County • Reconstruction of the Desert Line (railroad) • Congestion at the ports of Los Angeles/Long Beach • Modernization of short-line between Tijuana and Tecate, including expansion of freight yards in San Ysidro and Tijuana (railroad) • Expansion of capacity at the Land Ports of Entry (LPOEs) in San Luis Rio Colorado • Construction of Otay Mesa East LPOE • Repurposing of Hotville airport to handle freight
Border-Crossing Operations	• Higher efficiency in LPOEs in California compared to those in Arizona • Introduction of pre-inspection & other technology-based operational improvements at California LPOEs
Regional Production Capability[105]	• Relocation of cargo-generating companies from China to Tijuana and Mexicali due to quality concerns (particularly furniture cluster) • Relocation of suppliers of large maquiladoras to Tijuana and Mexicali • Manufacturing activities in Tijuana and Mexicali involve larger share of high-volume activities
Policy	• Baja California State policy to retain and expand maquiladoras in region • Baja California State policy to promote relocation (to the area) of companies supplying to maquiladoras • Mexico's Federal policy to promote domestic suppliers to maquiladoras • Mexico's Federal fiscal incentives policy towards maquiladoras

Source: HDR Analysis of Economic Trends Survey and Interviews with Companies

IMPACT OF INDIVIDUAL EVENTS ON KEY CHARACTERISTICS OF BORDER-CROSSING FLOWS

Each of the events listed in Table 59 was analyzed and classified into different "impact categories" based on the anticipated impact each event could have on three key elements of border-crossing flows: 1) O-D patterns; 2) modal distribution; and 3) mix of border-crossing cargo (or cluster mix)[106]. The resulting classification of events is presented in Table 52.

Table 60. Anticipated Impacts of "Micro" Events on Border-Crossing Flows

Category	Event	Changes in O-D patterns	Modal shares	Cluster trade mix
Infrastructure	Expansion of the port of Ensenada	**X**		**X**
	Construction of an intermodal facility in Tijuana	**X**	**X**	**X**

[105] Even though interviewees did not specifically identify the performance of current and future trade agreements (such as the TPP) in their responses, the events listed under this category correspond to direct manifestations of the performance of these trade agreements. As a result, trade agreements were not explicitly analyzed in this study.
[106] These three elements were identified by the study team to be critical elements in assessing the use of the regional transportation network and therefore are included in the border-crossing volume forecasting model developed for this study.

Category	Event	Changes in O-D patterns	Modal shares	Cluster trade mix
	Construction of cold-storage facilities in Imperial County	X		X
	Reconstruction of the Desert Line (railroad)	X	X	X
	Congestion at the ports of Los Angeles/Long Beach	X		
	Modernization of short-line between Tijuana and Tecate, including expansion of freight yards in San Ysidro and Tijuana (railroad)	X	X	X
	Expansion of capacity at the Land Ports of Entry (LPOEs) in San Luis Rio Colorado	X		X
	Construction of Otay Mesa East LPOE	X		
	Repurposing of Hotville airport to handle freight	X	X	X
Border-Crossing Operations	Higher efficiency in LPOEs in California compared to those in Arizona	X		
	Introduction of pre-inspection & other technology-based operational improvements at California LPOEs	X		X
Regional Production Capability	Relocation of cargo-generating companies from China to Tijuana and Mexicali due to quality concerns (particularly furniture cluster)	X		X
	Relocation of suppliers of large maquiladoras to Tijuana and Mexicali	X		X
	Manufacturing activities in Tijuana and Mexicali involve larger share of high-volume activities	X		X
Policy	Baja California State policy to retain and expand maquiladoras in region	X		X
	Baja California State policy to promote relocation (to the area) of companies supplying to maquiladoras	X		X
	Mexico's Federal policy to promote domestic suppliers to maquiladoras	X		
	Mexico's Federal fiscal incentives policy towards maquiladoras	X		

Source: HDR Analysis of Economic Trends Survey and Interviews with Companies

EVENTS THAT DEFINE EACH ALTERNATIVE SCENARIO

The matching of individual events presented in Table 59 to the different alternative scenarios (i.e., high-volume and low-volume) was done by analyzing each event and distinguishing, when appropriate, how a likely outcome of the event would affect the volume of border-crossing goods[107]. For example, the policy event identified as "Baja California State policy to retain and expand maquiladoras in region" was deemed to have two likely possible outcomes: success or failure. If the policy succeeds, more border-crossing

[107] For some "micro" events, only one outcome was included in the scenario definitions, since alternative outcomes were not deemed to be likely.

volumes are anticipated in the region (and therefore this outcome is included in the high-volume scenario); on the contrary, if the policy fails, less border-crossing volumes can be expected in the region (therefore, matching this outcome with the low-volume scenario).

An analysis of the events and impacts listed in Table 52 was conducted in order to assess the likelihood of those events occurring with a high degree of certainty in each one of the alternative scenarios. As a result of this analysis, the "micro" events listed below were included in each alternative scenario:

Alternative Scenario	Category	"Micro" Events in Scenario
High-Volume Scenario	Infrastructure	Port of Ensenada expands (including El Sauzal)
		Intermodal facility in Tijuana is built
		Cold storage facilities are built in Imperial County
		East-West railroad (Desert Line) begins operations
		Modernization of railroad short-line between Tijuana and Tecate is completed (including expansion of freight yards in SY and Tijuana)
	Border-Crossing Operations	Pre-inspection & other technology-based operational improvements are introduced at local LPOEs
	Regional Production Capability	Furniture companies relocate to Tijuana from China (higher quality)
		Suppliers of large maquiladoras do not relocate to Tijuana & Mexicali
		High value-added manufacturing activities in Tijuana and Mexicali increase
	Policy	BC State policy to retain and expand maquiladoras succeeds
		BC State policy to promote relocation of supplier companies to maquiladoras fails
		Mexican policy to promote domestic suppliers fails
		Maquiladoras go back to IMMEX treatment (are not charged VAT)
Low-Volume Scenario	Infrastructure	LPOEs in SLRC expand capacity
		Holtville air cargo project begins operations
	Regional Production Capability	High value-added manufacturing activities in Tijuana and Mexicali do not increase
	Policy	BC State policy to retain and expand maquiladoras fails
		BC State policy to promote relocation of supplier companies to maquiladoras succeeds
		Mexican policy to promote domestic suppliers is successful
		Maquiladoras are charged fully for VAT (no reimbursement)

Source: HDR Analysis of Economic Trends Survey and Interviews with Companies

IMPACT OF EVENTS INCLUDED IN ALTERNATIVE SCENARIOS

An analysis of the "micro" events included in each alternative scenario was conducted using professional judgment and knowledge of the bi-national region to arrive at the impacts listed below. Notice the impacts

are broken down into the key elements of border-crossing flows defined before: changes to O-D patterns; changes to modal distribution; and changes to the mix of border-crossing cargo (or cluster mix).

Table 61. Impacts of Micro Events on Cross-Border Movements in High-Volume Scenario

Micro Event Description	Changes in O-D Patterns	Modal Shares	Cluster Trade Mix
Expansion of the Port of Ensenada	Instead of entering the US through LA/LB, goods move through Ensenada. Therefore, increase in NB truck flows from Tijuana.	No Impact	No Impact
Construction of Intermodal facility in Tijuana	Decrease in truck volumes both directions from/to Tijuana	Switch from Truck to Rail	Increase Automotive sector share for Rail and Decrease Automotive sector share for Truck.
Construction of Cold-Storage Facilities in Imperial County	Potential clusters that could use cold-storage facilities are: Processed Food and Fishing. Increase shares based on 'OD Pairs Sample Data' worksheet in NB direction for Calexico-Mexicali.	No Impact	Increase Cluster Shares for Processed Food and Fishing.
Reconstruction of the Desert Line (railroad)	East-West railroad (Desert Line) begins operations, leading to decrease in NB truck movements between Mexicali and External.	Switch from Truck to Rail	Increase Automotive sector share for Rail and Decrease Automotive sector share for Truck.
Modernization of Short-Line between Tijuana and Tecate, including Expansion of Freight Yards in San Ysidro and Tijuana (railroad)	Decrease in NB freight movements by truck between Tijuana and External due to modernization of Short-Line (railroad).	Switch from Truck to Rail	Increase Automotive sector share for Rail and Decrease Automotive sector share for Truck.
Introduction of Pre-Inspection & Other Technology-Based Operational Improvements at California LPOEs	Increase truck volume shares in both directions for all California LPOEs	No Impact	No Impact
Relocation of Cargo-Generating companies from China to Tijuana and Mexicali due to Quality concerns (particularly Furniture Cluster)	Increase NB volume from Tijuana and Mexicali to External SuperZone.	No Impact	Increase Furniture sector share for Trucks.
Relocation of Suppliers of Large Maquiladoras to Tijuana and Mexicali	Increase in SB flows from LA/LB to Tijuana/Mexicali as a result of failure of relocation of suppliers	No Impact	Increase in sector shares for Lighting and Plastics of trade to Tijuana. Increase in sector share for Lighting, Plastics, Auto, Metal Manufacturing and Heavy Machinery of trade to Mexicali.

Manufacturing Activities in Tijuana and Mexicali Involve Larger Share of High-Volume Activities	Increase in NB volumes	No Impact	Increase in share of trade for following clusters: Electronics, Furniture, and Automotive.
Baja California State Policy to Retain and Expand Maquiladoras in Region	Success of this policy leads to increase in flows in both directions.	No Impact	Sectors increasing shares: NB Tijuana – Lighting. NB Mexicali – Lighting, Heavy Machinery. SB Tijuana – Lighting and Plastics. SB Mexicali – Lighting, Plastics, Auto, Metal Manufacturing and Heavy Machinery
Baja California State Policy to Promote Relocation (to the area) of Companies Supplying to Maquiladoras	Failure of this policy leads to increase in SB flows.	No Impact	Increase in sector shares for Lighting and Plastics of trade to Tijuana. Increase in sector share for Lighting, Plastics, Auto, Metal Manufacturing and Heavy Machinery of trade to Mexicali.
Mexico's Federal Policy to Promote Domestic Suppliers to Maquiladoras	Failure of this policy leads to increase in SB flows.	No Impact	Increase in sector shares for Lighting and Plastics of trade to Tijuana. Increase in sector share for Lighting, Plastics, Auto, Metal Manufacturing and Heavy Machinery of trade to Mexicali.
Mexico's Federal Fiscal Incentives Policy towards Maquiladoras	Re-introduction of fiscal incentives leads to increase in both NB and SB flows.	No Impact	Sectors increasing shares of trade: NB Tijuana – Lighting. NB Mexicali – Lighting, Heavy Machinery. SB Tijuana – Lighting and Plastics. SB Mexicali – Lighting, Plastics, Auto, Metal Manufacturing and Heavy Machinery

Source: HDR Analysis of Economic Trends Survey and Interviews with Companies

Table 62. Impacts of Micro Events on Cross-Border Movements in Low-Volume Scenario

Micro Event Description	Changes in O-D Patterns	Modal Shares	Cluster Trade Mix
Expansion of Capacity at the Land Ports of Entry (LPOEs) in San Luis Rio Colorado	Reduce volumes at LPOEs in Imperial County (Calexico and Andrade) on both directions.	No Impact	No Impact
Repurposing of Holtville Airport to Handle Freight	Holtville air cargo project begins operation. Anticipate switch in NB freight movements from truck to air	No Impact	Reduction of share of Electronics sector for Truck
Manufacturing Activities in Tijuana and Mexicali Do Not Involve Larger Share of High-Volume Activities	NB volume of crossings anticipated to decrease	No Impact	Decrease in share of trade for following clusters: Electronics, Furniture, and Automotive.

Baja California State Policy to Retain and Expand Maquiladoras in Region	Failure of this policy leads to decrease in flows in both directions.	No Impact	Sectors decreasing shares: NB Tijuana – Lighting. NB Mexicali – Lighting, Heavy Machinery. SB Tijuana – Lighting and Plastics. SB Mexicali – Lighting, Plastics, Auto, Metal Manufacturing and Heavy Machinery
Baja California State Policy to Promote Relocation (to the area) of Companies Supplying to Maquiladoras	Success of this policy leads to decrease in SB flows.	No Impact	Decrease in sector shares for Lighting and Plastics of trade to Tijuana. Decrease in sector share for Lighting, Plastics, Auto, Metal Manufacturing and Heavy Machinery of trade to Mexicali.
Mexico's Federal Policy to Promote Domestic Suppliers to Maquiladoras	Success of this policy leads to a decrease in SB flows.	No Impact	Decrease in sector shares for Lighting and Plastics of trade to Tijuana. Decrease in sector share for Lighting, Plastics, Auto, Metal Manufacturing and Heavy Machinery of trade to Mexicali.
Mexico's Federal Fiscal Incentives Policy towards Maquiladoras	If fiscal incentives are not re-introduced, decrease in both NB and SB flows.	No Impact	Sectors decreasing shares of trade: NB Tijuana – Lighting. NB Mexicali – Lighting, Heavy Machinery. SB Tijuana – Lighting and Plastics. SB Mexicali – Lighting, Plastics, Auto, Metal Manufacturing and Heavy Machinery.

Source: HDR Analysis of Economic Trends Survey and Interviews with Companies

Methodology and Forecast Results

The methodology to forecast border-crossing goods movement for the alternative scenarios is similar to that used to forecast flows in the baseline scenario.[108] It consists of two main steps: (i) estimation of goods movement flows in each border-region area by direction and mode; and, (ii) breakdown of those aggregate forecasts into movements linked to port operations and movements not linked to port operations. The first step is conducted using an econometric analysis that relies on high-level socio-economic inputs while the second step consists of an accounting exercise that uses shipment-level data to perform the appropriate flow allocations.

Econometric Analysis

The first step in the econometric analysis consisted of identifying variables that help explain the behavior of border-crossing truck volumes in the border region. To do this, a high-level statistical analysis was conducted between the historical values of northbound border-crossing truck volumes and two measures of economic activity: annual total value of retail sales in the U.S. and the annual index of industrial

[108] See Chapter 5 for a detailed description of the methodology.

production in the U.S.[109] The analysis showed a strong correlation between the variables at a regional level, providing support for the use of these variables in the forecast.[110]

Similarly, the econometric analysis used to estimate the future number of truck border-crossings in each alternative scenario was similar to that used to estimate border-crossing truck movements in the baseline scenario. In particular, it used the same structural relations (i.e., value of coefficients) between northbound border-crossing truck movements in each specific region analyzed (San Diego – Tijuana and Calexico – Mexicali) and the annual total value of retail sales in the U.S. and the annual index of industrial production in the U.S.[111]

These structural relations were combined with projections of future values for the explanatory variables under each alternative scenario to produce the forecasted number of northbound border-crossing trips by truck in each region and by scenario. The future values of explanatory variables were collected from several sources and subjected to a risk-analysis process to identify pessimistic, optimistic and most-likely forecasted values that were used to develop the different forecast scenarios.[112] In particular, the optimistic and pessimistic forecasts of the explanatory variables were used to generate the high-volume and low-volume scenario forecasts, respectively.

Truck and Rail Projections

For each alternative scenario, this section presents the results of the forecasting exercise in four different subsections, each one of them related to a specific combination of mode used to cross the border and flow-generator (inland vs. port). As such, the four results presented in each alternative scenario are:

- Inland-truck forecasts
- Inland-rail forecasts
- Port-truck forecasts
- Port-rail forecasts

The methodology used to generate the freight forecasts varies for each of the different border-crossing modes analyzed (truck and rail) under each alternative scenario is similar to that used in the baseline scenario. In particular, it relies on two steps: (i) forecasting aggregate, mode-wide movements by direction of flow for each of the two border-crossing regions analyzed (San Diego – Tijuana and Calexico – Mexicali, separately) under each scenario; and, (ii) disaggregate each border region's aggregate volumes by scenario into border-crossing movements generated by the ports in the San Pedro Bay area (identified in this study as "port flows") and border-crossing movements not generated by the ports (identified as "inland flows").[113]

The main difference between the methodology used in the forecast of border-crossing flows in the baseline scenario and that used in the forecast of border-crossing flows the alternative scenarios is in the generation of the aggregate forecasts (i.e., first step in the methodology). In the case of aggregate forecasts of truck volumes in the alternative scenarios, it is done using the "macro" and "micro" components that correspond to each particular scenario. In the case of the forecast of rail border-crossing movements in the alternative

[109] A traffic and revenue analysis conducted for the new Otay Mesa East LPOE in the San Diego-Tijuana border region found these variables explain the historical volumes of northbound border-crossing trucks from a socio-economic perspective.
[110] See Chapter 5 for a graphical representation of this correlation.
[111] The results of the econometric regression are presented in the Appendix of Chapter 5.
[112] See Chapter 5 for a list of sources and the actual forecasts for these variables under the alternative scenarios.
[113] See Chapter 5 for a detailed description of the forecasting methodologies.

scenarios, it is done using the high and low forecasts for growth rates for these flows found through a statistical analysis of the FAF3 database forecasts.

As in the baseline case, mode-wide forecasts were separated into inland flows versus port flows at each border region using available data on port throughput whose origin or destination is in the Tijuana or Mexicali areas. This data was used to generate port-based flow forecasts for each mode, which were then subtracted from the aggregate forecasts described in the previous paragraph to estimate the corresponding inland flows.

High-Volume Scenario Results

INLAND-TRUCK PROJECTIONS

The structural relations found through the econometric analysis were combined with the optimistic forecasts for the annual total value of retail sales in the U.S. and the annual index of industrial production in the U.S. to estimate the socio-economic-based ("macro"-component-based) total number of northbound truck border crossings through the San Diego – Tijuana and Calexico – Mexicali regions in future years.[114] These forecasts were then modulated using the impacts of the regional border-crossing events ("micro" component) to generate the aggregate truck forecasts for each region.

The assumption that northbound truck flows equal southbound truck flows at the aggregate level was also used in the case of the forecast for the alternative scenarios.[115] Furthermore, a similar methodology to that described in the baseline scenario was used to generate the number of northbound and southbound crossings by inland-truck in the high-volume scenario. That methodology required implementing the following steps:

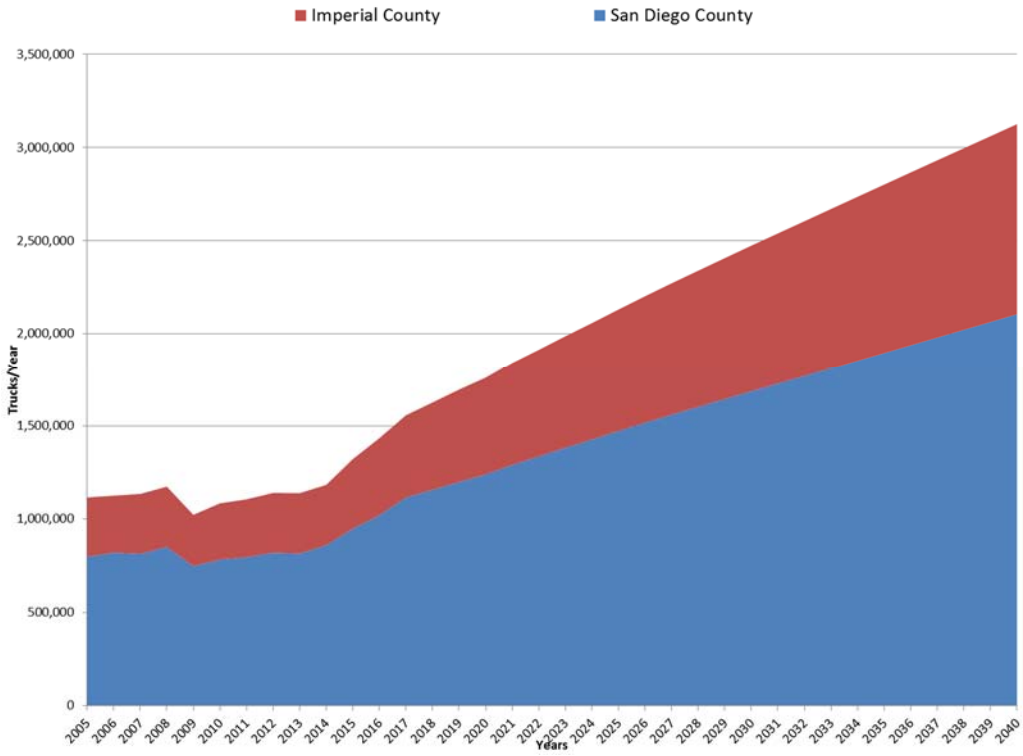
- Using the structural relations estimated through the econometric analysis and the forecasted values of the socio-economic conditions corresponding to each alternative scenario, derive annual forecasts of aggregate truck volumes crossing at the Southern California (SoCal) Land POEs for each alternative scenario in each direction and for each one of the relevant study regions of San Diego County and Imperial County[116].
- By definition, the aggregate truck volumes forecasted under each scenario and for each region can be broken down into four types of flows:
    - Northbound forecasted truck volumes at each region can be divided into: (a) trips that originate in Mexico and are destined to locations in the U.S. excluding the San Pedro Bay ports; (b) trips that originate in Mexico, enter the U.S. and are then exported to a foreign country through the San Pedro Bay Ports.
    - Southbound forecasted truck flows at each region can be divided into: (c) trips that originate in the U.S., excluding the San Pedro Bay Ports, that are destined for Mexico; (d) trips that originate in a foreign country, enter the U.S. through the San Pedro Bay ports and are then transported into Mexico.
- The forecast of inland-truck volumes under each alternative scenario corresponds to flows (a) and (c), with (a) representing northbound inland-truck flows and (c) representing southbound inland-truck flows. Hence, it is necessary to exclude truck forecasts that are related to the San Pedro Bay Ports from the aggregate forecasts generated in the fist bullet point.

[114] Please refer to Figure 40 and Figure 41 to identify the optimistic forecasts for these socio-economic variables.
[115] This assumption no longer holds after the "micro" adjustments have been introduced, since some of them apply only to a certain direction of flow. However, the imbalances are minimal, representing less than 2% of the directional volumes.
[116] Also called the San Diego – Tijuana and Calexico – Mexicali regions, respectively.

- Under each scenario, a forecast for the number of trucks in scenarios (b) and (d)[117] was developed. These volumes are subtracted from the total (aggregate) truck volumes for each corresponding direction and in each region that were generated through the econometric model. This subtraction allows the estimation of inland-truck projections.

Figure 70 shows the high-volume inland-truck volumes projections for Imperial County and San Diego County for northbound flows[118]. For northbound flows, inland-truck volumes are projected to grow at a faster pace in Imperial County than in San Diego County throughout the forecasting period (overall growth of 122 percent and 172 percent for San Diego County and Imperial County, respectively). However, the total number of truck border crossings is considerably higher in San Diego County (more than 2.1 million forecasted in 2040 for San Diego County as opposed to just over 1 million forecasted in Imperial County for that same year).[119]

Figure 70. Forecasted Inland-Truck Volumes – Northbound, High-Volume Scenario



Source: SCAG Forecasting Model

INLAND-RAIL PROJECTIONS

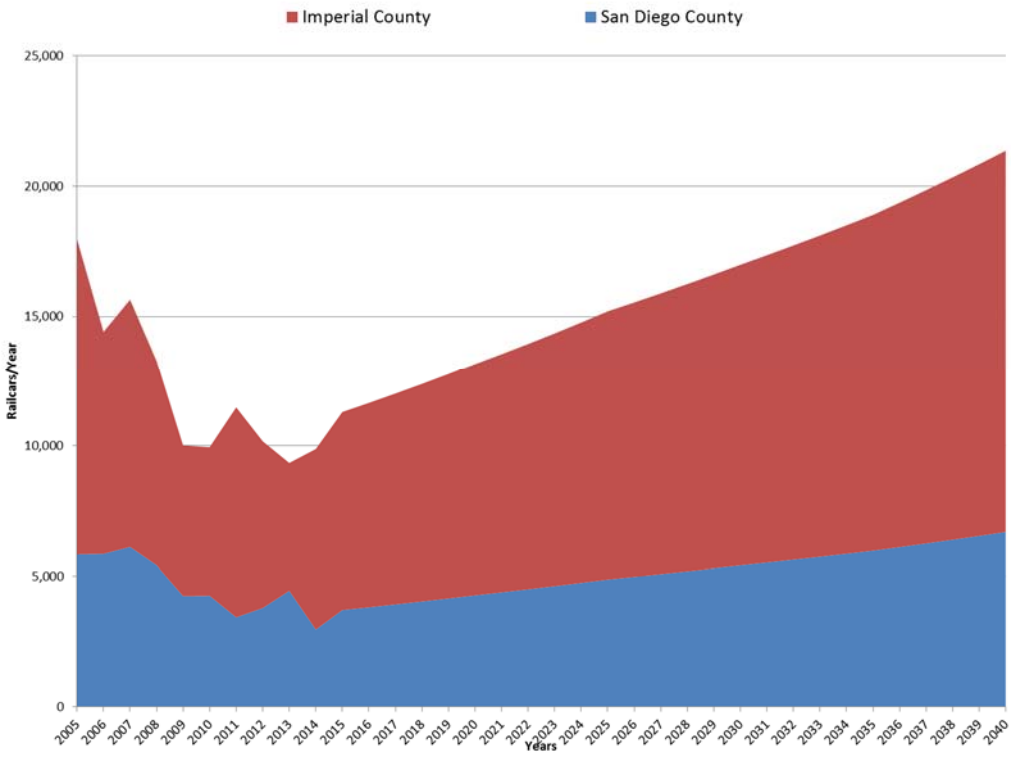
The analysis and forecasting methodology is fairly similar to that conducted for inland-truck projections and described above, with one exception: an econometric model approach was not used in the case of this mode since border-crossing rail movements are relatively small in the area[120]. As a result, FAF3 data was used to indirectly derive the future number of border-crossing rail movements between 2015 and 2040. To do this, the projected annual growth rates of border-crossing rail volumes (measured in tons) from the FAF3

[117] See corresponding subsection on this Chapter under each scenario forecast.
[118] As mentioned before, these forecasted volumes are assumed to also correspond to southbound volumes.
[119] These forecasts are also presented in the Chapter 8 Appendix to this Chapter in a tabular format.
[120] The large majority of the land movements of goods across the border are performed using truck and therefore more consideration was given in this study to the forecast methodology of truck border-crossings.

database[121] was calculated and applied to the historical (observed) number of railcars that cross the border. High-volume and low-volume border-crossing railcar projections were computed using a growth rate above that used in the baseline scenario and a growth rate below that used in the baseline scenario (respectively). The high-growth and low-growth rates were identified through a statistical analysis of growth rates for rail volumes (measured in tons) reported in FAF3. As a result, forecasted volumes are anticipated to grow at a higher (lower) growth rate than historically observed for the high-volume (low-volume) scenario.

Figure 45 shows the high-volume scenario inland-rail volumes projections for Imperial County and San Diego County for northbound and southbound flows[122]. For northbound and southbound flows, inland-rail volumes are projected to grow at a faster pace between 2015 and 2040 for Imperial County (overall growth rates of 80 percent and 93 percent for San Diego County and Imperial County respectively). Not only that, but inland-rail volumes are forecasted to be considerably higher in Imperial County than in San Diego in year 2040 (more than 14,400 railcars are forecasted in Imperial County for that year, while slightly less than 6,700 are forecasted in San Diego).

Figure 71: Forecasted Inland-Rail Volumes – Northbound, High-Volume Scenario



Source: SCAG Forecasting Model

PORT-TRUCK PROJECTIONS

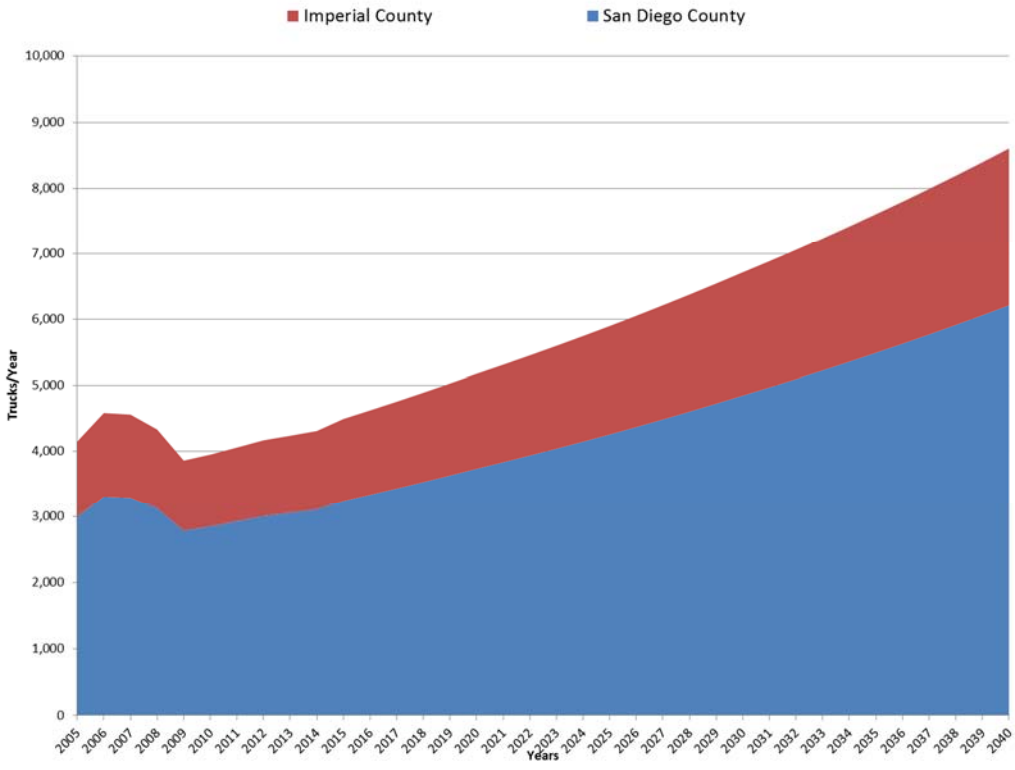
Port cargo volumes used to derive port-truck forecasts are comprised of containerized and non-containerized cargo. The methodology to develop the projections for port-truck volumes in the high-volume scenario is similar to that used on the baseline scenario and described in Chapter 5. However, an important consideration regarding differentiated growth rates of the containerized cargo volumes was introduced to generate port-truck projections for the high-volume scenario. As in the baseline scenario, the San Pedro Bay Cargo Forecast Update (2009) report was used to obtain historical numbers on TEU data. However,

[121] This analysis was done looking only at goods transported via rail.
[122] As in the case of trucks, southbound rail volumes are very similar to northbound volumes (though not identical).

unlike the baseline scenario, the growth rates from the 2007 report were used to forecast container volumes until 2040. The 2007 report provides optimistic (i.e., higher) growth rates for container cargo compared to the baseline scenario and are considered better suited to describe a scenario where high-volume of border-crossing goods movements is intended.

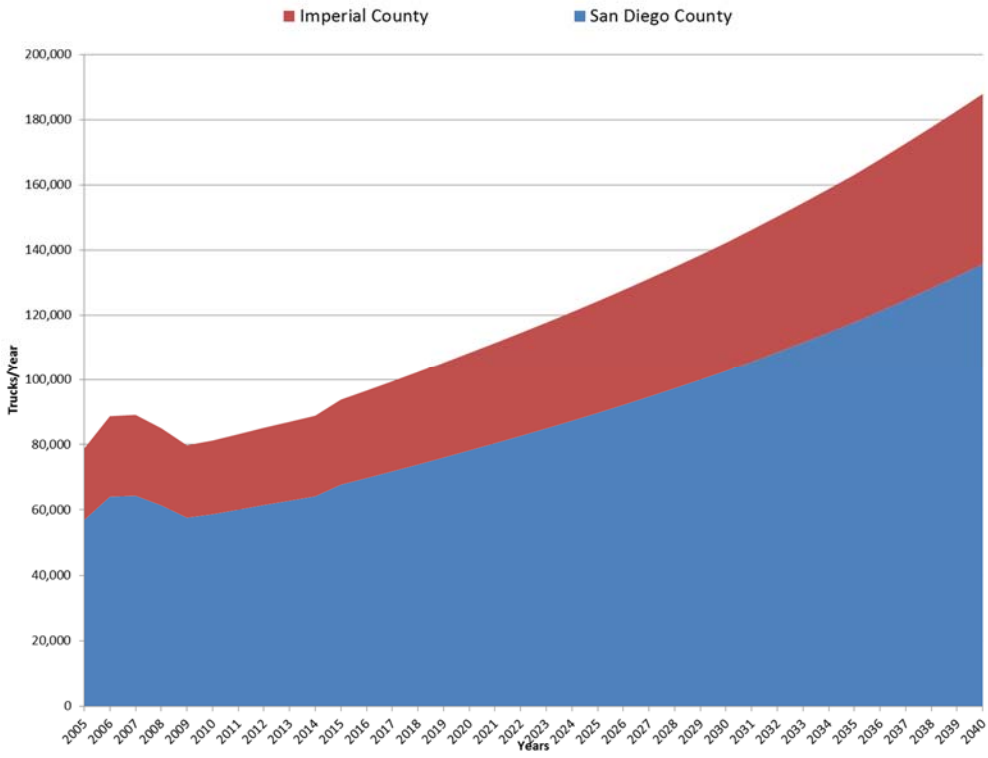
For non-containerized cargo forecasts, historical and forecasted data in metric tons with compound annual growth rates (CAGR) are provided in the San Pedro Bay Cargo Forecast 2007 report for dry bulk, liquid bulk, and general cargo. Unlike containerized cargo volumes, the 2009 report does not provide revised numbers. Forecast data for high-volume and low-volume scenarios were obtained from this document. The 2007 report provides tonnage numbers for the baseline case and then projects future volumes using two growth rates: high growth and low growth. For consistency purposes, tons per truck were used as factors to convert tonnage numbers into truckloads for each scenario. Containerized and non-containerized cargo forecasts are then added to generate aggregate port-truck volumes.

Figure 72: Forecasted Port-Truck Volumes – Northbound, High-Volume Scenario



Source: SCAG Forecasting Model

Figure 73: Forecasted Port-Truck Volumes – Southbound, High-Volume Scenario



Source: SCAG Forecasting Model

In order to estimate port-truck volumes for the high-volume scenario, the same methodology and assumption are used as in the case of the port-truck forecast in the baseline scenario. These assumptions were made in order to break down container and non-container volumes by mode, ports of entry and direction.[123]

Figure 46 and Figure 47 show port-truck projections for northbound and southbound flows for Imperial County and San Diego County for the high-volume scenario. For northbound flows, aggregate volumes are forecasted to surpass 8,600 trucks in 2040, compared to approximately 4,300 trucks in 2014. Southbound movements are much more prominent than northbound movements. Aggregate volumes are forecasted to reach almost 188,000 trucks in 2040, compared to approximately 89,000 trucks in 2014.

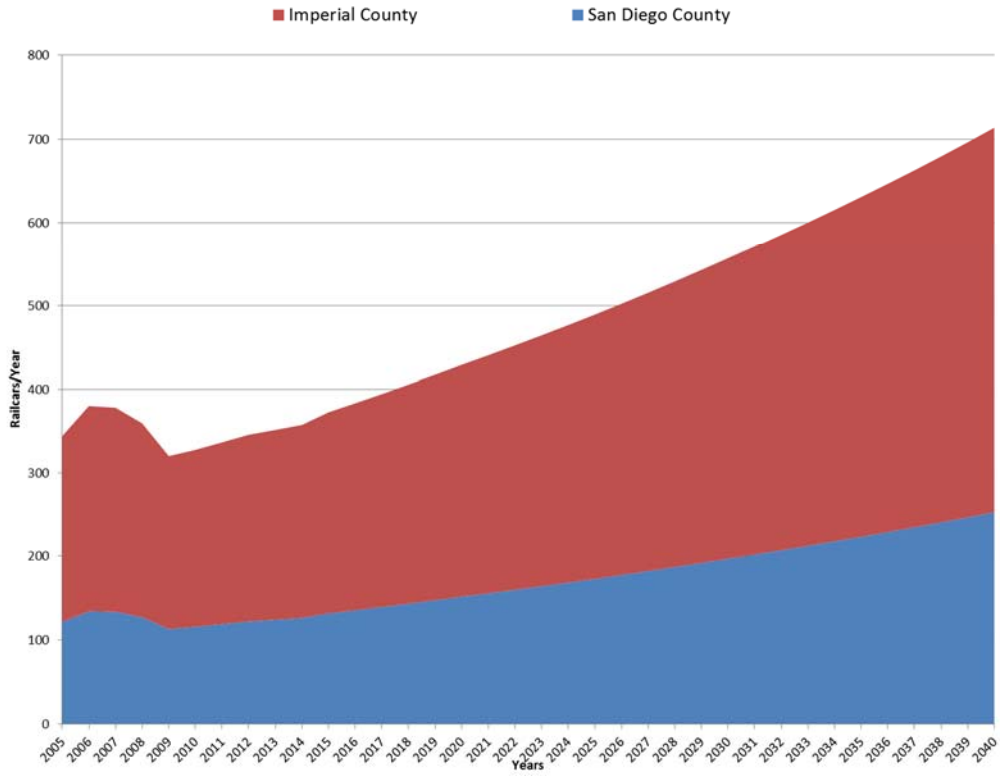
PORT-RAIL PROJECTIONS

The analysis and methodology used to produce these forecasts is similar to that used in the port-truck projections described above and relies on the approach used in the baseline scenario and described in detail in Chapter 5.

Figure 48 and Figure 49 show high-volume port-rail volumes projections for northbound and southbound flows for Imperial County and San Diego County. For northbound flows, aggregate volumes are forecasted to cross 700 railcars in 2040, compared to approximately 360 railcars in 2014. As can be seen in the chart below, the majority of northbound rail movements originate in Imperial County. The observation is similar for southbound flows, except that southbound volumes are much greater than northbound volumes. Aggregate volumes are forecasted to surpass 15,500 railcars in 2040, compared to approximately 7,400 railcars in 2014.

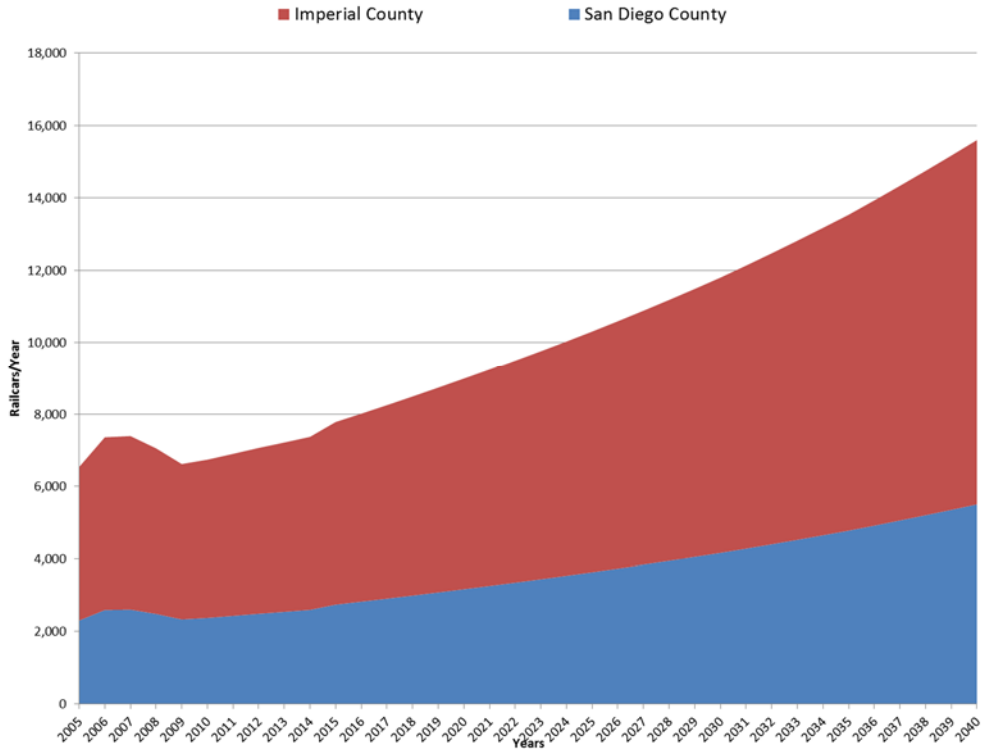
[123] Please refer to Chapter 5 for a detailed explanation of this methodology.

Figure 74: Forecasted Port-Rail Volumes – Northbound, High-Volume Scenario



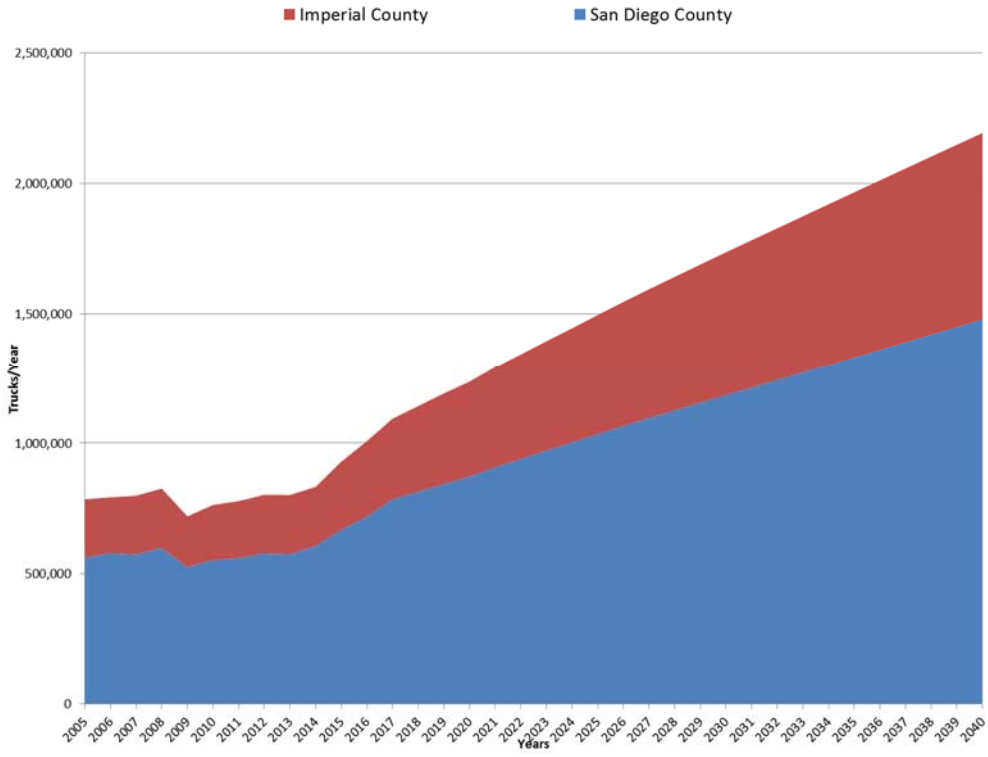
Source: SCAG Forecasting Model

Figure 75: Forecasted Port-Rail Volumes – Southbound, High-Volume Scenario



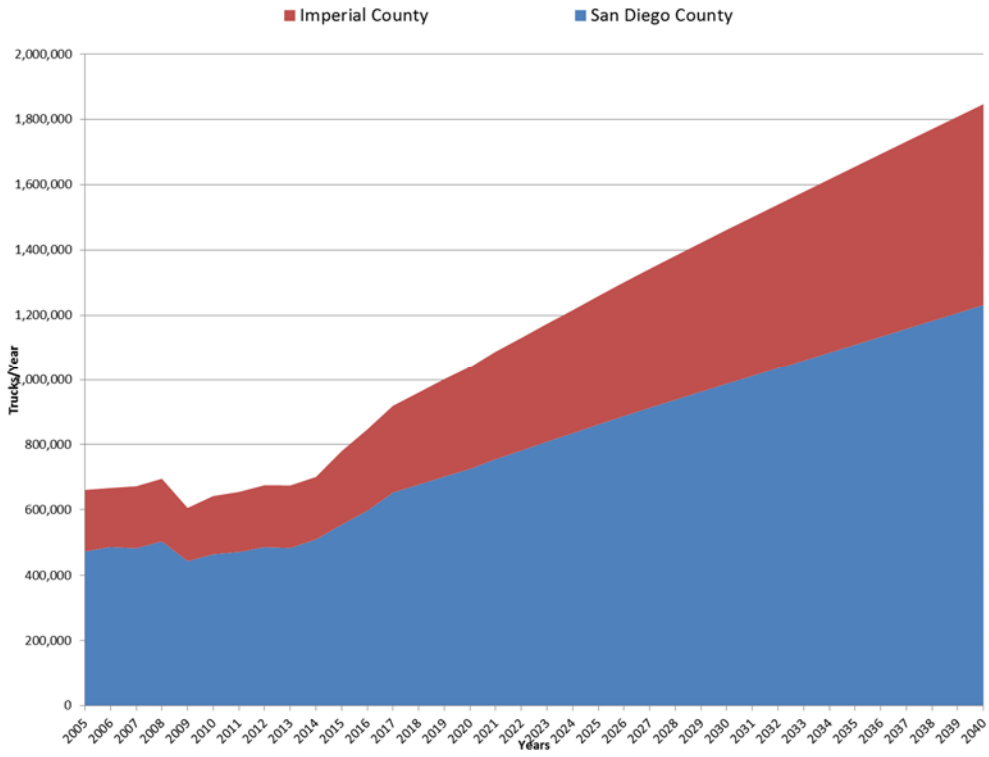
Source: SCAG Forecasting Model

Figure 76: Forecasted Drayage Volumes – Northbound, High-Volume Scenario



Source: SCAG Forecasting Model

Figure 77: Forecasted Drayage Volumes – Southbound, High-Volume Scenario



Source: SCAG Forecasting Model

DRAYAGE PROJECTIONS

Figure 50 and Figure 51 show high-volume scenario drayage projections for northbound and southbound flows for Imperial County and San Diego County. For northbound flows, aggregate drayage volumes are projected to grow by a factor of more than 2.5 in 2040 compared to 2014 volumes (more than 830,000 trucks in 2014 and almost 2.2 million trucks in 2040). For southbound flows, aggregate drayage volumes are projected to also increase by a factor of more than 2.5 in 2040 compared to 2014 volumes (700,000 trucks in 2014 and almost 1.85 million trucks in 2040).

Low-Volume Scenario Results

INLAND-TRUCK PROJECTIONS

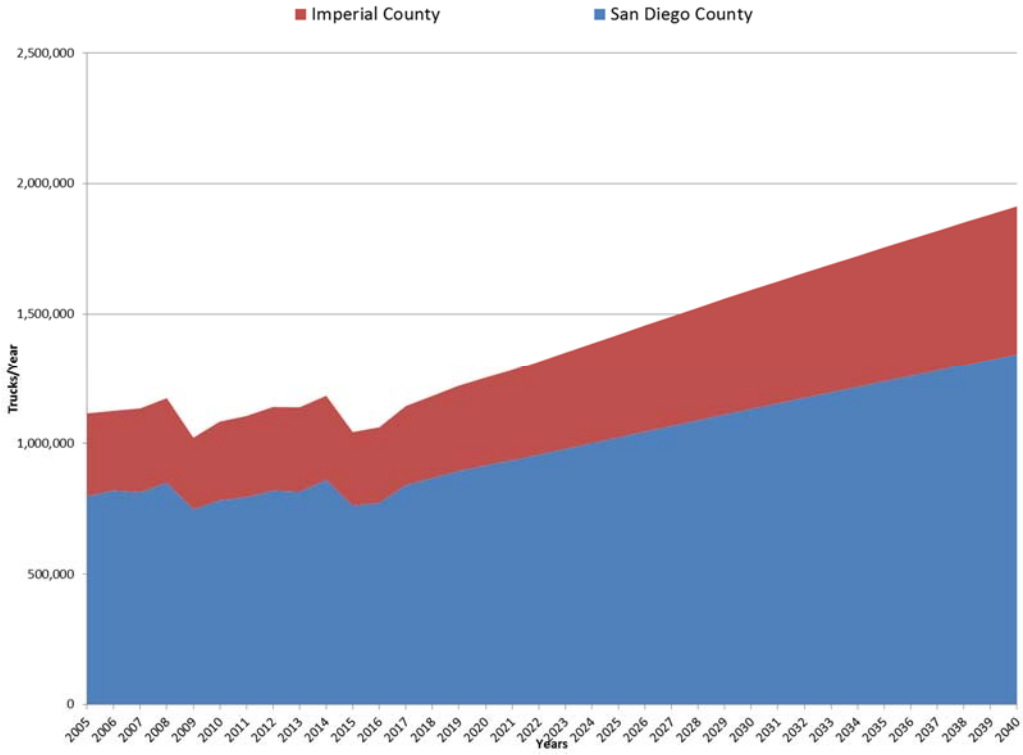
Structural relations found through the econometric analysis were combined them with the pessimistic forecasts for the annual total value of retail sales in the U.S. and the annual index of industrial production in the U.S. to estimate the socio-economic-based ("macro"-component-based) total number of northbound truck border crossings through the San Diego – Tijuana and Calexico – Mexicali regions in future years.[124] These forecasts were then modulated using the impacts of the regional border-crossing events ("micro" component) corresponding to the low-volume scenario to generate the aggregate truck forecasts for each region.

The methodology to that described in the high-volume scenario was used to generate the number of northbound and southbound crossings by inland-truck in the low-volume scenario.

Figure 78 depicts the high-volume inland-truck volumes projections for Imperial County and San Diego County for northbound flows[125]. For northbound flows, inland-truck volumes are projected to grow at a faster pace in Imperial County than in San Diego County throughout the forecasting period (overall growth of 77 percent and 101 percent for San Diego County and Imperial County, respectively). However, the total number of truck border crossings is considerably higher in San Diego County (more than 1.3 million forecasted in 2040 for San Diego County as opposed to less than 600,000 forecasted in Imperial County for that same year).[126]

[124] Please refer to Figure 40 and Figure 41 to identify the pessimistic forecasts for these socio-economic variables.
[125] This assumption no longer holds after the "micro" adjustments have been introduced, since some of them apply only to a certain direction of flow. However, the imbalances are minimal, representing less than 2% of the directional volumes.
[126] These forecasts are also presented in the Chapter Chapter 8 Appendix to this Chapter in a tabular format.

Figure 78. Forecasted Inland-Truck Volumes – Northbound, Low-Volume Scenario



Source: SCAG Forecasting Model

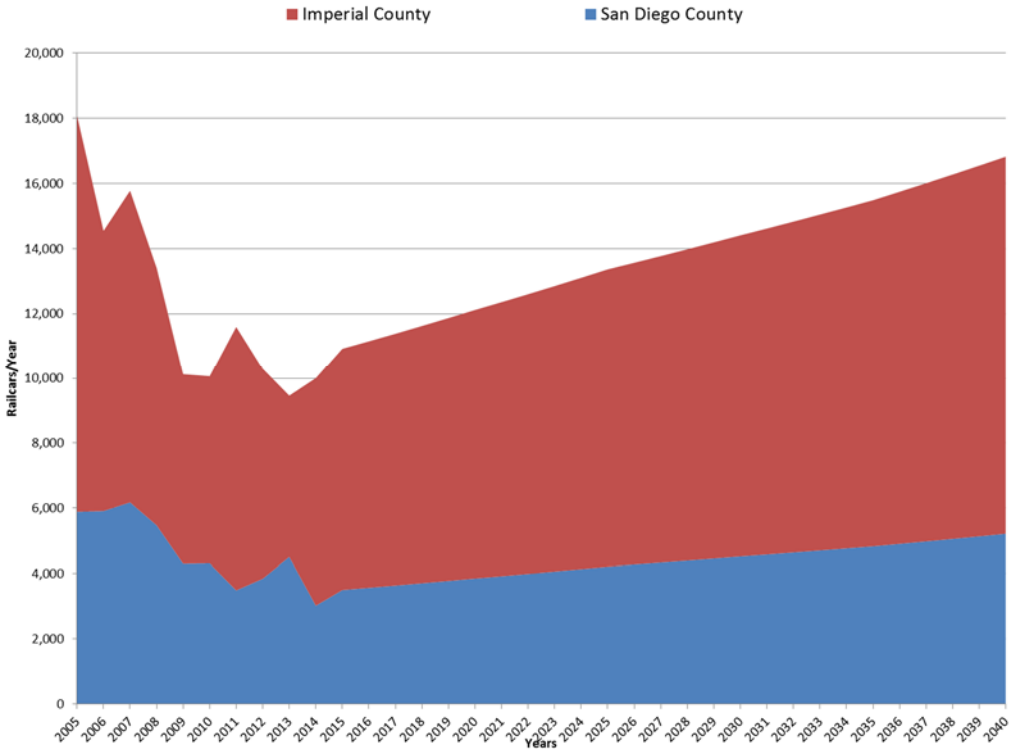
INLAND-RAIL PROJECTIONS

The analysis and forecasting methodology is similar to that conducted for inland-rail projections in the high-volume scenario, with the clarification that for this scenario the low-growth rates were used to estimate aggregate border-crossing rail volumes.

Figure 79 shows the low-volume scenario inland-rail volumes projections for Imperial County and San Diego County for northbound and southbound flows[127]. For northbound and southbound flows, inland-rail volumes are projected to grow at a slightly faster pace between 2015 and 2040 for Imperial County (overall growth rates of 49 percent and 56 percent for San Diego County and Imperial County respectively). Not only that, but inland-rail volumes are forecasted to be considerably higher in Imperial County than in San Diego in year 2040 (more than 11,600 railcars are forecasted in Imperial County for that year, while slightly more than 5,200 are forecasted in San Diego).

[127] As in the case of trucks, southbound rail volumes are very similar to northbound volumes (though not identical).

Figure 79. Forecasted Inland-Rail Volumes – Northbound, Low-Volume Scenario



Source: SCAG Forecasting Model

PORT-TRUCK PROJECTIONS

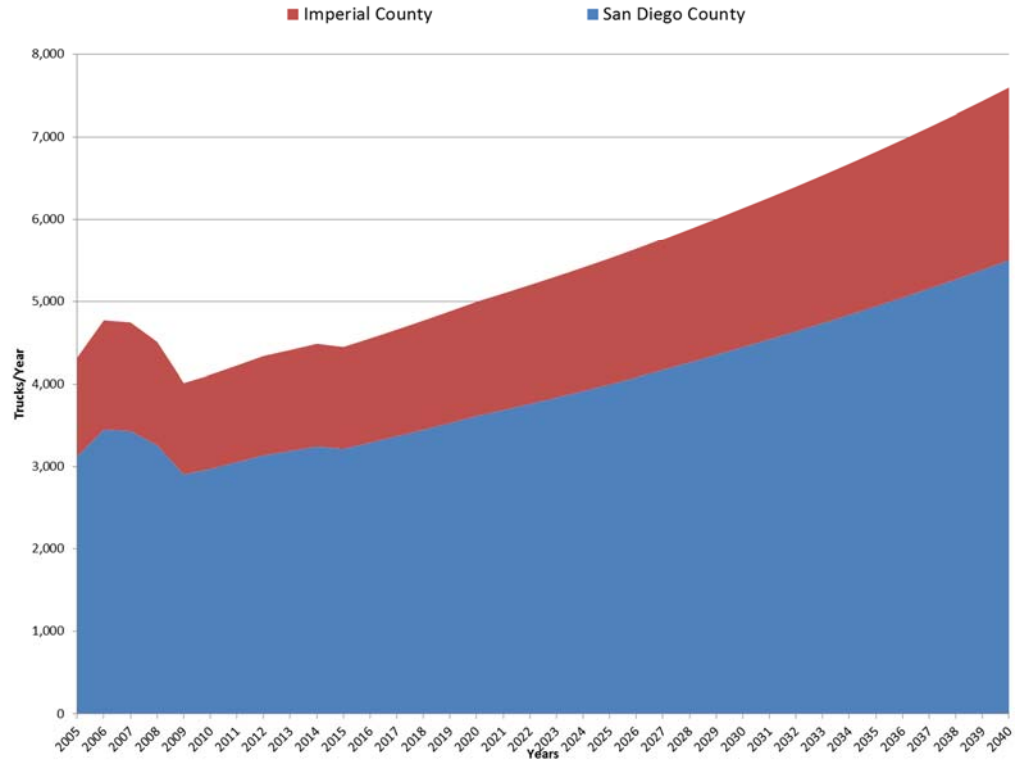
The methodology to develop the projections for port-truck volumes in the low-volume scenario is similar to that used on the high-volume scenario. The San Pedro Bay Cargo Forecast Update (2009) report was used to obtain historical numbers on TEU data. However, unlike the high-growth scenario, the growth rates from the 2009 report were used to forecast container volumes until 2040. The 2009 report provides pessimistic (i.e., lower) growth rates for container cargo compared to the baseline scenario since they are adjusted to account for the Great Recession. These growth rates are considered better suited to describe a scenario that reflects low-volume of border-crossing goods movements.

For non-containerized cargo forecasts, the low growth rate provided in the San Pedro Bay Cargo Forecast 2007 report for dry bulk, liquid bulk, and general cargo is used to generate future forecasts. Containerized and non-containerized cargo forecasts were then added to generate aggregate port-truck volumes in the low-volume scenario.

Finally, in order to estimate port-truck volumes for the low-volume scenario, the same methodology and assumption to break down container and non-container volumes by mode, ports of entry and direction are used as in the case of the high-volume scenario.

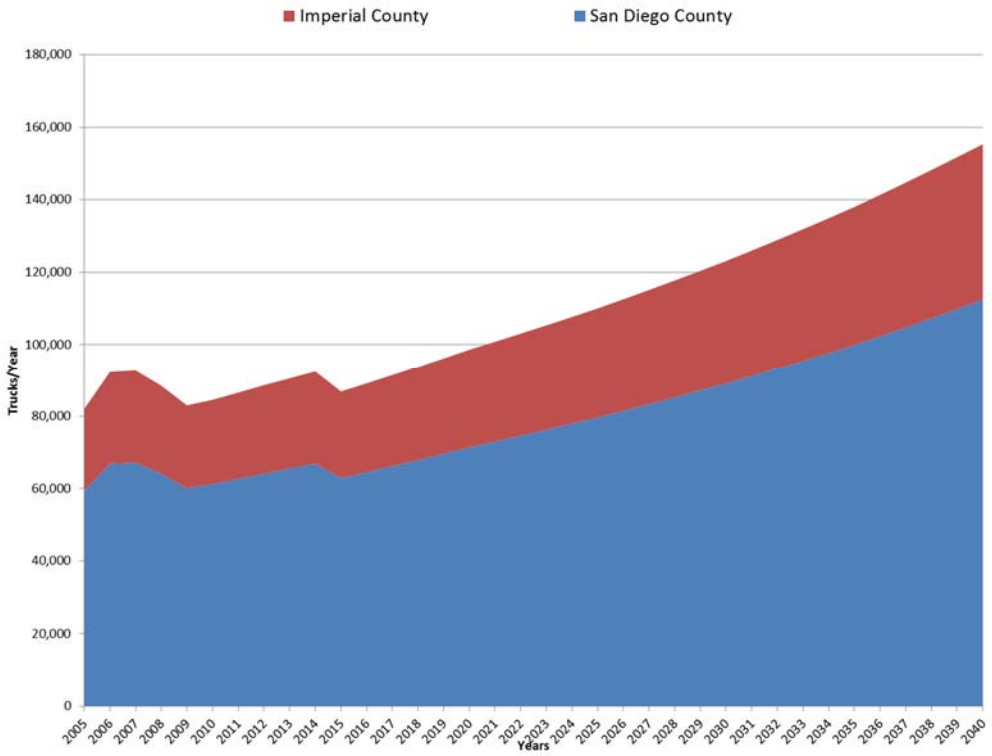
Figure 80 and Figure 81 show port-truck projections for northbound and southbound flows for Imperial County and San Diego County for the low-volume scenario. For northbound flows, aggregate volumes are forecasted to reach almost 7,600 trucks in 2040, compared to approximately 4,500 trucks in 2014. Southbound movements are much more prominent than northbound movements. Aggregate volumes are forecasted to reach more than 155,000 trucks in 2040, compared to more than 92,000 trucks in 2014.

Figure 80. Forecasted Port-Truck Volumes – Northbound, Low-Volume Scenario



Source: SCAG Forecasting Model

Figure 81. Forecasted Port-Truck Volumes – Southbound, Low-Volume Scenario



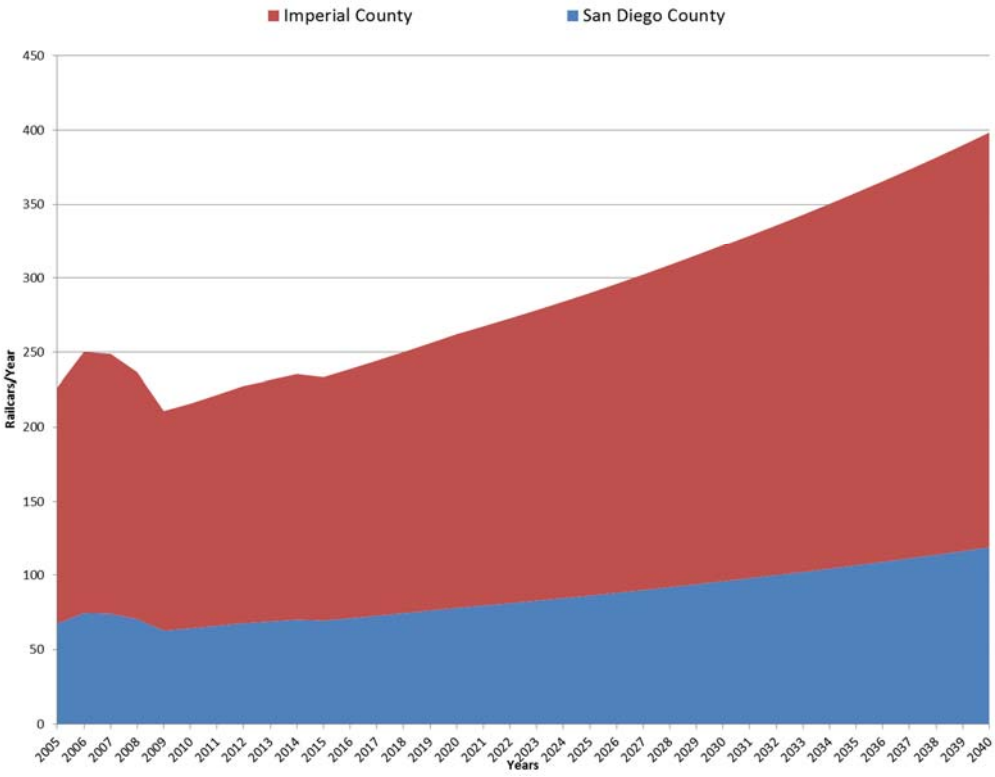
Source: SCAG Forecasting Model

PORT-RAIL PROJECTIONS

The analysis and methodology used to produce these forecasts is similar to that used in the port-rail projections in the high-volume scenario.

Figure 82 and Figure 83 show low-volume port-rail volumes projections for northbound and southbound flows for Imperial County and San Diego County. For northbound flows, aggregate volumes are forecasted to almost reach 400 railcars in 2040, compared to approximately 235 railcars in 2014. As can be seen in the chart below, the majority of northbound rail movements originate in Imperial County. The observation is similar for southbound flows, except that southbound volumes are much greater than northbound volumes. Aggregate volumes are forecasted to surpass 8,100 railcars in 2040, compared to approximately 4,850 railcars in 2014.

Figure 82. Forecasted Port-Rail Volumes – Northbound, Low-Volume Scenario

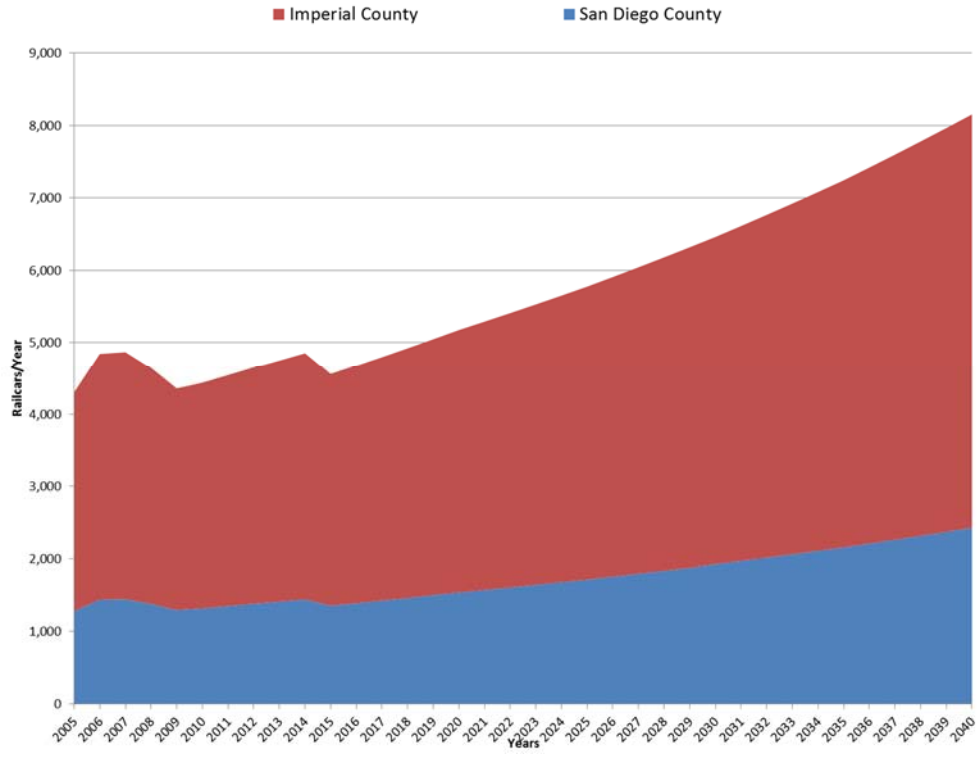


Source: SCAG Forecasting Model

DRAYAGE PROJECTIONS

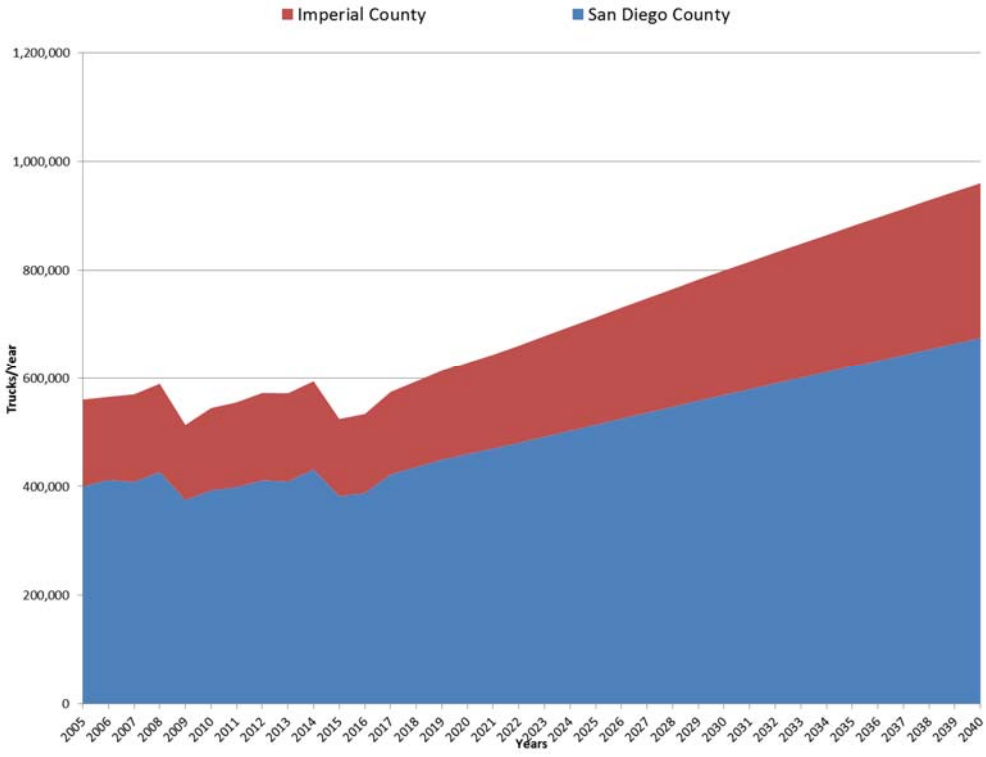
Figure 84 and Figure 85 show low-volume scenario drayage projections for northbound and southbound flows for Imperial County and San Diego County. For northbound flows, aggregate drayage volumes are projected to grow by a factor of more than 1.5 in 2040 compared to 2014 volumes (almost 600,000 trucks in 2014 and more than 950,000 trucks in 2040). For southbound flows, aggregate drayage volumes are projected to also increase by a factor of more than 1.5 in 2040 compared to 2014 volumes (more than 460,000 trucks in 2014 and more than 760,000 trucks in 2040).

Figure 83. Forecasted Port-Rail Volumes – Southbound, Low-Volume Scenario



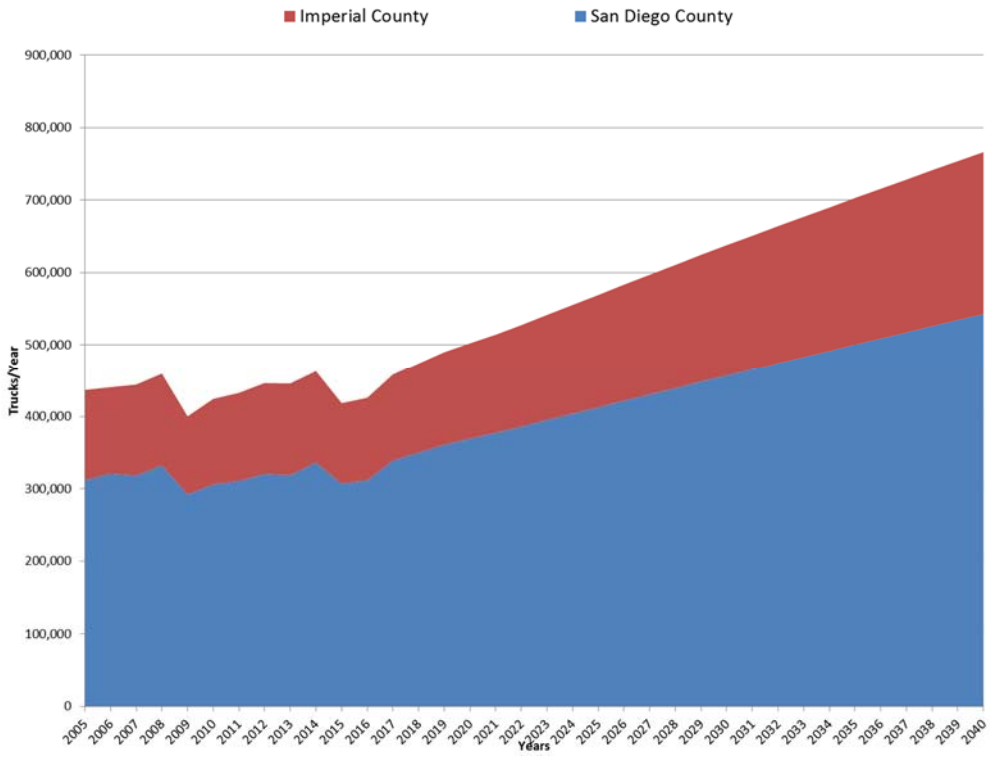
Source: SCAG Forecasting Model

Figure 84. Forecasted Drayage Volumes – Northbound, Low-Volume Scenario



Source: SCAG Forecasting Model

Figure 85. Forecasted Drayage Volumes – Southbound, Low-Volume Scenario



Source: SCAG Forecasting Model

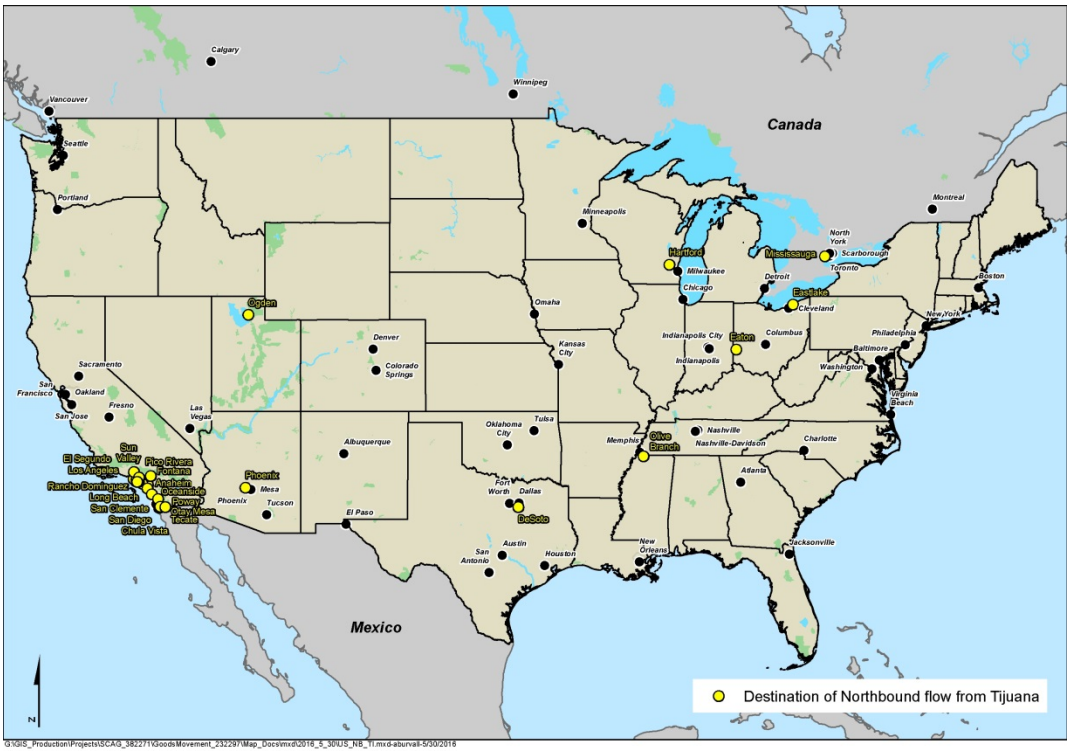
Disaggregation of Truck Projections

As in the case of the baseline scenario forecasts, the projections of freight flows were disaggregated by truck for each alternative scenario using information captured through interviews with cargo generators in the region that primarily transport their goods by truck[128] and Panjiva data[129]. Truck projections were disaggregated into 33 subregions, or "SuperZones" into which the SCAG region is divided plus 1 SuperZone for the San Diego region covering all the SANDAG geography.[130]

However, before proceeding to assign the truck flows of the alternative scenarios to the different SuperZones, it is important to highlight the geographical extent of the goods movement originating in the California-Baja California bi-national region. The U.S. origins and destinations for flows identified in this study are presented in the figures below, classified by originating or ending area in Mexico. Note these maps list all the U.S. locations mentioned by the cargo generators and do not represent the actual share of each place in the movement of bi-national goods. Maps with specific shares for each SuperZone will be presented in the next section of this document.

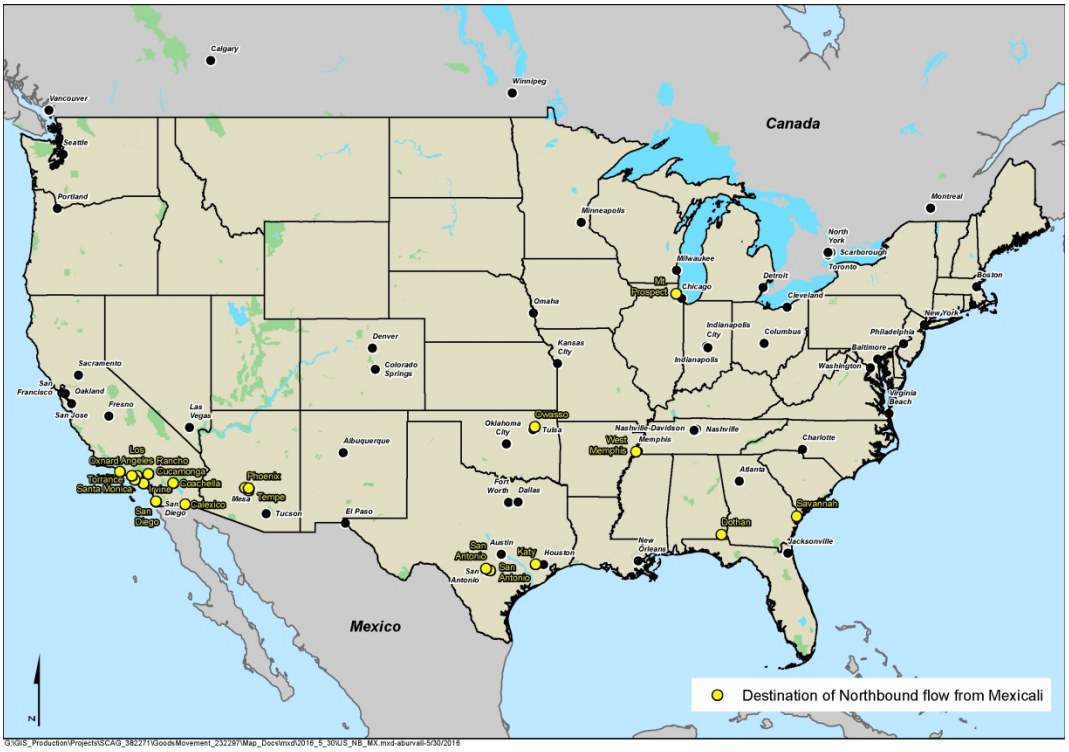
[128] Please refer to Chapter 3 for more information.
[129] Panjiva is a private company that maintains and updates a database with information on the movement of goods, by company, at the shipment-level. For more information, please refer to Chapter 3.
[130] See Chapter 5 for a detailed characterization of each SuperZone.

Figure 86: Destinations of Northbound Freight Flows Originating in Tijuana



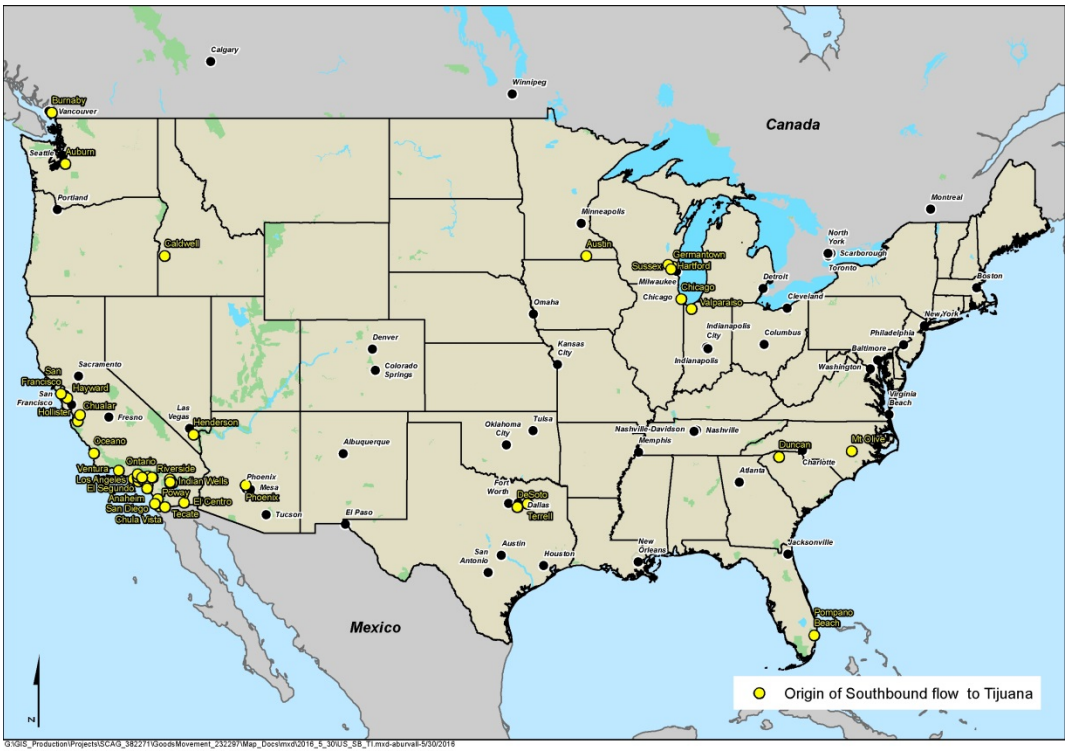
Source: HDR

Figure 87: Destinations of Northbound Freight Flows Originating in Mexicali



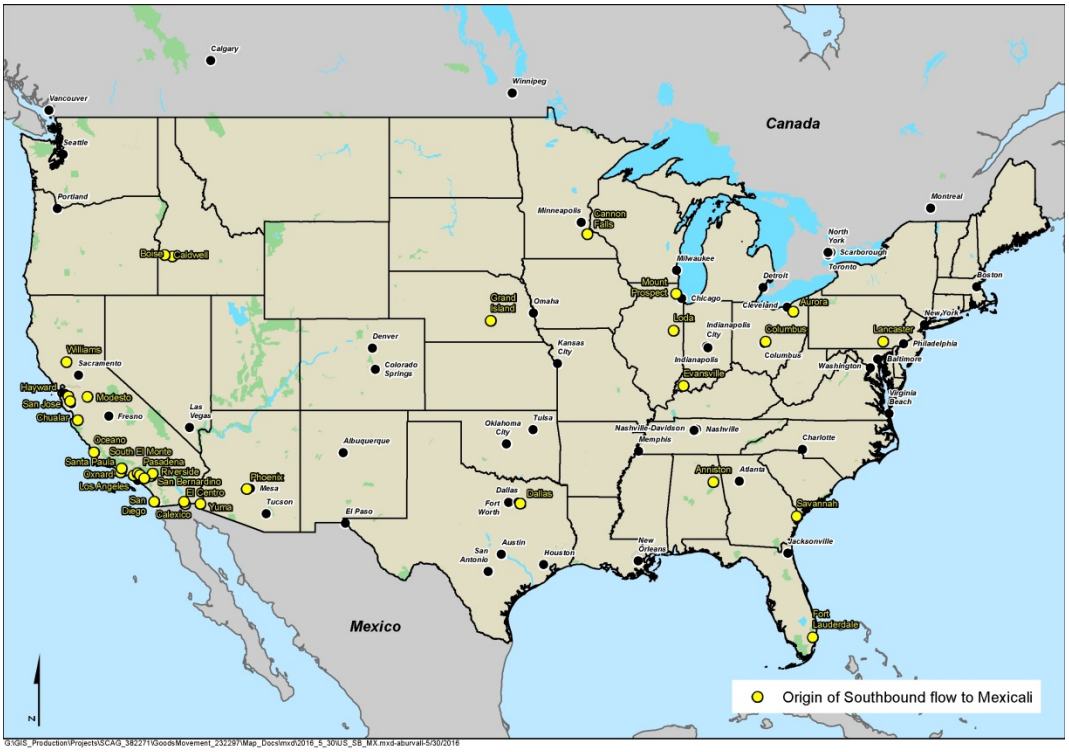
Source: HDR

Figure 88: Origins of Southbound Freight Flows Terminating in Tijuana



Source: HDR

Figure 89: Origins of Southbound Freight Flows Terminating in Mexicali



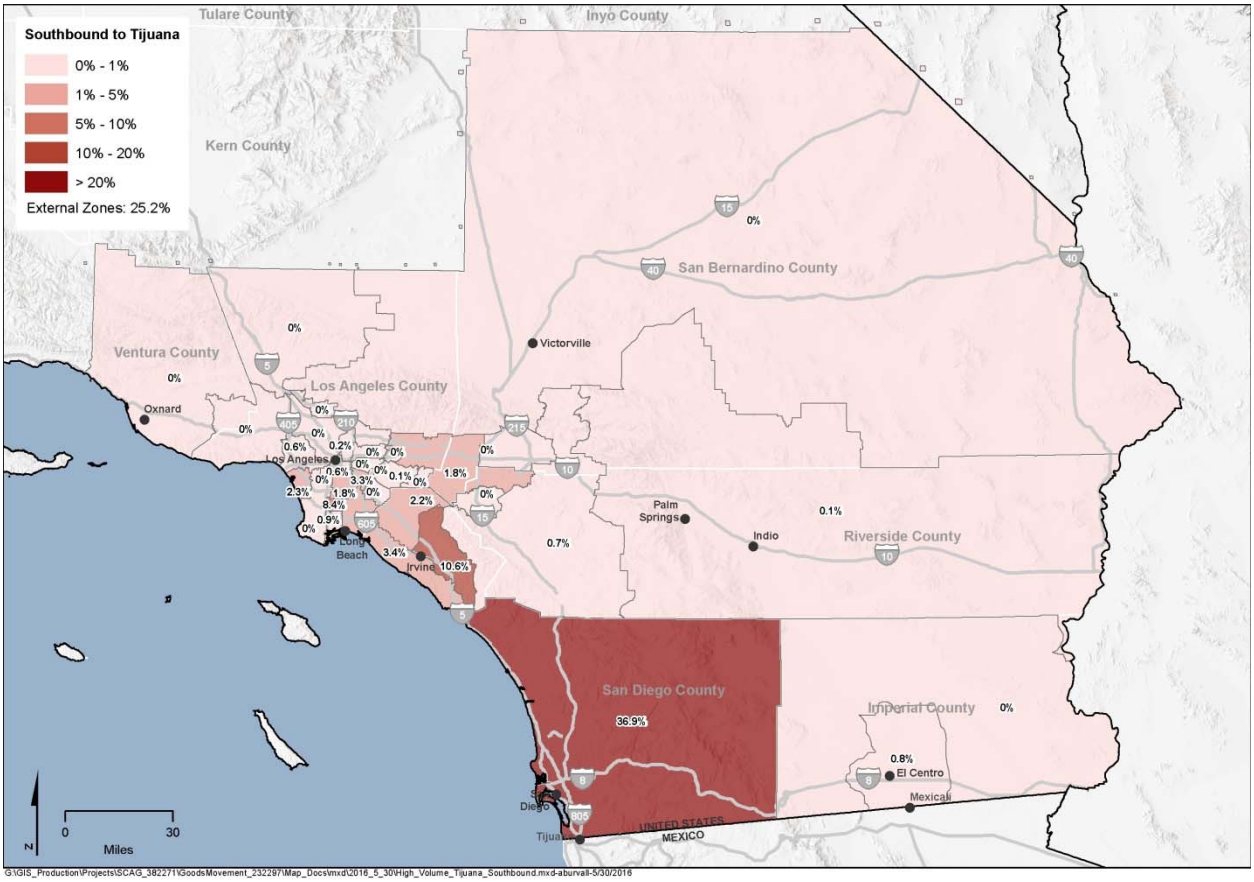
Source: HDR

Origin – Destination (O-D) Pairs Baseline Projections

The same methodology used in the baseline scenario forecasts to allocate truck flows to the different SuperZones was used to allocate the projections from the high-volume and low-volume scenarios.

The figures below show the maps of O-D pair truck percentages for the high-volume and low-volume scenarios for southbound flows to Tijuana[131]. As can be seen, the majority of truck shipments (35.5 percent in the low-volume scenario and 36.9 percent in the high-volume scenario) originate in the SANDAG region. Also, a significant amount of truck shipments (25.5 percent in the low-volume scenario and 25.2 percent in the high-volume scenario) originate in the rest of the U.S. (external zone). This is not represented in the figures below since there is no "specific" geography for this zone.

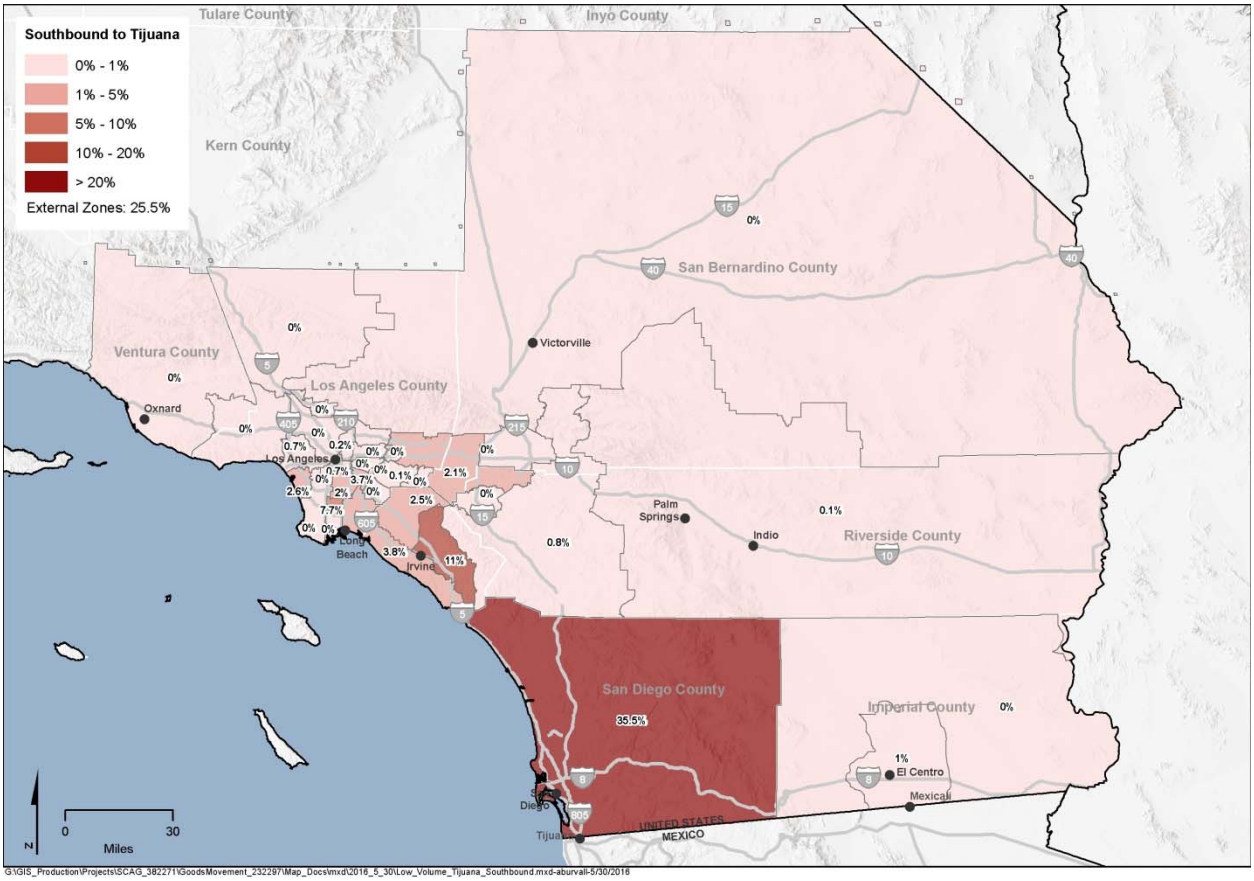
Figure 90: O-D Pairs Truck Percentages in High-Volume Scenario – Southbound Flows to Tijuana



Source: HDR

[131] Please refer to the Appendix section for additional maps and tables.

Figure 91: O-D Pairs Truck Percentages in Low-Volume Scenario – Southbound Flows to Tijuana



Source: HDR

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Chapter 9: Bottleneck Analysis for Alternative Scenarios

Introduction

The objective of this chapter is to conduct a review of regional Heavy Duty Truck (HDT) high-priority bottlenecks identified as part of the Southern California Association of Governments (SCAG) 2013 Comprehensive Regional Goods Movement Plan and Implementation Strategy[132]. This analysis identified 48 HDT bottlenecks using reviews of regional corridor studies, stakeholder outreach, and a quantitative analysis of traffic congestion. In 2015, a "refresh" analysis identified an additional 12 potential HDT bottlenecks.

To perform the bottleneck analysis for the alternative scenarios, forecast volumes of cross border flows for each alternative scenario were assigned to travel corridors to identify potential impacts of the Low Volume and High Volume scenarios on these bottlenecks.[133] Also, potential infrastructure projects from the SCAG Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) that could mitigate HDT high-priority bottleneck impacts were identified in each alternative scenario.

Overview or Bottlenecks

The basis for the bottleneck analysis are the 60 high-priority SCAG region truck bottlenecks from the 2013 study and the recently completed "refresh" analysis. The original Strategy produced a list of 48 high-priority bottlenecks, which were identified using a comprehensive quantitative exercise using 2008 modeling and traffic data, a review of existing studies such as Corridor System Management Plans, and stakeholder input.

In 2015, SCAG refreshed the list of HDT bottlenecks to account for any changes that may have occurred following the "Great Recession" (officially ended in 2009 though financial markets did not return to previous highs until 2013 and the unemployment rate did not return to returned to January 2008 levels until the late summer of 2015. SCAG also identified 12 potential new bottlenecks that had emerged since the 2013 study due to increased traffic congestion. This resulted in a list of 60 HDT high-priority bottlenecks.

Figure 53 is a map showing the locations of the "refreshed" HDT bottlenecks, and Table 53 is a table listing the bottlenecks and associated delays (where quantified). Forty-one of these bottlenecks are in Los Angeles County, eight are in the Inland Empire Counties of Riverside and San Bernardino, five in Orange County, and three each in Ventura and Imperial Counties. The three Imperial County locations are not described as truck bottlenecks, but were identified by stakeholders as being key goods movement projects that would improve freight system efficiencies.

[132] http://www.freightworks.org/DocumentLibrary/CRGMPIS_Summary_Report_Final.pdf
[133] The forecasted truck volumes in the high-volume and low-volume scenarios are reported in Chapter 8 of this report.

Figure 92. SCAG Regional High Priority HDT Bottlenecks

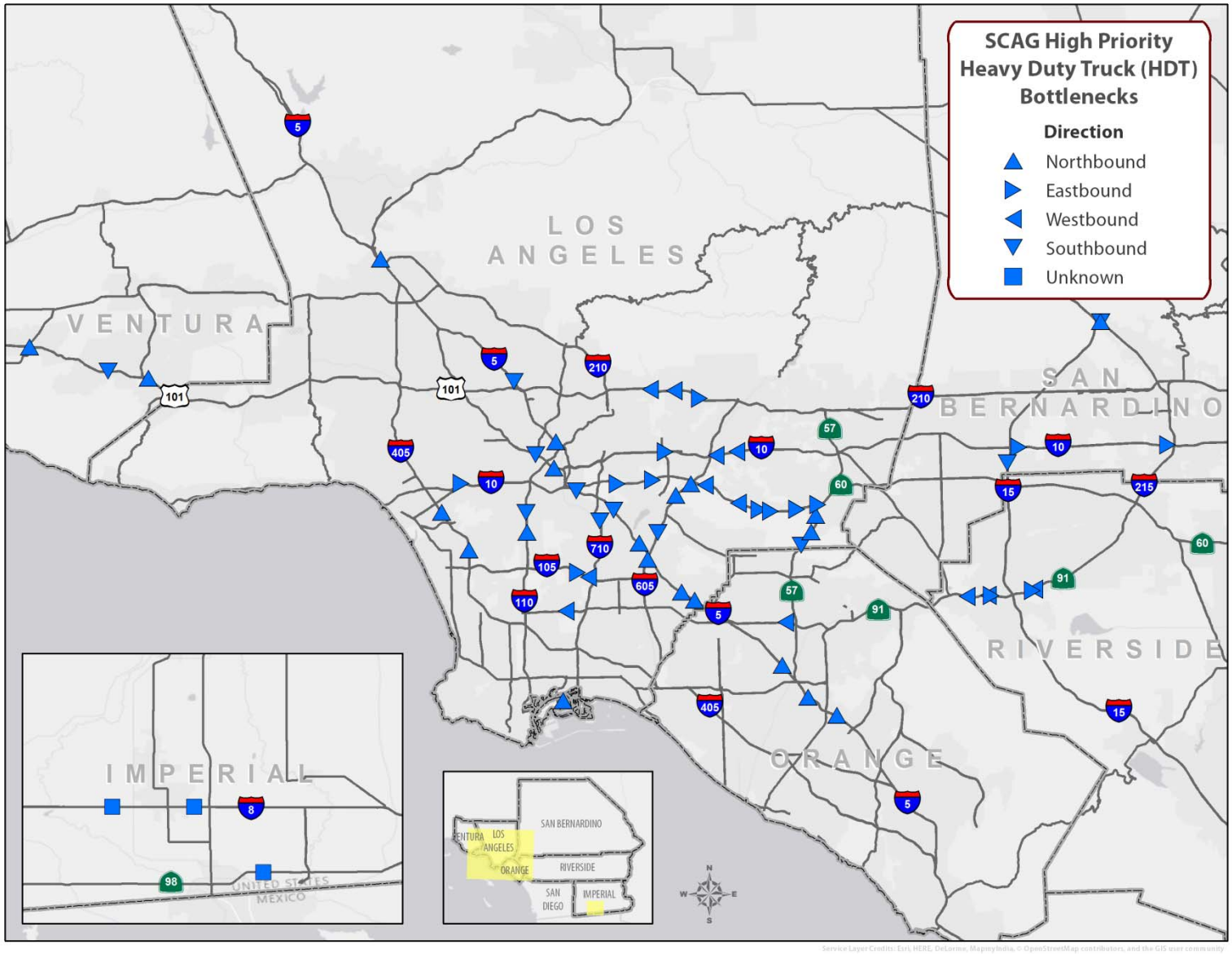


Table 63. List of SCAG Regional Truck Bottlenecks

"Refreshed" Bottlenecks

Source	Route	Dir	Absolute Postmile	County	2012 Estimated Total Truck Annual Vehicle-Hours of Delay	2012 Estimated Heavy Duty Truck (HDT) Annual Vehicle-Hours of Delay
2012 Comprehensive Regional Goods Movement Plan and Implementation Strategy	605	SB	13.8	LA	108,000	41,000
	5	NB	117.8	LA	101,800	39,500
	405	NB	46.5	LA	92,800	34,400
	101	SB	4.1	LA	61,000	15,300
	5	NB	124.9	LA	85,500	31,500
	605	NB	17.5	LA	79,300	39,900
	60	EB	18.3	LA	61,700	21,700
	110	NB	16.1	LA	72,400	20,300
	10	EB	25.6	LA	37,000	14,900
	91	WB	3.9	LA	50,300	19,000
	60	EB	21.6	LA	52,000	24,500
	110	SB	17.8	LA	55,900	19,700
	60	EB	19.3	LA	52,900	26,800
	10	WB	32.0	LA	79,300	33,100
	405	NB	50.8	LA	65,300	21,600
	60	EB	5.1	LA	37,800	10,400
	60	EB	8.2	LA	37,500	13,200
	91	WB	42.7	LA	40,000	16,400
	101	NB	132.4	LA	57,600	14,300
	5	SB	128.5	LA	33,500	13,400
	5	NB	101.5	ORA	28,300	11,100
	605	NB	19.2	LA	50,900	25,600
	5	SB	132.3	LA	33,900	18,800
	210	WB	31.0	LA	34,700	17,700
	60	WB	13.0	LA	58,500	22,700
	91	WB	40.9	RIV	22,400	8,200
	5	NB	160.8	LA	17,600	10,900
	10	WB	30.1	LA	59,000	20,700
	10	EB	6.6	LA	26,000	5,100
	105	WB	12.9	LA	71,400	33,500
	5	NB	119.2	LA	47,700	18,300
	60	WB	16.4	LA	53,300	20,700
	710	SB	17.5	LA	28,800	15,800
	91	WB	23.6	ORA	14,600	4,400

Other Identified Bottlenecks

Source	Route	Dir	Absolute Postmile	County	2012 Estimated Total Truck Annual Vehicle-Hours of Delay	2012 Estimated Heavy Duty Truck (HDT) Annual Vehicle-Hours of Delay
Corridor System Mgmt Plan (CSMP)	5	SB	144.3	LA	Not Estimated	
	10	EB	70.5	SBD		
	57	SB	12.3	ORA		
	91	WB	46.9	RIV		
	210	WB	28.8	LA		
Stakeholder Identified	Forrester Road			IMP	Not bottlenecks: Prioritized, key planned goods movement project locations	
	8	Imperial Interchange		IMP		
	98	(or Jasper Rd)		IMP		
	215	NB/SB	NA	SBD	Not Estimated	
	10	EB	57.5	SBD		
	101	NB	53.2	VEN		
	101	NB	42.1	VEN		
	57	NB	24.4	LA		
	710	NB	0.5	LA		

Potential New Bottlenecks

Source	Route	Dir	Absolute Postmile	County	2012 Estimated Total Truck Annual Vehicle-Hours of Delay	2012 Estimated Heavy Duty Truck (HDT) Annual Vehicle-Hours of Delay
Potential New Bottlenecks Identified in 2012 by SCAG Analysis	5	NB	137.7	LA	21,400	13,000
	57	NB	15.2	LA	36,100	19,900
	60	EB	23.5	LA	33,300	16,900
	105	EB	11.9	LA	24,000	8,300
	210	EB	33.4	LA	24,700	12,900
	605	NB	11.4	LA	34,500	14,500
	5	NB	104.6	ORA	14,500	6,000
	5	NB	108.7	ORA	13,400	3,200
	91	EB	42.9	RIV	11,200	5,200
	91	EB	46.6	RIV	9,800	4,600
	15	SB	107.7	SBD	16,700	10,200
	101	SB	45.7	VEN	3,800	1,900

Methodology

The methodology used to identify the bottlenecks for the alternative scenarios (i.e., High-Volume and Low-Volume) is similar to that used to identify the bottlenecks in the baseline scenario.[134] In summary, the traffic analysis zones (TAZs) from the SCAG HDT Regional Travel Demand Model (RTDM) were aggregated into 34 "SuperZones". Then, the cross-border truck O-D forecast matrices for the 2040 Low-Volume and 2040 High-Volume forecast scenarios were aggregated into these 34 zones. As an illustration, Table 54 shows the 2040 Baseline scenario forecast.[135] Annual cross border truck volumes were converted to average daily volumes by dividing the annual flows by 250 days to arrive at an average annual flow.

Table 64. 2040 Baseline Forecast Scenario (Illustrative)

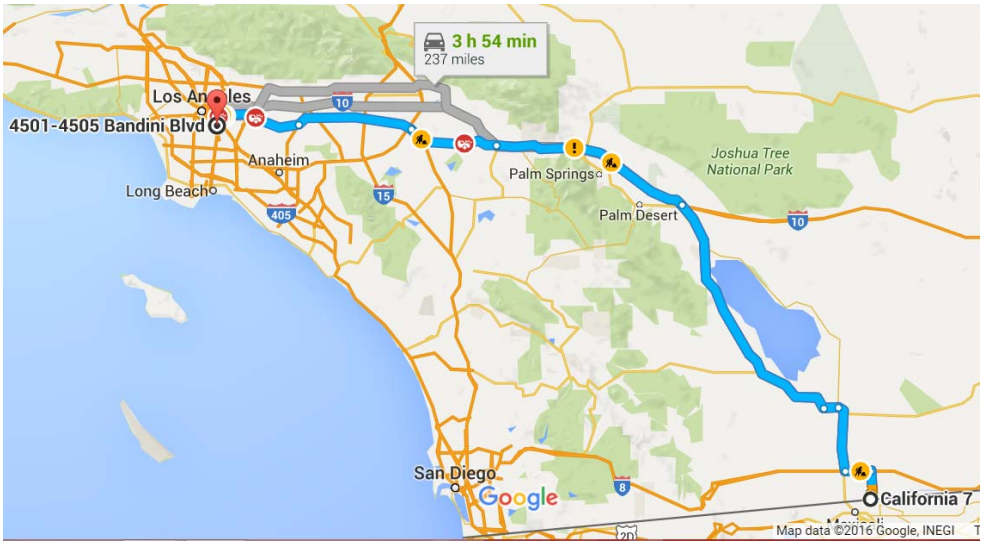
BASELINE - 2040

	NORTHBOUND																														
ORIGIN / DESTINATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	#	25	26	#	28	29	#	#	#	33	External	SANDAG
Tijuana	8,221	88,541	0	92,902	17,181	0	816	0	33,031	#####	0	0	0	48,661	0	0	2,714	0	5,602	0	0	0	25,519	0	129	0	0	0	0	#	#	0	0	342,264	840,140
Mexicali	0	0	0	0	0	0	0	0	496	496	2,478	0	31,757	0	#####	424,213	0	0	1,759	0	#####	719	0	0	0	0	0	0	0	0	0	0	0	46,682	496

	SOUTHBOUND																														
DESTINATION / ORIGIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	#	25	26	#	28	29	#	#	#	33	External	SANDAG
Tijuana	0	39,936	0	179,382	38,313	0	0	0	10,637	57,926	1,095	##	0	56,669	439	14,556	483	0	30,235	31,650	9,916	0	133,530	0	0	249	0	3,639	171	0	0	0	11,593	418,326	581,672
Mexicali	0	0	0	0	1,701	0	0	0	0	0	0	0	0	0	45,500	148,731	####	0	0	1,300	2,897	0	0	0	8,960	0	0	4,346	0	0	0	0	0	507,187	33,409

To assess how travel between O-Ds can impact truck bottlenecks, likely routes for each O-D pair were identified. This was done by using Google Maps to identify shortest travel time paths and any alternatives for major O-D pairs, illustrated in Figure 54. In areas where there are multiple potential routes, bottlenecks on all alternatives were flagged as beings equally likely to be impacted. As it was mentioned in Chapter 6 of this report, this approach will overstate the impact on bottlenecks since the evaluation double counts flows on bottlenecks that have other alternative routes available.

Figure 93. Illustrative Google Maps Shortest Path Evaluation



To assign truck travel between O-D pairs to specific bottlenecks, a matrix was developed in a Microsoft Excel workbook that shows each O-D pair under analysis and each bottleneck (illustrated in Figure 55). A bottleneck (shown in the columns) is flagged with a "1" if that bottleneck lies in the path between the O-D pair (shown in the rows). The summation of all the truck demands would be the total potential demand on that bottleneck.

[134] See Chapter 6 for a detailed discussion of the methodology.
[135] All forecast scenario results are presented in the Chapter 6 Appendix.

Figure 94. O-D Pairs and Bottlenecks Analysis Workbook

B	C	D	E	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN
Origin	**O_Zone**	**Destination**	**Dest_Zone**	BN_ID: 26	BN_ID: 27	BN_ID: 28	BN_ID: 29	BN_ID: 30	BN_ID: 31	BN_ID: 32	BN_ID: 33	BN_ID: 34	BN_ID: 35
Downtown Los Angeles	9	Mexicali	16	0	0	0	0	0	0	0	0	0	0
Downtown Los Angeles	9	Tijuana	10	0	0	0	0	0	0	0	1	0	0
Mexicali	16	Indio	11	0	0	0	0	0	0	0	0	0	0
Mexicali	16	Whittier	12	0	0	1	0	0	0	1	0	0	0
Mexicali	16	Torrance	13	0	0	0	0	1	0	1	0	0	0
Mexicali	16	Downey	14	0	0	0	0	0	1	0	0	1	0
Mexicali	16	Oxnard	15	0	1	0	0	0	0	0	0	0	0
Mexicali	16	Imperial County	16	0	0	0	0	0	0	0	0	0	0
Mexicali	16	San Bernardino	17	0	0	0	0	0	0	0	0	0	0
Mexicali	16	Simi Valley	18	0	0	0	0	0	0	0	0	0	0
Mexicali	16	South Gate	19	0	0	0	0	1	0	0	0	0	0
Mexicali	16	Inglewood	2	0	0	0	0	1	0	1	0	0	0
Mexicali	16	Los Angeles	20	0	0	0	0	0	0	0	0	0	0
Mexicali	16	Santa Monica	21	0	0	0	0	0	0	1	0	0	0
Mexicali	16	Florence	22	0	0	0	0	0	0	1	0	1	0
Mexicali	16	Carson	23	0	0	0	0	0	0	0	0	0	0
Mexicali	16	Calipatria	24	0	0	0	0	0	0	0	0	0	0
Mexicali	16	Whittier	25	0	0	1	0	0	0	1	0	0	0
Mexicali	16	Norwalk	26	0	0	0	0	0	1	0	0	1	0
Mexicali	16	West Puente Valley	27	0	0	1	0	0	0	0	0	0	0
Mexicali	16	East Los Angeles	28	0	0	1	0	0	0	0	0	0	0
Mexicali	16	Diamond Bar	29	0	0	0	0	0	0	0	0	0	0
Mexicali	16	Santa Clarita	3	0	1	0	0	0	0	0	0	0	0
Mexicali	16	Los Angeles	30	0	0	0	0	0	0	0	0	0	0

“External” flows in the O-D matrices were split into flows that travel between states east of California (which do not impact any regional bottlenecks) and flows that travel to northern California, Oregon, or Washington State (which would potentially impact SCAG region bottlenecks).

Bottleneck Analysis for Alternative Scenarios

For analysis purposes, the truck O-D annual volumes from the SuperZones were aggregated into very high-level, generalized travel regions as follows:

- Imperial County in the SCAG Region
- Remaining SCAG Region (Including Northern California and Oregon/Washington)
- San Diego County
- States East of California

As described in Chapter 6, the baseline scenario shows nearly 4.8 million annual cross-border truck trips, with approximately 68% of them crossing via San Diego County. Under the High-Volume scenario, the number of trips will exceed 6.7 million trips (26,956 daily) with 67% crossing via the borders in San Diego. The Low-Volume scenario forecasts nearly 3.6 million trips (14,300 daily) and 71% through San Diego.

The forecast scenarios do not show significant spatial shifts in O-D patterns. For the most part, the Low-Volume scenario forecast flows are uniformly lower among all O-Ds and the High-Volume forecast flows are uniformly higher, which means that cross border truck flows over specific bottlenecks will not shift to other bottlenecks.

Figure 95 shows the annual cross-border truck flows in both directions for the 2040 Low, Baseline, and High-Volume scenarios over the two POEs to the major regions defined previously. Table 65 presents the data used to make the chart. The trends shown in the two exhibits are very similar to those described in Chapter 6 for the Baseline scenario, with some minor differences.

Figure 95. Annual Cross border Truck Flows by Scenario and Region

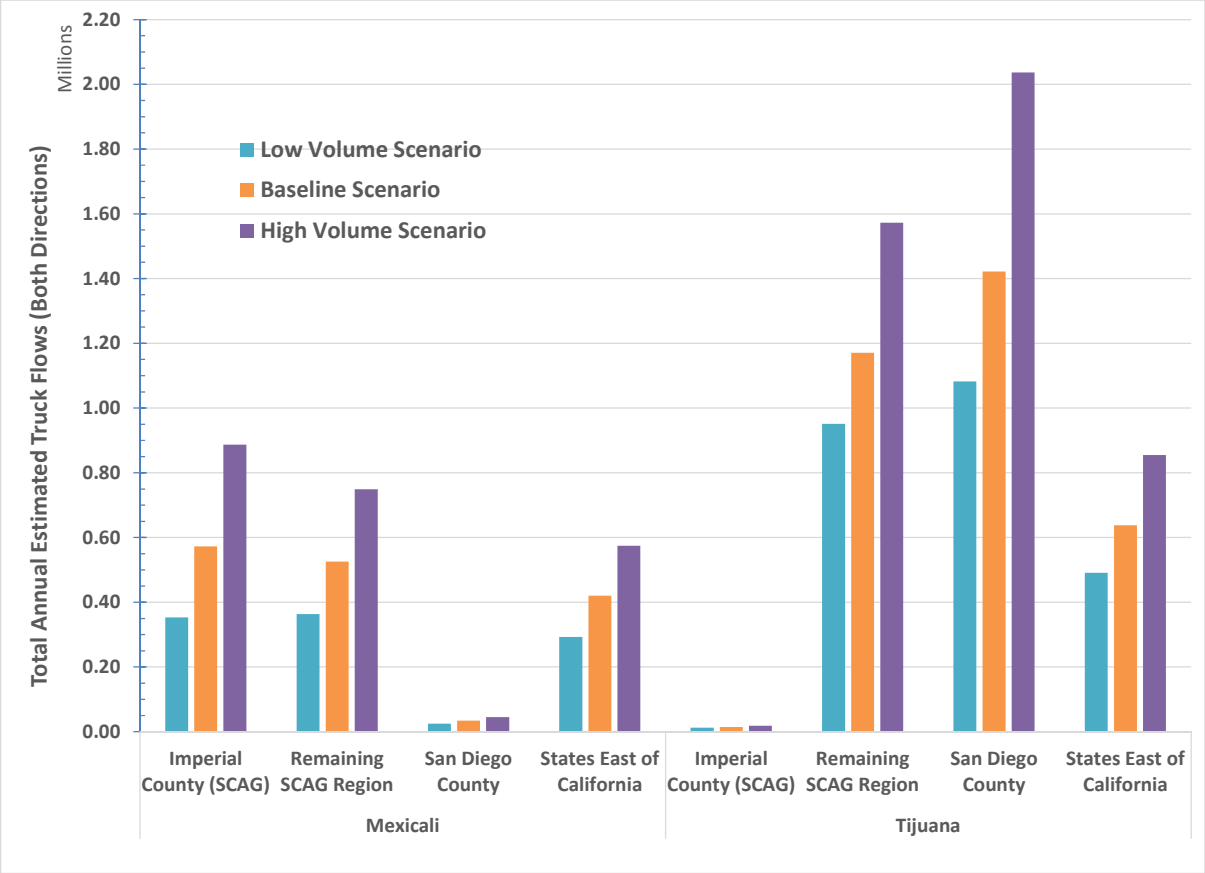


Table 65. 2040 Annual and Average Weekday Forecast Scenarios

Origin-Destination Pair		2040 "Low" Scenario		2040 "Baseline" Scenario		2040 "High" Scenario		Average Daily Truck Differences	
		Annual Trucks	Avg. Daily Trucks	Annual Trucks	Avg. Daily Trucks	Annual Trucks	Avg. Daily Trucks	"Low" vs. Baseline Scenario	"High" vs. Baseline Scenario
Mexicali	Imperial County (SCAG)	353,002	1,412	572,944	2,292	886,954	3,548	(880)	1,256
	From/To/Thru Remaining SCAG Region	363,733	1,455	525,442	2,102	749,065	2,996	(647)	894
	San Diego County	25,006	100	33,904	136	45,567	182	(36)	47
	States East of California	292,828	1,171	420,133	1,681	574,846	2,299	(509)	619
Tijuana	Imperial County (SCAG)	12,487	50	14,556	58	18,725	75	(8)	17
	From/To/Thru Remaining SCAG Region	950,850	3,803	1,170,466	4,682	1,572,474	6,290	(878)	1,608
	San Diego County	1,082,173	4,329	1,421,812	5,687	2,036,397	8,146	(1,359)	2,458
	States East of California	491,230	1,965	638,135	2,553	854,934	3,420	(588)	867
Total Cross Border Truck Trips		**3,571,309**	**14,285**	**4,797,393**	**19,190**	**6,738,961**	**26,956**	**(4,904)**	**7,766**

As in the baseline, the highest forecast flows are between Tijuana and locations within San Diego County followed by flows between Tijuana and the remaining SCAG region (excluding Imperial County) for both the High- and Low-Volume scenarios.

The third highest flows are between Tijuana and states east of California in the Low-Volume and Baseline scenarios. However, under the High-Volume scenario, traffic between Mexicali and Imperial County becomes the third highest O-D, slightly exceeding the flows between Tijuana and states east of California.

Under the High-Volume scenario, travel between locations in San Diego County and Tijuana would increase to just over 2.0 million trips (compared to 1.4 million trips under the Baseline scenario), and under the Low-Volume scenario, this would be reduced to just over 1.0 million trips, again representing about 30% of all cross border traffic.

Truck traffic between Tijuana and areas north of San Diego County (i.e., SCAG Region, northern California, and Oregon/Washington can be as high as 1.6 million in the High-Volume scenario (23% of all cross border traffic) and as low as 950,000 in the Low-Volume scenario (27% of traffic). This is in comparison to the 2040 Baseline's 1.2 million annual trips.

The third highest volumes that cross over the border travel between states east of California and the POE in San Diego County with just over 638,000 annual trucks in the Baseline (over 13% of all flows). In the High-Volume forecast this approaches 850,000 trucks with the Low-Volume forecast showing just over 490,000 annual trucks in 2040.

As described above, less than one-third of all cross border truck trips were over the Mexicali POE and most of these trips remain in Imperial County (just under 573,000 annual trips in the Baseline, 353,000 in the Low-Volume scenario, and nearly 887,000 in the High-Volume scenario). Between 364,000 and 750,000 trips (depending on the scenario) traveled north to other SCAG destinations or beyond to northern California. Between 293,000 and 575,000 travel to/from states east of California.

There are some shifts in O-D patterns between the Baseline, Low-Volume, and High-Volume scenarios. Truck flows increase for all O-D pairs in the High-Volume scenario, except for northbound travel between Mexicali and external zones, which is reduced by approximately 12%. Only 4% of external northbound Mexicali traffic travels through the SCAG region, so this shift would significantly impact SCAG regional bottlenecks. Also under the High-Volume scenario, there is added truck traffic between the Ports of Long Beach/Los Angeles (POLB/LA) and the two POEs where there is no cross border traffic reported in the 2040 Baseline or the 2040 Low-Volume scenario.

Results of Bottleneck Analysis

In terms of the impacts on specific HDT bottlenecks, Table 65, above reveals that, overall, the potential change in average daily trucks between the "Low" and "High" scenarios from the baseline is relatively small, which indicates that cross border traffic may not have large impacts on regional bottlenecks. For example, under the High forecast, around 7,800 additional trucks are expected beyond the baseline, while the Low forecast shows a reduction of 4,900 regional trucks.

Table 66 summarizes cross border truck flows over each bottleneck for the three scenarios. As described previously, the two forecast scenarios do not show significant spatial shifts among O-D pairs, so flows through bottlenecks will also not experience significant spatial shifts (i.e., one bottleneck showing a decrease in flows and another one showing an increase because traffic shifts from one O-D pair to another). All bottlenecks show increases in flows under the High-Volume scenario and decreases under the Low-Volume scenario.

Figure 96 is a map showing the 2040 Low-Volume scenario bottlenecks, and Figure 97 shows the 2040 High-Volume scenario bottlenecks. As before, these maps do not show the total truck volumes over these locations, but only show the cross border trucks. The triangles represent the directionality of the bottleneck and the color-coding in Table 66 corresponds to the color-coding on the maps (e.g., red for volumes greater than 1,000 average daily trucks).

Although the extent of the potential truck congestion impacts on the three Imperial County locations is unknown since they were not quantified in the 2013 study, truck traffic through that county has been allocated to each of those three.

The same bottlenecks discussed under the Baseline bottleneck discussion remain the most significant bottlenecks for international traffic. The I-5 northbound bottlenecks in Orange County are expected to carry nearly 3,300 average daily trucks in the High-Volume scenario, dropping to around 1,800 trucks in the Low-Volume scenario (compared to 2,400 daily trucks in the Baseline scenario).

Likewise, the Los Angeles County I-5 southbound bottlenecks will remain the most impacted in both the Low and High-Volume scenarios.

Table 66. Cross-Border Truck Flows through SCAG Region Bottlenecks

Route	Dir	Absolute Postmile	County	2014 Estimated 4+Axle HDT AADT	Assigned Cross Border Truck Flows			
					2015 Base Year	2040 Low Volume Scenario	2040 Baseline Scenario	2040 High Volume Scenario
Forrester Road			IMP	n/a	1,928	2,919	4,454	6,580
8	Imperial Ave		IMP					
98	(or Jasper Rd)		IMP					
5	NB	101.5	ORA	5,900	1,167	1,815	2,410	3,297
5	NB	104.6	ORA	7,100				
5	NB	108.7	ORA	7,300				
5	SB	128.5	LA	6,700	807	1,277	1,655	2,237
5	SB	132.3	LA	7,700	598	940	1,255	1,719
101	SB	4.1	LA	3,100	567	891	1,198	1,645
5	SB	144.3	LA	10,000	541	848	1,146	1,579
91	EB	42.9	RIV	7,800	403	657	902	1,249
91	EB	46.6	RIV	7,700				
215	N/SB	n/a	SBD	2,600	443	673	827	1,086
60	WB	13.0	LA	11,000	328	517	759	1,073
60	WB	16.4	LA	11,000	328			
210	EB	33.4	LA	8,800	319	521	738	1,036
110	NB	16.1	LA	4,600	284	440	652	932
101	NB	132.4	LA	3,300	298	459	643	893
105	WB	12.9	LA	7,300	260	412	511	667
5	NB	160.8	LA	12,800	224	345	506	714
210	WB	31.0	LA	10,900	197	308	455	645
210	WB	28.8	LA	8,200				
101	NB	53.2	VEN	2,900	191	299	444	633
101	NB	42.1	VEN	3,400				
91	WB	42.7	LA	7,500	236	366	440	573
91	WB	40.9	RIV	7,800				
5	NB	137.7	LA	9,600	225	345	422	548
5	NB	117.8	LA	6,100	222	339	414	541
5	NB	124.9	LA	6,700				
5	NB	119.2	LA	6,200				
605	SB	13.8	LA	12,600	205	330	389	503
405	NB	46.5	LA	2,600	190	295	354	461
405	NB	50.8	LA	4,000				

Table 4. Cross-Border Truck Flows through SCAG Region Bottlenecks (Cont.)

Route	Dir	Absolute Postmile	County	2014 Estimated 4+Axle HDT AADT	Assigned Cross Border Truck Flows			
					2015 Base Year	2040 Low Volume Scenario	2040 Baseline Scenario	2040 High Volume Scenario
10	EB	25.6	LA	4,100	106	182	247	332
10	EB	70.5	SBD	12,000	117	192	240	315
10	EB	57.5	SBD	15,300				
15	SB	107.7	SBD	11,100				
60	EB	18.3	LA	10,800	103	176	238	319
60	EB	21.6	LA	13,900				
60	EB	19.3	LA	12,000				
60	EB	23.5	LA	15,500				
91	WB	3.9	LA	9,100	110	178	229	300
10	EB	6.6	LA	1,600	113	181	213	274
105	EB	11.9	LA	5,200	112	180	211	272
101	SB	45.7	VEN	3,300	79	136	184	247
710	SB	17.5	LA	4,800	88	141	164	212
57	SB	12.3	ORA	7,100	75	120	140	180
10	WB	32.0	LA	6,800	68	109	127	164
10	WB	30.1	LA	5,800				
110	SB	17.8	LA	3,000	49	79	94	121
60	EB	5.1	LA	4,700	33	56	73	97
60	EB	8.2	LA	7,900				
91	WB	23.6	ORA	7,500	38	59	72	93
605	NB	17.5	LA	13,100	8	13	16	21
605	NB	11.4	LA	14,000				
605	NB	19.2	LA	13,100	7	11	14	18
57	NB	24.4	LA	5,800	1	2	2	3
57	NB	15.2	LA	3,900				
91	WB	46.9	RIV	7,700	0	0	0	0
710	NB	0.5	LA	11,700	0	0	0	0

Figure 96. 2040 Low-Volume Scenario Baseline Cross border Truck Bottleneck Daily Flows

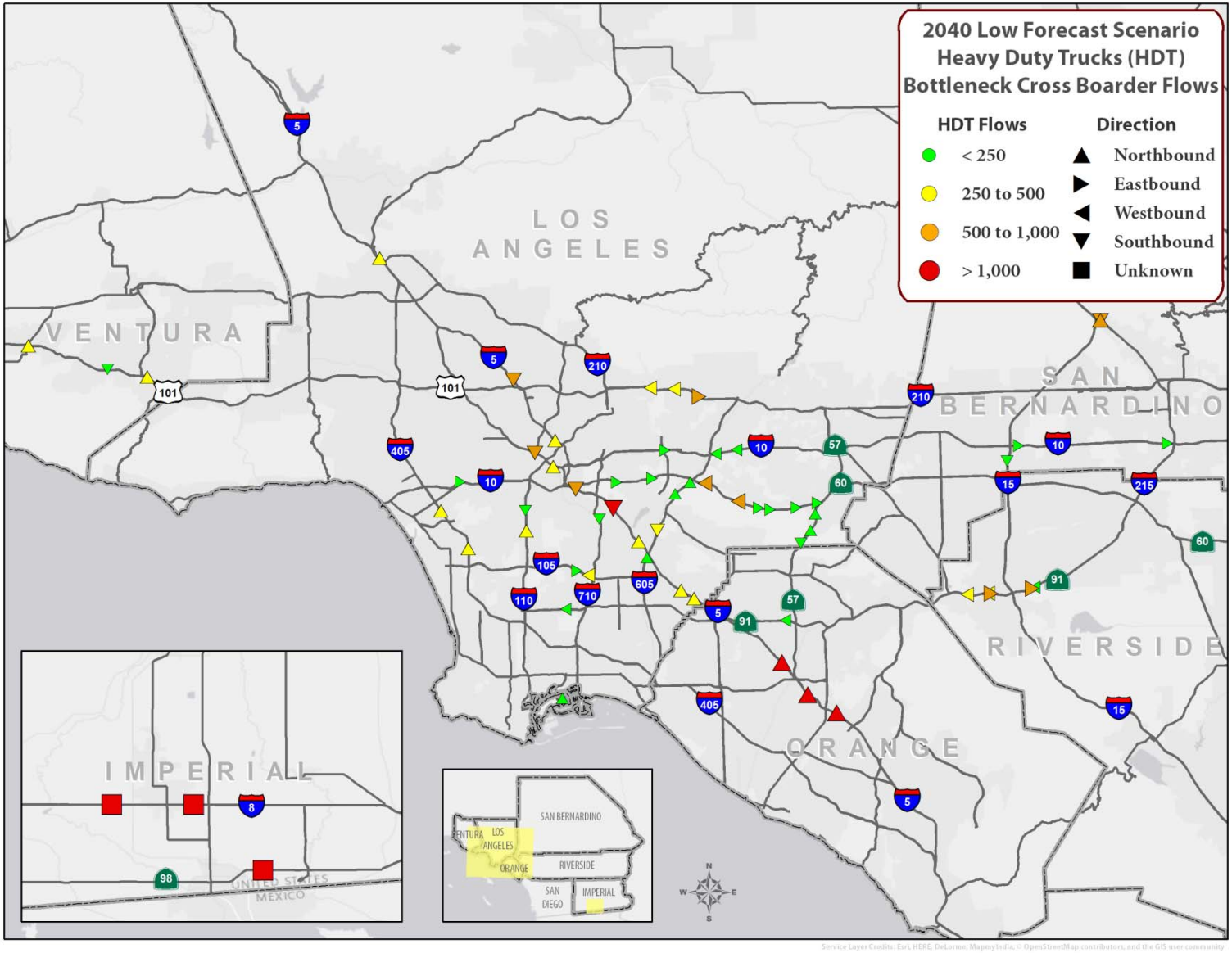
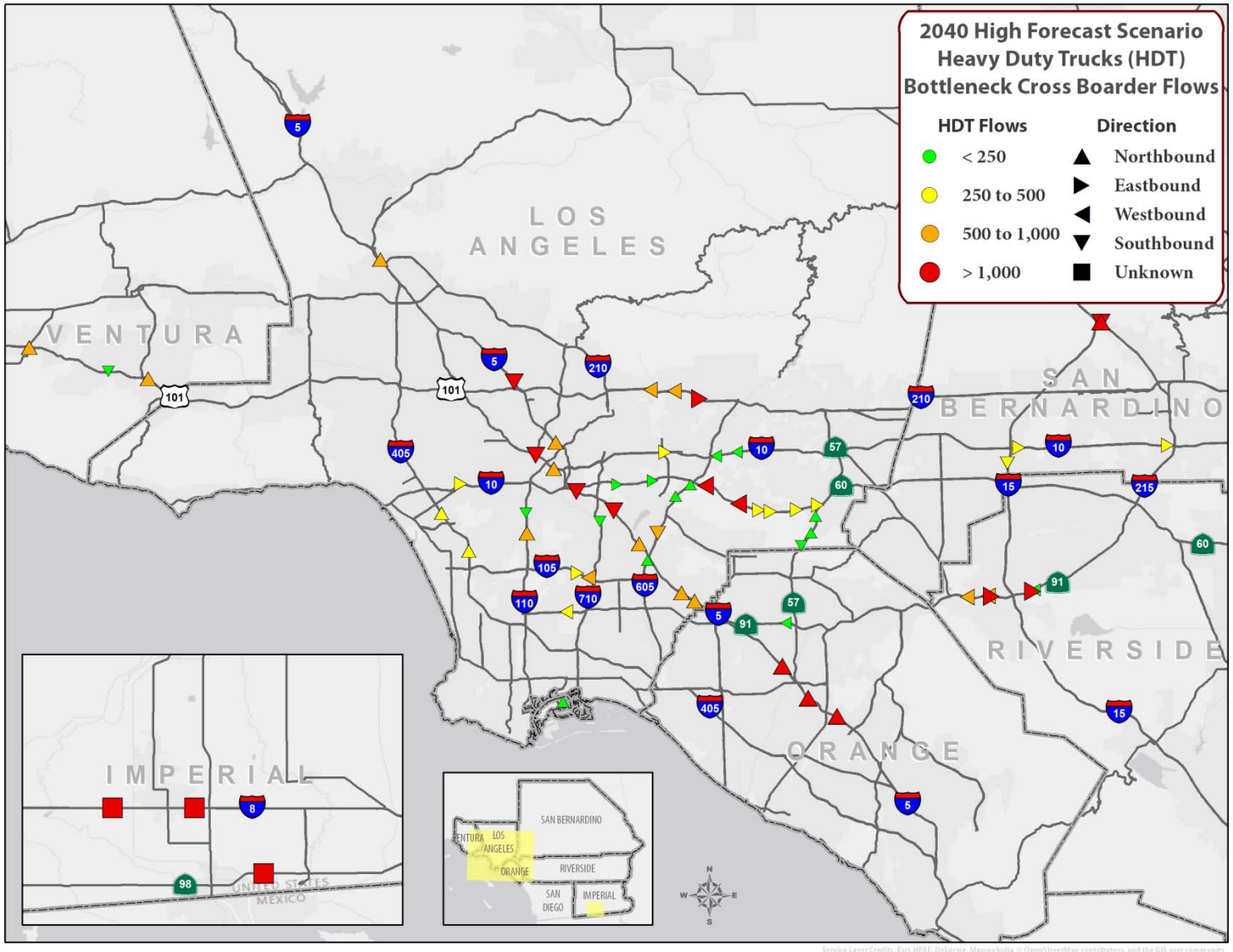


Figure 97. 2040 High-Volume Scenario Cross border Truck Bottleneck Daily Flows



Other bottlenecks that could be significantly impacted in the Low and High-Volume scenarios include:

- SR-91 EB in Riverside County
- I-215/I-15 Devore interchange in San Bernardino County
- SR-60 WB in Los Angeles
- I-210 EB in Los Angeles.

Potential Mitigation Projects

The study team identified several projects from the SCAG 2016 Regional Transportation Plan /Sustainable Communities Strategy (RTP/SCS) that could potentially mitigate impacts on regional HDT bottlenecks in the Low and High-Volume Scenarios. Table 67 summarizes these projects. The projects in *italics* were also listed in the 2040 Baseline discussion of projects that potentially mitigate bottlenecks.

Table 67. SCAG RTP/SCS Projects to Mitigate HDT Bottlenecks in 2040 Low and High-Volume Scenarios

Status	Route		Project Description
Completed	I-5/SR-14	HOV Direct Connector	I-5/SR-14 Direct HOV connector opened in January 2013, $161 million
	I-405	HOV	I-405 Sepulveda Pass Project: Northbound HOV lanes (10-miles) from I-10 to US 101, removes/replaces Skirball Center Dr, Sunset Blvd, and Mulholland Dr bridges, realigns 27 on-and off-ramps, widens 13 existing underpasses and structures, 18 miles of retaining walls and sound walls; opened May 23, 2014 (some ramps/bridges and striping work remain). Design-build project with cost of $1.14 billion
Construction	*I-5*	*HOV/ Mixed Flow/ Interchange*	*I-5 South LA County projects - $1.6 billion over the next 5 years I-5 between Orange County line and I-605. Improvements include HOV lanes, mixed flow lanes, interchange modifications, pedestrian overcrossings, and frontage road modifications, includes I-5 Carmenita Rd IC. Shoemaker bridge widening just opened to traffic*
	I-10/ I-605	Interchange	I-10/I-605 IC Improvement Project – $66 million direct fly-over connector from SB I-605 to EB I-10, began construction in fall 2012, expected completion fall, 2015
	I-15/ I-215	Interchange	I-15/I-215 IC improvements at Devore IC, $324 million, 1 MF lane in each direction b/w Glen Helen Pkwy and I-215, add deceleration lanes, truck bypass lanes – design/build starting Summer 2013, currently in construction.
	SR-91	Express Lanes/ Mixed Flow	SR-91 Fast Forward project will add MF lanes in each direction, tolled express lanes and connectors and improve interchanges, bridges, ramps and local streets between SR-71 and I-15. Project began construction (design/build process) in early 2014 for $1.3 billion, and is expected to open by 2017
	SR-91	Mixed Flow	SR-91 westbound general purpose lane between SR 57 and I-5 for four miles, widen bridges, reconstruct aux lanes, realign ramps, began construction in May 2013
	US-101/ SR-23	Mixed Flow/ Interchange	US 101/SR 23 interchange improvements project: add lane to SB SR-23/NB US 101 connector, soundwalls, add lane to NB and SB US 101 freeway at various locations, widen 3 bridges, realign Moorpark Rd and Hampshire Rd to relief congestion at this chokepoint, $33 million, Construction began early 2014
	I-405	HOV	I-405 Sepulveda Pass Project (see above), HOV open and many ramps and bridges completed, some striping and ramp/bridge work still being performed
	I-710	Interchange	I-710/Firestone Blvd/Atlantic interchange SR-2 Terminus project, 3 phases – Phase 1A $250K completed in November 2013 with mainline signage improvements and striping; Phase 1B $8.6 million ML traffic calming measures, Glendale Blvd improvements, landscaping,

Status	Route		Project Description
			pedestrian improvements to begin Winter 2014/2015. Phase 2 not funded
Planning/ Environmental / Design	*I-5*	*HOV/ Mixed Flow*	*I-5: Add 2 MF lanes from SR-73 to El Toro Rd and extend 2nd HOV lane from El Toro to Alicia Pkwy with operational improvements, split into 3 projects – all undergoing environmental phase.*
	I-10	Mixed Flow	I-10 Corridor project, part of SANBAG 10-year delivery plan, estimated construction cost of $500 million to more than $1 billion, depending on alternative chosen – add lane(s) and improvements along all or a portion of the existing 35-mile stretch of I-10 from 2 miles west of LA/SB county line to city of Redlands. Caltrans currently studying 3 alternatives
	SR-91	Express Lanes /Mixed Flow	SR-91: Add 1 MF lane from SR-71 to I-15, CD system, toll lanes and HOV conversion. Open house in mid-June, 2014. Design/Build to start thereafter.
	I-605	Mixed Flow/ Interchange	I-605 Congestion Hot Spots Project (along SR-91, I-605, and I-405 corridors) Feasibility Study – Final Report and Project Development Strategy released to Metro Board in early 2013
	I-710	Various	I-710 Corridor Project Recirculated DEIR/Supplemental DEIS being prepared from March 2014 due to new information gathered during public review. Preliminary findings suggest traffic patterns were different than identified in DEIR/DEIS. RDEIR/SDEIR to be circulated for public review and comments in Early 2016

Chapter 10: Findings and Recommendations

Introduction

The objective of this chapter is to provide an overview of the work conducted as part of this study, identify the key findings and generate recommendations to promote a more efficient movement of goods across the California – Baja California border.

Overview of Project Work

The team conducted a series of activities as part of this study with the goal of better understanding the characteristics of the movement of goods across the California – Baja California binational region, to forecast the future volumes of these flows and their impact on the SCAG transportation network and to derive recommendations for improving the efficiency with which these flows move. Therefore, the study was centered on a description of the current situation of border-crossing goods movement in the area, an identification of the emerging trends in goods movement that would affect the future of the movement of these goods, the forecast of border-crossing goods movement under alternative scenarios, the analysis of how these future flows affect highway bottlenecks in the region and the identification of economic development opportunities related to the movement of these goods. A summary of the work performed under each one of these activities is described in this section.

Current Situation

The study began by developing an understanding of the current border-crossing flows of goods by collecting data on origins and destinations (O-Ds) of goods moving across the California – Baja California border, and the cargo types transported. The targets for this data collection effort[136] were companies located on the Mexican side of the border (both in the greater Tijuana-Rosarito-Ensenada area and in the greater Mexicali area[137]) from a set of representative clusters[138] that generate cargo to be transported to the U.S. side of the border.

Based on data reported by the companies at an aggregate level, the study found that these companies use inputs and/or raw materials coming primarily from the U.S. (56% of their inbound shipments[139]) in addition to a significant amount of Mexican materials in their production (25% of their inbound shipments). The destinations of the shipments sent by these cargo-generating companies are also primarily located in the U.S. (72% of their outbound shipments[140]) with fewer shipments sent to Mexico (11% of their outbound shipments) compared to inbound shipments, suggesting that these companies are primarily focused on

[136] See Chapter 2 of this document for more details on this topic.
[137] Since the focus of this study is on border-crossing movement of goods, the targets were companies located in Mexico that receive and/or ship goods to the U.S.
[138] The clusters analyzed in this study are defined in Chapter 1 of this document.
[139] Inbound shipments are those that originate elsewhere and have the interviewed company as their destination.
[140] Outbound shipments are those that originate in the cargo generating company being interviewed and have destination elsewhere.

serving the U.S. consumer market.[141] Furthermore, cargo generating companies stated the preferred transportation mode for cross-border movement of goods in the region is truck.[142]

An analysis of manifest-level data collected from cargo generators in this binational region shows that O-Ds of border-crossing goods movement in the region extend not only to geographies like Northern California and the Pacific Northwest, but also to states in the Central U.S. (including Nebraska, Texas, Illinois, Indiana, Wisconsin), states in the Eastern U.S. (including Georgia, Alabama, North Carolina, South Carolina, Pennsylvania) and Canada.[143]

An assessment of current rail operations shows that the amount of goods moved across the border using this mode is very limited compared to the amount of goods moved by truck, with the majority of rail movement occurring in Imperial County. Furthermore, the study confirmed that the railroad network in the region is only used to move goods across the border between the State of Baja California in Mexico and cities in the U.S., since the railroad on the Mexican side has very limited connectivity with the rest of the Mexican railroad network.

Finally, during a previous border crossing study completed in 2012,[144] drayage was found to be an important component of the supply chain for cross-border movements. The current study deepened the understanding of this activity by identifying a potential economic impact from truck drayage in the binational region of approximately $510.5 million in output, including $253.1 million in value added, and approximately 3,500 jobs.[145] Additionally, information collected through interviews of drayage companies detected that some companies reported performing long-haul "drayage" trips, suggesting that companies engaged in drayage also offer long-haul transportation services.

Emerging Trends

As part of the study, a series of interviews was conducted with staff and representatives from government agencies, clusters/associations, chambers of commerce and private companies to identify emerging and future trends in border-crossing goods movement in the region. The main trends identified through these surveys were:

- Growth in the production of high-quality manufacturing products in the region is expected to be strong in the future
- Important components for some industries (i.e., electronics) currently come from Asia and this trend is not expected to change radically in the mid- to long-term
- Trucking will continue to be the preferred transportation mode for border-crossing movement of goods in the region

[141] Other origins of inbound shipments include Asia (14%), Europe (2%) and other/not-reported (3%). Similarly, other destinations of outbound shipments include Asia (7%), Europe (3%), Canada (1%), Latin America excluding Mexico (1%) and other/not-reported (5%).
[142] Trucks alone are estimated to transport approximately 85% of the goods moved across the border in this region. However, interviews were also conducted with rail operators to understand O-D patters and cargo moved by them.
[143] A detailed analysis of the data collected is presented in Chapter 3 of this document.
[144] SCAG Goods Movement and Border Crossing Study and Analysis, http://www.freightworks.org/DocumentLibrary/Goods-Movement-Border-Crossing-Study-and-Analysis_Final_6-06-12(1).pdf
[145] Details of the Economic Impact Analysis are provided in Chapter 4 (Summary of Drayage Data and Economic Impacts) of this report.

- Third-party logistics companies (3PLs) have left Otay Mesa area in recent years due to lower rent and better access to global networks in other regions (not necessarily located along the U.S. – Mexico border)

In addition, the interviewees identified a series of "events" that were used to define different scenarios for the future movement of border-crossing goods in the region that were developed as part of this study. These events were categorized into four groups:

- Infrastructure, related to the physical capacity of the movement of goods in, out and within the binational region;
- Border-crossing operations, related to the processes to move goods across the border;
- Regional production capabilities, linked to the ability of the binational region to produce intermediate and final goods; and,
- Policy, linked to actions by the local governments on both sides of the border to impact the competitiveness of the region with respect to the movement of border-crossing goods.

These events were used to develop the "baseline," "high-volume" and "low-volume" scenarios in terms of forecasted amount of border-crossing goods to be moved, mode of transportation and O-Ds.[146]

Forecasts of Goods Movement

The team developed three forecasts for border-crossing goods movements in the region: baseline, high-volume and low-volume. The forecasts were developed using primarily macro-economic conditions affecting flows of goods across the border that were later adjusted to capture the impact of the events identified as part of the emerging trends stage.

Each scenario's forecast was broken down by transportation mode (truck, rail) and type of generator/attractor (ports, non-ports/inland) and disaggregated into 35 O-D zones (34 within the SCAG and SANDAG region and 1 external zone to capture movement beyond the other zones).

The baseline scenario forecast was defined as the forecast of border-crossing goods movement featuring the most-likely future macro-economic conditions and the most-likely occurrence of events as identified in the trends exercise. The baseline scenario features an annual growth rate of 2.9 percent for border-crossing goods moved by truck (in each direction, northbound and southbound) throughout the region between 2015 and 2040. This leads to almost 2.5 million truck crosses in each direction by 2040. When these volumes are broken down by geographical area, truck volumes in the San Diego-Tijuana region are expected to grow an annual rate of 2.7 percent, while truck flows in the Imperial County-Mexicali region are anticipated to grow at an annual rate of 3.4 percent.

When the aggregate truck flows (i.e., northbound plus southbound) for the year 2040 are allocated to the different O-Ds, the highest flows are between Tijuana and locations within San Diego County with more than 1.4 million annual truck trips. This represents 30% of all cross border truck traffic. The second highest truck flows are between Tijuana and the SCAG region north of San Diego and Imperial Counties with nearly 1.2 million trips. This represents approximately 24% of all cross border traffic. The third highest 2040 baseline volumes (638,000 annual) also cross over at Tijuana and travel from/to states east of California. This major O-D is followed closely by Mexicali from/to Imperial County traffic at 573,000 annual.

Similarly, the baseline scenario features an annual growth rate of 2.2 percent for border-crossing goods moved by rail (in each direction, northbound and southbound) for the same period of analysis. This results

[146] A list of the identified "events" is provided in Chapter 5 of this document.

in almost 20,000 railcars crossing in each direction in 2040. Rail volumes in the San Diego-Tijuana region are expected to grow at an annual rate of 2.0 percent, while rail volumes in the Imperial County-Mexicali region are anticipated to grow at an annual rate of 2.2 percent.

The high-volume scenario forecast was defined as the forecast of border-crossing goods movement featuring optimistic future macro-economic conditions and the appearance of events that would increase the movement of goods across the border.[147] The high-volume scenario features an annual growth rate of 3.5 percent for border-crossing goods moved by truck (in each direction, northbound and southbound) throughout the region between 2015 and 2040. This means that more than 3.1 million trucks are anticipated to cross in each direction by 2040. When these volumes are broken down by geographical area, truck volumes in the San Diego-Tijuana region are expected to grow an annual rate of 3.2 percent, while truck flows in the Imperial County-Mexicali region are anticipated to grow at an annual rate of 4.1 percent.

As in the baseline scenario, the highest aggregate truck forecast flows in 2040 for the high-volume scenario are between Tijuana and locations within San Diego County with just over 2.0 million trips, followed by flows between Tijuana and the remaining SCAG region (excluding Imperial County) with approximately 1.6 million trips. Traffic between Mexicali and Imperial County becomes the third highest O-D in this scenario reaching nearly 890,000 trips in 2040, slightly exceeding the flows between Tijuana and states east of California that feature 850,000 in that same year.

The high-volume scenario features an annual growth rate of 2.6 percent for border-crossing goods moved by rail (in each direction, northbound and southbound) for the 2015-2040 period of analysis. This results in approximately 22,000 railcars crossing in each direction in 2040. Rail volumes in the San Diego-Tijuana region are expected to grow at an annual rate of 2.4 percent, while rail volumes in the Imperial County-Mexicali region are anticipated to grow at an annual rate of 2.7 percent

Finally, the low-volume scenario forecast was defined as the forecast of border-crossing goods movement featuring pessimistic future macro-economic conditions and the appearance of events that would decrease the movement of goods across the border.[148] The low-volume scenario features an annual growth rate of 2.5 percent for border-crossing goods moved by truck (in each direction, northbound and southbound) throughout the region between 2015 and 2040. This means that almost 2.0 million trucks are anticipated to cross in each direction by 2040. When these volumes are broken down by geographical area, truck volumes in the San Diego-Tijuana region are expected to grow an annual rate of 2.3 percent, while truck flows in the Imperial County-Mexicali region are anticipated to grow at an annual rate of 2.8 percent.

In this scenario, the highest aggregate truck forecast flows in 2040 are between Tijuana and locations within San Diego County with just over 1.0 million trips, followed by flows between Tijuana and the remaining SCAG region (excluding Imperial County) with approximately 950,000 trips. The third highest 2040 low-volume flows cross over at Tijuana and travel from/to states east of California reaching approximately 490,000 truck trips in 2040. The fourth major O-D is Mexicali from/to the remaining SCAG region (excluding Imperial County) with approximately 360,000 trips in that same year.

The low-volume scenario features an annual growth rate of 1.8 percent for border-crossing goods moved by rail (in each direction, northbound and southbound) for the same period of analysis. This results in approximately 17,000 railcars crossing in each direction in 2040. Rail volumes in the San Diego-Tijuana region are expected to grow at an annual rate of 1.6 percent, while rail volumes in the Imperial County-Mexicali region are anticipated to grow at an annual rate of 1.8 percent

[147] More details on the high-volume forecast can be found in Chapter 8.
[148] More details on the low-volume forecast can be found in Chapter 8.

Bottleneck Analysis

The bottleneck analysis conducted as part of this study identified highway corridors where the forecasted volumes of border-crossing goods moved by truck would hit heavy-duty truck "bottlenecks" as identified in the updated version of SCAG's 2013 Comprehensive Regional Goods Movement Plan and Implementation Strategy.

Under the three scenarios forecasted, the SCAG bottlenecks on I-5 in Orange and Los Angeles Counties carry the most international trucks. This is to be expected given that outside of San Diego County, the greater Los Angeles Basin and the Tijuana POE O-Ds represent almost a quarter of all cross border truck traffic. Although the extent of the potential congestion impacts on the three Imperial County locations is unknown since they were not quantified in the 2013 study, all truck traffic was assumed to go through to all three locations and therefore become the most impacted bottlenecks in that county.

Potential mitigation projects to address the bottlenecks affected by border-crossing goods movement include projects on I-5 in South LA County, I-15/I-215, SR-91, US 101/SR 23, I-405, I-710 at the crossing with SR-2, I-10 in SANBAG and I-605.[149]

Opportunities

The team identified opportunities for economic development in the binational area through a literature review of future trends in the Mexican economy, a qualitative analysis of the interviews with agencies and border-crossing goods movement stakeholders, and the analysis of case studies of supply chains in the region.

The literature review on the Mexican economy found that: (i) economic growth in Mexico is expected to remain high in the near future; (ii) Mexico is ideally located to serve as a global manufacturing hub since it straddles major East-West trade lanes and has executed a large number of free trade agreements with developed economies; and, (iii) the industrial base of Baja California is very different than that of the rest of the country and is likely to remain so due to the large degree of integration with the Southern California economy.

The qualitative analysis of interviews and case studies increased awareness about opportunities related to attraction of maquiladora and supplier companies to the binational region from Asia (near-shoring), growth in LPOE capacity to meet future demand for truck crossings, expansion of port capacity on the Mexican side of the border to help relieve congestion at Ports of Los Angeles and Long Beach, development of intermodal capacity in Tijuana to improve the access of automobiles produced in the region to their final destination, development of air cargo to link high-value goods produced in region with consumer markets and promotion of cold storage facilities in Imperial County to better handle agricultural goods crossing through the LPOEs in this county.

The combined assessment of the literature review and the qualitative analysis led to the identification of two key areas of opportunity for the region: (i) growth in high-end manufacturing and, (ii) increased demand for transportation of goods into, out of and within the California – Baja California border region and warehousing/storage services.[150]

Key Study Findings

[149] A detailed list of bottlenecks and mitigation projects can be found in Chapters 6 and 9 of this document.
[150] More details on the specific opportunities identified are provided in Chapter 7.

The information developed collected the different activities developed as part of this study was analyzed and the following key findings were identified:

12. Border-crossing traffic flows are large, but are not significant compared to the domestic flows of goods in the region
13. Bottlenecks in the SCAG and SANDAG region are not the result of border-crossing flows
14. The economic impact of drayage in the SCAG and SANDAG region is considerable
15. The main economic development opportunities in the region are linked to the potential for growing high-end manufacturing production and the increase in the offering of transportation modes and warehousing services
16. The movement of goods across the California-Baja California is of national relevance

Each finding is briefly described below.

Border-crossing traffic flows are large, but not significant when compared to domestic flows

The flows of goods moved by truck across the border range between 2.0 and 2.7 million in 2015 and are forecasted to be between 3.8 and 6.2 million in 2040. Despite the fact that this is an important number of truck trips, when comparing average daily forecasts for the different scenarios with average daily truck volumes from SCAG's 2013 Comprehensive Regional Goods Movement Plan and Implementation Strategy, the result is that these border-related truck flows represent only between 2 and 5 percent of total truck flows in the SCAG region. The vast majority of the truck flows in the region are domestic in nature, linking suppliers and consumers throughout the U.S. This includes flows that use the San Pedro Bay Ports to enter/exit the U.S but do not cross the border with Mexico in their route to their final destination.

Bottlenecks in the SCAG and SANDAG region are not the result of border-crossing flows

As a result of the previous observation, the heavy-duty truck bottlenecks in the SCAG area are not generated by goods that move across the California – Baja California border. However, these flows do use the routes that are identified as having bottlenecks and therefore the existence of those bottlenecks affects the efficiency with which international goods move in the SCAG region. Therefore, if improvements to the efficiency of border-crossing flows of goods are desired, these bottlenecks (generated by internal flows) need to be removed.

Economic impact of drayage in the SCAG and SANDAG region is important

Drayage along the California – Baja California border is a key element of the regional supply chains, since it connects supply chains on either side of the border and helps address the issue of long wait times at the land ports of entry (LPOEs) in the region by assigning this task to companies that specialize in moving freight across the border. In addition, this activity is a generator of economic development in the region, creating more than half a billion dollars in output (including a quarter of a billion in value added) and approximately 3,500 jobs only on the U.S. side of the border. Despite the importance of these impacts, the economies of San Diego and Imperial County are large compared to those impacts. For example, industrial GDP in the combined San Diego – Imperial County region was approximately 212 billion dollars during 2014, making the economic impacts of drayage equal to only 0.2 percent of that industrial GDP.

Main economic development opportunities in the region linked to high-end manufacturing, transportation modes and warehousing services

The anticipated economic conditions in Mexico and the characteristics of the Baja California economy are anticipated to foster a continued growth of high-end manufacturing in the California – Baja California border region. In particular, the increase in Mexican labor productivity, the continued growth in China's

manufacturing wages (which recently surpassed manufacturing wages in Mexico) and the strategic location of the California – Baja California region as a link between producers of inputs in Asia and the U.S. consumer markets point towards a strong development of the high-end manufacturing activities that are now predominant in this border region. At the same time, this anticipated growth in manufacturing will translate in a higher demand for transportation and warehousing services to link producers of border-crossing goods with their final input and consumer markets.

Movement of goods across the California-Baja California is of national relevance

This is evidenced by the important share of origins and destinations of truck trips that go beyond the Southern California region. In particular, the study found that an average 22% of aggregate truck trips in the San Diego-Tijuana area and 35% of truck trips in Calexico-Mexicali area either originate or terminate at a place outside of this region. This number, however, is likely to be larger than reported here, since it is possible that some cargo generators interviewed as part of this study did not know the true origin or destination of the goods that are shipped to or out of their facilities. As a result, there is a possibility they reported an intermediate stop as the true origin or destination of the goods moved by those companies.

Recommendations

A series of preliminary recommendations was developed as the analysis was progressing through the different stages. After all the tasks of the study were completed, a holistic assessment of the findings and the information contained in the chapters of this report was conducted to develop the final recommendations presented in this document. For organizational and presentation purposes, the final recommendations were categorized under a series of "strategic considerations" on border-crossing goods movement in the region that relate to specific issues that are anticipated to impact the future of goods movement across the California – Baja California border. Therefore, final recommendations are listed under each individual strategic consideration listed in this section.

Strategic Consideration 1: Truck is anticipated to be main transportation mode in foreseeable future for border-crossing goods in the region

Truck is currently the dominant mode for the movement of border-crossing goods and is anticipated to continue as the dominant mode in the medium-to-long term. The study found that highway bottlenecks in the SCAG region are not created by international flows of goods; however, these flows are affected by the bottlenecks. Also, even though this study did not focus on the analysis of the LPOEs in the region, other efforts have shown that congestion exists in these facilities. Therefore, in order to achieve a more efficient movement of border-crossing goods across the entire chain (i.e., from origin to destination), both the bottlenecks at the LPOEs and the highway networks need to be removed.

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Specific recommendations identified as part of this strategic consideration include:

RECOMMENDATION 1: PRIORITIZE INVESTMENT IN PROJECTS TO REMOVE HIGHWAY BOTTLENECKS IDENTIFIED IN BOTTLENECK ANALYSIS

The study identified a series of projects already listed in SCAG's 2016-2040 Regional Transportation Plan /Sustainable Community Strategies (RTP/SCS) that would help alleviate the main bottlenecks through

which border-crossing goods movements need to move through under the different scenarios forecasted. Some of the identified projects are already under construction while others are in the different planning stages.[151] In the case of projects under construction, it is important to secure funding for their completion and ensure they will be completed on schedule. On the other hand, in the case of projects currently in the different stages of planning and design, it is important to ensure all planning studies are completed within schedule and that sources of funding are identified so they can transition smoothly to the construction stage.

The projects under construction that would alleviate bottlenecks include the following:

- I-5 South LA County projects - $1.6 billion over the next 5 years. I-5 between Orange County line and I-605. Improvements include HOV lanes, mixed flow lanes, interchange modifications, pedestrian overcrossings, and frontage road modifications, includes I-5 Carmenita Rd IC. Shoemaker bridge widening just opened to traffic
- I-15/I-215 IC improvements at Devore IC, $324 million, 1 MF lane in each direction b/w Glen Helen Pkwy and I-215, add deceleration lanes, truck bypass lanes – design/build started Summer 2013
- SR-91 Fast Forward project will add MF lanes in each direction, tolled express lanes and connectors and improve interchanges, bridges, ramps and local streets between SR-71 and I-15. Project began construction (design/build process) in early 2014 for $1.3 billion, and is expected to open by 2017
- SR-91 westbound general purpose lane between SR 57 and I-5 for four miles, widen bridges, reconstruct aux lanes, realign ramps, began construction in May 2013
- US 101/SR 23 interchange improvements project: add lane to SB SR-23/NB US 101 connector, soundwalls, add lane to NB and SB US 101 freeway at various locations, widen 3 bridges, realign Moorpark Rd and Hampshire Rd to relief congestion at this chokepoint, $33 million, Construction began early 2014
- I-405 Sepulveda Pass Project (see above), HOV open and many ramps and bridges completed, some striping and ramp/bridge work still being performed
- I-710/Firestone Blvd/Atlantic interchange SR-2 Terminus project, 3 phases – Phase 1A $250K completed in November 2013 with mainline signage improvements and striping; Phase 1B $8.6 million ML traffic calming measures, Glendale Blvd improvements, landscaping, pedestrian improvements to begin Winter 2014/2015. Phase 2 not funded

In the case of these projects, it is important to secure funding for their completion and to ensure they will be completed on schedule.

The list of projects undergoing the different stages of planning and design includes:

- I-5: Add 2 MF lanes from SR-73 to El Toro Rd and extend 2nd HOV lane from El Toro to Alicia Pkwy with operational improvements, split into 3 projects. All these projects are undergoing the environmental study phase
- I-10 Corridor project, part of SANBAG 10-year delivery plan, estimated construction cost of $500 million to more than $1 billion, depending on alternative chosen – add lane(s) and improvements along all or a portion of the existing 35-mile stretch of I-10 from 2 miles west of LA/SB county line to city of Redlands. Caltrans currently studying 3 alternatives
- SR-91: Add 1 MF lane from SR-71 to I-15, CD system, toll lanes and HOV conversion. Open house in mid-June, 2014. Design/Build to start thereafter

[151] The comprehensive list of projects is provided in Chapter 10 (Findings and Recommendations) of this document.

- I-605 Congestion Hot Spots Project (along SR-91, I-605, and I-405 corridors) Feasibility Study – Final Report and Project Development Strategy released to Metro Board in early 2013
- I-710 Corridor Project Recirculated DEIR/Supplemental DEIS being prepared from March 2014 due to new information gathered during public review. Preliminary findings suggest traffic patterns were different than identified in DEIR/DEIS. RDEIR/SDEIR to be circulated for public review and comments in Early 2016

For these projects, is it important to ensure all planning studies are completed within schedule and that sources of funding are identified so they can move on to the construction stage.

RECOMMENDATION 2: INVEST IN AUGMENTING LPOE CAPACITY

The State Route 11/Otay Mesa East Port of Entry (POE) Project is anticipated to provide fast, predictable, and secure crossings via tolled approach roads that connect directly to a new state-of-the-art POE serving both personal and commercial vehicles. The goal is to operate the new POE with an average 20-minute border wait time. Currently SANDAG is moving forward with the construction of SR-11, while the new LPOE is still in the planning and design phases.

Similarly, there is a project to expand truck and auto inspection lanes at the existing LPOE in Calexico East. This project is anticipated to increase capacity at both the auto and commercial truck inspection services, decrease wait times and reduce localized vehicle-generated air pollution. However, the schedule for appropriation of construction funds remains uncertain.

These two projects should be given a high priority in terms of local support and funding in order to ensure the bottlenecks at the LPOEs are ameliorated.

RECOMMENDATION 3: PROMOTE CONSTRUCTION OF COLD STORAGE FACILITIES IN IMPERIAL COUNTY TO IMPROVE QUALITY OF AGRICULTURAL GOODS MOVED BY TRUCK

A recommendation specific to Imperial County relates to the construction of cold storage facilities. The important amount of drayage in the area and the delays due to border-crossing inspections at the LPOEs can compromise the freshness of agricultural products, in particular during the peak-period of international trade. Therefore, the construction of cold storage facilities constitutes a solution to preserving the quality and freshness of the agricultural products that cross the U.S.-Mexico border. In these facilities, products can be consolidated after drayage and/or inspection to preserve their freshness before being transported to their final destination (usually via long-haul truck). In addition to improving the quality of the imports, this activity could generate an important economic impact in the region by creating value added activities and jobs.

Strategic Consideration 2: Cali-Baja is competing with other border regions to attract and retain companies that want to be closer to final consumer markets but with ease of access to global networks

The attractiveness of the U.S. – Mexico border to companies producing goods for consumers in the U.S. market is undeniable given the high productivity of Mexican labor and their relative low manufacturing wages (compared to countries like China). However, the Cali-Baja region is not the only border region competing to host these companies. Places like Laredo – Laredo (in Texas – Tamaulipas) and El Paso – Cd. Juarez (in Texas – Chihuahua) are also places with a tradition in manufacturing activity and good transportation connectivity with the U.S. Furthermore, both these places have decent border-crossing railroad service that provides relief to the congested LPOEs that service international truck traffic. Therefore, in order for the Cali-Baja region to remain competitive vis-à-vis these other border regions, it

needs to promote modal diversification and generate redundancies in the transportation networks that serve these border-crossing goods movements.

RECOMMENDATION 4: PROMOTE MODAL DIVERSIFICATION IN REGION TO LEVERAGE THE REGION'S STRATEGIC LOCATION

The Cali-Baja region is strategically located between the input-producing regions in Asia (primarily China) and the consumer-markets in the U.S. However, the overwhelming majority of border-crossing goods in the region move by truck, with rail playing a very small role. Cargo producers and owners prefer redundancy in the transportation networks of the places where they operate and therefore the addition of rail and air cargo facilities would improve the prospects of Cali-Baja to attract them. Specific initiatives that would diversify the supply of transportation alternatives in the region include:

- Development of an intermodal terminal in Tijuana to transport automobiles produced locally in the Toyota plant to their destinations in the U.S. market
- Rehabilitation of the Desert Line and improving rail connectivity of El Centro with points to the east to provide an alternative for goods produced in the region with a final destination in states to the east of California
- Development of the Holtville Cargo Airport to transport high-value, low volume goods (such as medical devices and electronics) out of the region and into their final destinations throughout the entire U.S.

The implementation of these specific initiatives requires the confluence of private and public interests. As such, the role of the public agencies in the region could be that of facilitating discussions and generating consensus on the importance of these initiatives.

Strategic Consideration 3: Performance and level of integration of supply chains in the region is directly linked to characteristics of border-crossing processes

The movement of goods across the border in the region is undoubtedly sensitive to border-crossing wait times at the LPOEs. In response to this, companies have traditionally adapted their supply chains to minimize the impact of these wait times at the border, resulting for example, in the use of drayage to link pre-LPOE transportation services with post-LPOE ones. However, technological advances can be applied to different stages of the border-crossing process to expedite it.

RECOMMENDATION 5: PROMOTE USE OF STREAMLINED PROCESSES AND STATE-OF-THE-ART TECHNOLOGICAL ADVANCES

There are several streamlined processes and state-of-the art technologies that can be applied to the freight border-crossing experience that would reduce wait times at LPOEs and allow for a larger degree of integration of the supply chains on both sides of the border. Some specific improvements include:

- Use of non-intrusive inspection methods for cargo, including prior to arriving at booth – this would reduce inspection times (compared to the prevalent manual inspection method)
- Electronic transmission of data of cargo, prior to arriving at LPOE – this would reduce delays currently due to "paperwork inspection"
- Promote use of pre-inspection at point of origin (for example, maquiladora plant) combined with the use of GPS tracking of trucks between the origin and the LPOE – this method is being piloted by some companies including Foxconn at the border region of El Paso – Cd. Juarez.

The implementation of the proposed improvements at a border-wide scale requires the agreement and buy-in from several stakeholders and may not occur in the short-term. However, Cali-Baja authorities could

request CBP and other agencies for the development of pilot programs at the local level that can eventually be transformed into a permanent component of the border-crossing process.

Strategic Consideration 4: A large number of agencies and stakeholders on both sides of the border are involved in the movement of goods

The list of government agencies involved in the movement of goods across the border is long. In addition to the agencies, there are direct and indirect private stakeholders that are also involved in the movement of the goods. There are several initiatives implemented by individual agencies and stakeholders that do not realize their maximum potential due to a lack of coordination with other initiatives being deployed by other agencies or stakeholders.

RECOMMENDATION 6: PROMOTE HIGHER LEVELS OF COORDINATION BETWEEN AGENCIES AND STAKEHOLDERS TO ACHIEVE EFFICIENT SHIPMENT OF GOODS ACROSS THE BORDER

Even though there are several groups and forums aimed at fostering cooperation on border-related issues, specific coordination on operational issues from the perspective of supply chains could be improved. Agencies in the Cali-Baja region could lead a group similar to a binational supply-chain council where discussions between all the relevant agencies and stakeholders take place. Those discussions should be aimed at achieving the efficient movement of goods across the binational region and to coordinate the implementation of different programs available in the region to ensure these programs can reach their potential and are well integrated with border-crossing procedures.

Strategic Consideration 5: The State of Baja California is aggressively trying to attract producers and their suppliers to the region

The government of Baja California is investing in attracting manufacturing companies to the region as a way to strengthen its production base. In particular, it is targeting high-end manufacturing companies with high growth potential (such as aerospace, automotive, medical devices, furniture and electronics). The state is not only doing promotional tours of the region but is also pushing for better tax conditions for maquiladoras on Mexican side. In particular, they are discussing with the Mexican federal government and expedited value added tax (VAT) reimbursement that would improve the cash flow of maquiladoras in the region.

RECOMMENDATION 7: HARMONIZE POLICIES ON BOTH SIDES OF THE BORDER TO MAKE THE ARGUMENT MORE APPEALING

Even though the decision to relocate a company to the Cali-Baja region hinges primarily on the attractiveness of the site and conditions in Baja California (due to relatively lower manufacturing wages and high productivity of the Mexican labor), the attractiveness of the region as a whole could be enhanced by introducing policies on the U.S. side of the border that reinforce or complement the policies introduced on the Mexican side. The cost of these policies does not have to be onerous. A good example of this type of policies would be the development and constant update of a database containing warehouse locations and prices for space rental on the U.S. side of the border or of a database containing a list of transportation service providers that specialize in border-crossing activities.

An initial list of policies could be developed in consultation with staff from the State of Baja California. This list could be adapted/expanded as the binational region assesses their effectiveness in attracting new companies.

Strategic Consideration 6: Supply chains are constantly evolving, looking for ways to minimize cost and/or reach markets faster

A quick comparison of Phase I of this study with Phase II sheds light on the degree of evolution of supply chains in the region over short periods of time. For example, during Phase I the study identified common drop off and pick up locations for truck cargo that did not include secured parking lots as one of the options.

This new location was identified as part of Phase II of this study, probably as a result of supply chains reacting to local border-crossing conditions and transportation costs in the region. This study analyzed representative supply chains in the area, but local agencies should continue to learn about them to understand their evolution in future years.

RECOMMENDATION 8: CONTINUE FUNDING GOODS MOVEMENT STUDIES TO BETTER UNDERSTAND THEIR CHARACTERISTICS

Global trade and transportation costs driven by oil prices and other macro variables can significantly affect the way goods move across the border. Therefore, it is important to continue studying their movement and to identify, through conversation with cargo generators and transportation practitioners, the new requirements imposed by production processes and times to market on supply chains. Furthermore, the integration of the findings and recommendations from these kind of studies in combination with the findings and recommendations from other related studies in the region (such as the warehouse study being conducted by SCAG) shed a brighter light on the future of domestic and international movement of goods as well as on the policy options to make their transportation more efficient.

Chapter 1 Appendix

Information on Commodities Traded and Classification into Clusters

The list of clusters identified in California by the U.S. Cluster Mapping Project and the commodities from BTS that were matched to each cluster are presented below.

Table 68. Classification of Commodities into Clusters

Clusters	Commodities (from BTS)
Aerospace Vehicles and Defense	Aircraft; spacecraft; and parts thereof; Special classification provisions
Agricultural Products	Fertilizers; Live animals; Meat and edible meat offal; Dairy produce; Birds' eggs; Natural honey; Edible products of animal origin; not elsewhere included; Edible vegetables and certain roots and tubers; Edible fruit and nuts; Peel of citrus fruit or melons; Cereals; Oil seeds and oleaginous fruits; Miscellaneous grains; Seeds and fruit; Industrial plants; Cotton; Vegetable plaiting materials; Vegetable products not elsewhere specified or included; (Imports only) Temporary legislation; Temporary modifications established pursuant to trade legislation
Apparel	Furskins and artificial fur; Manufactures thereof; Articles of apparel and clothing accessories; knitted or crocheted; Articles of apparel and clothing accessories; not knitted or crocheted; Headgear and parts thereof; Umbrellas; sun umbrellas; walking sticks; seatsticks; whips; riding crops and parts thereof; Prepared feathers and down and articles made of feathers or of down; artificial flowers; Raw hides and skins; other than furskins
Automotive	Railway or tramway locomotives; rolling stock and parts thereof; railway fixtures and parts thereof; Vehicles; other than railway or tramway rolling stock; and parts and accessories thereof
Biopharmaceuticals	Pharmaceutical Products
Chemical Products	Inorganic chemicals; Organic or inorganic compounds of precious metals; of rare-earth metals; Organic chemicals; Tanning or dyeing extracts; Tannins and their derivatives; Dyes; pigments and other coloring matter; Essential oils and resinoids; Perfumery; cosmetic or toilet preparations; Soap; organic surface-active agents; washing preparations; lubricating preparations; prepared waxes;

	Explosives; Pyrotechnic products; Matches; Pyrophoric alloys; Certain combustible preparations Miscellaneous chemical products; Mineral fuels; mineral oils and products of their distillation; Bituminous substances; Mineral waxes Albuminoidal substances; Modified starches; Glues; Enzymes
Construction Materials	Salt; Sulfur; Earths and stone; Plastering materials; lime and cement; Articles of stone; plaster; cement; asbestos; mica or similar materials; Ceramic products; Glass and glassware
Entertainment	Works of art; collectors' pieces and antiques
Fishing and Fishing Products	Fish and crustaceans; mollusks and other aquatic invertebrates; Preparations of meat; of fish; or of crustaceans; mollusks or other aquatic invertebrates
Footwear	Footwear; gaiters and the like; Parts of such articles
Forest Products	Live trees and other plants; Bulbs; roots and the like; Cut flowers and ornamental foliage; Cork and articles of cork; Lac; Gums; Resins and other vegetable saps and extract; Wood and articles of wood; Wood charcoal
Furniture	Manufactures of straw; of esparto or of other plaiting materials; Basketware and wickerwork; Furniture; Bedding; mattress supports; cushions and similar stuffed furnishings; Lighting fittings
Heavy Machinery	Nuclear reactors; boilers; machinery and mechanical appliances; parts thereof
Information Technology	Photographic or cinematographic goods; Clocks and watches and parts thereof
Jewelry and Precious Metals	Natural or cultured pearls; precious or semiprevious stones; precious metals; articles thereof
Leather and Related Products	Articles of leather; Saddlery and harness; Travel goods; handbags and similar containers
Lighting and Electrical Equipment	Man-made filaments; Electrical machinery and equipment and parts thereof; Sound recorders and reproducers
Medical Devices	Optical; photographic; cinematographic; measuring; checking; precision; medical instruments
Metal Manufacturing	Iron and steel; Articles of iron or steel; Copper and articles thereof; Nickel and articles thereof; Aluminum and articles thereof; Lead and articles thereof; Zinc and articles thereof; Tin and articles thereof; Other base metals; Cermets; Articles thereof; Tools; implements; cutlery; spoons and forks; of base metal; Parts thereof of base metal; Miscellaneous articles of base metal; Arms and ammunition; Parts and accessories thereof; Ores; slag and ash

Plastics	Plastics and articles thereof; Rubber and articles thereof ; Miscellaneous manufactured articles
Processed Food	Products of animal origin; not elsewhere specified or included; Coffee; tea; mate and spices; Products of the milling industry; Malt; Starches; inulin; Wheat gluten; Sugars and sugar confectionery; Cocoa and cocoa preparations; Preparations of cereals; flour; starch or milk; Bakers' wares; Preparations of vegetables; fruit; nuts; or other parts of plants; Miscellaneous edible preparations; Beverages; spirits and vinegar; Residues and waste from the food industries; Prepared animal feed; Animal or vegetable fats and oils and their cleavage products; Prepared edible fats; Animal waxes
Publishing and Printing	Printed books; newspapers; pictures and other products of the printing industry; Manuscripts; Pulp of wood or of other fibrous cellulosic material; Waste and scrap of paper or paperboard; Paper and paperboard; Articles of paper pulp; of paper or of paperboard
Sporting, Recreational and Children's Goods	Musical instruments; Parts and accessories of such articles; Toys; games and sports equipment; Parts and accessories thereof
Textiles	Silk; Wool; fine or coarse animal hair; Horsehair yarn and woven fabric; Other vegetable textile fibers; Paper yarn and woven fabrics of paper yarn; Wadding; felt and nonwovens; Special yarns; Twine; cordage; ropes and cables and articles thereof; Carpets and other textile floor coverings; Special woven fabrics; Tuffed textile fabrics; Lace; Tapestries; Trimmings; Embroidery Impregnated; coated; covered or laminated textile fabrics; Textile articles for industrial use; Knitted or crocheted fabrics; Other made-up textile articles; Needle craft sets; Worn clothing and worn textile articles; rags; Man-made staple fibers
Tobacco	Tobacco and manufactured tobacco substitutes
Transportation and Logistics	Ships; boats; and floating structures

Source: HDR analysis based on U.S. Cluster Mapping Website - http://clustermapping.us/cluster

Additional clusters are provided for California. However, no commodities could be classified into the clusters listed below:

- Aerospace Engines
- Building Fixtures, Equipment and Services
- Business Services
- Communications Equipment
- Distribution Services
- Education and Knowledge Creation
- Financial Services
- Heavy Construction Services
- Hospitality and Tourism
- Motor Driven Products
- Oil and Gas Products and Services
- Power Generation and Transmission
- Prefabricated Enclosures
- Production Technology

Annual Value of Traded Goods by Truck and Rail in the Region
Table 69 and

Table 70 present results for goods transported via truck;

Table 71 and

Table 72 present results for goods transported via rail. Results are aggregated for all six (6) land LPOEs in the region: Andrade, Calexico, Calexico East, San Ysidro, Otay Mesa, and Tecate[152].

Table 69. Annual Total Value (Actual US Dollars) of Imported Goods – Trucks

Clusters	2007	2008	2009	2010	2011	2012	2013
Aerospace Vehicle and Defense	1,134,208,759	1,317,745,045	1,105,762,628	1,303,500,932	1,360,425,061	1,618,096,626	1,806,603,575

[152] The BTS data shows truck trade occurs at the LPOEs of Andrade, Calexico, Calexico East, Otay Mesa and Tecate. Similarly, the BTS database shows goods traded by rail use the LPOEs at Calexico, Calexico East, San Ysidro and Tecate.

Agricultural Products	1,016,266,466	1,079,150,485	1,050,057,546	1,225,928,718	1,463,448,086	1,523,339,056	1,689,278,783
Apparel	576,872,765	577,744,589	509,120,915	538,436,379	519,922,867	448,830,843	444,971,010
Automotive	1,531,587,793	1,819,688,689	1,597,925,636	2,088,795,204	2,282,864,219	2,592,439,914	2,913,273,559
Biopharmaceuticals	15,794,517	22,173,779	29,297,027	37,075,747	36,920,671	53,770,708	51,498,921
Chemical Products	114,043,128	122,621,651	119,050,973	124,786,946	126,471,977	118,855,192	112,553,176
Construction Materials	320,659,456	316,141,173	318,638,190	357,068,470	350,319,253	332,053,354	330,209,513
Entertainment	2,170,994	126,465	238,403	203,839	270,454	109,954	191,480
Fishing and Fishing Products	45,311,876	46,441,965	39,754,755	44,087,723	67,258,532	74,508,441	89,483,622
Footwear	53,518,833	49,175,652	51,610,213	61,831,520	68,062,480	73,438,783	90,203,135
Forest Products	100,522,915	88,923,754	68,159,522	64,227,300	62,427,718	64,627,354	77,813,113
Furniture	743,693,961	663,686,498	527,054,236	589,666,564	646,022,443	777,198,509	858,163,247
Heavy Machinery	1,570,840,942	1,600,449,763	1,299,663,343	1,760,100,273	2,049,778,619	2,167,994,688	2,059,084,251
Information Technology	2,325,428	1,933,467	4,791,506	3,395,179	1,395,559	754,273	1,134,713
Jewelry and Precious Metals	22,491,850	18,474,321	19,026,858	18,529,443	20,571,500	29,601,484	30,477,485
Leather and Related Products	25,838,948	22,178,721	22,328,205	23,751,409	30,489,665	33,058,916	38,099,702
Lighting and Electrical Equipment	15,904,579,049	15,385,301,385	12,997,448,652	13,178,412,671	13,089,683,393	13,448,722,814	13,564,979,954
Medical Devices	2,041,984,793	2,137,107,741	2,145,322,382	2,455,043,913	2,740,030,537	3,038,135,825	3,063,103,388
Metal Manufacturing	1,128,746,923	1,027,467,864	718,980,359	848,383,391	1,040,613,002	1,060,475,036	1,049,869,591
Plastics	723,596,249	716,017,097	671,051,781	718,515,576	733,802,515	816,979,637	922,242,000
Processed Food	575,650,034	570,525,643	644,017,172	678,618,179	746,704,942	776,483,083	816,588,681
Publishing and Printing	282,942,431	212,249,670	163,196,276	216,227,149	263,227,059	231,931,393	231,279,389
Sporting, Recreational and Children's Goods	246,734,575	197,964,624	193,183,667	227,192,585	270,657,730	284,302,422	254,407,517

Textiles	155,293,162	122,086,584	124,492,546	146,504,568	159,800,966	168,941,062	183,480,546
Tobacco	0	0	1,113,160	4,229,261	3,951,282	4,387,482	3,213,390
Transportation and Logistics	2,063,961	1,978,802	1,589,636	1,580,696	1,627,889	1,961,992	1,841,821
Total	**28,337,739,808**	**28,117,355,427**	**24,422,875,587**	**26,716,093,635**	**28,136,748,419**	**29,740,998,841**	**30,684,045,562**

Source: HDR analysis based on BTS data - **http://transborder.bts.gov/programs/international/transborder/TBDR_QAPC07.html**

Table 70. Annual Total Value (Actual US Dollars) of Exported Goods – Trucks

Clusters	2007	2008	2009	2010	2011	2012	2013
Aerospace Vehicle and Defense	45,799,430	43,774,485	26,654,812	56,597,850	109,437,207	131,144,864	140,181,373
Agricultural Products	576,934,966	667,692,882	554,506,566	639,998,229	679,588,997	771,032,238	845,104,139
Apparel	260,968,692	261,848,876	250,363,990	311,805,728	408,168,664	392,314,311	305,126,892
Automotive	1,243,167,442	1,270,446,414	722,008,617	1,040,115,667	1,191,671,801	1,397,525,020	1,349,737,537
Biopharmaceuticals	16,971,061	26,328,730	37,295,917	50,657,352	59,459,536	100,247,189	115,264,497

Chemical Products	446,092,856	538,448,096	502,061,436	648,590,986	594,764,162	565,139,638	532,480,102
Construction Materials	198,323,903	195,176,882	150,875,450	189,434,097	209,269,603	250,333,073	227,146,843
Entertainment	1,162,029	837,679	1,835,847	1,026,284	504,193	434,996	215,762
Fishing and Fishing Products	51,444,570	62,761,500	44,521,391	49,363,850	63,367,439	63,440,185	72,128,293
Footwear	13,870,337	15,958,199	12,004,693	50,603,269	68,010,495	39,374,145	43,218,232
Forest Products	258,690,515	231,270,646	184,291,440	218,723,062	247,167,728	285,525,157	312,425,454
Furniture	152,816,276	160,830,176	126,102,944	159,976,678	195,952,026	205,494,622	216,906,546
Heavy Machinery	2,352,575,539	2,343,980,896	1,747,267,081	2,038,258,998	2,487,500,532	2,614,165,289	2,688,118,020
Information Technology	36,713,370	30,878,988	49,246,183	66,720,727	68,136,605	59,134,156	47,965,929
Jewelry and Precious Metals	33,009,911	39,220,405	43,992,478	74,884,748	72,149,846	79,024,572	80,473,625
Leather and Related Products	15,146,239	24,287,222	21,757,735	34,734,678	35,372,303	39,849,834	41,641,206
Lighting and Electrical Equipment	3,440,189,384	3,548,235,070	3,169,920,907	3,747,779,098	4,105,742,823	4,319,006,007	4,814,539,163
Medical Devices	542,337,040	755,818,245	967,450,921	645,226,037	639,937,103	753,887,697	767,217,237
Metal Manufacturing	1,792,450,784	1,789,432,380	1,232,890,754	1,527,830,824	1,719,059,759	1,919,438,590	2,068,330,737
Plastics	1,769,548,194	1,815,629,167	1,620,902,891	1,832,452,698	2,050,279,357	2,134,131,391	2,220,197,211
Processed Food	540,695,846	570,617,149	486,146,155	496,060,948	591,081,243	616,778,722	651,146,253
Publishing and Printing	656,152,943	660,872,445	573,795,692	644,827,072	649,103,851	686,238,740	699,610,111
Sporting, Recreational and Children's Goods	142,547,367	157,764,892	131,835,202	151,927,662	265,914,979	228,850,599	229,315,332
Textiles	414,650,272	378,396,349	327,459,308	418,527,777	441,626,214	326,703,407	347,029,031
Tobacco	160,952	1,380,390	99,792	1,147,840	4,790,327	3,140,638	2,041,307
Transportation and Logistics	2,839,384	2,767,733	2,855,238	2,459,641	3,845,552	3,046,718	4,626,513
Total	**15,005,259,302**	**15,594,655,896**	**12,988,143,440**	**15,099,731,800**	**16,961,902,345**	**17,985,401,798**	**18,822,187,345**

Source: HDR analysis based on BTS data - **http://transborder.bts.gov/programs/international/transborder/TBDR_QAPC07.html**

Table 71. Annual Total Value (Actual US Dollars) of Imported Goods – Rail

Clusters	2007	2008	2009	2010	2011	2012	2013
Aerospace Vehicle and Defense	428,797	386,956	161,543	131,565	253,774	157,651	599,460
Agricultural Products	17,853,975	26,135,665	3,450,224	1,285,993	10,661,505	6,490,978	309,796
Apparel	0	0	0	0	0	0	0
Automotive	42,594,228	0	0	0	0	0	0
Biopharmaceuticals	0	0	0	0	0	0	0

Chemical Products	0	0	0	0	0	0	0
Construction Materials	2,441,663	682,128	1,567,627	3,053,410	2,914,051	4,713,064	5,578,817
Entertainment	0	0	0	0	0	0	0
Fishing and Fishing Products	0	0	0	0	0	13,500	0
Footwear	0	0	0	0	0	0	0
Forest Products	0	0	0	0	0	0	0
Furniture	7,750	0	0	600	5,413	0	0
Heavy Machinery	0	0	0	75,768	0	0	0
Information Technology	0	0	0	0	0	0	0
Jewelry and Precious Metals	0	0	0	0	0	0	0
Leather and Related Products	0	0	0	0	3,625	0	0
Lighting and Electrical Equipment	0	0	0	0	0	0	0
Medical Devices	0	0	0	0	0	0	0
Metal Manufacturing	32,748,950	42,998,951	4,379,040	9,714,978	13,024,338	8,015,203	5,370,272
Plastics	0	0	0	203,622	0	0	0
Processed Food	9,561,418	4,094,408	5,520,511	8,159,185	9,476,320	16,196,281	18,204,726
Publishing and Printing	0	0	0	0	0	0	0
Sporting, Recreational and Children's Goods	0	0	0	0	0	27,058	0
Textiles	0	0	0	0	0	0	0
Tobacco	0	0	0	0	0	0	0
Transportation and Logistics	0	0	0	0	0	0	0
Total	**105,636,781**	**74,298,108**	**15,078,945**	**22,625,121**	**36,339,026**	**35,613,735**	**30,063,071**

Source: HDR analysis based on BTS data - **http://transborder.bts.gov/programs/international/transborder/TBDR_QAPC07.html**

Table 72. Annual Total Value (Actual US Dollars) of Exported Goods – Rail

Clusters	2007	2008	2009	2010	2011	2012	2013
Aerospace Vehicle and Defense	0	0	0	0	0	0	0
Agricultural Products	45,084,963	70,606,971	33,616,497	52,167,479	113,607,300	77,478,896	36,614,243
Apparel	0	18,613	0	0	8,960	145,464	44,826
Automotive	0	80,564	7,647	136,639	623,267	433,481	621,359

Biopharmaceuticals	0	0	0	0	5,254	1,553,037	0
Chemical Products	213,190,179	253,770,803	138,760,345	200,377,056	220,647,218	205,301,861	191,551,851
Construction Materials	4,510,173	6,147,289	2,748,300	1,650,570	347,542	333,061	474,916
Entertainment	0	0	0	0	0	0	0
Fishing and Fishing Products	0	0	0	0	0	0	0
Footwear	0	0	0	0	0	0	0
Forest Products	20,300,344	16,523,235	8,240,155	8,756,122	7,666,467	8,640,005	10,581,474
Furniture	0	3,011	0	0	0	0	11,457
Heavy Machinery	1,094,813	15,022	11,043	0	32,074,501	31,112,014	435,922
Information Technology	0	0	0	4,504	0	0	0
Jewelry and Precious Metals	0	0	0	0	15,871	0	0
Leather and Related Products	0	0	0	0	0	2,648	0
Lighting and Electrical Equipment	6,000	9,550,829	0	22,722	8,079,170	15,861,725	2,167,519
Medical Devices	0	46,878	0	115,285	0	186,581	0
Metal Manufacturing	11,355,094	6,416,221	1,982,979	5,205,988	8,134,194	6,835,642	1,220,198
Plastics	14,266,481	7,398,294	4,077,891	10,643,424	15,566,854	112,284,579	27,667,596
Processed Food	76,269,010	66,315,523	76,529,231	87,739,901	87,869,176	105,679,160	91,974,215
Publishing and Printing	22,890,540	19,967,121	18,770,438	31,191,609	30,164,504	30,439,502	36,326,081
Sporting, Recreational and Children's Goods	0	3,302	0	0	0	0	4,990
Textiles	0	16,824	0	0	0	26,217	0
Tobacco	0	0	0	0	0	0	0
Transportation and Logistics	0	0	0	0	0	0	0

Total	**408,967,597**	**456,880,500**	**284,744,526**	**398,011,299**	**524,810,278**	**596,313,873**	**399,696,647**

Source: HDR analysis based on BTS data - **http://transborder.bts.gov/programs/international/transborder/TBDR_QAPC07.html**

Value to Weight Ratios

Table 73 presents the value-to-weight ratios for goods moved by truck found in the BTS data aggregated into the different clusters as defined by the U.S. Cluster Mapping Project. Similarly, Table 74 presents the value-to-weight ratios for goods moved by rail aggregated into the different clusters using the BTS data.

These value-to-weight ratios were then used to estimate the weight traded for each cluster and the share that each cluster represents of total weight traded, as presented in Table 75 through Table 78.

Table 73. Ratio of Value-to-Weight by Cluster for Goods Moved by Truck

Cluster Description	Import Value (USD)	Import Weight (kgs)	Ratio of Value to Weight ($/kg)
Aerospace Vehicles and Defense	992,271,596	159,772,646	6.21
Agricultural Products	2,697,674,297	2,045,374,362	1.32
Apparel	1,062,321,439	78,916,790	13.46
Automotive	2,444,535,389	409,007,314	5.98
Biopharmaceuticals	26,234,370	2,403,711	10.91
Chemical Products	249,878,889	161,164,142	1.55
Construction Materials	270,786,150	429,743,797	0.63
Entertainment	319,960	17,019	18.80
Fishing and Fishing Products	256,418,636	36,406,386	7.04
Footwear	99,481,150	4,471,791	22.25
Forest Products	69,029,599	62,844,533	1.10
Furniture	534,499,099	132,669,978	4.03
Heavy Machinery	2,249,567,253	153,667,544	14.64
Information Technology	3,384,858	407,498	8.31
Jewelry and Precious Metals	10,931,642	65,998	165.64
Leather and Related Products	33,311,413	2,444,059	13.63
Lighting and Electrical Equipment	13,647,569,881	507,014,207	26.92
Medical Devices	2,066,966,262	91,219,016	22.66
Metal Manufacturing	1,002,765,688	487,700,804	2.06
Plastics	584,848,341	185,411,154	3.15
Processed Food	583,522,043	436,851,905	1.34
Publishing and Printing	357,137,582	134,084,243	2.66
Sporting, Recreational and Children's Goods	337,921,492	71,668,395	4.72
Textiles	114,495,649	19,641,523	5.83
Tobacco	3,951,282	115,195	34.30
Transportation and Logistics	74,660	20,809	3.59

Source: HDR analysis using BTS data - http://transborder.bts.gov/programs/international/transborder/TBDR_VWR.html

Table 74. Ratio of Value-to-Weight by Cluster for Goods Moved by Rail

Cluster Description	Import Value (USD)	Import Weight (kgs)	Ratio of Value to Weight ($/kg)
Aerospace Vehicles and Defense	1,942,557	1,815,857	1.07
Agricultural Products	9,597,444	20,997,346	0.46
Apparel	0	0	0.00
Automotive	974,199,942	127,479,166	7.64
Biopharmaceuticals	0	0	0.00
Chemical Products	14,675,230	13,004,554	1.13
Construction Materials	15,740,332	106,519,465	0.15
Entertainment	0	0	0.00
Fishing and Fishing Products	0	0	0.00
Footwear	0	0	0.00
Forest Products	0	0	0.00
Furniture	894,196	241,747	3.70
Heavy Machinery	140,733,142	33,661,123	4.18
Information Technology	0	0	0.00
Jewelry and Precious Metals	0	0	0.00
Leather and Related Products	3,625	435	8.33
Lighting and Electrical Equipment	18,930,027	3,260,648	5.81
Medical Devices	0	0	0.00
Metal Manufacturing	32,110,988	29,053,209	1.11
Plastics	17,933,825	3,902,682	4.60
Processed Food	100,042,359	63,429,607	1.58
Publishing and Printing	1,364,680	1,969,730	0.69
Sporting, Recreational and Children's Goods	0	0	0.00
Textiles	0	0	0.00
Tobacco	0	0	0.00
Transportation and Logistics	0	0	0.00

Source: HDR analysis using BTS data - http://transborder.bts.gov/programs/international/transborder/TBDR_VWR.html

Table 75. Estimated Weight of Imported Goods Moved by Truck

Cluster Description	Import Value	Import Weight (kgs.)	Ratio of Value To Weight ($/kg)	Percentage of Total Imported Weight
Aerospace Vehicle and Defense	1,806,603,575	290,893,980	6.21	5.4%
Agricultural Products	1,689,278,783	1,280,809,739	1.32	23.9%
Apparel	444,971,010	33,055,611	13.46	0.6%
Automotive	2,913,273,559	487,434,217	5.98	9.1%
Biopharmaceuticals	51,498,921	4,718,563	10.91	0.1%
Chemical Products	112,553,176	72,593,312	1.55	1.4%
Construction Materials	330,209,513	524,050,030	0.63	9.8%
Entertainment	191,480	10,185	18.80	0.0%
Fishing and Fishing Products	89,483,622	12,704,908	7.04	0.2%
Footwear	90,203,135	4,054,734	22.25	0.1%
Forest Products	77,813,113	70,841,042	1.10	1.3%
Furniture	858,163,247	213,007,841	4.03	4.0%
Heavy Machinery	2,059,084,251	140,655,684	14.64	2.6%
Information Technology	1,134,713	136,606	8.31	0.0%
Jewelry and Precious Metals	30,477,485	184,003	165.64	0.0%
Leather and Related Products	38,099,702	2,795,376	13.63	0.1%
Lighting and Electrical Equipment	13,564,979,954	503,945,949	26.92	9.4%
Medical Devices	3,063,103,388	135,180,376	22.66	2.5%
Metal Manufacturing	1,049,869,591	510,610,056	2.06	9.5%
Plastics	922,242,000	292,373,153	3.15	5.5%
Processed Food	816,588,681	611,336,496	1.34	11.4%
Publishing and Printing	231,279,389	86,831,864	2.66	1.6%
Sporting, Recreational and Children's Goods	254,407,517	53,956,256	4.72	1.0%
Textiles	183,480,546	31,475,758	5.83	0.6%
Tobacco	3,213,390	93,683	34.30	0.0%
Transportation and Logistics	1,841,821	513,347	3.59	0.0%

Source: HDR analysis using BTS data - http://transborder.bts.gov/programs/international/transborder/TBDR_VWR.html

Table 76. Estimated Weight of Exported Goods Moved by Truck

Cluster Description	Export Value	Export Weight (kgs.)	Ratio of Value To Weight ($/kg)	Percentage of Total Exported Weight
Aerospace Vehicle and Defense	140,181,373	22,571,591	6.21	0.5%
Agricultural Products	845,104,139	640,757,241	1.32	12.9%
Apparel	305,126,892	22,666,995	13.46	0.5%
Automotive	1,349,737,537	225,831,267	5.98	4.6%
Biopharmaceuticals	115,264,497	10,561,052	10.91	0.2%
Chemical Products	532,480,102	343,433,169	1.55	6.9%
Construction Materials	227,146,843	360,487,221	0.63	7.3%
Entertainment	215,762	11,477	18.80	0.0%
Fishing and Fishing Products	72,128,293	10,240,794	7.04	0.2%
Footwear	43,218,232	1,942,709	22.25	0.0%
Forest Products	312,425,454	284,432,070	1.10	5.7%
Furniture	216,906,546	53,839,168	4.03	1.1%
Heavy Machinery	2,688,118,020	183,624,870	14.64	3.7%
Information Technology	47,965,929	5,774,547	8.31	0.1%
Jewelry and Precious Metals	80,473,625	485,846	165.64	0.0%
Leather and Related Products	41,641,206	3,055,216	13.63	0.1%
Lighting and Electrical Equipment	4,814,539,163	178,862,594	26.92	3.6%
Medical Devices	767,217,237	33,858,705	22.66	0.7%
Metal Manufacturing	2,068,330,737	1,005,944,435	2.06	20.3%
Plastics	2,220,197,211	703,856,535	3.15	14.2%
Processed Food	651,146,253	487,478,553	1.34	9.8%
Publishing and Printing	699,610,111	262,662,618	2.66	5.3%
Sporting, Recreational and Children's Goods	229,315,332	48,634,556	4.72	1.0%
Textiles	347,029,031	59,532,207	5.83	1.2%
Tobacco	2,041,307	59,512	34.30	0.0%
Transportation and Logistics	4,626,513	1,289,487	3.59	0.0%

*Source: HDR analysis using BTS data - **http://transborder.bts.gov/programs/international/transborder/TBDR_VWR.html***

Table 77. Estimated Weight of Imported Goods Moved by Rail

Cluster Description	Import Value	Import Weight (kgs.)	Ratio of Value To Weight ($/kg)	Percentage of Total Imported Weight
Aerospace Vehicle and Defense	599,460	560,361	1.07	1.0%
Agricultural Products	309,796	677,774	0.46	1.2%
Apparel	0	0	0.00	0.0%
Automotive	0	0	7.64	0.0%
Biopharmaceuticals	0	0	0.00	0.0%
Chemical Products	0	0	1.13	0.0%
Construction Materials	5,578,817	37,753,499	0.15	68.2%
Entertainment	0	0	0.00	0.0%
Fishing and Fishing Products	0	0	0.00	0.0%
Footwear	0	0	0.00	0.0%
Forest Products	0	0	0.00	0.0%
Furniture	0	0	3.70	0.0%
Heavy Machinery	0	0	4.18	0.0%
Information Technology	0	0	0.00	0.0%
Jewelry and Precious Metals	0	0	0.00	0.0%
Leather and Related Products	0	0	8.33	0.0%
Lighting and Electrical Equipment	0	0	5.81	0.0%
Medical Devices	0	0	0.00	0.0%
Metal Manufacturing	5,370,272	4,858,886	1.11	8.8%
Plastics	0	0	4.60	0.0%
Processed Food	18,204,726	11,542,297	1.58	20.8%
Publishing and Printing	0	0	0.69	0.0%
Sporting, Recreational and Children's Goods	0	0	0.00	0.0%
Textiles	0	0	0.00	0.0%
Tobacco	0	0	0.00	0.0%
Transportation and Logistics	599,460	560,361	1.07	1.0%

Source: HDR analysis using BTS data - http://transborder.bts.gov/programs/international/transborder/TBDR_VWR.html

Table 78. Estimated Weight of Exported Goods Moved by Rail

Cluster Description	Export Value	Export Weight (kgs.)	Ratio of Value To Weight ($/kg)	Percentage of Total Exported Weight
Aerospace Vehicle and Defense	0	0	1.07	0.0%
Agricultural Products	36,614,243	80,104,862	0.46	21.6%
Apparel	44,826	0	0.00	0.0%
Automotive	621,359	81,308	7.64	0.0%
Biopharmaceuticals	0	0	0.00	0.0%
Chemical Products	191,551,851	169,744,964	1.13	45.7%
Construction Materials	474,916	3,213,897	0.15	0.9%
Entertainment	0	0	0.00	0.0%
Fishing and Fishing Products	0	0	0.00	0.0%
Footwear	0	0	0.00	0.0%
Forest Products	10,581,474	0	0.00	0.0%
Furniture	11,457	3,097	3.70	0.0%
Heavy Machinery	435,922	104,266	4.18	0.0%
Information Technology	0	0	0.00	0.0%
Jewelry and Precious Metals	0	0	0.00	0.0%
Leather and Related Products	0	0	8.33	0.0%
Lighting and Electrical Equipment	2,167,519	373,350	5.81	0.1%
Medical Devices	0	0	0.00	0.0%
Metal Manufacturing	1,220,198	1,104,004	1.11	0.3%
Plastics	27,667,596	6,020,903	4.60	1.6%
Processed Food	91,974,215	58,314,182	1.58	15.7%
Publishing and Printing	36,326,081	52,431,758	0.69	14.1%
Sporting, Recreational and Children's Goods	4,990	0	0.00	0.0%
Textiles	0	0	0.00	0.0%
Tobacco	0	0	0.00	0.0%
Transportation and Logistics	0	0	0.00	0.0%

Source: HDR analysis using BTS data - http://transborder.bts.gov/programs/international/transborder/TBDR_VWR.html

Chapter 2 Appendix: Draft Surveys

DRAFT – Cargo Generator O-D Survey

SCAG/HDR Phase 2: Supply Chain Interview/Survey Questionnaire (Cargo Generators)

The following questions are intended to assist the Southern California Association of Governments with future Southern California/Baja California transportation infrastructure planning. Only aggregated information from multiple companies will be made public; no individual company details will be released; all responses will be considered Confidential. Please note: Sections A-C are asked only once; Section D is repeated for multiple inbound and outbound shipments under review.

Participant # (FORMAT: "001", "002", etc.):_____

Date: ____/_____/ 2014 Time: ____:_____ Interviewer:_____

Location of Interview (Street Address, City, State):_____

_____

Interview Participant(s): _____

Participant Company Name: _____

A. Company Profile

1. Type of Cargo Generator:
[ ] Manufacturer-Dependent [ ] Manufacturer–Contract [ ] Manufacturer–Shelter
[ ] Agricultural/Seafood/Other Food [ ] Wholesaler [ ] Retailer

2. Number of Employees at this Location:
[ ] 1-99 [ ] 100-249 [ ] 250-499 [ ] 500-999
[ ] 1,000-1,499 [ ] 1,500-1,999 [ ] 2,000+

3. Primary Industry Sector (for Mfr & Agri; select one or multiple):
[ ] aerospace [ ] agricultural products [ ] automotive
[ ] chemicals/gas [ ] construction material [ ] forest/paper products
[ ] furniture [ ] machinery [ ] lighting/electrical/electronic
[ ] medical devices [ ] metal goods [ ] plastic goods

[ ] processed foods [ ] metal goods [ ] plastic goods
[ ] medical devices [ ] sports/recreation [ ] textiles/apparel/leather
[ ] live animals [ ] other consumer goods* [ ] other*

**Please describe:*_____

B. Supply Chain Questions for this Company:

1. Please estimate the approximate percentage (*mark [ ]by value or [ ]by volume*) of inbound materials/supplies, and outbound finished goods/products, that are shipped to/from this location from suppliers/customers in the following global regions or countries:

Global Location	**Inbound** *(materials, supplies, packaging, etc., from Suppliers)*	**Outbound** *(finished or intermediate goods, final products, to Customers)*
US – Southern California	%	%
US – Other California	%	%
US – Other US (non-CA)	%	%
Canada	%	%
Mexico – Baja California	%	%
Mexico – Other (non-BC)	%	%
Asia	%	%
Europe	%	%
Latin America (non-MX)	%	%
Other	%	%
Total	*100%*	*100%*

2. To better understand the transportation infrastructure needs and economic impacts of Baja California-related supply chains, please provide the company name and contact information of 2-3 representative Suppliers and Customers that we could contact with your permission *(this information will be held in strict confidentiality; please let us know if a non-disclosure agreement will be necessary for this section)*:

	Major Supplier Name	Contact Info
	Major Customer Name	**Contact Info**
1		
1		
2		
2		
3		
3		

3. For North American supply locations only, please provide the zip codes of 5-10 of your site's top Suppliers:

4. For North American customer locations only, please provide the zip codes of 5-10 of your site's top Customers (as applicable):

C. Shipping Volume & Transportation Mode Questions for this Company:

1. In a typical month, approximately how many TOTAL INBOUND truckload shipments arrive at your location? _____

2. How many TOTAL OUTBOUND truckload shipments depart from your location each month? _____

3. Of these monthly truckload shipments Inbound and Outbound, please estimate the approximate percentage that Initially Entered or Ultimately Exited Baja California at the following transportation facilities:

Baja California Shipment Entry/Exit Point	**Inbound** *(materials, supplies, packaging, etc., from Suppliers)*	**Outbound** *(finished or intermediate goods, final products, to Customers)*
Otay Mesa Land Port (Mesa de Otay)	%	%
Calexico East Land Port (Mexicali II)	%	%

Tecate Land Port	%	%
Ensenada Sea Port	%	%
Tijuana Airport	%	%
Tijuana-Tecate Rail Line	%	%
Mexicali Rail Line (FerroMex)	%	%
Other Port or Transportation Facility	%	%
From Original Supplier or To Customer in Baja California (not including VMI/local storage)	%	%
Total	*100%*	*100%*

4. Approximately what percentage of your total monthly inbound shipments come from vendors that store goods locally under a VMI/Vendor Managed Inventory agreement? _____%

5. Approximately what percentage of your Inbound and Outbound truckload shipments include the following modes:

Transport Mode	Inbound	Outbound
Truck Only	%	%
Truck-Rail	%	%
Truck-Air	%	%
Truck-Seaport	%	%
Total	*100%*	*100%*

6. If convenient access existed, what percentage, if any, of your future shipments could feasibly use Rail or Rail-Intermodal services? Inbound _____% Outbound _____%

D. 1H-2014 Shipment-Specific Questions for this Company:

The following set of questions are meant to be repeated for 20-30 Inbound and 20-30 Outbound shipments to/from your location that are generally representative of the types of goods traveling Inbound and Outbound from your site. Please answer each set of questions COMPLETELY for individual shipments that have occurred over several representative months during Q1-2014.

1. Participating Company Name: _____

2. Shipment _____ of _____.

3. Direction of Shipment: [ ]Inbound [ ]Outbound

4. Month of 2014 Shipment: [ ]Jan [ ]Feb [ ]Mar [ ]Apr [ ]May [ ]Jun

5. Type of good(s) within this shipment: 4-6 Digit HTS Code _____ or general type below:

[ ] aerospace	[ ] agricultural products	[ ] automotive
[ ] chemicals/gas	[ ] construction material	[ ] forest/paper products
[ ] furniture	[ ] machinery	[ ] lighting/electrical/electronic
[ ] medical devices	[ ] metal goods	[ ] plastic goods
[ ] processed foods	[ ] metal goods	[ ] plastic goods
[ ] medical devices	[ ] sports/recreation	[ ] textiles/apparel/leather
[ ] live animals	[ ] other consumer goods*	[ ] other*

**Please describe:*_____

6. **Origination & Destination (please answer "A" and "B" for each Shipment):**
   A. What was the location of the initial North American origination point of this shipment?
   Is it this location? [ ] Yes [ ] No

   Zip Code:

   City:

   Country:

   Type of facility/place [Facility Code]:_____

   (1-Mfg/Maquiladora, 2-Warehouse/DC, 3-Customs Broker, 4-Farm, 5-Airport, 6-Seaport, 7-Rail Yard, 8-Retail, 9-Home, 10-Other)

   B. What was the location of the ultimate Final North American destination point of this shipment?
   Is it this location? [ ] Yes [ ] No

   Zip Code:

   City:

   Country:

Type of facility/place [Facility Code]:_____

(1-Mfg/Maquiladora, 2-Warehouse/DC, 3-Customs Broker, 4-Farm, 5-Airport, 6-Seaport, 7-Rail Yard, 8-Retail, 9-Home, 10-Other)

7. **Please list any <u>intermediary locations</u> between the Initial North American Origination (6A) and the Final North American Destination (6B) for this shipment (if unsure, please provide an estimated location and probable facility type):**

   A. Intermediary Location #1: Company _____
   Zip Code:

   City:

   Country:

   Type of facility/place [Facility Code]:_____

   (1-Mfg/Maquiladora, 2-Warehouse/DC, 3-Customs Broker, 4-Farm, 5-Airport, 6-Seaport, 7-Rail Yard, 8-Retail, 9-Home, 10-Other)

   B. Intermediary Location #1: Company _____
   Zip Code:

   City:

   Country:

   Type of facility/place [Facility Code]:_____

   (1-Mfg/Maquiladora, 2-Warehouse/DC, 3-Customs Broker, 4-Farm, 5-Airport, 6-Seaport, 7-Rail Yard, 8-Retail, 9-Home, 10-Other)

8. This shipment was likely transported in a (please estimate):
   [ ]Tractor w/ Semi-Trailer [ ] Tractor w/ intermodal container
   [ ] Tractor w/ Flatbed [ ] Tractor w/ Tanker/Gas
   [ ] Van [ ]Box Truck [ ] NA/Don't Know

9. Was this shipment moved by trucks that your company directly owns or manages (i.e.: internal company fleet)? [ ]Yes [ ]No [ ]Don't Know/No Answer

10. Did this shipment include a drayage (short-distance) service provider to move the product across the border on this trip? [ ]Yes [ ]No [ ]Don't Know/No Answer

    A. If "Yes" to the above, please what Drayage Provider?_____

11. What transportation mode(s) did this shipment likely use?
    [ ] Truck Only [ ] Truck-Rail [ ] Truck-Air [ ] Truck-Seaport
    [ ] Don't Know/No Answer

12. If NOT "Truck Only", what was the location of the seaport, airport, or rail hub that this shipment likely used?:_____

13. Was this an in-bond shipment? [ ]Yes [ ]No [ ]Don't Know/No Answer

14. Based on your experience, what major freeway corridor(s) would this shipment most likely have traveled over? _____

-- END OF CARGO GENERATOR QUESTIONNAIRE --

DRAFT – Railroad O-D Survey

INTRODUCTION:

We are conducting a survey for SCAG to learn more about the products that move across the California – Baja California border via railroad. This survey will take approximately _____ minutes to complete. No personal information will be collected and all answers will be kept strictly confidential

1. Survey #:

Date:
Time:
Interviewer:
Interview Participant: (confidential)
Participant Company: (confidential)

2. Interview location:

Office of Railroad: _____

3. General Questions for international shipments via railroad:

a) Port of Entry being used:
[ ] Calexico-Mexicali
[ ] San Ysidro-Tijuana

b) During a typical week, how many shipments/loaded railroad cars are sent:

[ ] North bound
[ ] South bound

c) During a typical week, what are the primary commodities and percentages:

[ ] Petroleum products
[ ] Agricultural products
[ ] Lumber and wood products
[ ] Chemical products
[ ] Metal manufacturing
[ ] Processed food products

4.- For the next questions, please try to provide information on shipments that make up at least 50% of the total shipments on a typical week:

We will be looking for information regarding the origin and destination of these primary products:

a) Northbound shipments: Origin in (with zip codes):

[ ] Baja California
[ ] Other states in Mexico – name

Type of facility where good movement originates:

[ ] firm / producer
[ ] warehouse / DC
[ ] seaport
[ ] airport
[ ] rail yard / intermodal facility

(b) Northbound shipments: Final Destinations (with zip codes):

[ ] San Diego / Imperial counties
. [ ] California - name city or county
. [ ] Other State – name city or county
. [ ] Seaport – name of port and final destination
. [ ] Airport – name of airport and final destination

Type of facility where good movement terminates:

[ ] retailer / final consumer
[ ] warehouse / DC
[ ] seaport
[ ] airport
[ ] rail yard / intermodal facility

c) Southbound shipments: Origin in (with zip codes):
[ ] San Diego/ Imperial Counties
[ ] California – name city or county
[ ] Other state – name city or county
[ ] Seaport – name of port and place of origin
[ ] Airport – name of airport and place of origin

Type of facility where good movement originates

[ ] firm / producer
[ ] warehouse
[ ] seaport
[ ] airport

[ ] rail yard / intermodal facility

d) Southbound shipments: Final Destination (with zip codes)
   [ ] Baja California
   [ ] Other states in Mexico - name

Type of facility where good movement terminates:

[ ] retailer / final consumer
[ ] warehouse / DC
[ ] seaport
[ ] airport
[ ] rail yard / intermodal facility

If possible, we would like to request copies from the origin-destination and composition information for a random number of shipments containing at least one of the primary products groups:

- Agricultural
- Chemical (including Petroleum)
- Construction Materials
- Metal Manufacturing
- Processed food
- Publishing and Printing
- Other

-- END OF RAILROAD QUESTIONNAIRE --

DRAFT – Drayage O-D Survey

SCAG/HDR Phase 2: Supply Chain Interview/Survey Questionnaire (Drayage/Trucking)

The following questions are intended to assist the Southern California Association of Governments with future Southern California/Baja California transportation infrastructure planning. Only aggregated information from multiple companies will be made public; no individual company details will be released; all responses will be considered confidential.

Participant # (FORMAT: "001", "002", etc.):_____

Date: ____/_____/ 2014 Time: ____:_____ Interviewer:_____

Location of Interview (Street Address, City, State):_____

_____

Interview Participant(s): _____

Participant Company Name: _____

A. Company & Employment Information

1. **Size of Company/Interviewee:**

[ ] Owner/operator of single unit [ ] Fleet of 2-9 Trucks
[ ] Fleet of 10-24 Trucks [ ] Fleet of 25+ Trucks

2. **Number of Employees at this Location:**

[ ] 1 [ ] 2-9 [ ] 10-19 [ ] 20-49 [ ] 50-99 [ ] 100+

3. In a typical week, approximately how many TOTAL NORTHBOUND drayage shipments from sites in Baja California does your company move? _____

4. In a typical week, approximately how many TOTAL SOUTHBOUND drayage shipments from sites in California does your company move? _____

5. Please estimate the approximate number of northbound and southbound drayage shipments across the California-Baja California border that your company provided to customers in the following months:

	April 2014	May 2014	June 2014
Northbound drayage-only			
Southbound drayage-only			

6. Based on your experience and knowledge of your customer base, please estimate by commodity the approximate proportions for the goods within the drayage shipments your company handles northbound and southbound in a typical month:

Primary Industry Sector	Northbound	Southbound
aerospace	%	%
agricultural products	%	%
automotive	%	%
chemicals/gas	%	%
construction material	%	%
forest/paper products	%	%
furniture	%	%
machinery	%	%
lighting/electrical/electronic	%	%
medical devices	%	%
metal goods	%	%
plastic goods	%	%
processed foods	%	%
metal goods	%	%
plastic goods	%	%
medical devices	%	%
sports/recreation	%	%
textiles/apparel/leather	%	%
live animals	%	%
other consumer goods*	%	%
other*	%	%
do not know	%	%
Total	*100%*	*100%*

**Please describe:*_____

7. What is the approximate total dollar value of goods your company provides drayage services for during a typical month? US$_____ [ ]DK/NA

8. Approximately what proportions of your drayage loads are shipped via the following types of containers:

Container Type	% of Drayage Loads
Semi-Trailer	%
Intermodal Container	%
Flatbed	%
Tanker	%
Other	%
	100%

9. Approximately what percentage of your drayage loads are shipped via the FAST program? _____%

B. Supply Chain Questions: Top Customers

1. To better understand the transportation infrastructure needs and economic impacts of Baja California-related supply chains, please provide the company name and contact information of 2-3 representative Customers that we could contact with your permission *(this information will be held in strict confidentiality; please let us know if a non-disclosure agreement will be necessary for this section)*:

	Major Customer Name	Contact Info
1		
2		
3		

2. Based on your knowledge and experience of the drayage industry, what are some major long-or medium-haul companies in the United States are dropping off, and picking up, containers that are crossing the California-Baja California border

Long- & Medium-Haul Company Name	Contact Info

C. Shipping Routes & Transportation Mode Questions for this Company:

1. Of these monthly drayage shipments that your company handles Northbound and Southbound, please estimate the approximate percentage that Initially Entered or Ultimately Exited Baja California at the following transportation facilities:

Baja California Shipment Entry/Exit Point	Northbound (Outbound from Baja CA)	Southbound (Inbound to Baja CA)
Otay Mesa Land Port (Mesa de Otay)	%	%
Calexico East Land Port (Mexicali II)	%	%
Tecate Land Port	%	%
Ensenada Sea Port	%	%
Tijuana Airport	%	%
Tijuana-Tecate Rail Line	%	%
Mexicali Rail Line (FerroMex)	%	%
Other Port or Transportation Facility	%	%
Total	*100%*	*100%*

2. Approximately what proportion of your border-crossing drayage loads are picked up, or dropped off, at the following types of locations:

Type of Location	Northbound (Outbound from Baja CA)	Southbound (Inbound to Baja CA)
Truck/Container Parking Lot	%	%
US-based Warehouse/3PL	%	%
Mexico-based Warehouse/3PL	%	%
US-based manufacturer	%	%
Mexico-based manufacturer	%	%
Sea port	%	%
Rail yard	%	%
Airport	%	%
Other	%	%

3. In approximate numbers, how many monthly drayage shipments that your company handles either originate from, or are destined for, the following:

SoCal Location	Originates From	Destined To
Ports of LA/Long Beach		
Other Southern California seaport		
Southern California airport		
Rail hub in Southern California		
Circle if don't know/unsure	*DK/NA*	*DK/NA*

4. Based on your company records, could you please provide 10 representative examples of the zip codes of the locations that your drayage trucks pick-up and drop-off containers/loads for typical northbound and southbound border-crossing trip:

Northbound (Outbound from Baja CA)	Pickup Zip Code	Drop-Off Zip Code
Sample 1		
Sample 2		
Sample 3		
Sample 4		
Sample 5		
Sample 6		
Sample 7		
Sample 8		
Sample 9		
Sample 10		

Southbound (Inbound to Baja CA)	Pickup Zip Code	Drop-Off Zip Code
Sample 1		
Sample 2		
Sample 3		
Sample 4		
Sample 5		
Sample 6		
Sample 7		
Sample 8		
Sample 9		
Sample 10		

5. Approximately what percentage of the border-crossing drayage shipments your company handles stay within 5-miles of a land Port of Entry? _____%

-- END OF DRAYAGE QUESTIONNAIRE --

DRAFT – Trade & Supply Networks Trends Survey

INTRODUCTION:

We are conducting survey for SCAG to learn more about the current and future scenarios of binational cross border trade and supply networks of goods crossing the U.S. and Mexico borders through the California - Baja California Ports of Entry. This survey will take approximately _____ minutes to complete. No personal information will be collected and all answers will be kept strictly confidential.

1. Survey #:
Date:
Time:
Interviewer:
Interview Participant: (confidential)
Participant agency/company: (confidential)

2. Interview location: _____

3. Main Topics for Questions:

a) Regarding the integration of the California-Baja California Border Region
-
-

b) Regarding how Border Security is anticipated to evolve and how much will it affect binational trade in the region in future years. -
-

c) Expectations regarding the improvements of Border Infrastructure of LPOE in the region
-
-

d) Regarding the Improvement of Mexico's export capacity
-
-

e) Regarding the evolution of the inventory management systems in the border region
-
-

f) Regarding the Emergence and Future of Near-shoring in the Baja California-Southern California region

-
-

g) Emergence and future of renewable energy projects in the border region
-
-

h) Expectations regarding the planned improvements of rail line infrastructure in the region
-
-

i) Government policies for retention and attraction of foreign investment in Baja California and their anticipated success

-
-

4. Other Potential Topics to be Considered:

j) Perspectives for tourism in the region
-
-

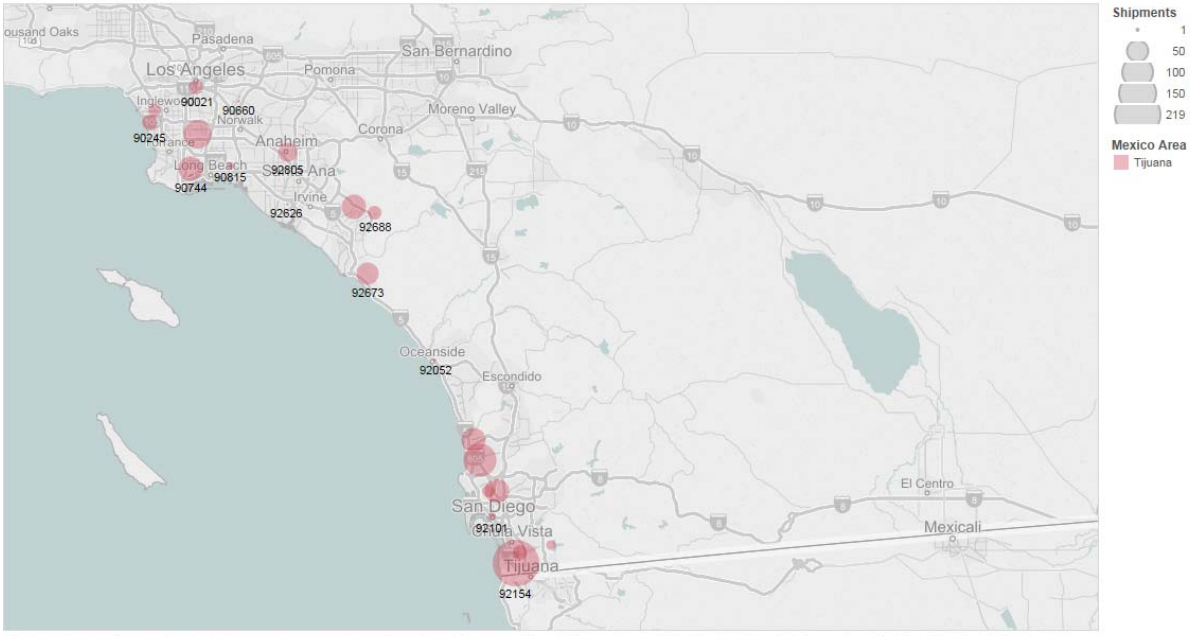
k) Perspective for cross border trucking in the region
-
-

-- END OF TRADE & SUPPLY NETWORK TRENDS QUESTIONNAIRE --

Chapter 3 Appendix

Additional Maps

Figure 98. SoCal Destinations of Northbound Shipments Originating in Tijuana Border Region



Map based on Longitude and Latitude. Color shows details about Mexico Area. Size shows Count. The marks are labeled by Location. Details are shown for Flow. The view is filtered on Flow and Mexico Area. The Flow filter keeps Northbound. The Mexico Area filter keeps Tijuana.

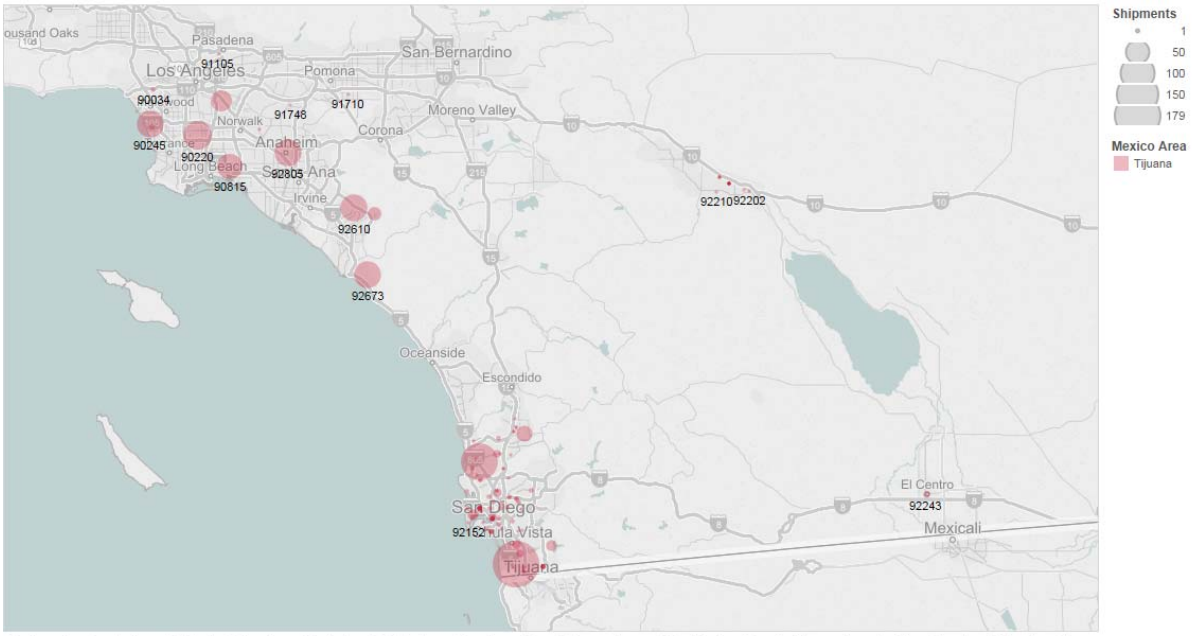
Source: HDR Analysis of Truck O-D Survey

Figure 99. SoCal Destinations of Northbound Shipments Originating in Mexicali Border Region

Map based on Longitude and Latitude. Color shows details about Mexico Area. Size shows Count. The marks are labeled by Location. Details are shown for Flow. The view is filtered on Flow and Mexico Area. The Flow filter keeps Northbound. The Mexico Area filter keeps Mexicali.

Source: HDR Analysis of Truck O-D Survey

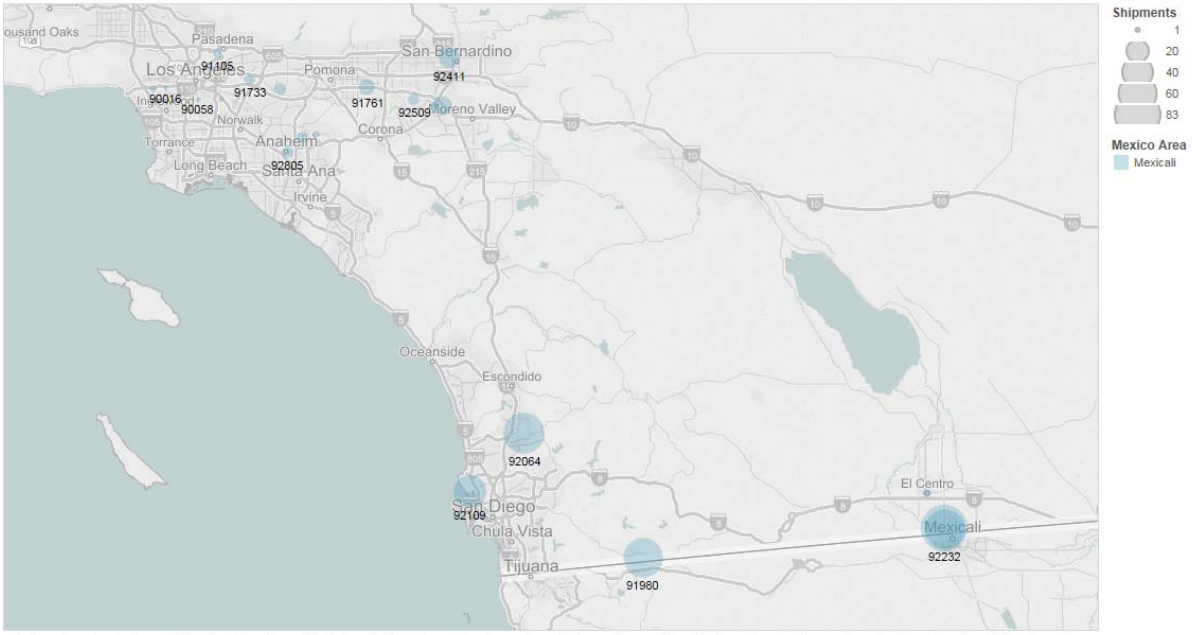
Figure 100. SoCal Origins of Southbound Flows Destined for Tijuana Border Region



Map based on Longitude and Latitude. Color shows details about Mexico Area. Size shows Count. The marks are labeled by Location. Details are shown for Flow. The view is filtered on Flow and Mexico Area. The Flow filter keeps Southbound. The Mexico Area filter keeps Tijuana.

Source: HDR Analysis of Truck O-D Survey

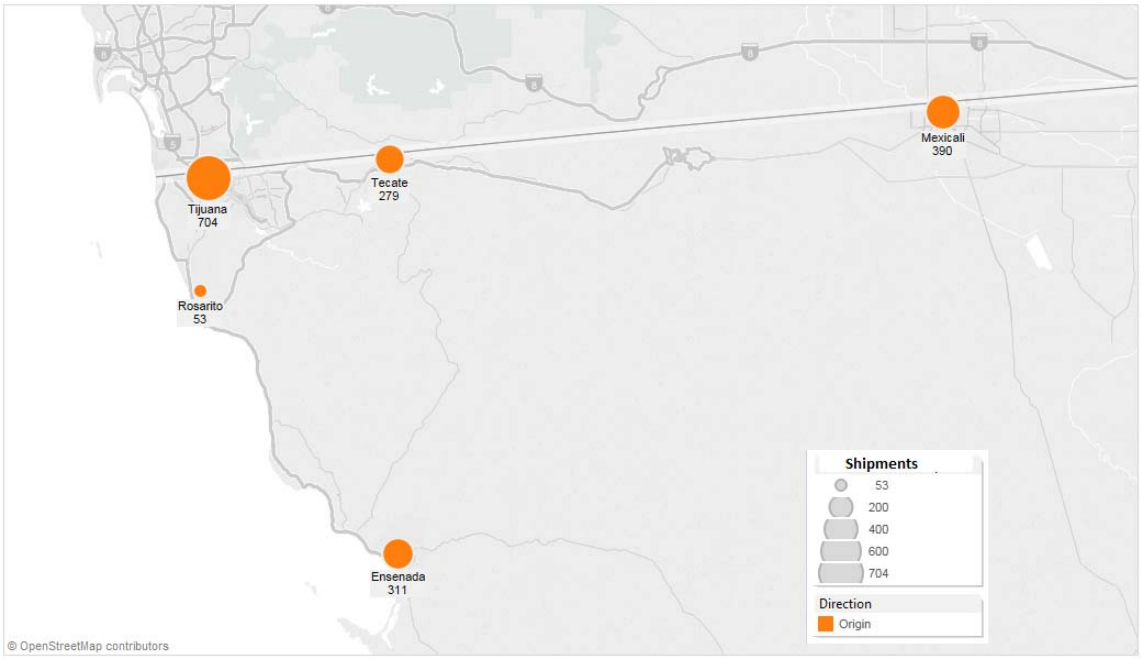
Figure 101. SoCal Origins of Southbound Flows Destined for Mexicali Border Region



Map based on Longitude and Latitude. Color shows details about Mexico Area. Size shows Count. The marks are labeled by Location. Details are shown for Flow. The view is filtered on Flow and Mexico Area. The Flow filter keeps Southbound. The Mexico Area filter keeps Mexicali.

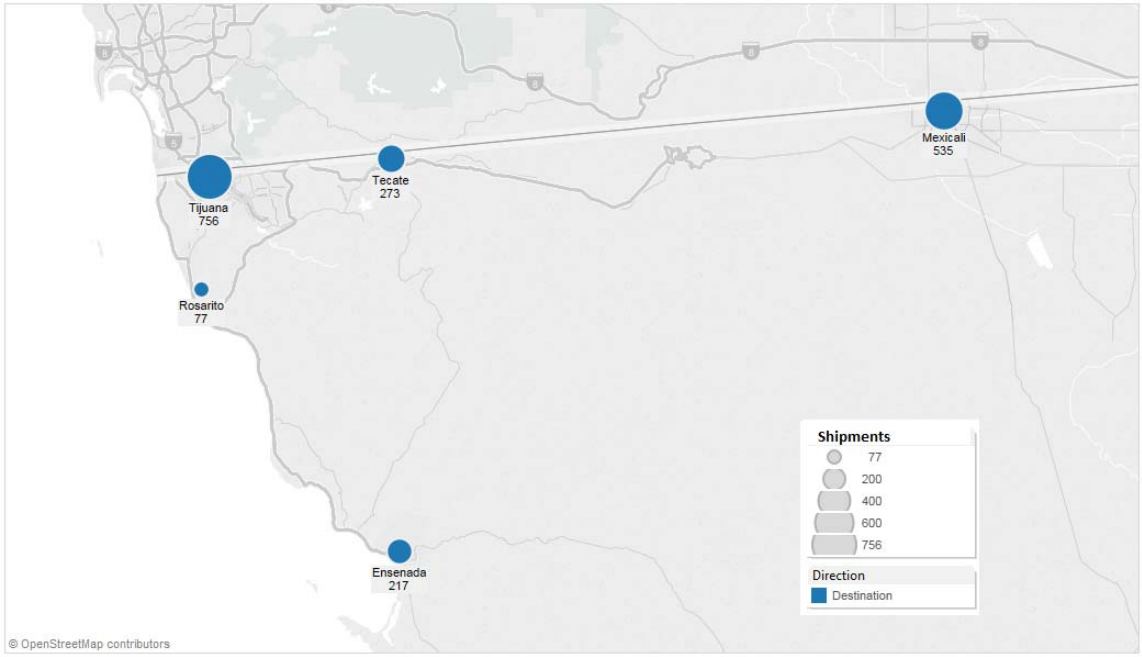
Source: HDR Analysis of Truck O-D Survey

Figure 102. Mexico Origins of Northbound Flows



Source: HDR Analysis of Truck O-D Survey
Note: Due to confidentiality, only city-level Mexican origins are represented in the map

Figure 103. Mexico Destinations of Southbound Flows



Source: HDR Analysis of Truck O-D Survey
Note: Due to confidentiality, only city-level Mexican destinations are represented in the map

Additional Tables

Table 79. Primary Industry Sectors of Interviewed Companies

Industry Sector	Number of companies
Electronics/Electrical/Lighting	8
Medical Devices	7
Automotive	6
Furniture	5
Plastic Goods	5
Agricultural Products	4
Construction Material	4
Live Animals	4
Metal Goods	4
Processed Foods	4
Aerospace	3
Other consumer goods	3
Sports/recreation	2
Textiles/apparel/leather	2
Machinery	1
Other	5

Source: HDR Analysis of Truck O-D Survey

Table 80. Mexican City of Origin, Northbound Shipments

Northbound Flow Origin City	Number of shipments
Tijuana	704
Mexicali	390
Ensenada	311
Tecate	279
Rosarito	53

Source: HDR Analysis of Truck O-D Survey

Table 81. Mexican City of Destination, Southbound Shipments

Southbound destinations	Number of shipments
Tijuana	756
Mexicali	535
Tecate	273
Ensenada	217
Rosarito	77

Source: HDR Analysis of Truck O-D Survey

Chapter 4 Appendix

Complete Drayage Trucking Interview/Survey

The complete questionnaire addressed to drayage companies is presented below.

Figure 104: SCAG/SANDAG 2014-2015 Drayage/Trucking Interview/Survey

Crossborder Group

SCAG/SANDAG 2014-2015 Drayage/Trucking Interview/Survey

V150310-Final2

Thank you for participating in this confidential, supply chain study. Any questions can be directed toward Crossborder Group staff, or Annie Nam of SCAG (NAM@scag.ca.gov).

The following questions are intended to assist the Southern California Association of Governments (SCAG) and the San Diego Association of Governments (SANDAG) with short- and long-term Southern California/Baja California transportation infrastructure planning - including regional Border Crossings (Otay Mesa East, Calexico); Seaports (Los Angeles, Long Beach); Southern California freeways; and Binational Rail Planning.

All company data will be considered Confidential AND will be anonymized during the data entry process to de-link responses from individual company information; only aggregated information from multiple companies will be made public; and no individual company details will be released. Please ask Crossborder Group to sign a non-disclosure agreement if desired.

Company Control Number (provided by Crossborder Group): _____

A. Company & General Shipping Information

1. Size of Company/Interviewee:
   - ☐ Owner/operator of single unit
   - ☐ Fleet of 2-9 Trucks
   - ☐ Fleet of 10-24 Trucks
   - ☐ Fleet of 25+ Trucks
2. Number of Employees at this Location:

   ☐ 1 ☐ 2-9 ☐ 10-19 ☐ 20-49 ☐ 50-99 ☐ 100+
3. In a typical week, approximately how many TOTAL NORTHBOUND drayage shipments from sites in Baja California does your company move? _____
4. In a typical week, approximately how many TOTAL SOUTHBOUND drayage shipments from sites in California does your company move? _____
5. Please estimate the approximate number of northbound and southbound drayage shipments across the California-Baja California border that your company provided to customers in the following months:

	Oct 2014	Nov 2014	Dec 2014
Northbound drayage-only			
Southbound drayage-only			

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6. Based on your experience and knowledge of your customer base, please estimate by commodity or generic component the approximate percentages for drayed shipments your company handles northbound and southbound in a typical month:

Primary Industry Sector	Northbound		Southbound
Aerospace	%		%
Agricultural products	%		%
Automotive	%		%
Chemicals/gas	%		%
Construction material	%		%
Electrical/electronic/Lighting	%		%
Forest/paper products	%		%
Furniture	%		%
Machinery	%		%
Medical devices	%		%
Metal goods	%		%
Medical devices	%		%
Plastic goods	%		%
Processed foods	%		%
Sports/recreation	%		%
Textiles/apparel/leather	%		%
Live animals	%		%
Other consumer goods*	%		%
Other*	%		%
Do not know	%		%
Total must add up to 100%	0 %		0 %

**Please describe:* _____

7. What is the approximate total dollar value of goods your company provides drayage services for during a typical month? US$ _____ ☐Don't Know

8. Approximately what percentage of your drayage loads are shipped via the following:

Container Type	% of Drayage Loads
Semi-Trailer	%
Intermodal Container	%
Flatbed	%
Tanker	%
Other	%
Total must add up to 100%	0 %

9. Approximately what percentage of your drayage loads are shipped via the FAST program? _____

B. Supply Chain Questions: Top Companies, Shipping Routes & Transport Modes

1. To better understand the transportation infrastructure needs and economic impacts of Baja California-related supply chains, please provide the company name of 2-3 representative Customers that we could contact with your permission *(this information will be held in strict confidentiality; please let us know if a non-disclosure agreement will be necessary for this section)*:

	Major Customer Name
1	
2	
3	

2. Based on your knowledge of the drayage industry, what are two major long-or medium-haul companies in the United States that are dropping off, and picking up, containers that are crossing the California-Baja California border

Long- or Medium-Haul Company Name	Contact Info

3. Of the typical drayage shipments that your company handles each month Northbound and Southbound, please estimate "where" the approximate percentage Initially Entered or Ultimately Exited Baja California at the following transportation facilities:

Baja California Shipment Entry/Exit Point	Northbound (Outbound from Baja CA)	Southbound (Inbound to Baja CA)
Otay Mesa Land Port (Mesa de Otay)	%	%
Calexico East Land Port (Mexicali II)	%	%
Tecate Land Port	%	%
Ensenada Sea Port	%	%
Tijuana Airport	%	%
Mexicali Airport	%	%
Tijuana-Tecate Rail Line	%	%
Mexicali Rail Line (FerroMex)	%	%
Other Port or Transportation Facility	%	%
Total must add up to 100%	0 %	0 %

4. Approximately what proportion of your Northbound and Southbound border-crossing drayage loads are picked up, or dropped off, at the following types of locations:

Type of Location	Northbound (Outbound from Baja CA) - Pickup Site -	Northbound (Outbound from Baja CA) - Drop Off Site -	Southbound (Inbound to Baja CA) - Pickup Site -	Southbound (Inbound to Baja CA) - Drop Off Site -
Truck/Container Parking Lot	%	%	%	%
US-based Warehouse/3PL/Broker	%	%	%	%
Mexico-based Warehouse/3PL/Broker	%	%	%	%
US-based manufacturer	%	%	%	%
Mexico-based manufacturer	%	%	%	%
Sea port	%	%	%	%
Rail yard	%	%	%	%
Airport	%	%	%	%
Other	%	%	%	%
Total must add up to 100%	0%	0%	0%	0%

5. In approximate numbers, how many monthly drayage shipments that your company handles either originate from, or are destined for, the following:

SoCal Location	Originates From	Destined To
Ports of LA/Long Beach		
Other Southern California seaport		
Southern California airport		
Rail hub in Southern California		
Check if don't know/unsure	☐ *DK/NA*	☐ *DK/NA*

6. Based on your company records, could you please provide 10 representative examples of the zip codes (código postal) of the locations that your drayage trucks pick-up and drop-off containers/loads for typical northbound and southbound border-crossing trip:

Northbound (Outbound from Baja CA)	Pickup Código Postal (MX)	Drop-Off Zip Code (US)
Sample 1		
Sample 2		
Sample 3		
Sample 4		
Sample 5		
Sample 6		
Sample 7		
Sample 8		
Sample 9		
Sample 10		

Southbound (Inbound to Baja CA)	Pickup Zip Code (US)	Drop-Off Código Postal (MX)
Sample 1		
Sample 2		
Sample 3		
Sample 4		
Sample 5		
Sample 6		
Sample 7		
Sample 8		
Sample 9		
Sample 10		

7. Approximately what percentage of the border-crossing drayage shipments your company handles in the US stay within 10-miles of a land Port of Entry? _____%

-- END OF DRAYAGE/TRUCKING QUESTIONNAIRE --

Pickup and Drop-off Locations for Drayage Container/Loads for Typical Border-Crossing Trips

Table 82: Northbound (Outbound from Baja California) and Southbound (Inbound to Baja California) Flows

Label	Direction	Location*	Latitude	Longitude
Origin	Northbound	22427	32.524883	-116.97862
Origin	Northbound	22500	23.634501	-102.552784
Origin	Northbound	22200	32.516456	-116.904285
Origin	Northbound	22684	23.634501	-102.552784
Origin	Northbound	21397	32.596703	-115.397827
Origin	Northbound	22830	31.870501	-116.602433
Origin	Northbound	22643	32.468541	-116.998487
Origin	Northbound	22570	23.634501	-102.552784
Origin	Northbound	21400	32.57456	-116.627329
Origin	Northbound	22216	32.492097	-116.919007
Origin	Northbound	21395	32.589506	-115.363759
Origin	Northbound	22850	31.859818	-116.574256
Origin	Northbound	22244	32.457582	-116.886617
Origin	Northbound	22210	32.508562	-116.930047
Origin	Northbound	21220	32.661592	-115.400049
Origin	Northbound	21600	32.61711	-115.38894
Origin	Northbound	21701	23.634501	-102.552784
Origin	Northbound	22230	23.634501	-102.552784
Origin	Northbound	22670	23.634501	-102.552784
Origin	Northbound	21360	32.621454	-115.442258
Origin	Northbound	22190	32.479507	-116.979355
Origin	Northbound	Tijuana, MX	32.514947	-117.038247
Origin	Northbound	Tecate, MX	32.568584	-116.634697
Destination	Northbound	92154	32.575276	-117.070725
Destination	Northbound	90815	33.793908	-118.119249
Destination	Northbound	92408	34.083127	-117.271059
Destination	Northbound	92231	32.683227	-115.502815
Destination	Northbound	90723	33.896867	-118.163152
Destination	Northbound	95691	38.567979	-121.539671
Destination	Northbound	90058	33.997344	-118.235365
Destination	Northbound	92411	34.121414	-117.317158
Destination	Northbound	91744	34.029428	-117.934098
Destination	Northbound	92647	33.721018	-118.003035
Destination	Northbound	90040	33.99471	-118.151352
Destination	Northbound	91748	33.981777	-117.896946
Destination	Northbound	92115	32.760742	-117.072056
Destination	Northbound	95928	39.729523	-121.81555
Destination	Northbound	95612	38.395963	-121.556853
Destination	Northbound	91342	34.30538	-118.432181
Destination	Northbound	90731	33.733894	-118.291425
Destination	Northbound	85226	33.287221	-111.940325

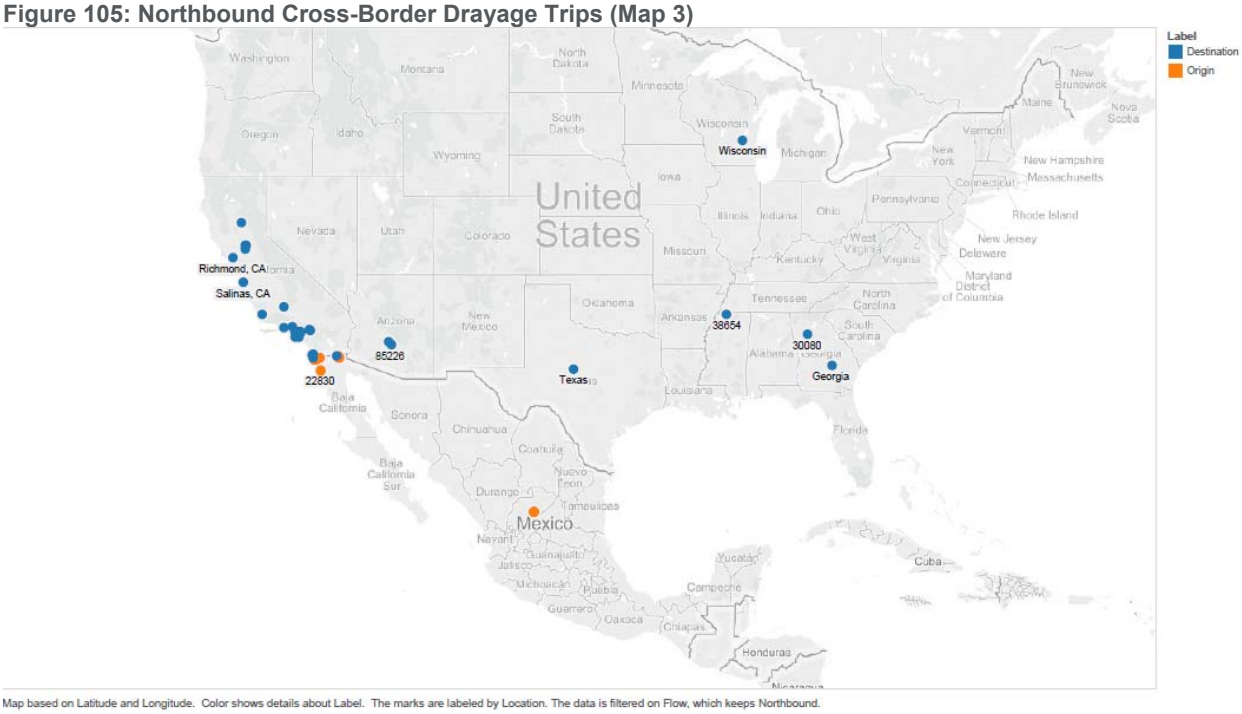
Label	Direction	Location*	Latitude	Longitude
Destination	Northbound	85009	33.443804	-112.131099
Destination	Northbound	30080	33.88069	-84.506488
Destination	Northbound	38654	34.928494	-89.831773
Destination	Northbound	Los Angeles, CA	34.052234	-118.243685
Destination	Northbound	San Diego, CA	32.715738	-117.161084
Destination	Northbound	Camarillo, CA	34.216394	-119.037602
Destination	Northbound	Long Beach, CA	33.77005	-118.193739
Destination	Northbound	Bakersfield, CA	35.373292	-119.018712
Destination	Northbound	Salinas, CA	36.677737	-121.655501
Destination	Northbound	Santa Maria, CA	34.953034	-120.435719
Destination	Northbound	Sacramento, CA	38.581572	-121.4944
Destination	Northbound	Richmond, CA	37.935758	-122.347749
Destination	Northbound	Georgia	32.165622	-82.900075
Destination	Northbound	Wisconsin	43.78444	-88.787868
Destination	Northbound	Texas	31.968599	-99.901813
Origin	Southbound	92154	32.59672	-116.902812
Origin	Southbound	92408	34.086852	-117.261733
Origin	Southbound	90606	33.972283	-118.071298
Origin	Southbound	91762	34.042015	-117.661085
Origin	Southbound	90670	33.94148	-118.071298
Origin	Southbound	90723	33.897774	-118.164929
Origin	Southbound	90815	33.79633	-118.11812
Origin	Southbound	92231	32.682647	-115.57995
Origin	Southbound	90058	34.006375	-118.223423
Origin	Southbound	91749	34.021851	-117.956279
Origin	Southbound	91746	34.054103	-117.98933
Origin	Southbound	91764	34.073987	-117.614146
Origin	Southbound	90745	33.8232	-118.25851
Origin	Southbound	92356	34.437557	-116.891034
Origin	Southbound	90802	33.741532	-118.194179
Origin	Southbound	91768	34.064817	-117.778383
Origin	Southbound	90023	34.022447	-118.200028
Origin	Southbound	92243	32.753882	-115.591792
Origin	Southbound	91769	34.060299	-117.758378
Origin	Southbound	90813	33.7845	-118.197103
Origin	Southbound	Los Angeles, CA	34.052234	-118.243685
Origin	Southbound	Richmond, CA	37.935758	-122.347749
Origin	Southbound	Long Beach, CA	33.77005	-118.193739
Origin	Southbound	San Diego, CA	32.715738	-117.161084
Origin	Southbound	Bakersfield, CA	35.373292	-119.018712
Origin	Southbound	National City, CA	32.678109	-117.099197
Destination	Southbound	22200	32.516456	-116.904285
Destination	Southbound	22684	23.634501	-102.552784
Destination	Southbound	21190	32.618352	-115.523697

Label	Direction	Location*	Latitude	Longitude
Destination	Southbound	22643	32.468541	-116.998487
Destination	Southbound	22400	32.538898	-117.005845
Destination	Southbound	22444	23.634501	-102.552784
Destination	Southbound	21000	32.640247	-115.474301
Destination	Southbound	22850	31.859818	-116.574256
Destination	Southbound	44100	20.674257	-103.350065
Destination	Southbound	22490	23.634501	-102.552784
Destination	Southbound	21395	32.589506	-115.363759
Destination	Southbound	64000	25.677638	-100.318918
Destination	Southbound	22644	32.440476	-116.98377
Destination	Southbound	21397	32.596703	-115.397827
Destination	Southbound	21356	32.607742	-115.452254
Destination	Southbound	22210	32.508562	-116.930047
Destination	Southbound	22684	23.634501	-102.552784
Destination	Southbound	22226	32.479577	-116.927839
Destination	Southbound	Mexico D.F, MX	19.432608	-99.133208
Destination	Southbound	Mexicali, MX	32.624539	-115.452262
Destination	Southbound	La Paz, MX	24.142641	-110.312753
Destination	Southbound	Loreto, MX	26.011756	-111.347753
Destination	Southbound	Guadalajara, MX	20.659699	-103.349609
Destination	Southbound	Ensenada, MX	31.866743	-116.596371
Destination	Southbound	Tijuana, MX	32.514947	-117.038247
Destination	Southbound	Monterrey, MX	25.686614	-100.316113
Destination	Southbound	Guerrero Negro, MX	27.959176	-114.056646
Destination	Southbound	Tecate, MX	32.568584	-116.634697
Destination	Southbound	Vizcaino, MX	27.600423	-113.574497
Destination	Southbound	Santa Rosalia, MX	27.336194	-112.270149
Destination	Southbound	Cabo San Lucas, MX	22.890533	-109.916737
Destination	Southbound	Ciudad Juarez, MX	31.690364	-106.424548

**Respondents have provided information on location by zip code, city, or state. Longitude and Latitude data were derived from the following website: http://www.findlatitudeandlongitude.com/batch-geocode/#.VXdVQs9VhBc*
Source: HDR Analysis of Drayage Survey

Evidence of Long-Haul Drayage Movements

Figure 105: Northbound Cross-Border Drayage Trips (Map 3)



Source: HDR Analysis of Drayage Survey

Tax Impact Report

Table 83: Tax Impacts of the Drayage Industry by Tax and Institution

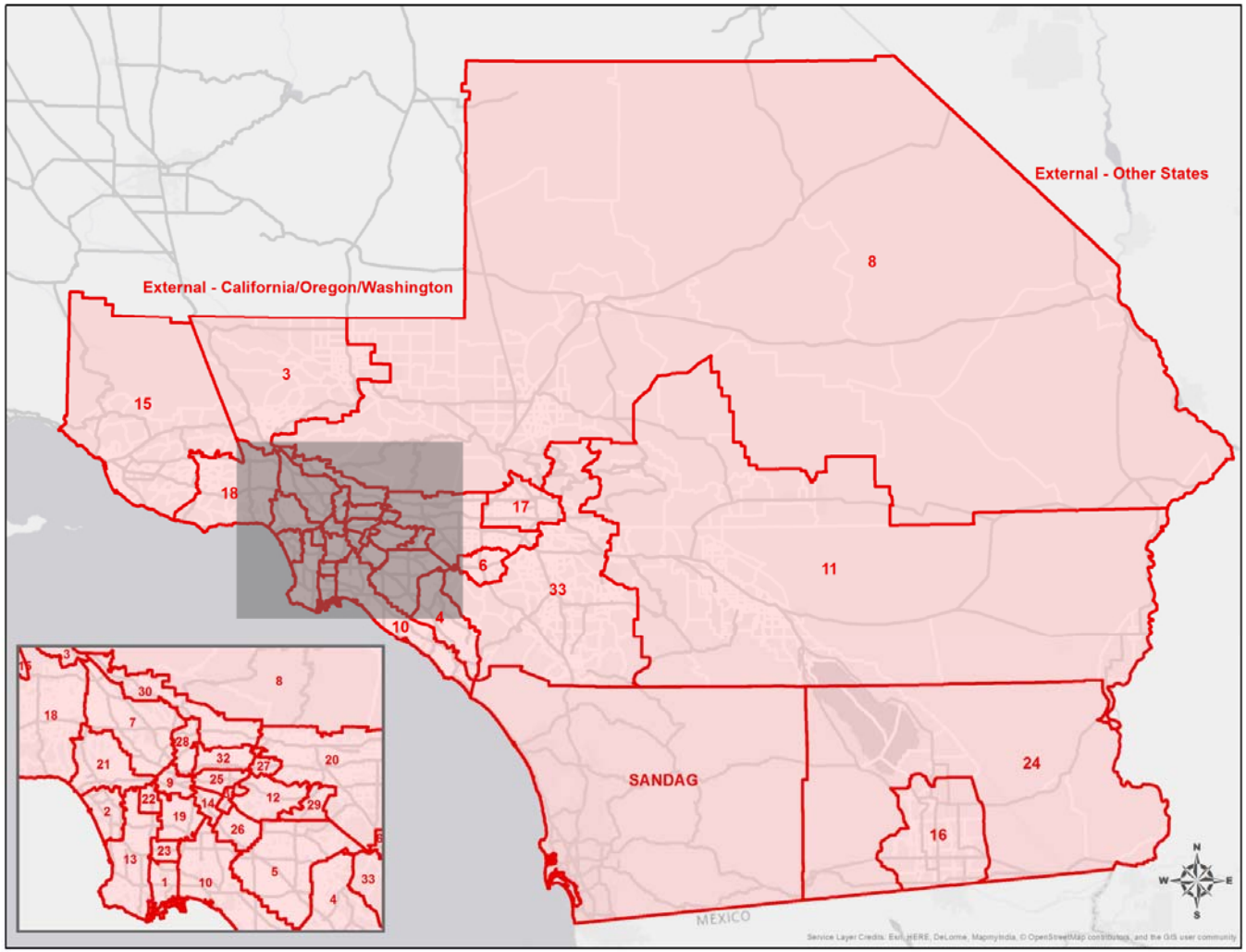
Description	Employee Compensation	Proprietor Income	Tax on Production and Imports	Corporations
Dividends				
Social Ins Tax- Employee Contribution	$117,757			
Social Ins Tax- Employer Contribution	$227,664			
Tax on Production and Imports: Sales Tax			$6,007,019	
Tax on Production and Imports: Property Tax			$5,270,690	
Tax on Production and Imports: Motor Vehicle License			$147,705	
Tax on Production and Imports: Severance Tax			$3,398	
Tax on Production and Imports: Other Taxes			$969,612	
Tax on Production and Imports: State/Local NonTaxes			$189,337	
Corporate Profits Tax				
Personal Tax: Income Tax				$5,784,466
Personal Tax: NonTaxes (Fines and Fees)				$1,037,098
Personal Tax: Motor Vehicle License				$218,467
Personal Tax: Property Taxes				$73,022
Personal Tax: Other Tax (Fishing/Hunting)				$47,803
Total State and Local Tax	**$345,421**	**-**	**$12,587,761**	**$7,160,855**
Social Ins Tax- Employee Contribution	$7,148,681	$2,381,180		
Social Ins Tax- Employer Contribution	$7,099,008			
Tax on Production and Imports: Excise Taxes			$1,018,825	
Tax on Production and Imports: Custom Duty			$421,829	
Tax on Production and Imports: Federal NonTaxes			$107,245	
Corporate Profits Tax				
Personal Tax: Income Tax				$15,303,321
Total Federal Tax	**$14,247,689**	**$2,381,180**	**$1,547,899**	**$15,303,321**
TOTAL	**$14,593,110**	**$2,381,180**	**$14,135,660**	**$22,464,176**

Notes: All dollar amounts are expressed in 2015 dollars. State and local tax impacts are combined and cannot be separated within IMPLAN®. Totals may not add due to rounding.

Chapter 5 Appendix

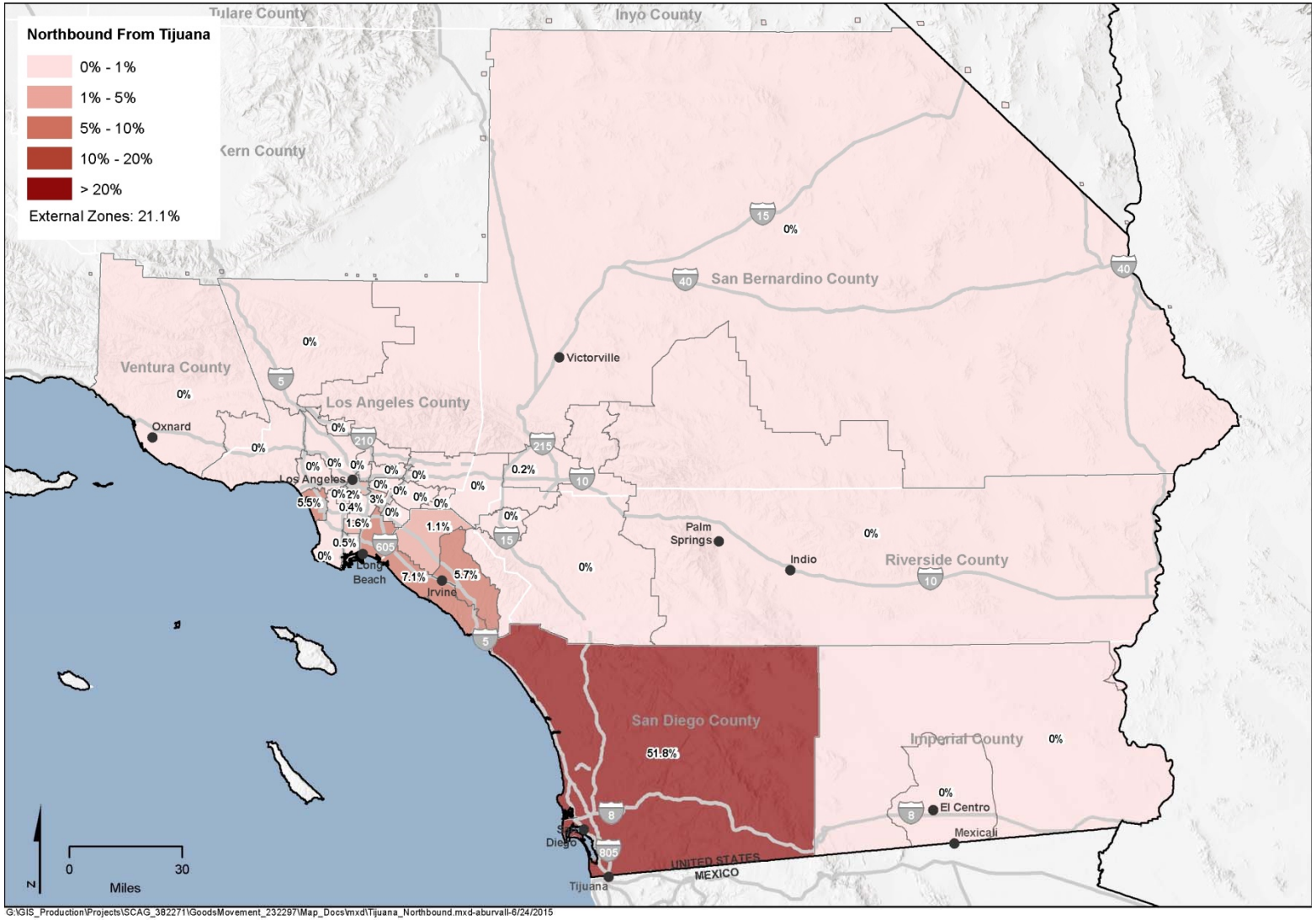
Additional maps

Figure 106: Super Zones Locations



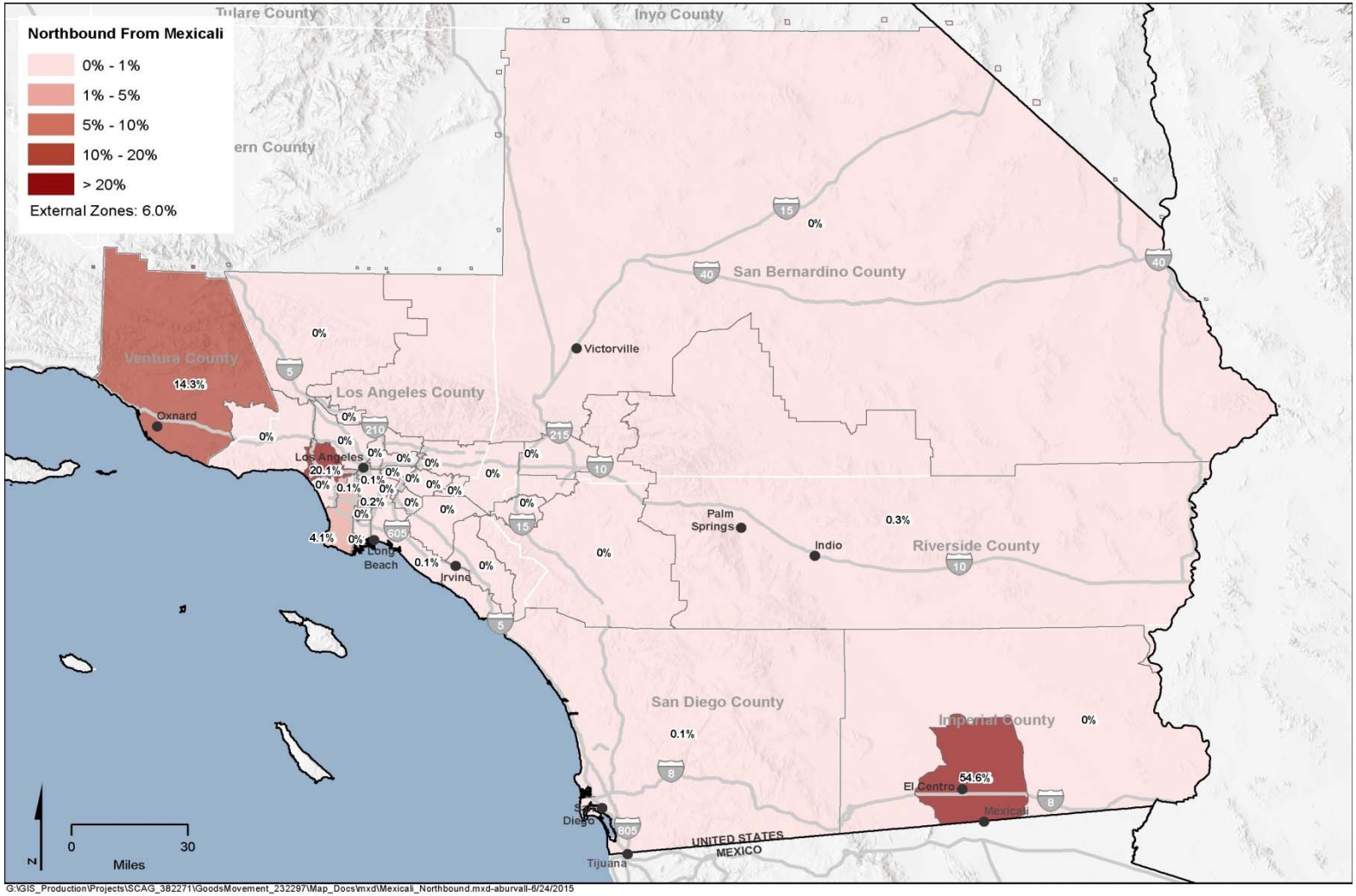
Source: HDR

Figure 107: O-D Pairs Truck Percentages – Northbound from Tijuana



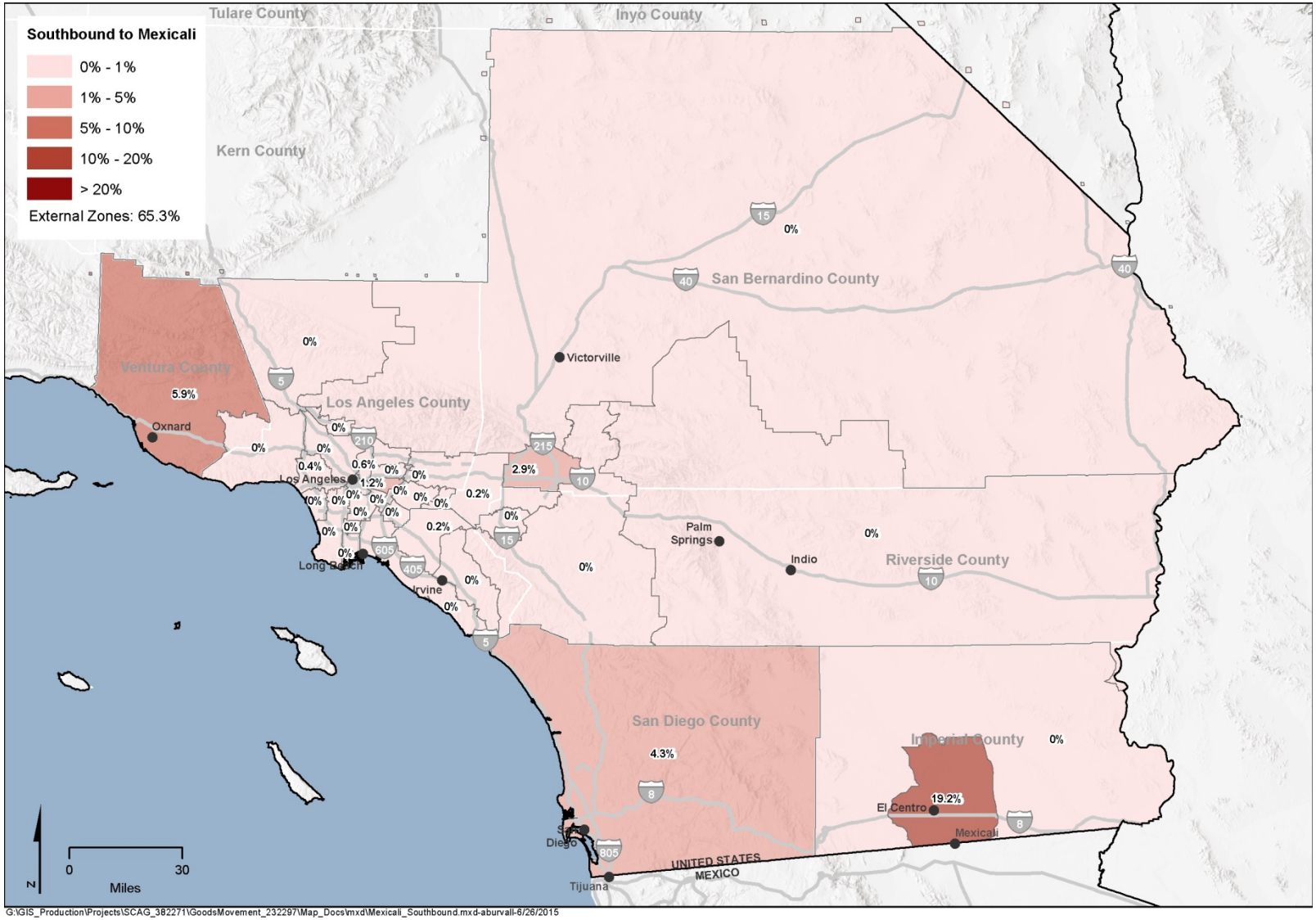
Source: HDR

Figure 108: O-D Pairs Truck Percentages – Northbound from Mexicali



Source: HDR

Figure 109: O-D Pairs Truck Percentages – Southbound to Mexicali



Source: HDR

Econometric Model Specification

As part of the SR-11 Investment Grade Traffic and Revenue Study (IGT&R) for SANDAG, several model specifications and combinations of socioeconomic variables were evaluated to determine the structural relation between truck border-crossing volumes in the San Diego – Tijuana border region and socio-economic indicators. The potential explanatory variables were initially identified and categorized into four groups: U.S. at the national level, U.S. at the local level, Mexican at the national level and Mexican at the local level. A number of so-called "dummy variables" were also considered for inclusion in the econometric model, to control for the impact of discrete events and policy changes. In addition, various functional forms were evaluated, including logarithmic transformations of the dependent variables (cross-border truck traffic) and the explanatory variables. The relative strengths of the different specifications were assessed using econometric criteria for suitable fit, ability to back-cast historical data, and independence between explanatory variables.

The equation that better met the econometric criteria set for the SR-11 IGT&R study relates truck border-crossings to two measures of economic activity in the U.S.:

- Annual total value of retail sales in the U.S.
- Annual index of industrial production in the U.S.

The model specification used in that study was the following:

$$Log(OM\_TRUCK_t) = \beta_0 + \beta_1 \,.\, Log(US\_RETAIL\_SALES_t) + \beta_2 \,.\, Log(US\_IIP_t) + \varepsilon_t$$

Where:

- OM_TRUCK_t is the annual number of truck crossings at Otay Mesa, northbound, in year t;
- $US\_RETAIL\_SALES_t$ is the total value of retail sales in the U.S. in year t;
- US_IPP_t is the index of industrial production in the U.S. in year t;
- ε_t is the regression error in year t; and
- β_i, i = 0,…, 2 are the coefficients to be estimated.

The analysis performed for the SR-11 IGT&R was updated to include recent observations of truck crossings at San Diego – Tijuana and extended to account for the Calexico – Mexicali border region under a separate calculation. As a result, the econometric procedure estimated, using recent historical data, the structural relations (i.e., value of coefficients) existing between the explanatory variables and the number of border-crossing trips for trucks for each one of the two relevant border regions studied (i.e., San Diego – Tijuana and Calexico – Mexicali). Each set of coefficients was later combined with projections of future values for the explanatory variables to produce the forecasted number of border-crossing truck trips for each one of the regions under analysis.

The structural relations (coefficients) found through the econometric analysis are reported below (by region):

Table 84. Estimated Truck Border-Crossing Structural Relations for San Diego - Tijuana Border Region

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.76651	0.735567	9.19904	0
LOG_US_IIP	1.17642	0.329263	3.572888	0.0023
LOG_US_RETAIL	0.11618	0.104446	1.112345	0.2815

R-squared	0.898449	Mean dependent var	13.5224
Adjusted R-squared	0.886502	S.D. dependent var	0.142275
S.E. of regression	0.047932	Akaike info criterion	-3.100594
Sum squared resid	0.039057	Schwarz criterion	-2.951235
Log likelihood	34.00594	Hannan-Quinn criter.	-3.071438
F-statistic	75.20171	Durbin-Watson stat	0.985403
Prob(F-statistic)	0.000000		

Source: HDR Econometric Analysis

Table 85. Estimated Truck Border-Crossing Structural Relations for Calexico - Mexicali Border Region

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.104473	2.329028	0.474221	0.6422
LOG_US_IIP	1.149416	0.612411	1.876869	0.0801
LOG_US_RETAIL	0.496148	0.159198	3.116539	0.0071

R-squared	0.806037	Mean dependent var	12.55286
Adjusted R-squared	0.780175	S.D. dependent var	0.179465
S.E. of regression	0.084143	Akaike info criterion	-1.961583
Sum squared resid	0.106201	Schwarz criterion	-1.813188
Log likelihood	20.65425	Hannan-Quinn criter.	-1.941122
F-statistic	31.16715	Durbin-Watson stat	0.858652
Prob(F-statistic)	0.000005		

Source: HDR Econometric Analysis

Inputs Used in Forecast of US IIP

Historical Data for US IIP	
Year	**Value**
1995	71.8
1996	74.9
1997	80.4
1998	85.0
1999	88.7
2000	92.2
2001	89.1
2002	89.3
2003	90.4
2004	92.5
2005	95.5
2006	97.6
2007	100.0
2008	96.6
2009	85.7
2010	90.6
2011	93.6
2012	97.1
2013	99.9
2014	104.1

Forecasts for US IIP			
Year	**Median**	**Min**	**Max**
2015	104.5	103.5	105.0
2016	108.1	104.6	111.0
2017	111.2	107.6	114.1
2018	114.0	110.3	117.0
2019	116.8	113.0	119.9
2020	119.8	115.0	122.8
2021	122.6	116.9	126.6
2022	125.5	118.8	130.0
2023	128.4	120.8	133.4
2024	131.2	122.7	136.6
2025	134.1	124.6	139.9
2026	137.0	126.6	143.1
2027	139.8	128.5	146.2
2028	142.7	130.4	149.2
2029	145.4	132.4	152.2
2030	147.8	134.3	155.2
2031	150.0	136.2	158.2
2032	152.2	138.2	161.2
2033	154.3	140.1	164.2
2034	156.3	142.0	167.2
2035	158.4	144.0	170.2

Growth Factors (from forecast sources and RAP sessions)		
Median	**Min**	**Max**
0.4%	-0.6%	0.8%
3.5%	1.1%	5.7%
2.8%	2.8%	2.8%
2.6%	2.6%	2.6%
2.4%	2.4%	2.4%
2.5%	1.7%	2.5%
2.4%	1.7%	3.1%
2.3%	1.7%	2.7%
2.3%	1.6%	2.6%
2.2%	1.6%	2.5%
2.2%	1.6%	2.4%
2.1%	1.6%	2.3%
2.1%	1.5%	2.2%
2.0%	1.5%	2.1%
1.9%	1.5%	2.0%
1.7%	1.5%	2.0%
1.5%	1.4%	1.9%
1.5%	1.4%	1.9%
1.4%	1.4%	1.9%
1.3%	1.4%	1.8%
1.3%	1.4%	1.8%

2036	160.3	145.9	173.2	1.2%	1.3%	1.8%
2037	162.0	147.8	176.2	1.1%	1.3%	1.7%
2038	163.6	149.8	179.2	1.0%	1.3%	1.7%
2039	165.3	151.7	182.2	1.0%	1.3%	1.7%
2040	166.9	153.6	185.2	1.0%	1.3%	1.6%

Source for historical data: Federal Reserve Economic Data

Inputs Used in US Retail Sales Forecast

Historical Data for US Retail Sales	
Year	**Value (in Mill. of $)**
1995	184801
1996	196796
1997	205731
1998	215147
1999	233591
2000	248606
2001	255189
2002	260713
2003	271894
2004	289421
2005	307440
2006	322631
2007	332932
2008	328026
2009	301204
2010	318405
2011	342166
2012	358853
2013	372419
2014	386024

Forecasts for US Retail Sales (in Mill. Of $)			
Year	**Median**	**Min**	**Max**
2015	405655	395389	414578
2016	427102	404863	446434
2017	448206	414149	477809
2018	468698	423287	508171
2019	489295	432398	538754
2020	505621	441190	561629
2021	522550	450101	585527
2022	538542	463875	603446
2023	555756	478703	622735
2024	573564	494042	642689
2025	590796	508884	661997
2026	607363	523155	680562
2027	623181	536780	698286
2028	638164	549686	715075
2029	652231	561802	730837
2030	665304	573063	745486
2031	675949	582232	757413
2032	686088	590965	768774
2033	695693	599239	779537

Growth Factors (from forecast sources and RAP sessions)		
Median	**Min**	**Max**
5.1%	2.4%	7.4%
5.3%	2.4%	7.7%
4.9%	2.3%	7.0%
4.6%	2.2%	6.4%
4.4%	2.2%	6.0%
3.3%	2.0%	4.2%
3.3%	2.0%	4.3%
3.1%	3.1%	3.1%
3.2%	3.2%	3.2%
3.2%	3.2%	3.2%
3.0%	3.0%	3.0%
2.8%	2.8%	2.8%
2.6%	2.6%	2.6%
2.4%	2.4%	2.4%
2.2%	2.2%	2.2%
2.0%	2.0%	2.0%
1.6%	1.6%	1.6%
1.5%	1.5%	1.5%
1.4%	1.4%	1.4%

2034	704737	607029	789671	1.3%	1.3%	1.3%
2035	713194	614313	799147	1.2%	1.2%	1.2%
2036	721039	621070	807938	1.1%	1.1%	1.1%
2037	728250	627281	816017	1.0%	1.0%	1.0%
2038	734804	632927	823362	0.9%	0.9%	0.9%
2039	740683	637990	829948	0.8%	0.8%	0.8%
2040	746608	643094	836588	0.8%	0.8%	0.8%

Source for historical data: Federal Reserve Economic Data

Breakdown of Baseline Scenario Forecasted Volumes (by mode and border-crossing region)

Year	Truck Forecast (in number of trucks)							
	Northbound				Southbound			
	Land-Based Truck		Port-Based Truck		Land-Based Truck		Port-Based Truck	
	San Diego County	Imperial County	San Diego County	Imperial County	San Diego County	Imperial County	San Diego County	Imperial County
2015	868,035	324,018	3,304	1,246	795,474	299,994	68,415	25,798
2016	908,809	333,573	3,393	1,279	802,924	309,021	70,410	26,551
2017	992,287	355,845	3,484	1,314	841,792	330,574	72,445	27,318
2018	1,027,095	376,541	3,577	1,349	923,325	350,537	74,523	28,101
2019	1,062,156	396,183	3,672	1,385	956,149	369,430	76,643	28,901
2020	1,098,531	416,206	3,770	1,422	989,185	388,690	78,808	29,717
2021	1,133,152	435,580	3,863	1,457	1,023,493	407,284	80,895	30,504
2022	1,168,864	454,698	3,957	1,492	1,056,119	425,650	83,020	31,306
2023	1,205,126	474,148	4,053	1,528	1,089,800	444,334	85,185	32,122
2024	1,240,661	494,449	4,151	1,565	1,123,994	463,855	87,389	32,953
2025	1,277,392	514,882	4,252	1,603	1,157,422	483,494	89,635	33,800
2026	1,314,185	535,822	4,356	1,643	1,192,008	503,625	91,952	34,674
2027	1,349,877	556,773	4,463	1,683	1,226,589	523,742	94,313	35,564
2028	1,386,714	577,208	4,572	1,724	1,260,027	543,327	96,720	36,472
2029	1,421,229	598,019	4,684	1,766	1,294,566	563,271	99,175	37,397
2030	1,452,199	617,703	4,798	1,809	1,326,738	582,072	101,678	38,341
2031	1,480,369	635,674	4,912	1,852	1,355,320	599,142	104,341	39,345
2032	1,508,529	651,676	5,028	1,896	1,380,940	614,183	107,055	40,369
2033	1,535,493	667,589	5,147	1,941	1,406,502	629,116	109,821	41,412
2034	1,561,240	682,880	5,270	1,987	1,430,820	643,409	112,642	42,476
2035	1,588,111	697,515	5,395	2,034	1,453,867	657,026	115,519	43,560
2036	1,612,549	712,497	5,521	2,082	1,477,987	670,971	118,637	44,736
2037	1,634,520	726,252	5,651	2,131	1,499,434	683,598	121,814	45,934
2038	1,655,189	738,737	5,785	2,181	1,518,357	694,934	125,052	47,155

2039	1,676,933	750,442	5,921	2,233	1,535,921	705,468	128,352	48,400
2040	1,697,548	762,404	6,061	2,286	1,554,502	716,237	131,715	49,668

Year	Rail Forecast (in number of railcars)							
	Northbound				Southbound			
	Land-Rail		Port-Rail		Land-Rail		Port-Rail	
	San Diego County	Imperial County	San Diego County	Imperial County	San Diego County	Imperial County	San Diego County	Imperial County
2015	3,615	6,983	71	168	2,210	4,219	1,477	3,482
2016	3,702	7,532	73	173	2,256	4,325	1,520	3,583
2017	3,791	7,735	75	177	2,303	4,434	1,564	3,687
2018	3,882	7,944	77	182	2,351	4,547	1,608	3,793
2019	3,976	8,158	79	187	2,401	4,664	1,654	3,901
2020	4,071	8,378	81	192	2,452	4,785	1,701	4,011
2021	4,162	8,604	83	197	2,500	4,901	1,746	4,117
2022	4,256	8,822	85	201	2,549	5,022	1,792	4,225
2023	4,351	9,046	87	206	2,600	5,147	1,839	4,335
2024	4,449	9,276	90	211	2,652	5,275	1,886	4,448
2025	4,549	9,511	92	216	2,706	5,407	1,935	4,562
2026	4,629	9,753	94	222	2,739	5,484	1,985	4,680
2027	4,711	9,942	96	227	2,772	5,562	2,036	4,800
2028	4,795	10,135	99	233	2,806	5,641	2,088	4,923
2029	4,879	10,331	101	238	2,840	5,722	2,141	5,047
2030	4,966	10,531	104	244	2,875	5,805	2,195	5,175
2031	5,049	10,735	106	250	2,903	5,876	2,252	5,310
2032	5,133	10,937	109	256	2,931	5,949	2,311	5,448
2033	5,219	11,142	111	262	2,959	6,023	2,370	5,589
2034	5,306	11,350	114	268	2,988	6,099	2,431	5,733
2035	5,394	11,563	116	275	3,017	6,175	2,493	5,879
2036	5,498	11,780	119	281	3,056	6,276	2,561	6,038
2037	5,604	12,033	122	288	3,096	6,379	2,629	6,200
2038	5,711	12,291	125	294	3,137	6,484	2,699	6,364
2039	5,821	12,554	128	301	3,179	6,592	2,770	6,532

2040	5,933	12,823	131	308	3,221	6,703	2,843	6,704

Characteristics of SCAG SuperZones

Table 86: Location of SuperZones in SCAG area

Super Zone	Counties	Representative City/Area	Latitude	Longitude
1	Los Angeles	Ports of LA/LB	33.790281	-118.246728
2	Los Angeles	Inglewood/LAX	33.960352	-118.408424
3	Los Angeles	Santa Clarita/Palmdale/Lancaster	34.612044	-118.455558
4	Orange	Irvine	33.676778	-117.702594
5	Orange	Santa Ana	33.843246	-117.895870
6	Riverside	Corona	33.889323	-117.538185
7	Los Angeles	Burbank/San Fernando Valley	34.169493	-118.340529
8	Los Angeles/San Bernardino	Victorville/High Desert	34.899124	-116.234011
9	Los Angeles	Downtown Los Angeles	34.029741	-118.219700
10	Los Angeles/Orange	Long Beach	33.683435	-117.929385
11	San Bernardino/Riverside	Indio	33.866732	-115.874373
12	Los Angeles	Whittier	33.997862	-117.955811
13	Los Angeles	Torrance/South Bay Cities	33.849909	-118.336169
14	Los Angeles	Downey	33.982047	-118.125207
15	Ventura	Oxnard/Ventura	34.485026	-119.096231
16	Imperial	Calexico/El Centro/Brawley	32.858230	-115.499589
17	San Bernardino	San Bernardino	34.110550	-117.369902
18	Los Angeles	Simi Valley/Malibu	34.166821	-118.677117
19	Los Angeles	South Gate	33.948348	-118.206672
20	Los Angeles	Pomona/Ontario Airport	34.044438	-117.666960
21	Los Angeles	Santa Monica/West LA	34.071279	-118.419001

Super Zone	Counties	Representative City/Area	Latitude	Longitude
22	Los Angeles	Florence	33.990657	-118.288591
23	Los Angeles	Carson	33.871898	-118.244092
24	Imperial	Calipatria/Imperial County	33.067978	-115.347439
25	Los Angeles	Whittier	34.039358	-118.094795
26	Los Angeles	Norwalk	33.923069	-118.041651
27	Los Angeles	West Puente Valley	34.075815	-117.969689
28	Los Angeles	Highland Park	34.114702	-118.187897
29	Los Angeles	Diamond Bar	33.981192	-117.836388
30	Los Angeles	La Canada/Flintridge	34.208358	-118.199687
31	Los Angeles	West Whittier-Los Nietos	33.997626	-118.063209
32	Los Angeles	El Monte	34.088255	-118.083477
33	Orange/Riverside/San Bernardino	Moreno Valley	33.779276	-117.201903

Source: HDR

Forecasted O-D Tables

The O-D tables with the forecasted number of border-crossing truck trips for the baseline scenario for years 2015 and 2040 are presented below, by direction of flow.

Table 87: Baseline Truck Volume Estimates for O-D Pairs – 2015 and 2040 estimates

Scenario	BASELINE
Year	2015

	NORTHBOUND																																		
ORIGIN / DESTINATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	4,415	47,550	0	49,892	9,227	0	438	0	17,739	62,119	0	0	0	26,133	0	0	1,458	0	3,008	0	0	0	13,705	0	69	0	0	0	0	292	297	0	0	183,810	451,189
Mexicali	0	0	0	0	0	0	0	0	214	214	1,069	0	13,698	0	47,862	182,984	0	0	759	0	67,360	310	0	0	0	0	0	0	0	0	0	0	0	20,136	214

	SOUTHBOUND																																		
DESTINATION / ORIGIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	0	21,447	0	96,335	20,576	0	0	0	5,713	31,109	588	1,110	0	30,434	236	7,817	259	0	16,237	16,997	5,325	0	71,711	0	0	134	0	1,954	92	0	0	0	6,226	224,658	312,381
Mexicali	0	0	0	0	734	0	0	0	0	0	0	0	0	0	19,626	64,155	9,568	0	0	561	1,250	0	0	0	3,865	0	0	1,874	0	0	0	0	0	218,775	14,411

Scenario	BASELINE
Year	2040

	NORTHBOUND																																		
ORIGIN / DESTINATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	8,632	92,968	0	97,547	18,040	0	856	0	34,682	121,452	0	0	0	51,094	0	0	2,850	0	5,882	0	0	0	26,795	0	135	0	0	0	0	571	581	0	0	359,377	882,147
Mexicali	0	0	0	0	0	0	0	0	496	496	2,478	0	31,757	0	110,958	424,213	0	0	1,759	0	156,161	719	0	0	0	0	0	0	0	0	0	0	0	46,682	496

	SOUTHBOUND																																		
DESTINATION / ORIGIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	0	41,933	0	188,351	40,229	0	0	0	11,169	60,822	1,150	2,171	0	59,503	461	15,283	507	0	31,746	33,232	10,412	0	140,206	0	0	261	0	3,821	180	0	0	0	12,172	439,243	610,756
Mexicali	0	0	0	0	1,701	0	0	0	0	0	0	0	0	0	45,500	148,731	22,181	0	0	1,300	2,897	0	0	0	8,960	0	0	4,346	0	0	0	0	0	507,187	33,409

Source: HDR

Chapter 6 Appendix

Table 88. 2015 Base Year and 2040 Baseline Forecast

Scenario	BASELINE
Year	2015

	NORTHBOUND																																	
ORIGIN / DESTINATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	4,415	47,550	0	49,892	9,227	0	438	0	17,739	62,119	0	0	0	26,133	0	0	1,458	0	3,008	0	0	0	13,705	0	69	0	0	0	0	292	297	0	0	183,810	451,189
Mexicali	0	0	0	0	0	0	0	0	214	214	1,069	0	13,698	0	47,862	182,984	0	0	759	0	67,360	310	0	0	0	0	0	0	0	0	0	0	0	20,136	214

	SOUTHBOUND																																	
DESTINATION / ORIGIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	0	21,447	0	96,335	20,576	0	0	0	5,713	31,109	588	1,110	0	30,434	236	7,817	259	0	16,237	16,997	5,325	0	71,711	0	0	134	0	1,954	92	0	0	0	6,226	224,658	312,381
Mexicali	0	0	0	0	734	0	0	0	0	0	0	0	0	0	19,626	64,155	9,568	0	0	561	1,250	0	0	0	3,865	0	0	1,874	0	0	0	0	0	218,775	14,411

Scenario	BASELINE
Year	2040

	NORTHBOUND																																	
ORIGIN / DESTINATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	8,632	92,968	0	97,547	18,040	0	856	0	34,682	121,452	0	0	0	51,094	0	0	2,850	0	5,882	0	0	0	26,795	0	135	0	0	0	0	571	581	0	0	359,377	882,147
Mexicali	0	0	0	0	0	0	0	0	496	496	2,478	0	31,757	0	110,958	424,213	0	0	1,759	0	156,161	719	0	0	0	0	0	0	0	0	0	0	0	46,682	496

	SOUTHBOUND																																	
DESTINATION / ORIGIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	0	41,933	0	188,351	40,229	0	0	0	11,169	60,822	1,150	2,171	0	59,503	461	15,283	507	0	31,746	33,232	10,412	0	140,206	0	0	261	0	3,821	180	0	0	0	12,172	439,243	610,756
Mexicali	0	0	0	0	1,701	0	0	0	0	0	0	0	0	0	45,500	148,731	22,181	0	0	1,300	2,897	0	0	0	8,960	0	0	4,346	0	0	0	0	0	507,187	33,409

Chapter 7 Appendix

List of Economic Trends Survey Interviewees

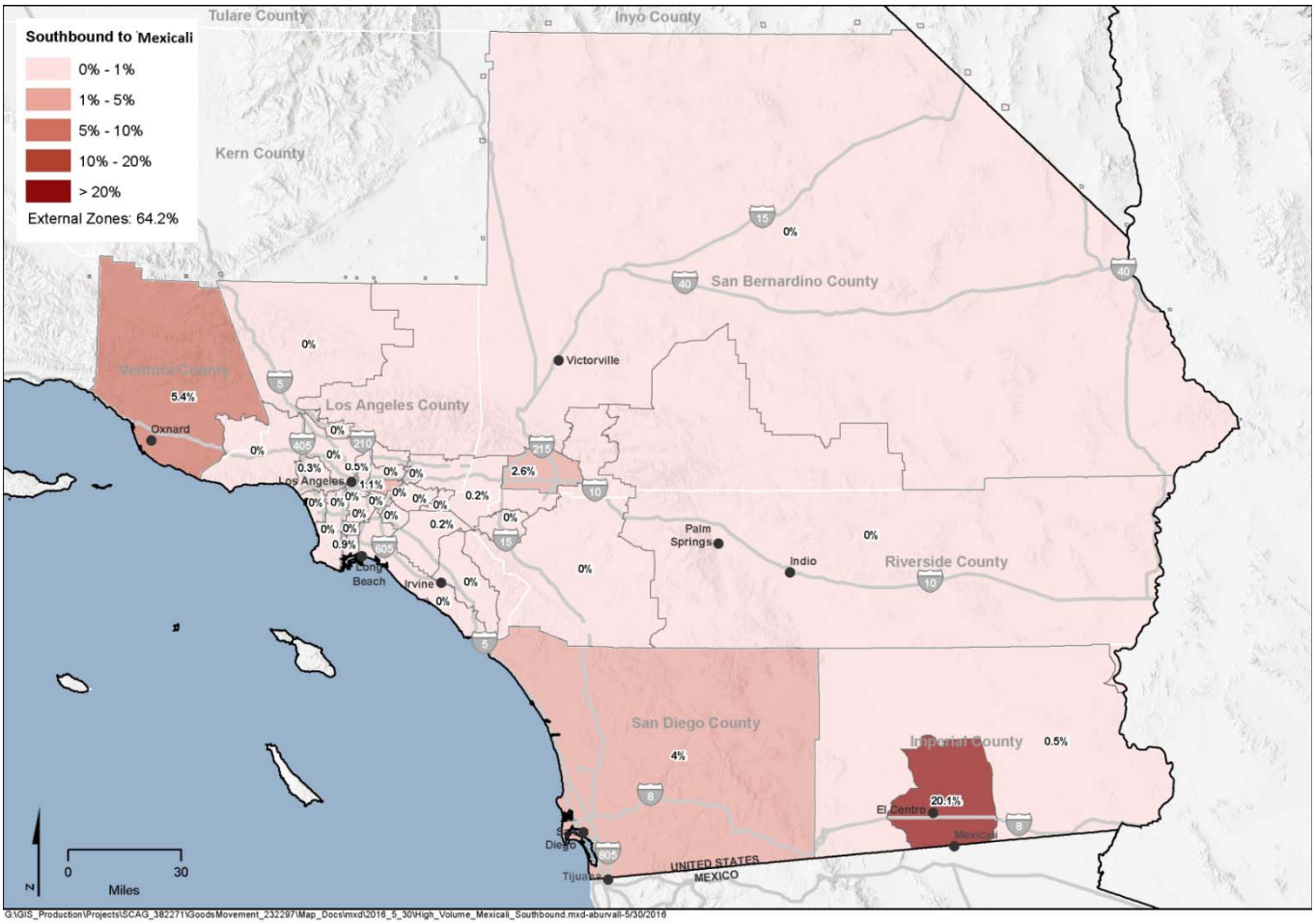
No.	Company/Agency
1	CDT Consejo Desarrollo Económico de Tijuana
2	City of San Diego
3	City of Tijuana
4	South County EDC
5	CANACAR
6	Imperial Valley EDC
7	Cluster Electronics - CANIETI
8	Cluster Automotriz
9	Maquiladora Association Tijuana
10	Cali Baja Group
11	Terminal Intermodal Tijuana
12	Cluster Productos Madera
13	Cluster Aeroespacial de Baja California
14	Calexico Chamber of Commerce
15	San Diego Greater Chamber of Commerce
16	CDEM Mexicali
17	Coca Cola Baja California
18	Transmex International
19	Foxconn de BC
20	CaliBaja Ambiental
21	Secretaria Desarrollo Económico Estado BC
22	Mueblex
23	Desarrollo Económico Industrial de Tijuana
24	Aluminio de BC
25	Amex de Mexico
26	Hyundai Translead de Mexico
27	Ossur de Mexico
28	Sharp de Mexico
29	Cluster Medical Devices

Source: LaSalle Solutions

Chapter 8 Appendix

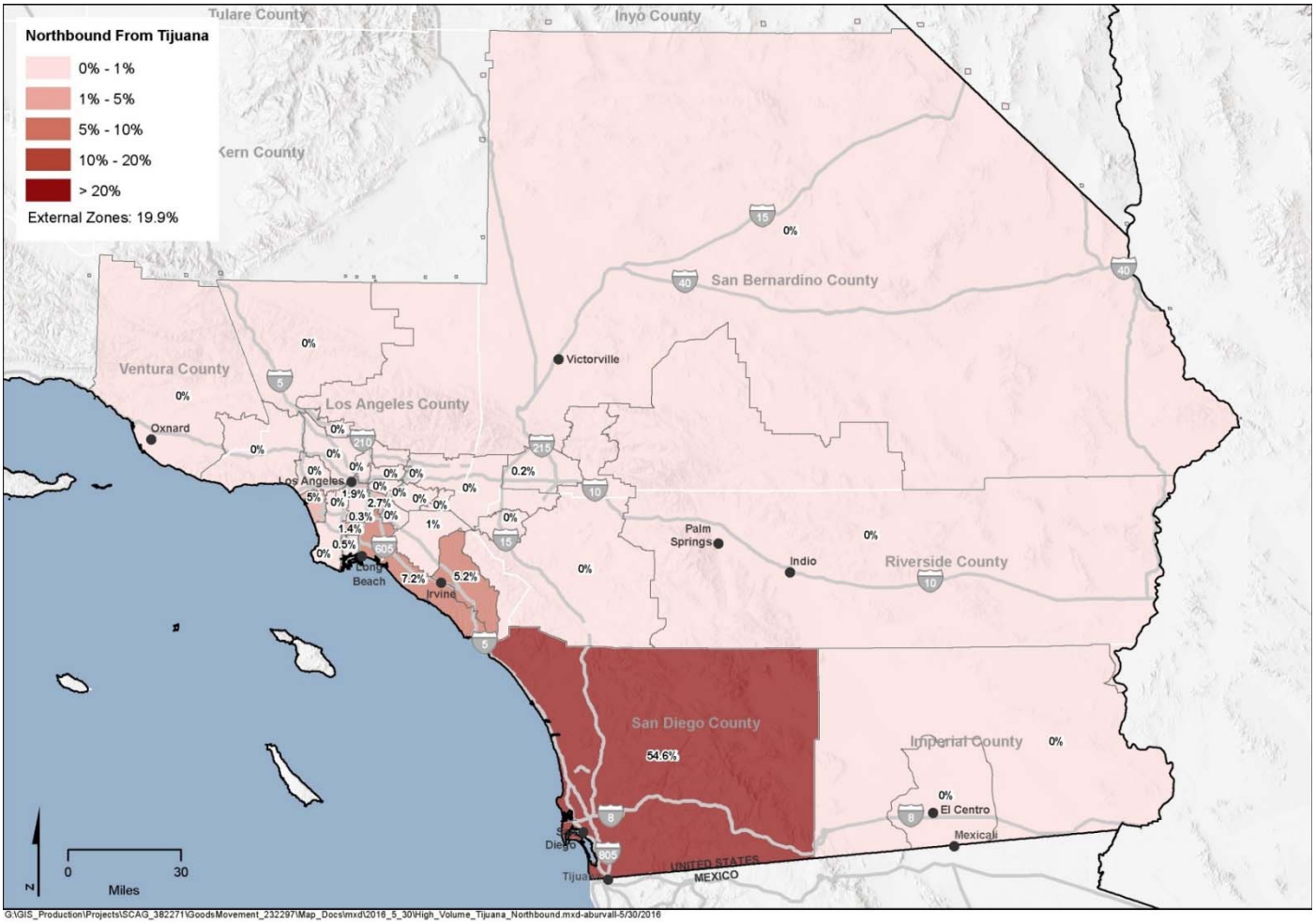
Additional maps

Figure 110: O-D Pairs Truck Percentages in High-Volume Scenario – Southbound Flows to Mexicali



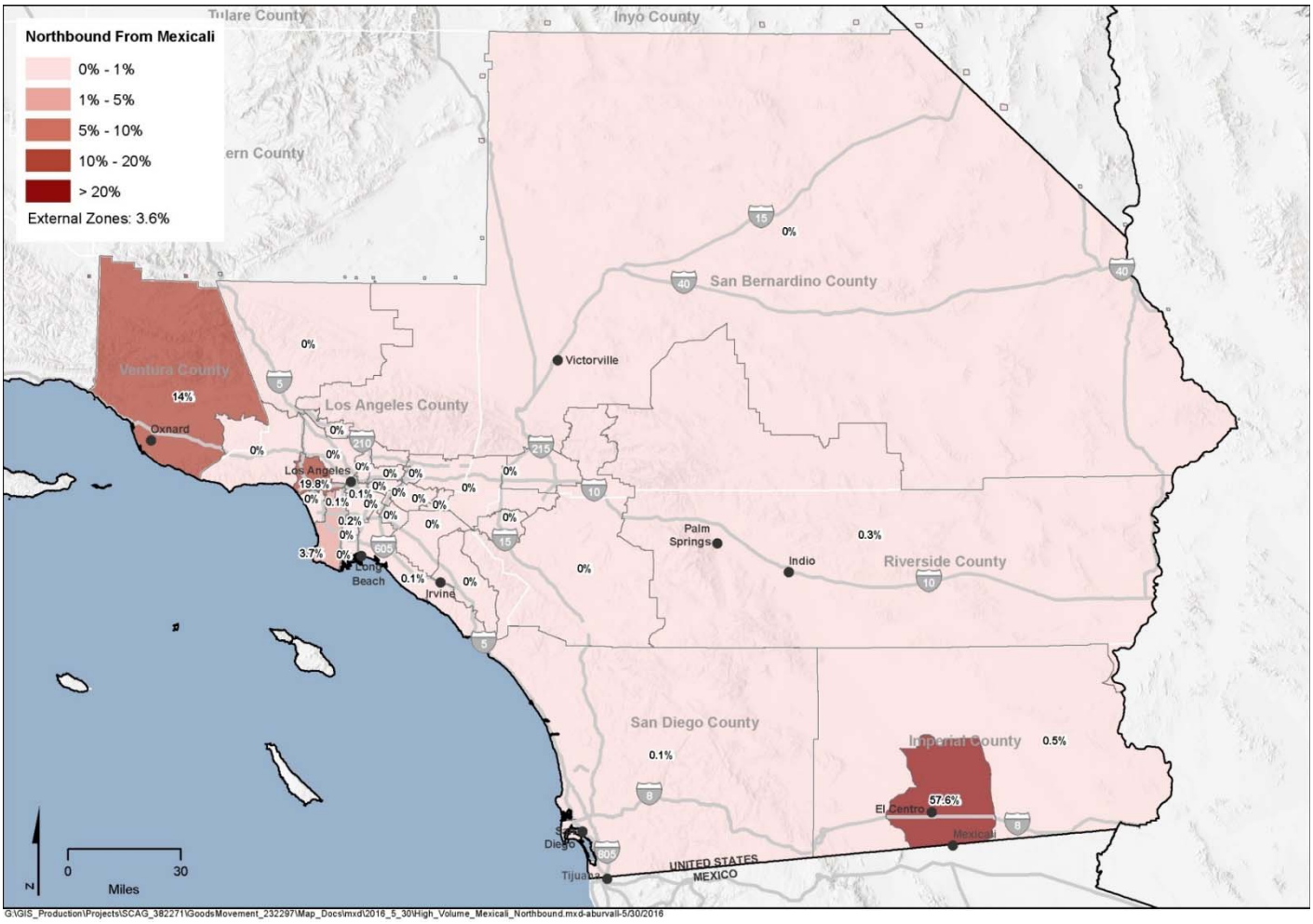
Source: HDR

Figure 111: O-D Pairs Truck Percentages in High-Volume Scenario – Northbound Flows from Tijuana



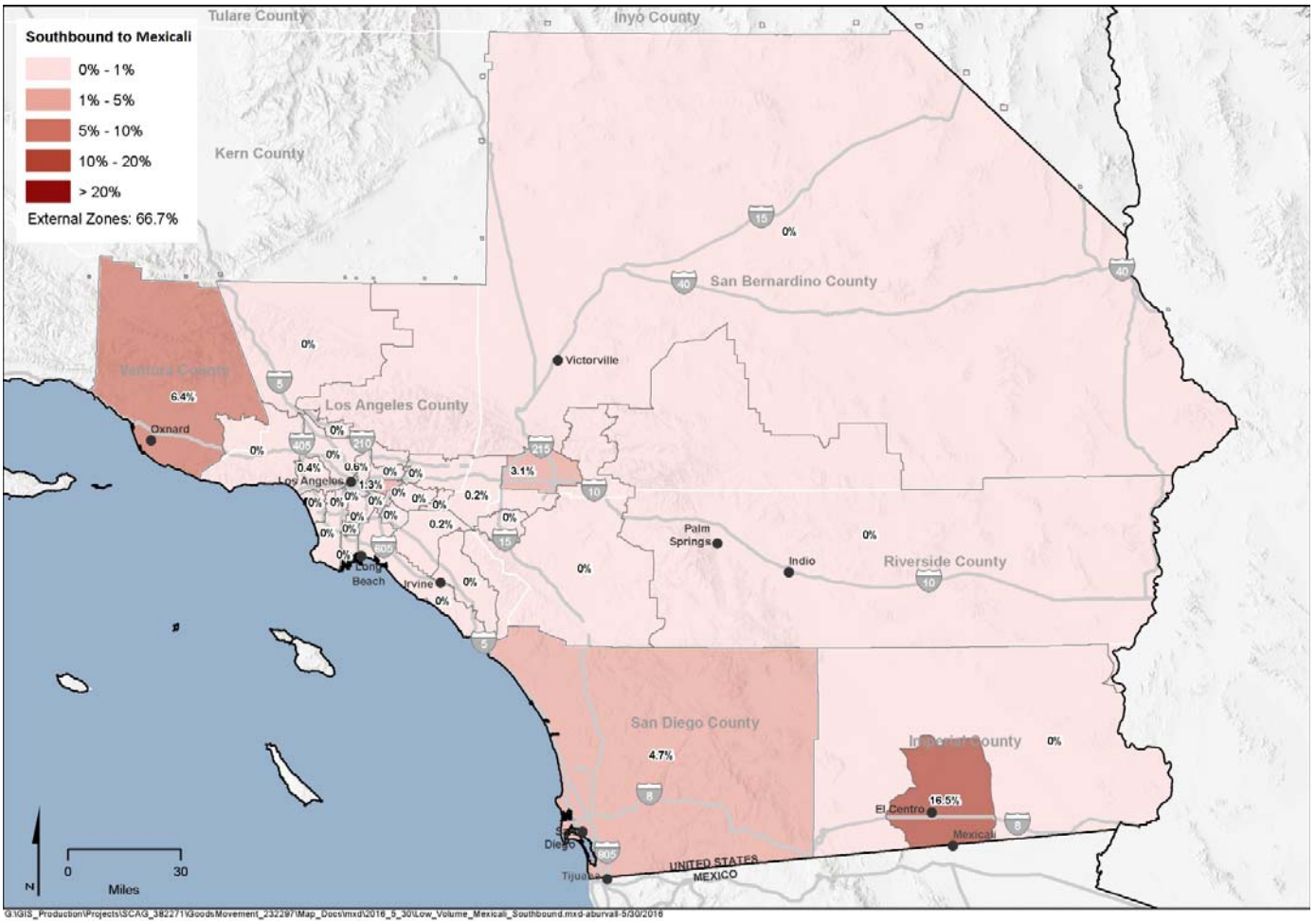
Source: HDR

Figure 112: O-D Pairs Truck Percentages in High-Volume Scenario – Northbound Flows from Mexicali



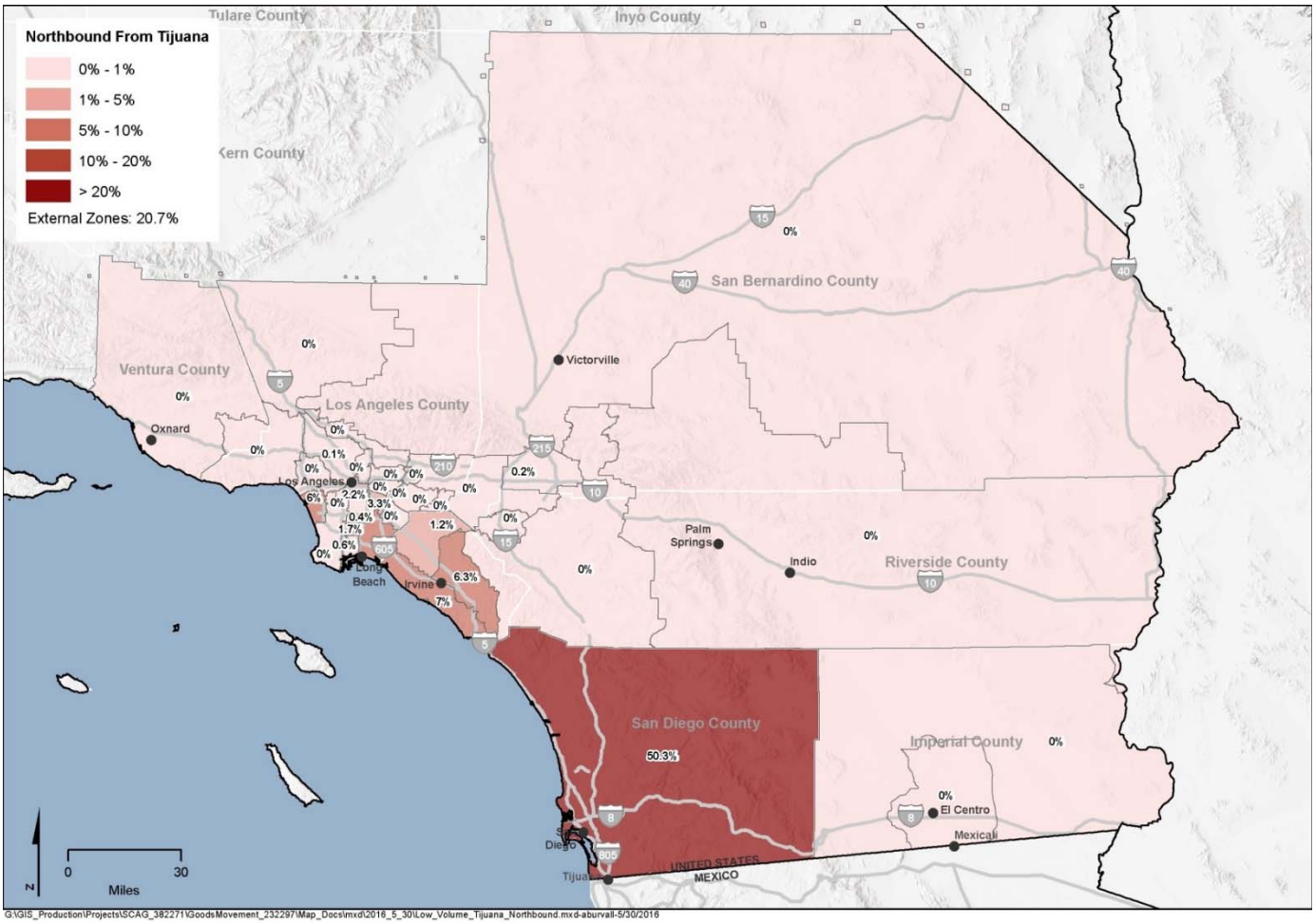
Source: HDR

Figure 113: O-D Pairs Truck Percentages in Low-Volume Scenario – Southbound Flows to Mexicali



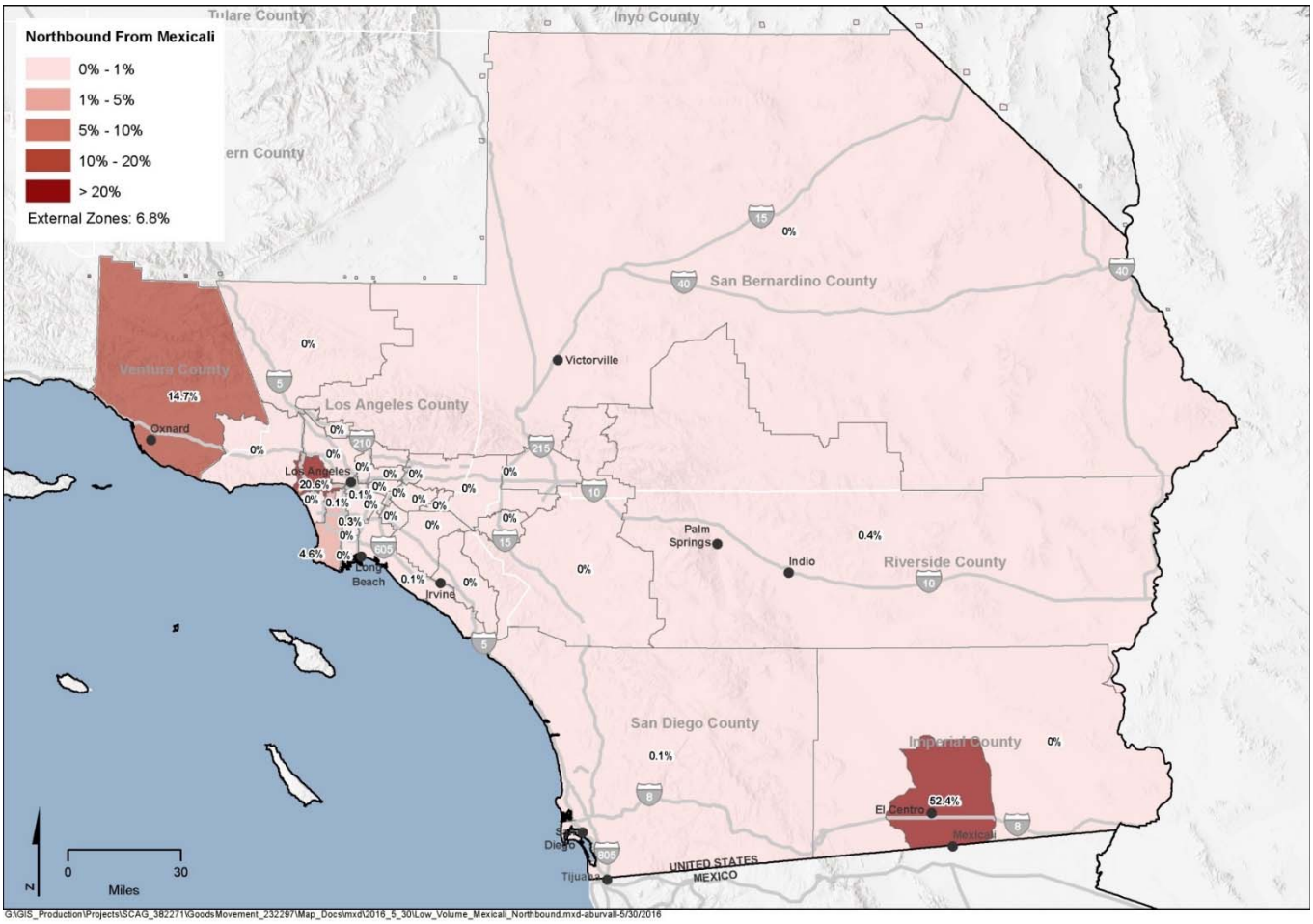
Source: HDR

Figure 114: O-D Pairs Truck Percentages in Low-Volume Scenario – Northbound Flows from Tijuana



Source: HDR

Figure 115: O-D Pairs Truck Percentages in Low-Volume Scenario – Northbound Flows from Mexicali



Source: HDR

Breakdown of High-Volume Scenario Forecasted Volumes (by mode and border-crossing region)

Year	Truck Forecast (in number of trucks)							
	Northbound				Southbound			
	Land-Based Truck		Port-Based Truck		Land-Based Truck		Port-Based Truck	
	San Diego County	Imperial County	San Diego County	Imperial County	San Diego County	Imperial County	San Diego County	Imperial County
2015	947,426	324,044	3,243	1,250	798,293	300,526	67,716	26,096
2016	1,020,337	374,498	3,336	1,286	871,553	356,639	69,726	26,871
2017	1,115,639	414,240	3,432	1,323	941,899	396,641	71,779	27,662
2018	1,157,358	442,274	3,530	1,360	1,034,436	424,592	73,876	28,470
2019	1,199,324	469,396	3,630	1,399	1,073,717	451,589	76,019	29,296
2020	1,239,515	497,043	3,733	1,439	1,113,196	479,106	78,209	30,140
2021	1,291,055	521,568	3,833	1,477	1,150,866	503,395	80,412	30,989
2022	1,336,650	551,494	3,936	1,517	1,199,788	533,228	82,661	31,855
2023	1,382,950	577,151	4,040	1,557	1,242,759	558,655	84,957	32,740
2024	1,427,304	603,922	4,147	1,598	1,286,383	585,207	87,302	33,644
2025	1,473,036	630,421	4,256	1,640	1,328,023	611,458	89,698	34,567
2026	1,517,640	657,574	4,369	1,684	1,370,980	638,360	92,180	35,524
2027	1,561,056	684,242	4,484	1,728	1,412,728	664,728	94,715	36,501
2028	1,603,231	710,332	4,602	1,774	1,453,243	690,480	97,305	37,499
2029	1,645,384	735,751	4,723	1,820	1,492,467	715,520	99,952	38,519
2030	1,687,488	760,984	4,846	1,868	1,531,613	740,345	102,658	39,562
2031	1,729,109	785,964	4,969	1,915	1,570,648	764,885	105,551	40,676
2032	1,770,801	809,814	5,095	1,963	1,609,003	788,183	108,506	41,815
2033	1,812,550	833,635	5,223	2,013	1,647,365	811,423	111,525	42,979
2034	1,854,339	857,392	5,355	2,064	1,685,718	834,573	114,611	44,168
2035	1,896,153	881,056	5,490	2,116	1,724,042	857,597	117,765	45,383
2036	1,937,977	904,592	5,627	2,169	1,762,320	880,463	121,202	46,708
2037	1,979,793	927,968	5,768	2,223	1,800,307	903,041	124,711	48,060
2038	2,021,587	951,151	5,912	2,278	1,838,212	925,390	128,296	49,442

2039	2,063,341	974,108	6,059	2,335	1,876,018	947,476	131,958	50,853
2040	2,105,284	996,803	6,211	2,394	1,913,705	969,262	135,699	52,295

Year	Rail Forecast (in number of railcars)							
	Northbound				Southbound			
	Land-Based Rail		Port-Based Rail		Land-Based Rail		Port-Based Rail	
	San Diego County	Imperial County	San Diego County	Imperial County	San Diego County	Imperial County	San Diego County	Imperial County
2015	3,712	6,917	132	241	1,070	2,774	2,746	5,037
2016	3,818	7,593	135	248	1,098	2,875	2,828	5,187
2017	3,927	7,836	139	255	1,127	2,980	2,911	5,339
2018	4,040	8,088	143	263	1,158	3,090	2,996	5,495
2019	4,155	8,348	147	270	1,190	3,206	3,083	5,655
2020	4,274	8,616	151	278	1,223	3,326	3,172	5,818
2021	4,389	8,893	155	285	1,252	3,438	3,261	5,981
2022	4,506	9,162	160	293	1,281	3,555	3,353	6,149
2023	4,626	9,439	164	301	1,312	3,677	3,446	6,319
2024	4,750	9,725	168	308	1,344	3,804	3,541	6,494
2025	4,877	10,019	173	317	1,377	3,936	3,638	6,672
2026	4,980	10,322	177	325	1,383	3,998	3,739	6,857
2027	5,085	10,561	182	334	1,389	4,061	3,842	7,045
2028	5,192	10,805	187	342	1,395	4,126	3,947	7,238
2029	5,301	11,055	192	351	1,400	4,193	4,054	7,435
2030	5,413	11,311	197	360	1,406	4,262	4,164	7,636
2031	5,521	11,572	202	370	1,400	4,314	4,281	7,851
2032	5,630	11,831	207	379	1,394	4,368	4,401	8,071
2033	5,742	12,096	212	389	1,388	4,423	4,523	8,296
2034	5,856	12,367	217	398	1,381	4,479	4,648	8,525
2035	5,973	12,643	223	408	1,374	4,536	4,776	8,760
2036	6,110	12,926	228	419	1,375	4,621	4,916	9,015
2037	6,250	13,257	234	429	1,378	4,709	5,058	9,277
2038	6,394	13,597	240	440	1,380	4,800	5,204	9,543
2039	6,540	13,945	246	451	1,383	4,894	5,352	9,816

2040	6,690	14,302	252	462	1,386	4,992	5,504	10,094

Breakdown of Low-Volume Scenario Forecasted Volumes (by mode and border-crossing region)

Year	Truck Forecast (in number of trucks)							
	Northbound				Southbound			
	Land-Based Truck		Port-Based Truck		Land-Based Truck		Port-Based Truck	
	San Diego County	Imperial County	San Diego County	Imperial County	San Diego County	Imperial County	San Diego County	Imperial County
2015	760,339	324,005	3,220	1,227	795,474	299,728	62,911	23,973
2016	771,953	283,546	3,295	1,255	724,419	262,079	64,543	24,595
2017	840,369	290,405	3,371	1,285	734,896	268,382	66,208	25,229
2018	867,453	303,417	3,451	1,315	803,522	280,788	67,908	25,876
2019	894,722	315,602	3,532	1,346	829,789	292,362	69,642	26,537
2020	915,517	327,962	3,616	1,378	856,213	304,100	71,412	27,212
2021	935,514	338,010	3,689	1,406	875,977	313,528	73,010	27,821
2022	956,781	347,882	3,763	1,434	895,069	322,835	74,636	28,440
2023	979,342	359,746	3,839	1,463	915,439	334,112	76,289	29,070
2024	1,001,157	372,504	3,917	1,493	937,111	346,270	77,971	29,711
2025	1,022,935	385,245	3,998	1,523	957,994	358,402	79,683	30,364
2026	1,045,637	397,927	4,083	1,556	978,815	370,466	81,507	31,059
2027	1,067,304	410,892	4,170	1,589	1,000,483	382,776	83,365	31,766
2028	1,088,890	423,367	4,259	1,623	1,021,063	394,588	85,255	32,487
2029	1,111,372	435,686	4,350	1,658	1,041,533	406,236	87,179	33,220
2030	1,132,758	448,208	4,444	1,693	1,062,891	418,074	89,138	33,967
2031	1,153,750	460,124	4,538	1,729	1,083,097	429,301	91,221	34,760
2032	1,175,730	471,316	4,634	1,766	1,102,787	439,766	93,341	35,568
2033	1,196,686	482,838	4,733	1,804	1,123,457	450,549	95,498	36,390
2034	1,217,610	493,874	4,835	1,842	1,143,047	460,836	97,694	37,227
2035	1,239,511	504,805	4,939	1,882	1,162,572	471,008	99,929	38,079
2036	1,260,354	516,032	5,045	1,922	1,183,064	481,462	102,353	39,002

2037	1,281,142	526,716	5,154	1,964	1,202,302	491,314	104,818	39,941
2038	1,302,895	537,251	5,266	2,006	1,221,449	501,006	107,325	40,897
2039	1,323,555	548,044	5,380	2,050	1,241,549	510,941	109,877	41,869
2040	1,344,292	558,238	5,498	2,095	1,260,491	520,268	112,473	42,858

Year	Rail Forecast (in number of railcars)							
	Northbound				Southbound			
	Land-Based Rail		Port-Based Rail		Land-Based Rail		Port-Based Rail	
	San Diego County	Imperial County	San Diego County	Imperial County	San Diego County	Imperial County	San Diego County	Imperial County
2015	3,498	6,983	69	164	2,209	4,388	1,358	3,202
2016	3,565	7,426	71	168	2,243	4,470	1,393	3,285
2017	3,635	7,588	73	172	2,278	4,555	1,429	3,370
2018	3,705	7,753	74	176	2,314	4,641	1,466	3,456
2019	3,777	7,921	76	180	2,350	4,729	1,503	3,544
2020	3,850	8,093	78	184	2,386	4,819	1,541	3,634
2021	3,919	8,269	80	188	2,423	4,911	1,576	3,716
2022	3,990	8,439	81	192	2,461	5,005	1,611	3,799
2023	4,062	8,612	83	195	2,499	5,101	1,647	3,883
2024	4,136	8,789	85	199	2,538	5,200	1,683	3,968
2025	4,211	8,969	86	203	2,577	5,301	1,720	4,055
2026	4,271	9,152	88	208	2,600	5,355	1,759	4,148
2027	4,331	9,295	90	212	2,622	5,409	1,799	4,243
2028	4,393	9,440	92	217	2,645	5,465	1,840	4,339
2029	4,455	9,587	94	221	2,668	5,521	1,882	4,437
2030	4,519	9,737	96	226	2,691	5,578	1,924	4,537
2031	4,579	9,888	98	231	2,708	5,625	1,969	4,643
2032	4,641	10,037	100	236	2,726	5,674	2,015	4,751
2033	4,703	10,188	102	241	2,744	5,722	2,061	4,860
2034	4,766	10,342	104	246	2,761	5,771	2,109	4,972
2035	4,829	10,497	107	251	2,779	5,821	2,157	5,086
2036	4,904	10,655	109	257	2,804	5,887	2,209	5,209
2037	4,980	10,839	111	262	2,829	5,954	2,262	5,335
2038	5,057	11,026	114	268	2,854	6,022	2,316	5,462
2039	5,135	11,216	116	274	2,879	6,091	2,372	5,592

2040	5,214	11,409	119	280	2,905	6,161	2,428	5,724

Forecasted O-D Tables

The O-D tables with the forecasted number of border-crossing truck trips for the high-volume and low-volume scenarios for year 2040 are presented below, by direction of flow.

Table 89. O-D Forecast Table for High-Volume Scenario

Scenario	High-Volume
Year	2015

	NORTHBOUND																																
ORIGIN / DESTINATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	4,817	51,879	0	54,434	10,067	0	478	0	19,354	74,904	0	0	0	28,512	0	0	1,590	0	3,282	0	0	0	14,952	0	75	0	0	0	0	319	324	0	0	207,674	568,320
Mexicali	0	0	0	0	0	0	0	0	240	240	1,199	0	15,373	0	58,221	239,170	0	0	852	0	82,358	348	0	1,879	0	0	0	0	0	0	0	0	0	15,083	240

	SOUTHBOUND																																
DESTINATION / ORIGIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	9,393	23,120	0	105,724	22,180	0	0	0	6,158	33,534	634	1,197	0	32,806	254	8,426	280	0	17,503	18,322	5,740	0	83,407	0	0	144	0	2,107	99	0	0	0	6,711	250,626	367,261
Mexicali	3,827	0	0	0	839	0	0	0	0	0	0	0	0	0	22,435	82,905	10,937	0	0	641	1,428	0	0	1,914	4,418	0	0	2,143	0	0	0	0	0	265,394	16,473

Scenario	High-Volume
Year	2040

	NORTHBOUND																																
ORIGIN / DESTINATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	10,698	115,227	0	120,902	22,359	0	1,061	0	42,986	166,367	0	0	0	63,327	0	0	3,533	0	7,290	0	0	0	33,210	0	167	0	0	0	0	708	720	0	0	461,258	1,262,275
Mexicali	0	0	0	0	0	0	0	0	652	652	3,262	0	41,817	0	158,373	650,586	0	0	2,316	0	224,028	946	0	5,111	0	0	0	0	0	0	0	0	0	41,028	652

	SOUTHBOUND																																
DESTINATION / ORIGIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	20,872	51,375	0	234,935	49,287	0	0	0	13,684	74,517	1,409	2,660	0	72,900	565	18,725	621	0	38,895	40,715	12,756	0	185,342	0	0	320	0	4,681	220	0	0	0	14,913	556,928	816,109
Mexicali	10,435	0	0	0	2,287	0	0	0	0	0	0	0	0	0	61,169	226,040	29,820	0	0	1,748	3,895	0	0	5,218	12,045	0	0	5,842	0	0	0	0	0	723,594	44,914

Source: HDR

Table 90. O-D Forecast Table for Low-Volume Scenario

Scenario	Low-Volume
Year	2015

	NORTHBOUND																																
ORIGIN / DESTINATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	3,869	41,668	0	43,721	8,086	0	384	0	15,545	48,708	0	0	0	22,900	0	0	1,277	0	2,636	0	0	0	12,010	0	61	0	0	0	0	256	260	0	0	143,893	349,566
Mexicali	0	0	0	0	0	0	0	0	182	182	909	0	11,651	0	37,290	132,851	0	0	645	0	52,166	264	0	0	0	0	0	0	0	0	0	0	0	17,126	182

	SOUTHBOUND																																
DESTINATION / ORIGIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	0	19,380	0	81,536	18,592	0	0	0	5,162	28,109	531	1,003	0	27,499	213	7,063	234	0	14,672	15,358	4,812	0	56,924	0	0	121	0	1,766	83	0	0	0	5,626	188,826	262,580
Mexicali	0	0	0	0	627	0	0	0	0	0	0	0	0	0	16,768	43,369	8,174	0	0	479	1,068	0	0	0	3,302	0	0	1,601	0	0	0	0	0	175,468	12,312

Scenario	Low-Volume
Year	2040

	NORTHBOUND																																
ORIGIN / DESTINATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	6,839	73,659	0	77,288	14,293	0	678	0	27,479	86,104	0	0	0	40,482	0	0	2,258	0	4,660	0	0	0	21,230	0	107	0	0	0	0	452	460	0	0	254,369	617,949
Mexicali	0	0	0	0	0	0	0	0	364	364	1,821	0	23,345	0	74,721	266,201	0	0	1,293	0	104,527	528	0	0	0	0	0	0	0	0	0	0	0	34,317	364

	SOUTHBOUND																																
DESTINATION / ORIGIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	0	34,262	0	144,150	32,870	0	0	0	9,126	49,695	939	1,774	0	48,617	377	12,487	414	0	25,939	27,153	8,507	0	100,637	0	0	214	0	3,122	147	0	0	0	9,946	333,832	464,224
Mexicali	0	0	0	0	1,255	0	0	0	0	0	0	0	0	0	33,560	86,802	16,361	0	0	959	2,137	0	0	0	6,609	0	0	3,205	0	0	0	0	0	351,194	24,642

Source: HDR

Chapter 9 Appendix

Table 91. Low-Volume Scenario Forecast

Scenario	Low-Volume
Year	2015

	NORTHBOUND																																		
ORIGIN / DESTINATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	3,869	41,668	0	43,721	8,086	0	384	0	15,545	48,708	0	0	0	22,900	0	0	1,277	0	2,636	0	0	0	12,010	0	61	0	0	0	0	256	260	0	0	143,893	349,566
Mexicali	0	0	0	0	0	0	0	0	182	182	909	0	11,651	0	37,290	132,851	0	0	645	0	52,166	264	0	0	0	0	0	0	0	0	0	0	0	17,126	182

	SOUTHBOUND																																		
DESTINATION / ORIGIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	0	19,380	0	81,536	18,592	0	0	0	5,162	28,109	531	1,003	0	27,499	213	7,063	234	0	14,672	15,358	4,812	0	56,924	0	0	121	0	1,766	83	0	0	0	5,626	188,826	262,580
Mexicali	0	0	0	0	627	0	0	0	0	0	0	0	0	0	16,768	43,369	8,174	0	0	479	1,068	0	0	0	3,302	0	0	1,601	0	0	0	0	0	175,468	12,312

Scenario	Low-Volume
Year	2040

	NORTHBOUND																																		
ORIGIN / DESTINATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	6,839	73,659	0	77,288	14,293	0	678	0	27,479	86,104	0	0	0	40,482	0	0	2,258	0	4,660	0	0	0	21,230	0	107	0	0	0	0	452	460	0	0	254,369	617,949
Mexicali	0	0	0	0	0	0	0	0	364	364	1,821	0	23,345	0	74,721	266,201	0	0	1,293	0	104,527	528	0	0	0	0	0	0	0	0	0	0	0	34,317	364

	SOUTHBOUND																																		
DESTINATION / ORIGIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	0	34,262	0	144,150	32,870	0	0	0	9,126	49,695	939	1,774	0	48,617	377	12,487	414	0	25,939	27,153	8,507	0	100,637	0	0	214	0	3,122	147	0	0	0	9,946	333,832	464,224
Mexicali	0	0	0	0	1,255	0	0	0	0	0	0	0	0	0	33,560	86,802	16,361	0	0	959	2,137	0	0	0	6,609	0	0	3,205	0	0	0	0	0	351,194	24,642

Table 92. High-Volume Scenario Forecast

Scenario	High-Volume
Year	2015

	NORTHBOUND																																		
ORIGIN / DESTINATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	4,817	51,879	0	54,434	10,067	0	478	0	19,354	74,904	0	0	0	28,512	0	0	1,590	0	3,282	0	0	0	14,952	0	75	0	0	0	0	319	324	0	0	207,674	568,320
Mexicali	0	0	0	0	0	0	0	0	240	240	1,199	0	15,373	0	58,221	239,170	0	0	852	0	82,358	348	0	1,879	0	0	0	0	0	0	0	0	0	15,083	240

	SOUTHBOUND																																		
DESTINATION / ORIGIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	9,393	23,120	0	105,724	22,180	0	0	0	6,158	33,534	634	1,197	0	32,806	254	8,426	280	0	17,503	18,322	5,740	0	83,407	0	0	144	0	2,107	99	0	0	0	6,711	250,626	367,261
Mexicali	3,827	0	0	0	839	0	0	0	0	0	0	0	0	0	22,435	82,905	10,937	0	0	641	1,428	0	0	1,914	4,418	0	0	2,143	0	0	0	0	0	265,394	16,473

Scenario	High-Volume
Year	2040

	NORTHBOUND																																		
ORIGIN / DESTINATION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	10,698	115,227	0	120,902	22,359	0	1,061	0	42,986	166,367	0	0	0	63,327	0	0	3,533	0	7,290	0	0	0	33,210	0	167	0	0	0	0	708	720	0	0	461,258	1,262,275
Mexicali	0	0	0	0	0	0	0	0	652	652	3,262	0	41,817	0	158,373	650,586	0	0	2,316	0	224,028	946	0	5,111	0	0	0	0	0	0	0	0	0	41,028	652

	SOUTHBOUND																																		
DESTINATION / ORIGIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	External	SANDAG
Tijuana	20,872	51,375	0	234,935	49,287	0	0	0	13,684	74,517	1,409	2,660	0	72,900	565	18,725	621	0	38,895	40,715	12,756	0	185,342	0	0	320	0	4,681	220	0	0	0	14,913	556,928	816,109
Mexicali	10,435	0	0	0	2,287	0	0	0	0	0	0	0	0	0	61,169	226,040	29,820	0	0	1,748	3,895	0	0	5,218	12,045	0	0	5,842	0	0	0	0	0	723,594	44,914

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