CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

SEPTEMBER 2021

In partnership with

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INFRASTRUCTURE

DRAFT REPORT
09/09/2021

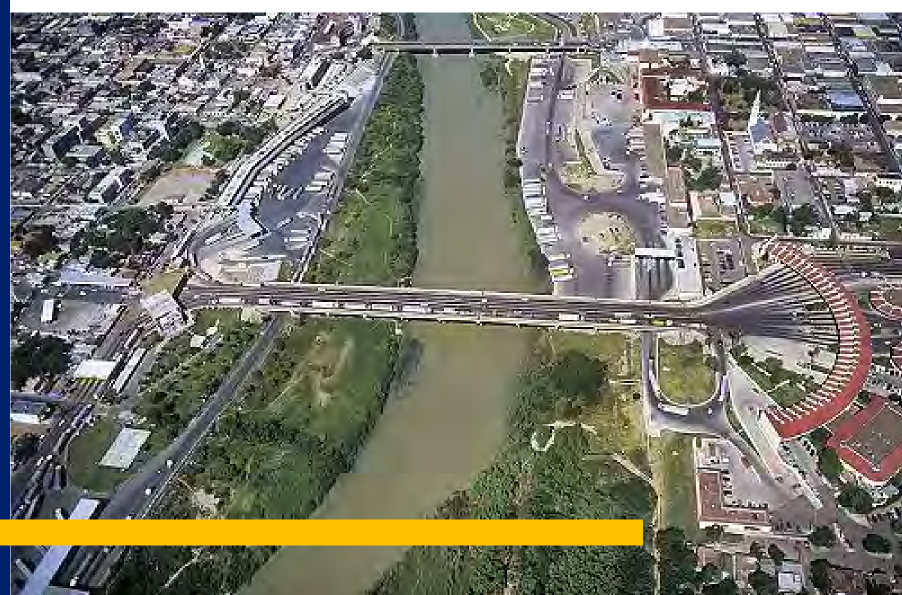

Table of Contents

List of Figures

LIST OF ABBREVIATIONS

BMP	Bridge Master Plan
BTMP	Border Transportation Master Plan
CAGR	Compound Annual Growth Rate
CAPUFE	Caminos y Puentes Federales
CBP	U.S. Customs and Border Protection
CTPAT	Customs Trade Partnership Against Terrorism
CV	Commercial Vehicles
FAST	Free and Secure Trade for Commercial Vehicles
FHWA	Federal Highway Administration
GDP	Gross Domestic Product
LOS	Level of Service
MPO	Metropolitan Planning Organization
NAFTA	North American Free Trade Agreement
OFO	Office of Federal Operations
POE	Port Of Entry
PV	Passenger Vehicles
RFID	Radio Frequency Identification
RMA	Regional Mobility Authority
SAM	Statewide Analysis Model
SAT	Servicio de Administracion Tributaria
SCT	Secretaria de Comunicaciones y Transportes
SENTRI	Secure Electronic Network for Travelers Rapid Inspection
TAZ	Traffic Analysis Zone
TTI	Texas Transportation Institute
TxDOT	Texas Department of Transportation
USMCA	United States-Mexico-Canada Agreement
WTB	World Trade Bridge

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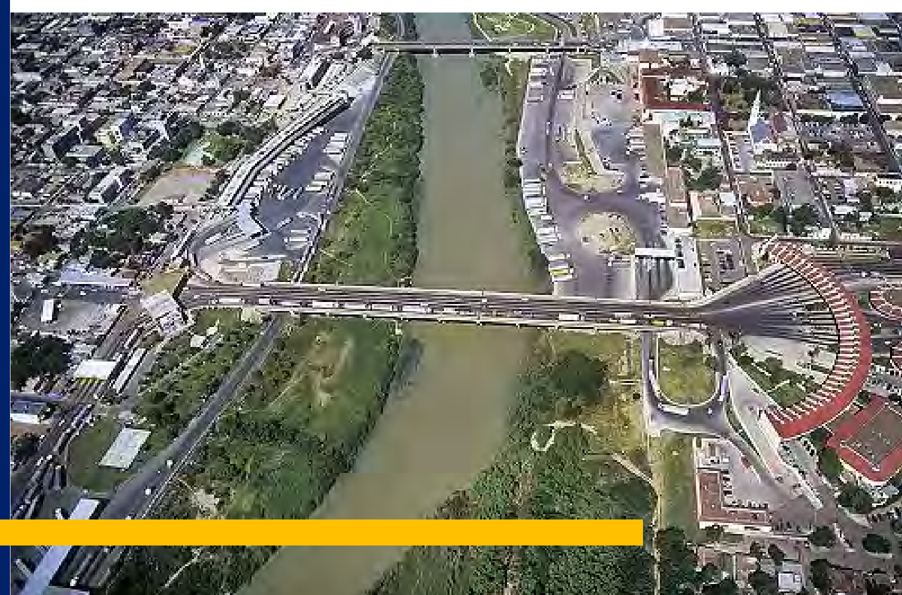
CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN



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SECTION I: PROJECT SCOPE & REVIEW

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

SECTION I: PROJECT SCOPE AND OVERVIEW

Incorporated in 1755 and located on the north bank of the Rio Grande River in Webb County, Texas, the City of Laredo is the largest inland port, the second largest port of entry (POE), and the third largest Customs District Area in the United States. The city owns, maintains, and operates four international bridges that connect to two Mexican states: Tamaulipas and Nuevo Leon. Its location in the center of several trade routes makes it strategically positioned for international trade between Canada, the United States, and Mexico.

The Laredo International Bridge System Master Plan-i.e., the Laredo Bridge Master Plan (BMP)-consists of streamlining the four existing international bridges/POEs relevant to the City of Laredo and Webb County:

- The Laredo-Colombia Solidarity International Bridge
- The World Trade International Bridge
- The Gateway to the Americas International Bridge
- The Juarez-Lincoln International Bridge

The goal of the Laredo BMP is to reduce waiting times through expansions, conversions, and/or upgrades to maximize crossing. Each bridge is to be optimized for the maximum number of crossings by diverting traffic between bridges, if applicable. Furthermore, the Laredo BMP is intended to optimize the existing Webb County POE system to assess the conditions, infrastructure, operational efficiency, and compliance with statutory requirements.

Optimizing Webb County's POEs and the distribution of traffic among them will accommodate increasing demand in Texas border crossings, especially for commercial vehicles. After the passing of the North American Free Trade Agreement (NAFTA) in 1994, commercial vehicle traffic dramatically increased across all Texas and New Mexico commercial border crossings, and freight exchange is expected to increase considerably in the years to come with the implementation of NAFTA's successor, the United States – Mexico – Canada Agreement (USMCA). With an increase in Texas border crossings, traffic congestion is expected to increase at each international bridge system.

The primary aim of the Laredo BMP Study is to produce several alternative option forecasts to support the City of Laredo in their effort to optimize traffic distribution to better accommodate and facilitate northbound commercial vehicles and border crossings. Given the continuing demographic growth within the study area, strategically planning infrastructure to serve future demand is essential to ensuring a competitive transportation network favoring regional economic growth. The BMP contributes to this effort and aides the decision-making process by providing modeled options for the Laredo BMP over a 20-year period while considering the region's competing and contributing infrastructure and existing and future international bridges.

EXISTING BRIDGE SYSTEM

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

Existing Bridge System

There are four existing international bridges/POEs connecting the city of Laredo (Webb County) to the cities of Nuevo Laredo (Tamaulipas) and Colombia (Nuevo Leon), thus providing access to retail, industrial, and educational centers on both sides of the border. Information about each of these bridges – based on visits, interviews with stakeholders, and information obtained from TxDOT and the Customs and Border Protection (CBP) – is summarized below.

BRIDGE 1 – *GATEWAY TO THE AMERICAS INTERNATIONAL BRIDGE*

The Gateway to the Americas International Bridge is owned by the City of Laredo on the U.S. side and owned by the Government of Mexico and operated by CAPUFE on the Mexico side. It is locally referred to as Laredo International Bridge, Convent Street Bridge, Bridge #1, Old Bridge, Laredo-Nuevo Laredo Bridge 1, Puente Nuevo Laredo, Puente Laredo I, and Puente Viejo. The original bridge was destroyed by flooding in 1954 and reconstructed 1956 as a four-lane bridge, which is open 24 hours a day for passenger vehicles and pedestrians. The Gateway to the Americas POE has four northbound and four southbound inspection lanes. On the U.S. side, the bridge links to Convent Avenue and Salinas Avenue and intersects with Matamoros Street and Houston Street, which connect to IH-35, US 83, and US 81. On the Mexico side, the bridge links to MEX 2, MEX 1, and MEX 85.

Source www. texastribune.org

U.S. Customs and Border Protection (CBP) Office of Field Operations (OFO) Laredo Port of Entry is planning to implement facilitation measures to assist the traveling public with their experience while utilizing SENTRI lanes as a method of travel. As one of its measures, CBP is announcing modifications to expand its SENTRI-only vehicular traffic processing window at the Gateway to the Americas Bridge. The Gateway to the Americas Bridge will be processing SENTRI-only vehicular traffic beginning, May 3rd, 2021. Source www.cbp.gov

BRIDGE 2 – *JUÁREZ-LINCOLN INTERNATIONAL BRIDGE*

The Juarez-Lincoln International Bridge is owned by the City of Laredo and operated by the Laredo Bridge System on the U.S. side and owned by the Government of Mexico and operated by Caminos y Puentes Federales de Ingresos y Servicios Conexos (CAPUFE) on the Mexico side. It is locally referred to as Bridge #2, Laredo-Nuevo Laredo Bridge 2, Puente Juarez-Lincoln, and Laredo II. This eight-lane bridge opened to traffic on November 26, 1976.

Source www.border-now.org

Travel is limited to passenger vehicles and commercial buses. The POE also offers Ready Lanes, which use Radio Frequency Identification (RFID) technology to facilitate the border-crossing process.

The Juarez-Lincoln POE is open 24 hours a day, 7 days a week and has 15 northbound passenger vehicle inspection lanes. On an average day in 2019, there were about four northbound SENTRI lanes, five Ready Lanes, and four standard lanes open. In the southbound direction, this POE has a capacity of five inspection lanes. On the U.S. side, the bridge links to IH-35 near US 83, which connects to US 59 and Loop 20. On the Mexico side, the bridge links to MEX 85 and MEX 2.

Source www.wikimapia.org

BRIDGE 3 – *COLOMBIA-SOLIDARITY INTERNATIONAL BRIDGE*

The Colombia-Solidarity International Bridge is locally referred to as Colombia Bridge, Puente Solidaridad, Puente Colombia, and Puente Internacional Solidaridad Colombia. This eight-lane bridge was completed on July 31, 1991 and serves passenger vehicles, commercial vehicles, and pedestrians. The bridge is open to passenger vehicles daily from 8:00 a.m. to midnight. For commercial vehicles, its hours of operation are 8:00 a.m. to 10:30 p.m. Monday through Friday and 8:00 a.m. to 4:00 p.m. on Saturdays. This POE has four inspection lanes for passenger vehicles and eight inspection lanes for commercial vehicles. On average in 2019, the POE opened on standard passenger vehicle lane, one SENTRI lane, and three commercial vehicle inspection lanes. In the southbound direction, there are four passenger vehicle inspection lanes and five commercial vehicle inspection lanes. The bridge links to FM 255 and FM 1472 on the U.S. side and to MEX 2 on the Mexico side.

Source www.virtualbx.com

BRIDGE 4 – *WORLD TRADE INTERNATIONAL BRIDGE*

The World Trade International Bridge is locally referred to as Laredo North, Bridge 4, Laredo IV, Puente Internacional Nuevo Laredo III, and Puente del Comercio Mundial Nuevo Laredo III. This eight-lane bridge opened on April 15, 2000 and serves commercial vehicle traffic only. Its hours of operation are 8:00 a.m. to midnight Monday through Friday, 8:00 a.m. to 4:00 p.m. on Saturdays and 8:00 a.m. to 4:00 p.m. on Sundays. This commercial POE has 16 northbound and 18 southbound inspection lanes, including Free and Secure Trade (FAST) lanes which became operational in April 2004. On the U.S. side, the bridge links to Loop 20, near FM 1472 and IH-35. On the Mexico side, the bridge links to MEX 85 and MEX 2.

Source www.freightwaves.com

INFRASTRUCTURE

SECTION II: DATA COLLECTION

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

EXISTING TRAFFIC STUDIES

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

SECTION II: DATA COLLECTION

Existing Traffic Studies

This section provides a listing of the studies done in the region that our S&B team reviewed as part of the gathering of relevant and useful information for our study. These studies include a list of projects that are currently being developed, under construction and planned for the future. Please refer to ***Appendix A and B*** *for both future projects and alternatives.*

TXDOT – LONG-RANGE STRATEGIES TO IMPROVE TRAFFIC CONDITIONS ON FM 1472 (MINES ROAD)

This study was done by the Texas A&M Transportation Institute to identify potential short-term, medium-and long-term improvements along FM 1472. For the analysis of short-term improvements, TxDOT requested TTI to focus on the southern portion of the study area, a 2.7-mile section between Loop 20 and the Con-Way truckload facility just north of Pan American Boulevard. This document summarizes TTI's analysis of short-term strategies, which are defined as strategies that can be accomplished quickly with minimal project planning and funds and without adding new pavement, for example re-timing and re-phasing of traffic signals, elimination of movements at intersections, and adding or converting lanes by only using restriping. *Source [TTI, Short, Medium and Long-Range Strategies to Improve Traffic Conditions on FM 1472 (Mines Road), February 2016]*

MPO - NORTH LAREDO – WEBB COUNTY TRANSPORTATION PLANNING STUDY

The purpose of the North Laredo-Webb County Transportation Planning Study is to provide a clear assessment of mobility conditions in an area northwest of the IH-35/IH-69W interchange (North Laredo), and to provide a roadmap for growing the transportation network to meet existing congestion and increasing mobility demands into the future. The Webb County-City of Laredo Regional Mobility Authority (RMA) was identified by the Laredo Metropolitan Planning Organization (MPO) Policy Committee as the appropriate entity to take the lead on this effort. The RMA's mission is to assist with the establishment of a comprehensive transportation system to directly benefit the traveling public within the region through the development of additional transportation alternatives. This mission fits the intent of this study, which is to conduct a detailed analysis of the existing transportation infrastructure of North Laredo and identify potential alternatives comprehensively. *Source [North Laredo, Webb County Transportation Planning Study, March 2020]*

TXDOT - BORDER MASTERPLAN – TX-MX

The BTMP builds on the long-standing coordination and collaboration relationship between Texas and Mexico regarding binational planning, programming, and implementation of policies, programs, and projects to facilitate efficient and safe cross-border movement of people and goods. The BTMP builds on three regional border master plans developed between 2012 and 2013. The plans were for the following regions:

- El Paso/Santa Teresa/Chihuahua Region (ELP)
- Laredo/Coahuila/Nuevo León/Tamaulipas Region (LRD)
- Rio Grande Valley/Tamaulipas Region (RGV)

The BTMP is a comprehensive, multimodal, binational long-range plan for the Texas-Mexico border region and identifies transportation issues, needs, challenges, opportunities, and strategies for moving people and goods efficiently across the Texas-Mexico border, the border regions, and beyond. It outlines transportation policy, program, and project strategies that support binational, state, regional, and local economic competitiveness. Therefore, the BTMP takes a holistic approach to border planning, developing one plan for the entire Texas-Mexico border, with the understanding that each border region is distinct and has unique geographic, trade, economic, and population characteristics. *Source [Texas – Mexico Border Transportation Master Plan 2021, March 4, 2021].*

MEXICO STUDY – NUEVO LAREDO STUDY/ PROGRAMA MUNICIPAL DE ORDENAMIENTO Y DESARROLLO URBANO

The Municipal Program of Territorial Planning and Urban Development of Nuevo Laredo-2030 (PMOTDU NLD-30) is the instrument that defines section LXIV of article 4 of the State Law on Human Settlements Territorial Planning and Urban Development of the State of Tamaulipas (LAHOTDU-Tamaulipas) and that is the normative instrument that defines urban land use policies and strategies, growth, conservation, improvement, and planning in the municipal territory.

In 2017, through the Nuevo Laredo Secretariat of Economic Development, the Holistic Vision Model was developed to promote the Economic and Social Development of Nuevo Laredo, Tamaulipas; with which a "Navigation Charter" is defined to enhance the economic and social development of Nuevo Laredo through the development of industrial-logistics infrastructure and services, as an enhancer of the logistics platform of the municipality, as well as the strengthening of existing infrastructures, which serve as an engine for attracting investments and which in turn consolidate NLD as a business destination with a better quality of life , through the involvement, articulation and joint work of the public, private and civil society sectors.

The Holistic Planning document identified six strategic goals that start from the current productive vocations of the municipality, such as manufacturing industries (mainly maquiladoras), transport and storage services (mainly freight transport and customs services), and trade (mainly retail trade), which totaled almost 80% of municipal GDP in 2014; and in which they must be the new competitive advantages to be promoted, that accompany and articulate with the existing ones to promote the sustainable and sustainable integral development of Nuevo Laredo, which are: the logistics and industrial infrastructure, the value services (essentially medical and business tourism) and the energy platform. *Source [Programa Municipal de Ordenamiento Territorial y Desarrollo Urbano de Nuevo Laredo, Tamaulipas -2030, Sep 2019]*

Stakeholder Meetings

This section summarizes stakeholder outreach activities that were conducted as part of the 2020 City of Laredo Bridge Master Plan. Since the 2020 BMP study was done during the pandemic, there were several meetings conducted virtually however there were other in-person meetings as noted below.

The goals of the project were top-of-mind for every decision made, and the engagement activities selected reflected and reinforced the related project goals.

1. Encourage binational coordination.
2. Expand outreach to private-sector, Federal, State, and local stake holders.
3. Encourage communication with the S&B team on any related issues or concerns in regard to the border master study.
4. Identify and address City of Laredo impacts of cross border travel for pedestrian, passenger, and commercial vehicles in the region.

The following is a summary of the issues discussed during the meetings:

1. US Custom Brokers – Nick Laurel, March 11, 2021

During the presentation, the primary focus of the concerns raised were about connectivity between the parks and IH 35. One specific project mentioned was the realignment of Killam Industrial Blvd to the bridge at Tres Equis. This idea arose from the potential of closing the Mines Road exit from World Trade Bridge. This would direct all traffic east on Loop 20 to IH 35. From there the commercial vehicles could travel North and enter the industrial parks from the East. Currently all commercial vehicles entering the parks along Mines Road travel down Mines Road. Redirecting inbound traffic to IH 35 would alleviate some of the demand on Mines Road.

Moving forward they would like to see priority given to the connection at Vallecillo Road. This connection point would help with the level of service for Mines Road. Additionally, there were concerns brought up about CBP's decision to move empty loads to Colombia Bridge. This has had an impact of available transfer commercial vehicles moving product across the border. This lack of commercial vehicles to transfer loads across the border has led to delays in the import/export process and additional costs.

When discussing the underutilization of Colombia bridge, the US Custom Brokers felt that they could not envision a scenario that would increase the utilization of Colombia Bridge. The infrastructure on the Mexico side, as well as the additional fuel costs deter most brokers from using Colombia Bridge. General operational issues with the Port of Laredo.

2. Mexico Custom Brokers - March 11, 2021

Limit of Ports of Entry - Each Mexico Custom Broker has a limit on the ports that they can use for crossing product. When referencing the Mexico Custom Brokers Associations website, there are approximately 223 the number of Brokers that can use Port of Laredo as opposed to the Port of Colombia. This limits the number of loads that can be sent to Colombia.

3. Laredo Motor Carriers Association – Noe Montes, March 11, 2021

Companies represented during the call had trucking companies in both Mexico and the US. They spoke about their desire for more connectivity to IH 35. When the idea of improvements to Las Tiendas road was brought up, they did not feel that would be very successful since so much traffic goes to Mile Marker 13.

With the discussion of Bridge 4/5, their issue was not with having an additional bridge but the location of the bridge. They felt that the distance between the current industrial parks and the new bridge would be the same as the distance to Colombia Bridge and they felt the same thing would happen to that proposed bridge.

They suggested a new bridge but along FM 1472 so that it would have better proximity to the existing warehouse developments.

A. B-1 visitors for business drivers

Those drivers from Mexico with B-1 licenses have seen a rise in recent years. These drivers were primarily the drivers that moved loads across the border to brokers' warehouses. As more trucking companies recruit these drivers to move the product from Mexico to its final destination, it leaves this area with less drivers available to transfer trailers across the border.

It was also stated that the requirements for B-1 drivers would prevent many from applying. This is primarily due to the English requirements. The group felt that the promotion of B-1 Drivers would allow for more truck loads to cross the border into Laredo and head directly to its final destination without having to stop in a Laredo Transfer Warehouse to switch to load to an Over the Road Driver.

Also, trucking companies move to hire more B-1 visa drivers since they do not have a Texas Commercial Driver's License, are paid less.

Laredo US Broker and Laredo Motor Carriers comments:

- They do not like the CBP empty truck Pilot program because it makes it for them more complicated to get driver. Because with the new set-up they just want to go loaded.
- Drivers avoid Colombia Bridge (especially empty) because of the DOT inspection. They have less commercial vehicles going through Colombia Bridge and that is why they get revised more often.
- They see it very difficult to change the situation for Colombia Bridge because at the end the client pays the shipment, and they just go with the price.
- The Bridge 4/5 in the south of the City of Laredo was not seen as a very good option, because it will increase the travel distance. They prefer a new Bridge between Colombia Bridge and World Trade Bridge.
- They would support a direct connection from IH-35 to Killam Blvd. Access from east getting to the Industrial Parks from the WTB and using IH-35 instead of Mines Road.

4. TxDOT – Mr. Roberto Rodriguez, P.E. Planning Director – TxDOT Laredo District March 11, 2021

During this meeting Roberto gave the current timeframes on projects that would affect this study. He gave us feedback as to which projects were funded or not, as well as the district desire to accelerate some of the projects on the list.

5. CBP – Mr. Armando Taboada, Jr., Assistant Director of Field Operation – May 10, 2021

- The CBP Pilot program does not permit to cross empty commercial vehicles at the WTB, the exemptions are empty commercial vehicles that are CTPAT or FAST.
- Due to the CBP empty truck Pilot program around 1,200 vehicles moved from using the WTB and crossed the U.S. Mexico Border at Colombia Bridge in the NB direction.
- In terms of vehicle crossings, Colombia is with this change close to the NB crossings that are observed at Pharr International Bridge (around 2,200 commercial vehicles a day NB at Pharr).
- Due to the CBP Empty Truck Pilot Program, the waiting times decreased significantly at the WTB.
- Mr. Taboada claimed that because of the success of the Pilot Program, the CBP officers could confiscate more "illegal" shipments in the 5 months of the actual year than in the whole last year.
- Mr. Taboada says that the maximum capacity of the WTB is around 8,500 commercial vehicles per day.
- The CBP Empty Pilot Program is set until September of this year and then will be expanded. Perhaps it can be also established permanently in the next phase.
- Mr. Taboada has not received any official complaint about the WTB Empty Truck pilot program, but he has received positive feedback from several companies that operate at the border.
- Mr. Taboada sees the direct access to the Killam Blvd. as valid options for commercial vehicles coming from the WTB and want to access the Killam industrial Park.
- Mr. Taboada showed us the waiting time page from TTI, and he thinks of it as an independent source of information.
- The CBP does not want to move any buildings from WTB facility because these buildings are required for CBP operation.
- Mr. Taboada mentioned the expansion that is currently underway for the WTB exit lanes at I69.
- On Bridge 4/5 he mentioned that he would like to see better utilization of the Colombia bridge first.

6. ALFA – Mr. Gonzalo Prida, President and Mr. Arturo Dominguez (ALFA member) – May 20, 2021

- The biggest concern for the industry is time and cost.
- The empty commercial vehicles being sent to Colombia is affecting them negatively – they said that 2000 commercial vehicles are being sent to Colombia daily.
- Mentioned that they have talked to a lot of people on different agencies and there is no response to their concerns. There was no communication from authorities (CBP) when they made the move to send the empty commercial vehicles to Colombia.

- They are in favor of Bridge 4/5 in south Laredo. Anything that is going to help them address the 5% annual commercial growth in Laredo will be welcomed.
- The connection of FM 1472 to Eagle Pass will benefit Laredo by taking traffic from IH 35. This connection will be part of the Port to Plains corridor.
- They are in favor of the use of more technology at the POEs for processing cargo.
- They mentioned the new FAST LANE relocation project currently underway.
- They want to see more exit booths to help expedite crossing time.

7. CBP – Mr. Eugene Crawford – Laredo Deputy Port Director and Mrs. Margarita Garza, Chief of Staff – May 20, 2021
    - Bridge facilities were recently renovated. Bridge I will now serve as the SENTRI Lane permanently. It used to be located at Bridge II.
    - Bridge I – Pedestrian improvements along with a new bike lane. Updated 4 inspections booths. They expanded the pedestrian booths from 4 to 14.
    - Bridge II – They have new area to process the buses. They are now separate from the passenger cars. They have the permanent x-ray scanners for both buses and passenger cars.
    - Mentioned that the congestion at the four block area – outside of the POE facility – affects their operation during high-peak season travel. Need to look at ways to improve the traffic signal system to expedite relief.
    - There is no more room to grow. Facilities at both bridges are landlocked.
    - 60% reduction on crossings overall for both pedestrians and passenger vehicles due to the pandemic.
    - On Bridge 4/5. He mentioned that he would like to see better utilization of Colombia bridge first. He understands that the project takes about 10 – 12 years to materialize. If we design, he said, build the lanes it to accommodate the proposed pedestrian, POV, and commercial traffic expected.
8. RMA – Mr. Jed Brown, Chairman and Mrs. Melissa D. Montemayor, VP-Group Director-Roadway Engineering at HNTB – May 20, 2021
    - Vallecillo is the number one (1) project on their list – they are trying to secure $17.5 Million. Meeting with Chairman Bugg form the Texas Transportation Commission to discuss funding. The City of Laredo and Killam Corporation are contributing to the project.
    - Mentioned the upcoming new right turn lane project at Killam and FM 1472 (NE quadrant). Project has let and will begin construction in June 2021.
    - They discussed the North Laredo Webb – County Transportation Planning Study. Discussed all the projects they have listed on their study.
    - The RMA supports a new Bridge in south Laredo. They see the need for a future bridge.

9. City of Laredo – Ms. Vanessa Guerra, Planner IV, Planning and Zoning, and Mrs. Graciela S. Briones, MPO Planner, and Mr. Juan Mendive, Interim MPO Director - June 1, 2021

- The S&B Team provided an overview of the City of Laredo bridge system master plan.
- The plan is to optimize the existing Laredo bridge system as a whole.
- Evaluate more alternatives based on a traffic demand model developed for Laredo and Nuevo Laredo.
- Ms. Guerra asked about the Travel Demand model – the model has been updated for this study.
- Ms. Guerra asked about the findings or recommendations of the study for the short-term, medium-range and long-range timeframe. How are we going to fix the problem?
- Ms. Guerra mentioned that TxDOT / TTI is looking at long term studies in the FM 1472 area.
- Ms. Guerra asked about status of the bridge master plan.
- Ms. Guerra asked for us to check the LOS along FM 1472.
- Ms. Guerra likes the option of a direct connection from World Trade Bridge to the Killam Industrial Park and the Milo Industrial area through IH 35.
- Mr. Mendive mentioned the upcoming project that includes building overpasses along Loop 20 and how that is going to help with the traffic operations.
- Mr. Mendive mentioned that the Hachar-Reuthinger is already programmed. The Hachar overpass is not programmed. It is not on the TIP. Juan mentioned that the project could be programmed on the next TIP revision.
- Las Tiendas road may help in the future for the development of industrial parks and for future warehouses.
- Asked if we have looked at the Ports to Plain corridor and future connection to FM 1472. We will be looking at that alternative in our study.
- Mr. Mendive - Look at riverbank road as a relief route to get passenger vehicle cars out of the Mines Rd.
- Mr. Mendive – The incorporation of bike lanes is very important to the community. There is a great community of bikers in the area.
- There are a lot of bikers using Bridge I every day.
- Bridge I renovation provides a dedicated lane for bikes.
- There are various bike clubs that use FM 1472 to ride to the Colombia Bridge.
- MPO want to provide bike lanes in areas outside of truck routes.

SECTION III: EXISTING SYSTEM MODEL

INFRASTRUCTURE

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

CHAPTER 1: INTRODUCTION

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

SECTION III: EXISTING SYSTEM MODEL

Chapter 1: INTRODUCTION

S&B Infrastructure, Ltd. (S&B) and C&M Associates, Inc. (C&M) are supporting the City of Laredo in developing the Laredo International Bridge System Master Plan. As part of the S&B project team (The team), C&M developed a traffic model and forecasted traffic and revenue (T&R) for a 20-year period to assist the City of Laredo in programming future infrastructure improvements. This report presents C&M's traffic analysis and provides projected traffic trends and performance measures for the four international bridges. The results of this analysis aim to support the City of Laredo in planning for the infrastructure required to efficiently process pedestrian, non-commercial, and commercial traffic traveling to and from Mexico and the United States.

1.1 Project Background and Description

Incorporated in 1755 and located on the north bank of the Rio Grande River in Webb County, Texas, the City of Laredo is the largest inland port, the second largest port of entry (POE), and the third largest Customs District Area in the United States.[1] The city owns, maintains, and operates four international bridges that connect to two States in Mexico: Tamaulipas and Nuevo Leon (see Figure 1-1). Its location in the center of several trade routes makes the City strategically positioned for international trade between Canada, the United States, and Mexico.

In addition to commercial traffic, workers, students, and shoppers cross the U.S./Mexico border daily. Within the Laredo border region, it is common for workers to live on one side of the border and work on the other. Students from universities on both sides of the border cross the Webb County/Nuevo Laredo border on a daily basis. Lower cost of living and/or lower education costs contribute to these daily border crossings. The shopping malls (e.g., Mall del Norte) and other points of interest in Laredo are popular destinations for shoppers and tourists from Mexico, attracting visitors not only from the border cities but also from the Monterey Metropolitan area, one of the largest urban areas in north Mexico. Additionally, many persons travel from Laredo to Nuevo Laredo to visit restaurants or seek medical treatment.

The Laredo International Bridge System Master Plan—i.e., the Laredo Bridge Master Plan (BMP)—consists of streamlining the four existing international bridges/POEs relevant to the City of Laredo and Webb County:

- The Laredo–Colombia Solidarity International Bridge
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The goal of the Laredo BMP is to reduce waiting times through expansions, conversions, and/or upgrades to maximize crossings. Each bridge is to be optimized for the maximum number of crossings by diverting traffic between bridges, if applicable. Furthermore, the Laredo BMP is intended to optimize the existing Webb County

POE system to assess the conditions, infrastructure, operational efficiency, and compliance with statutory requirements.

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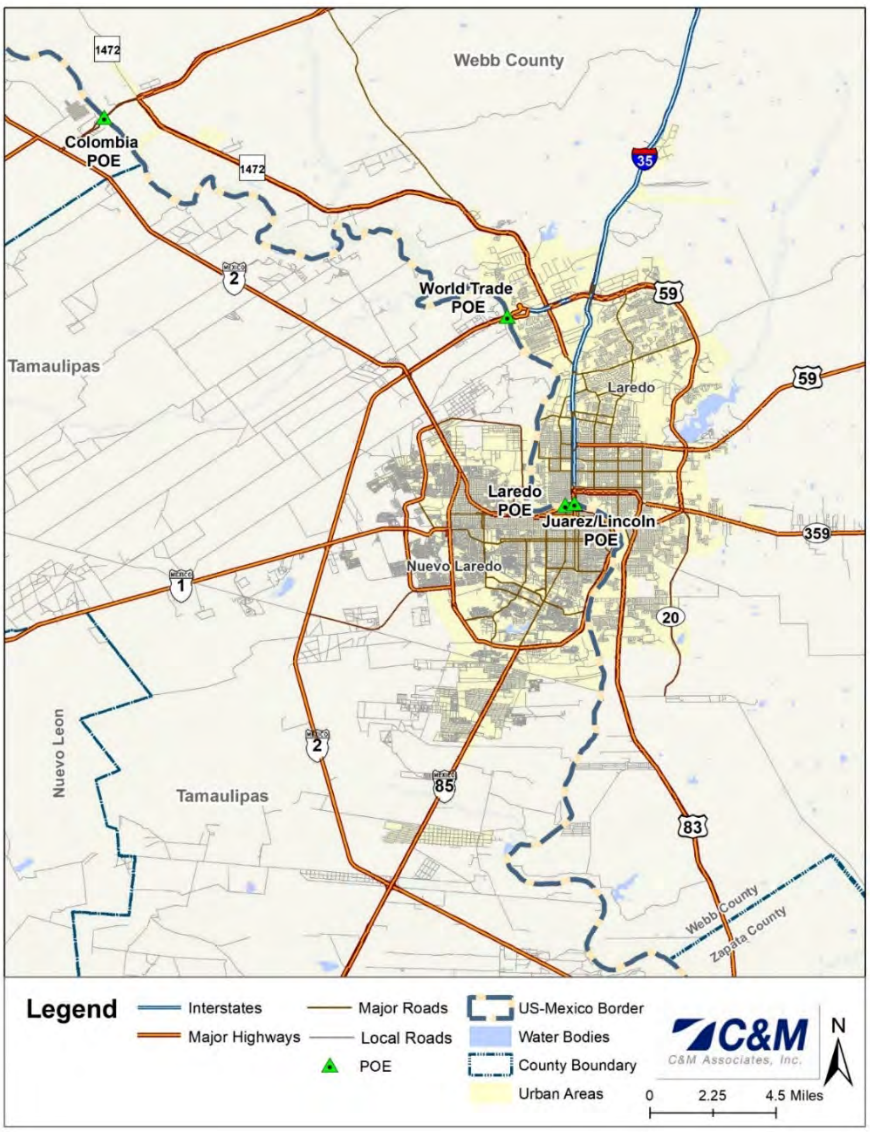


Figure 1-1. Project Location and Existing POEs

1.2. Study Area

As shown in Figure 1-2, the study area for the traffic analysis comprises Webb County on the U.S. side of the border (with a focus on the City of Laredo) and Nuevo Laredo on the Mexico side of the border. The location of the Laredo International Bridge System, in combination with the economic opportunities offered by USMCA, strategically sets, and make this one of the most dynamic areas in the United States in terms of economic growth. Moreover, with the USMCA, the number of commercial vehicle crossings is expected to exhibit a growth spurt. Due to the popularity of industrial and retail centers in Webb County, the Laredo International Bridge System is the region's most attractive route for commercial vehicles, with roughly 40 percent of all U.S./Mexico border crossing commercial vehicle traffic using Laredo international bridges.[3]

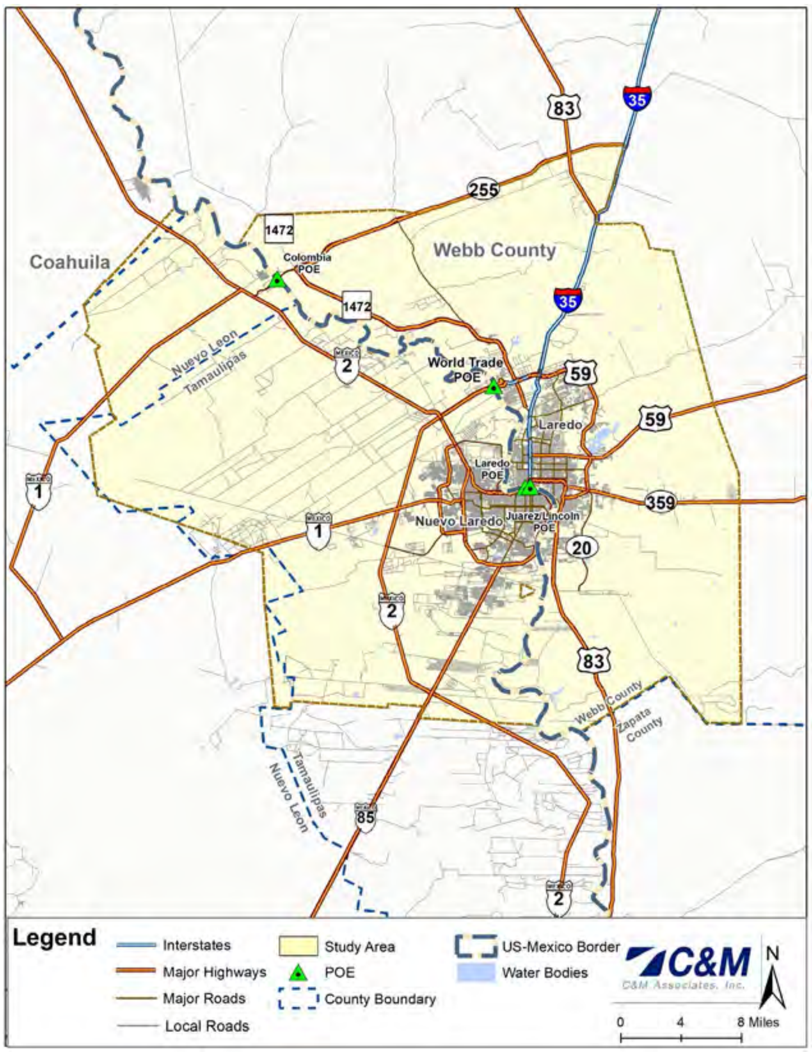


Figure 1-2. Project Study Area

1.3. Study Details

The Laredo BMP Study comprises the following tasks:

1. Project Management/Mobilization
2. Data Collection/ Assessments of existing assets
3. Development of Traffic Model/Forecast
    a. Review of Existing Information
    b. Field Work/Surveys
    c. Socioeconomic Data Review
    d. Border Demand Forecast
    e. Travel Demand Model
    f. Traffic and Revenue Forecast
4. Development of Options
5. Evaluation of Options
6. Action Plan – Report

C&M is responsible for Task 3 and is supporting the S&B project team in the remaining tasks by providing model results to aid in developing and evaluating potential bridge system improvement options. This report documents the efforts summarized under Task 3.

The primary aim of the Laredo BMP Study is to produce several alternative option forecasts to support the City of Laredo in their effort to optimize traffic distribution to better accommodate and facilitate northbound commercial vehicles and border crossings. Given the continuing demographic growth within the study area, strategically planning infrastructure to serve future demand is essential to ensuring a competitive transportation network favoring regional economic growth. The present traffic analysis contributes to this effort and aides the decision-making process by providing modeled options for the Laredo BMP over a 20-year period while considering the region's competing and contributing infrastructure and existing and future international bridges.

For its modeling approach, the S&B team considered the following: existing information (including historical traffic and border crossings within the study area, historical shipment data, border-crossing delays, and previously developed traffic forecasts); field observations and data (including origin-destination [OD] data); and historical, current, and projected socioeconomic data.

The U.S. is the top-ranked destination for Mexican exports, while Mexico is the second-ranked destination for U.S. exports. Truck crossing volumes through the Laredo International Bridge System are a function of the U.S./Mexico and Texas/Mexico bilateral trade and the underlying economic activity of these two countries. The S&B team analyzed the historical and future trends of key economic variables to develop econometric models, which forecast the regional traffic demand for all crossing types (commercial vehicles, passenger vehicles, and pedestrians) for a forecast period of 2021 to 2040.

A key component of the S&B team's traffic analysis is the development of a Binational Assignment Model to properly model border-crossing traffic, which involved incorporating U.S.-based and Mexico-based travel demand models (TDM). The team developed a four-step TDM for the City of Nuevo Laredo to use in combination with an existing TDM for the Laredo Metropolitan Planning Organization (MPO) area to develop the Binational Assignment Model in the TransCAD 7.0 platform. The team evaluated all four TDM steps based on current transportation data, observed traffic patterns within the study area, and expected future road network improvements. The Binational Assignment Model was calibrated to existing traffic conditions within the study area and used to develop traffic forecasts for 2021 and 2040.

Additionally, in each of the binational model runs, the team included a discrete event simulation (DES) of the corresponding POE's operations to obtain waiting time, queue length, crossing time, and the number of vehicles in the queue. The operational POE simulation provides results for evaluating and characterizing each proposed alternative for optimizing the Laredo International Bridge System (for the results of the team's analysis of alternatives, please see Appendix A).

1.4. Organization of the Report

The remainder of this report is organized as follows:

- Chapter 2 presents a summary and analysis of existing information relevant to the traffic analysis, including field data previously collected by the team within the study area.
- Chapter 3 presents a summary and analysis of the socioeconomic data relevant to model development.
- Chapter 4 presents The Team's econometric modeling procedure, including the model's independent variables, the details of the model, and the demand forecast results for the Laredo International Bridge System.
- Chapter 5 presents the team's travel demand modeling methodology and calibration/validation results.
- Chapter 6 presents the team's POE operation simulation methodology and calibration/validation results; and
- Chapter 7 presents C&M's traffic analysis assumptions and results for each of the international bridges and for each bridge system alternative.

CHAPTER 2: EXISTING INFORMATION

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

Chapter 2: Existing Information

This chapter presents an overview of existing traffic-related data corresponding to the study area, including historical traffic of the existing international bridges, historical shipment data, border-crossing delays, border traffic trends, border policies, and the impact of the COVID-19 pandemic on border crossings. This chapter also presents field data previously collected by the S&B team within the study area, including OD surveys, vehicle intercept surveys, and analysis of a commercial Mexican Customs manifest.

As is demonstrated throughout this chapter, border-crossing forecasts depend on several factors and are not solely driven by quantitative variables like travel times and costs. Regulations, load types, business sectors, and POE characteristics, among other qualitative measurements, must be considered to accurately estimate border-crossing volumes.

2.1. Stakeholder Input

To assess the present study's existing data needs, the S&B team contacted the following project stakeholders on both sides of the border:

- City of Laredo
- Laredo MPO
- CBP, Field Operations
- CBP, Port Director
- U.S. Customs Brokers
- MEX Customs Brokers
- Alfa Group (MEXICO)
- Webb County-City of Laredo RMA
- Laredo Motor Carriers Association
- TxDOT Laredo District
- Texas Freight and Border Trade Advisory Committee
- Secretaría de Comunicaciones y Transportes (SCT)
- Delegación de Nuevo Laredo de la Cámara Nacional del Autotransporte de Carga (CANACAR)
- Municipality Nuevo Laredo
- Asociación de Agentes Aduanales de Nuevo Laredo
- Servicio de Administración Tributaria (SAT)

The S&B team compiled the obtained existing information in a database to use in the modeling procedures (see Chapters 4 and 5).

2.2. Study Area Road Network

A thorough understanding of the study area's major roadway network is vital to evaluating the Laredo International Bridge System, as the performance of the system will be impacted by the surrounding network. The S&B team identified the roadway network and assessed both the existing and future capacities of its facilities. Figure 1-1 shows the major roadways that impact the international bridge system within the binational study area.

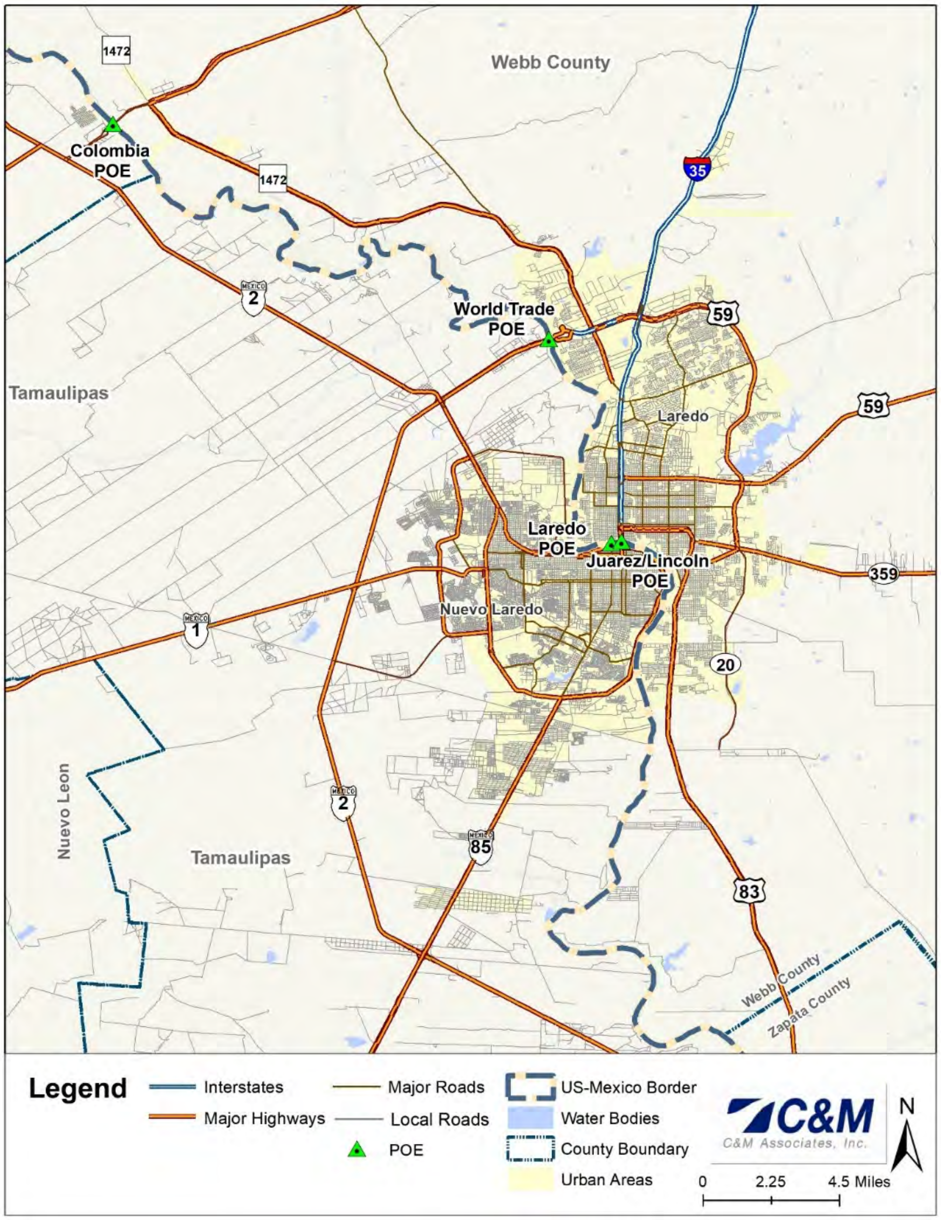


Figure 2-1. Study Area Roadway Network

Interstate 35 (IH-35)

IH-35 is a major north–south interstate highway. Its southern terminus is in Laredo, Texas and connects to the Juarez–Lincoln International Bridge. Its northern terminus is in Duluth, Minnesota near Canada (roughly 150 miles from the U.S./Canada border). In addition to the Dallas–Fort Worth and Minneapolis–Saint Paul metropolitan areas, other major cities along the IH-35 corridor include—from south to north—San Antonio, Austin, Oklahoma City, Wichita, Kansas City, and Des Moines.

Within the study area, IH-35 functions as an expressway with overpasses, frontage roads, and entrance and exit ramps at major crossroads. The highway has a posted speed of 75 mph, which decreases within the urban area of Laredo. From US 59, the speed limit ranges from 50 to 65mph until Park Street and is 50 mph between Park Street and Moctezuma Street, then decreases to 35 mph until the International Bridge Juarez-Lincoln.

Figure 2-2 presents annual average daily traffic (AADT) volumes at both ends of IH-35 within Webb County and near its interchange with SH 39 from 2013 to 2019. As expected, traffic increases with proximity to the interchange. From 2013 to 2019, traffic exhibited a compound annual growth rate (CAGR) of about -1.2 percent near the more populated areas north of Jefferson and about 3.9 north of SH 83.

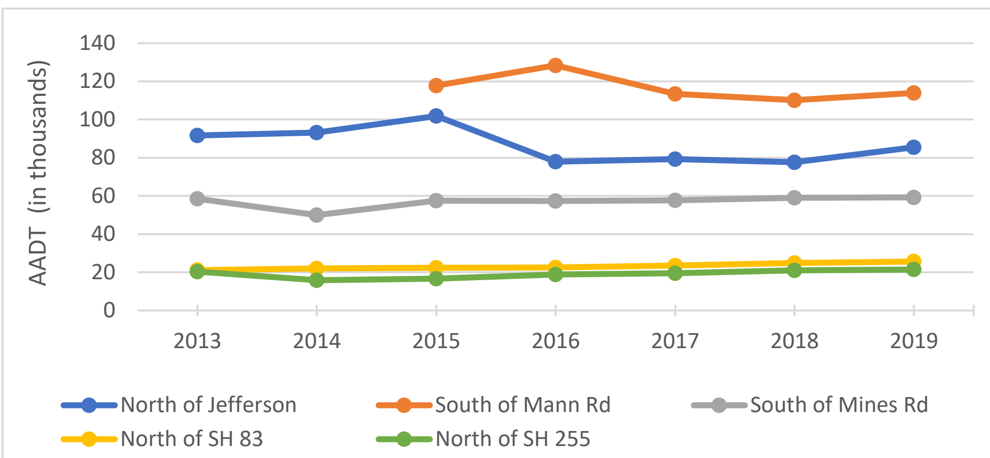


Figure 2-2. I-35 AADT at Selected Locations, 2013–2019

Mexico Federal Highway 85 (MEX 85)

MEX 85 connects Mexico City with the U.S./Mexico border at the city of Nuevo Laredo, Tamaulipas. Several cities are located along MEX 85, including Monterrey, Nuevo León; Ciudad Victoria, Tamaulipas; Ciudad Valles, San Luis Potosí; and Pachuca, Hidalgo. MEX 85 is the original route of the Pan-American Highway—from the border to the capital—as well as the Inter-American Highway, which spans 3,400 miles between Nuevo Laredo, Mexico, and Panama City, Panama.

The majority of MEX 85 in the States of Tamaulipas and Nuevo Leon is at freeway grade with a speed limit of 68 mph at the interstate sections and 25–37 mph in urban areas. In the State of Nuevo León, MEX 85 has a tolled facility, MEX 85D, that allows users to travel a faster/direct path between Nuevo Laredo and Monterrey.

Figure 2-3 presents historical AADT volumes along MEX 85 from 2010 to 2019. As shown, traffic exhibited a CAGR of about 10 percent near the more populated areas South of Valle Elizondo and about 18 percent south of Loop Nuevo Laredo.

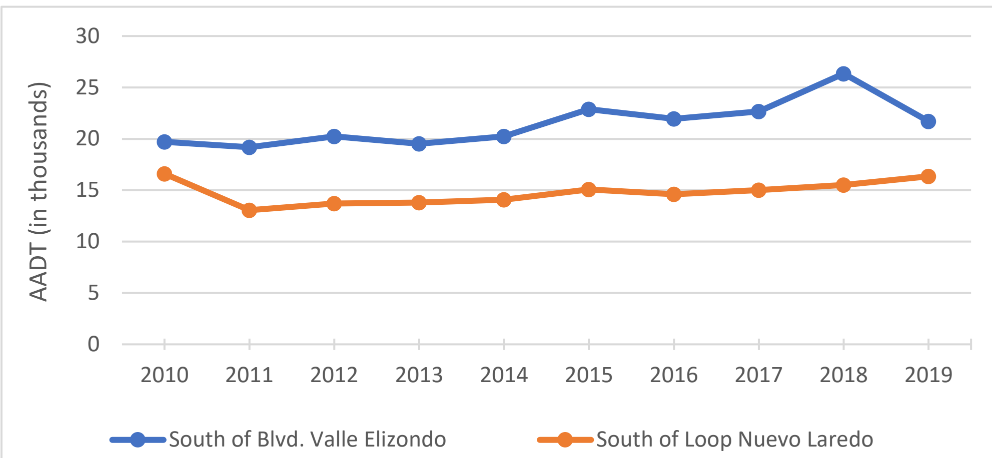


Figure 2-3. MEX 85 AADT at Selected Locations, 2010–2019

Mexico Federal Highway 2 (MEX 2)

MEX 2 runs parallel to the U.S./Mexico border. The highway starts in the west at Tijuana, Baja California and ends in the east in Matamoros, Tamaulipas. MEX 2 passes through the border states of Baja California, Sonora, Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas. It has a total length of 1,220 miles. Its alignment is continuous along the U.S./Mexico border, except for one segment between El Porvenir, Chihuahua and Ciudad Acuña, Coahuila. In Nuevo Laredo, MEX 2 serves as a western loop around the urban area of Nuevo Laredo (Libramiento Nuevo Laredo II) and connects the World Trade POE access roads with MEX 85 to the metropolitan area of Monterrey. Additionally, MEX 2 connects to all U.S./Mexico POEs, with the exception of the international bridge between Ojinaga, Chihuahua and Presidio, Texas.

The majority of MEX 2's alignment is located within a zone where foreign vehicles are not required to have a temporary import permit (30 kilometers along the border within Mexico territory). This means that anyone can drive directly from the United States with a U.S. licensed car on MEX 2 without further permits. MEX 2 has a speed limit ranging from 44 to 62 mph along the described segments.

Figure 2-4, presents AADT from 2010 to 2019 at selected locations on MEX 2.

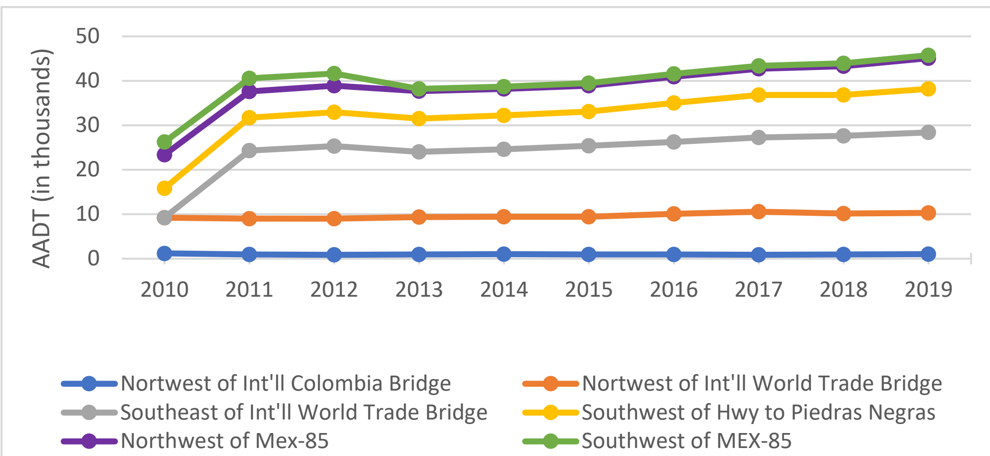


Figure 2-4. MEX 2 AADT at Selected Locations, 2010–2019

Texas State Highway Loop 20 (Loop 20)

Loop 20 encircles the area east of Laredo. Loop 20 is also known as the “Bob Bullock Loop” and “Cuatro Vientos Road” and extends from the World Trade International Bridge in the north to Mangana-Hein Road in the south. It has a speed limit of 45 mph. In recent years, there have been several new urban developments within the City of Laredo accessible by Loop 20. Some include the construction of new passenger terminals at the Laredo International Airport, the Laredo Energy Arena, the new campus of Texas A&M International University, and Doctors Hospital. Additionally, most of the newly constructed warehouses in the City of Laredo are located along the northern part of Loop 20. The portion of Loop 20 east of IH-35 and west of the World Trade International Bridge is part of IH-69W.

As illustrated in Figure 2-5, the most significant changes in AADT on Loop 20 are observed place south of Sinatra Parkway with a CAGR of about 8 percent from 2015 to 2019.

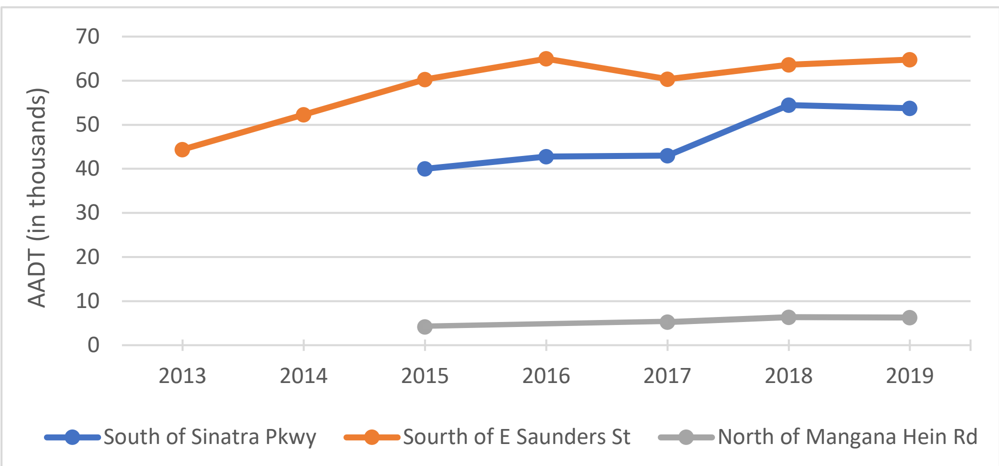


Figure 2-5. Loop 20 AADT at Selected Locations, 2013–2019

Interstate Highway 69W (IH-69W)

IH-69W is a proposed north–south interstate highway running through South Texas. IH-69W is planned to be extended 180 miles northeast to connect to the existing IH-69E in Brownsville, Texas. For its entire length, IH-69W is proposed to run concurrently with US 59 and Loop 20, with a speed limit of 60 mph.

The existing IH-69W is a relatively short segment (1.4 miles) running east–west through the northern part of Laredo. IH-69W begins at the World Trade International Bridge and ends at IH-35.

From 2013 to 2019, traffic on IH-69W exhibited a CAGR of about 10 percent near its interchange with IH-35, as illustrated in Figure 2-6.

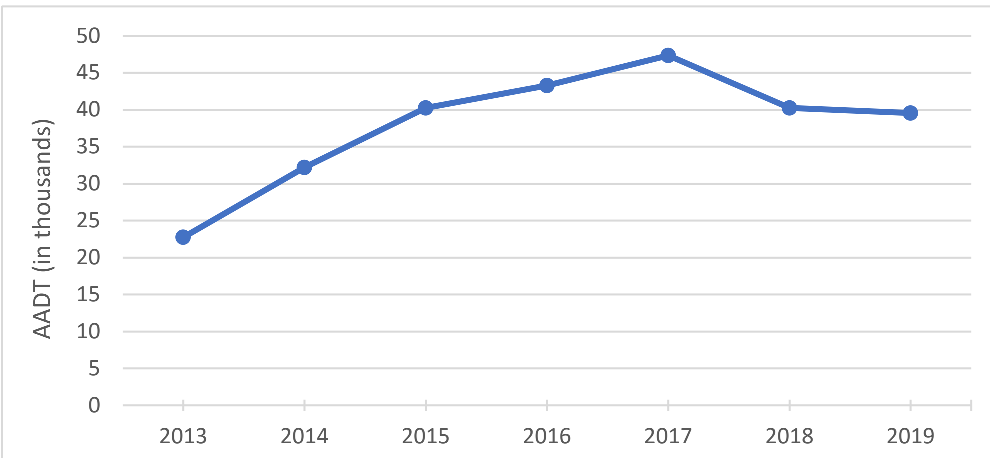


Figure 2-6. I-69W AADT West of I-35, 2013–2019

U.S. Route 59 (US 59)

US 59 is a north–south U.S. highway, but its trajectory is east–west in South Texas. US 59 is a border-to-border route with a length of 1,911 miles and a speed limit of 60 mph. It is part of the “NAFTA superhighway” and connects to Mexico and Canada.

The highway's northern terminus is 9 miles north of Lancaster, Minnesota at the U.S./Canada border, where it continues as Manitoba Highway 59. Its southern terminus is at the U.S./Mexico border in Laredo, Texas where it continues as MEX 85. US 59 connects Laredo with the sea POEs in the Houston and Corpus Christi areas. AADT on US 59 exhibited CAGRs of 10 percent in the southeast and 5 percent north of E Saunders from 2013 to 2019, as illustrated in Figure 2-7

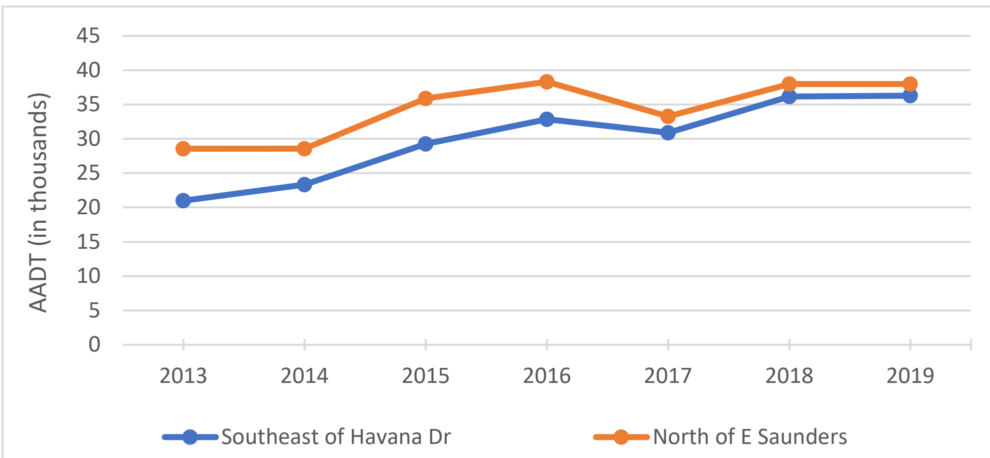


Figure 2-7. US 59 AADT at Selected Locations, 2013–2019

U.S. Route 83 (US 83)

US 83 is a major north–south U.S. highway located in the central United States with a length of 1,885 miles and a speed limit of 60 mph. In Laredo, from Riverhill Drive to Market Street, the speed limit changes to 45 mph and decreases to 40 mph until IH-35.

Its northern terminus is north of Westhope, North Dakota at the U.S./Canada border, where it continues as Manitoba Highway 83. The southern terminus is in Brownsville, Texas at the Veterans International Bridge on the U.S./Mexico border, connecting with both MEX 101 and MEX 180. In Laredo, US 83 crosses the city from north to south and functions as an urban highway.

Figure 2-8 presents historical AADT volumes at selected locations along US 83. As shown, south of Espejo Molina Road, an AADT of approximately 5,000 with a CAGR of -5 percent is observed. Within the urban zone, US 83 exhibited an AADTs of roughly 42,000 in 2019. The highest growth rate can be observed northwest of IH-35, with a CAGR of 4 percent.

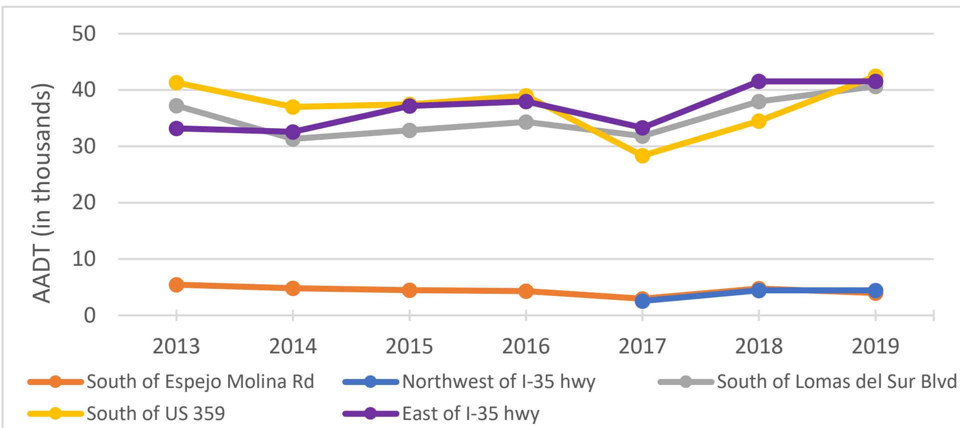


Figure 2-8. US 83 AADT at Selected Locations, 2013–2019

State Highway 359 (SH 359)

SH 359 is an east–west Texas State Highway that connects the city of Skidmore in southeastern Texas (near Corpus Christi) with Laredo at the U.S./Mexico border. SH 359 also connects the POEs in Laredo (connecting to Loop 20) with the sea POE in Corpus Christi. It has a speed limit of 55 mph in suburban areas and 45 mph in urban areas.

Close to the city and east of US 83, SH 359 exhibited modest AADT growth from 2013 to 2019 with a CAGR of 0.2 percent, whereas the AADT east of Loop 25 exhibited a CAGR of 4.5 percent.

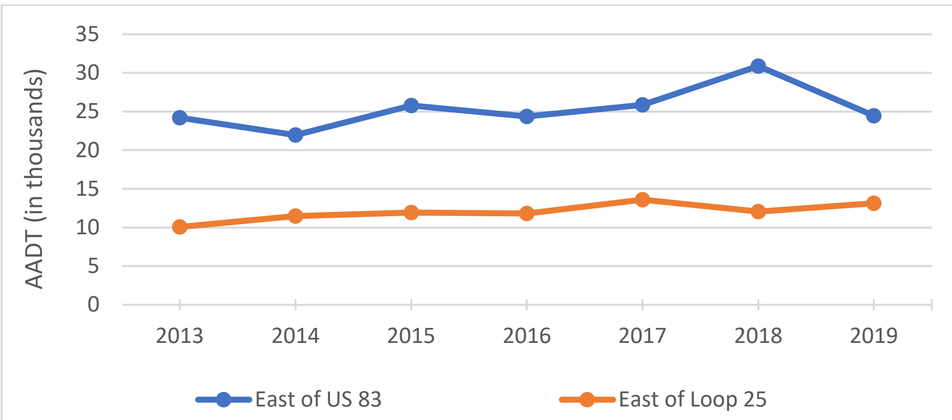


Figure 2-9 presents historical AADT volumes at both locations.

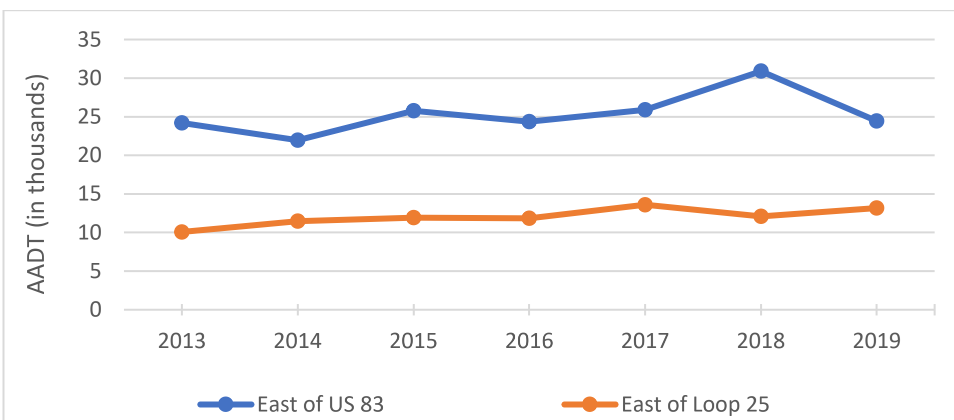


Figure 2-9. US 359 AADT at Selected Locations, 2013–2019

Farm-to-Market Road 1472 (FM 1472)

FM 1472 connects the largest warehousing/industrial area in Laredo, Texas with the commercial-vehicle-carrying POEs of Laredo, including the World Trade International Bridge. Its southern terminus is located at IH-35 Exit 4. After the Colombia–Solidarity International Bridge, it runs roughly parallel to the Rio Grande into rural Webb County. The portion of FM 1472 known as Mines Road is the most important connector between the commercial POEs of Laredo and the commercial warehouses and distribution centers in Laredo; it has a speed limit of 55 mph. Figure 2-10 presents historical AADT volumes at selected locations.

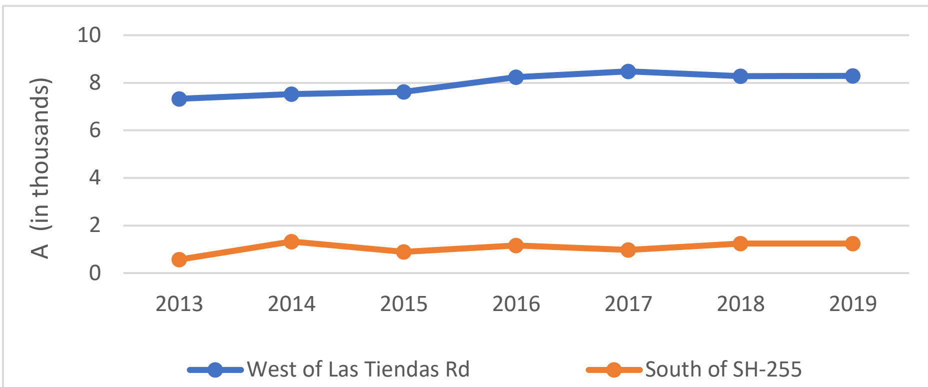


Figure 2-10. FM-1472 AADT at Selected Locations, 2013–2019

Existing Traffic Counts

S&B analyzed existing daily traffic count data within the study area network to calibrate the developed Binational Assignment Model (see Chapter 5) to existing conditions. The S&B team analyzed count data from 2019, as this was the most recent year for which comprehensive traffic data were available at the time this study was conducted. The AADT count locations are illustrated in Figure 2-11.

The sources of the traffic counts differed for the U.S. and Mexico portions of the binational road network. The Binational Assignment Model count data and their sources are presented in Table 2-1.

Table 2-1. Sources for Binational Assignment Model Traffic Volumes

Traffic Road Data	Source	Link
AADT, Mexico	SCT	http://www.sct.gob.mx/carreteras/direccion-general-de-servicios-tecnicos/datos-viales/
AADT, Texas, U.S.	TxDOT	http://txdot.ms2soft.com/tcds/tsearch.asp?loc=Txdot&mod=

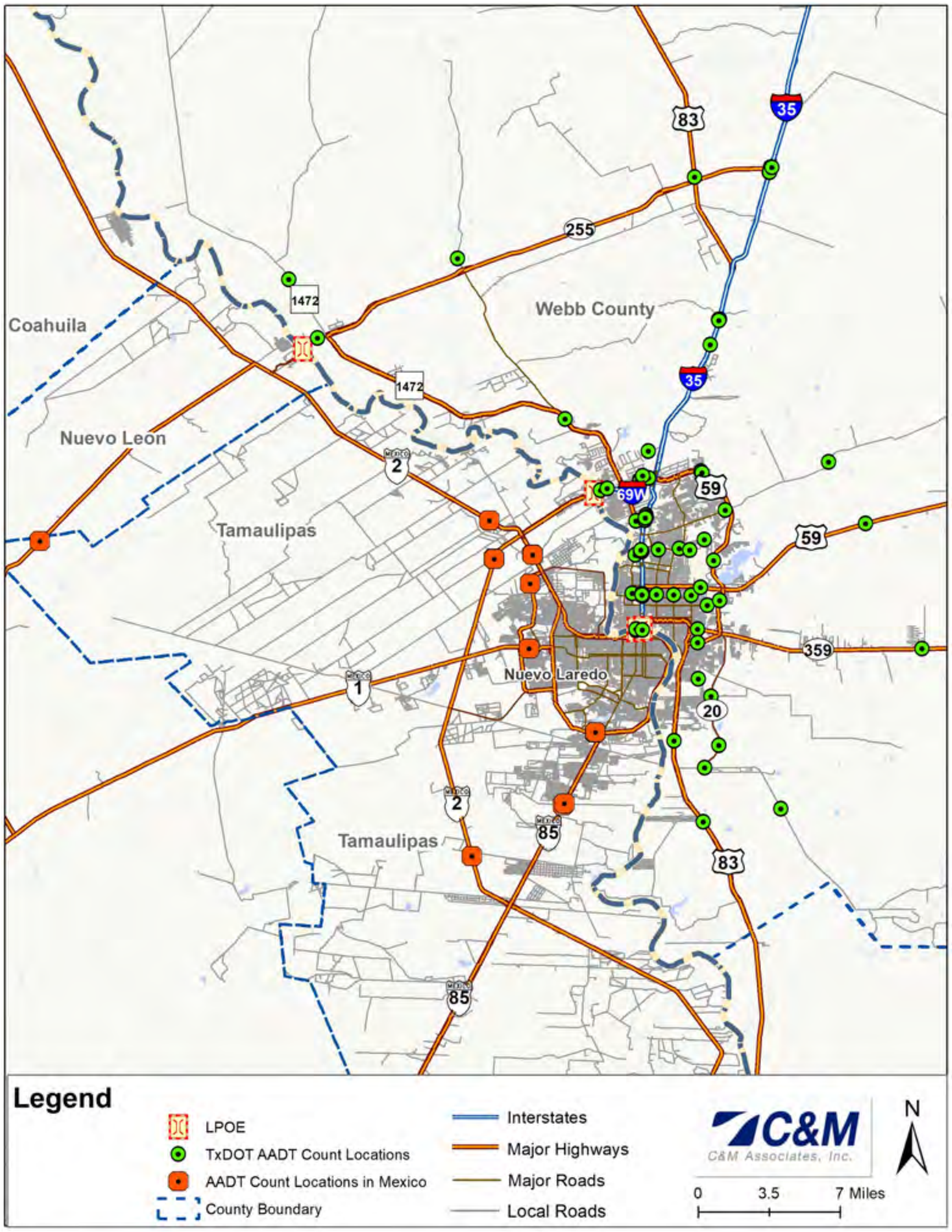


Figure 2-11. 2019 AADT Count Locations

Figure 2-12 presents the absolute change in AADT from 2013 to 2019 based on current available. As shown, the most significant changes in AADT from 2013 to 2019 are observed on I-2 and US 281 (north to south), with differences of over 5,000. In addition, several segments exhibited differences in AADT values of 3,000 to 5,000 (FM 493, FM 2557, and part of I-2 close to the city of Mission). US 281 (west to east), FM 495, and the I-2 segment between US 281 and FM 115 exhibited moderate AADT changes ranging from 1,000 to 3,000. The smallest AADT change (below 1,000) was observed on US 83 east of US 281 and the multiple arterials that run north–south and link US 83 and US 281.

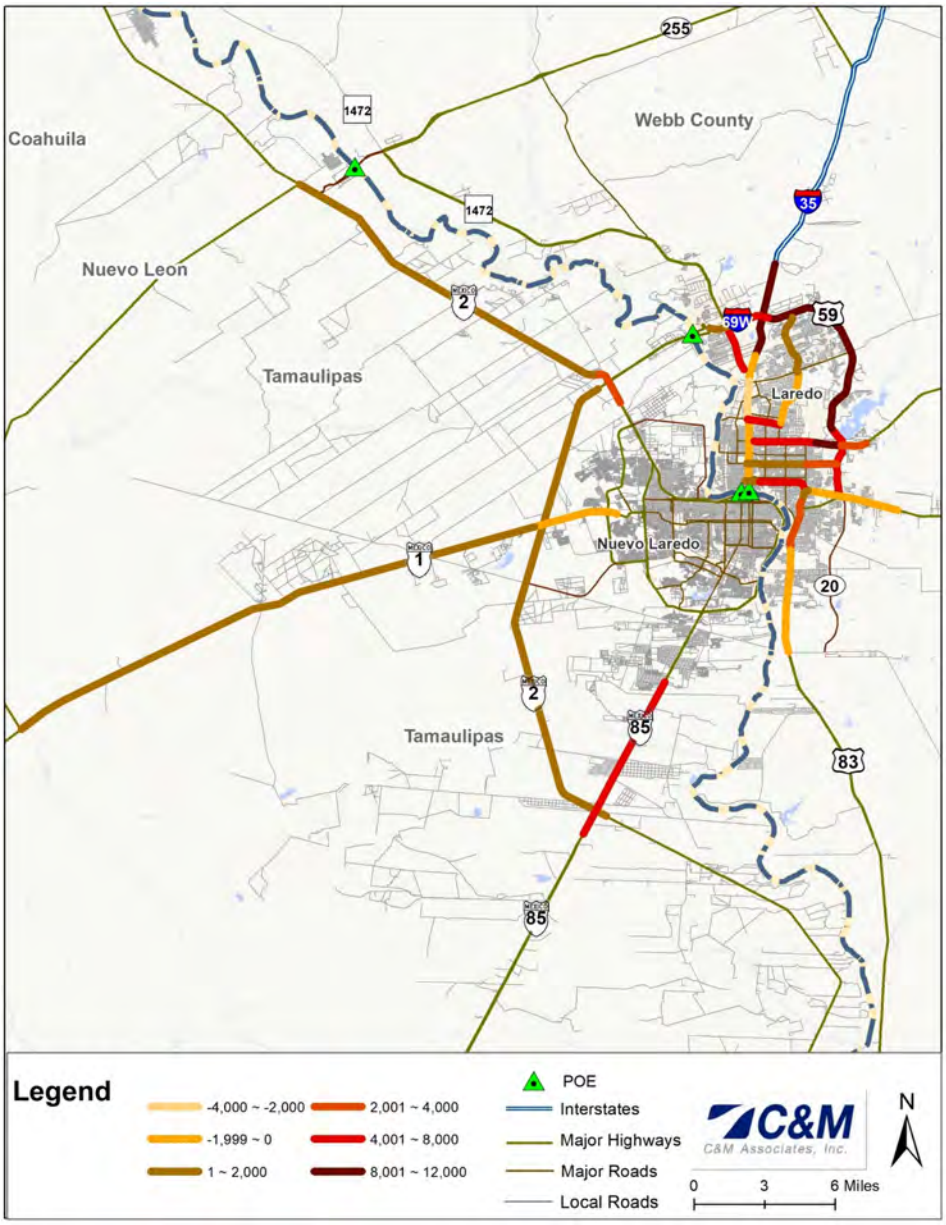


Figure 2-12. Change in AADT, 2013–2019

2.3. Laredo International Bridge System

There are four existing international bridges/POEs connecting the City of Laredo (Webb County) to the Cities of Nuevo Laredo (Tamaulipas) and Colombia (Nuevo Leon), thus providing access to retail, industrial, and educational centers on both sides of the border (see Figure 1-1). Information about each of these bridges—based on visits, interviews with stakeholders, and information obtained from TxDOT and the CBP—is summarized below.[4,5]

The **Juárez–Lincoln International Bridge** is owned by the City of Laredo and operated by the Laredo Bridge System on the U.S. side and owned by the Government of Mexico and operated by Caminos y Puentes Federales de Ingresos y Servicios Conexos (CAPUFE) on the Mexico side. It is locally referred to as Bridge #2, Laredo–Nuevo Laredo Bridge 2, Puente Juárez–Lincoln, or Laredo II. This eight-lane bridge opened to traffic on November 26, 1976. Travel is limited to passenger vehicles, pedestrians, and commercial buses. Secure Electronic Network for Travelers' Rapid Inspection (SENTRI) lanes were introduced at this POE in October 2006. The POE also offers Ready Lanes, which use Radio Frequency Identification (RFID) technology to facilitate the border-crossing process.

The Juárez-Lincoln POE is open 24 hours a day, 7 days a week and has 15 northbound passenger vehicle inspection lanes. On an average day in 2019, there were about four northbound SENTRI lanes, five Ready Lanes, and four standard lanes open. In the southbound direction, this POE has a capacity of five inspection lanes. On the U.S. side, the bridge links to IH-35 near US 83, which connects to US 59 and Loop 20. On the Mexico side, the bridge connects to MEX 85 and MEX 2.

The **Gateway to the Americas International Bridge** is owned by City of Laredo on the U.S. side and owned by the Government of Mexico and operated by CAPUFE on the Mexico side. It is locally referred to as Laredo International Bridge, Convent Street Bridge, Bridge #1, Old Bridge, Laredo–Nuevo Laredo Bridge 1, Puente Nuevo Laredo, Puente Laredo I, or Puente Viejo. The original bridge was destroyed by flooding in 1954 and reconstructed in 1956 as a four-lane bridge, and currently operates 24 hours a day for passenger vehicles and pedestrians. The Gateway to the Americas POE has four northbound and four southbound inspection lanes. On the U.S. side, the bridge links to Convent Avenue and Salinas Avenue and intersects with Matamoros Street and Houston Street, which connect to IH-35, US 83, and US 81. On the Mexico side, the bridge links to MEX 2, MEX 1, and MEX 85.

The **World Trade International Bridge** is locally referred to as Laredo North, Bridge 4, Laredo IV, Puente Internacional Nuevo Laredo III, or Puente del Comercio Mundial Nuevo Laredo III. This eight-lane bridge opened on April 15, 2000 and serves commercial vehicle traffic only. Its hours of operation are 8:00 a.m. to midnight Monday through Friday, 8:00 a.m. to 4:00 p.m. on Saturdays and 10:00 a.m. to 2:00 p.m. on Sundays. This commercial POE has 16 northbound and 18 southbound inspection lanes, including Free and Secure Trade (FAST) lanes which became operational in April 2004. On the U.S. side, the bridge links to Loop 20, near FM 1472 and IH-35. On the Mexico side, the bridge links to MEX 85 and MEX 2.

The **Laredo–Colombia Solidarity International Bridge** is locally referred to as Colombia Bridge, Puente Solidaridad, Puente Colombia, or Puente Internacional Solidaridad Colombia. This eight-lane bridge was completed on July 31, 1991 and serves passenger vehicles, commercial vehicles, and pedestrians. The bridge is open to passenger vehicles daily from 8:00 a.m. to midnight. For commercial vehicles, its hours of operation are 9:00 a.m. to 10:30 p.m. Monday through Friday and 10:00 a.m. to 4:00 p.m. on Saturdays. This POE has four inspection lanes for passenger vehicles and eight inspection lanes for commercial vehicles. On an average day in 2019, the POE opened one standard passenger vehicle lane, one SENTRI lane, and three commercial vehicle inspection lanes. In the southbound direction, there are four passenger vehicle inspection lanes and five commercial vehicle inspection lanes. The bridge links to FM 255 and FM 1472 on the U.S. side and to MEX 2 on the Mexico side.

2.4. Historical Border Crossings

Figure 2-13 through Figure 2-15 illustrate northbound border crossings to Webb County since 1995 by commercial vehicles, passenger vehicles, and pedestrians[1] based on data from the Bureau of Transportation Statistics (BTS).[6] The annual crossings for each vehicle type indicate unique trends, as described below. The volumes presented here represent the cumulative crossing volumes of all land POEs within the study area described in the previous section.

As shown in Figure 2-13, the greatest increase in Webb County northbound commercial vehicle crossings occurred in the years immediately following NAFTA's approval in 1994. Overall, commercial vehicle traffic continued to increase until 1999 by an average of 19 percent, whereas the sharpest decrease in traffic occurred from 2008 to 2009 during the Great Recession. After 2009, northbound commercial vehicle crossings returned to a moderate growth rate. The observed growth over the last few years is primarily attributed to increases in steel, metal, and machinery imports, which is discussed in Section 2.6. Overall, the growth rate for commercial vehicle crossings between 2009 and 2019 is 5.5 percent.

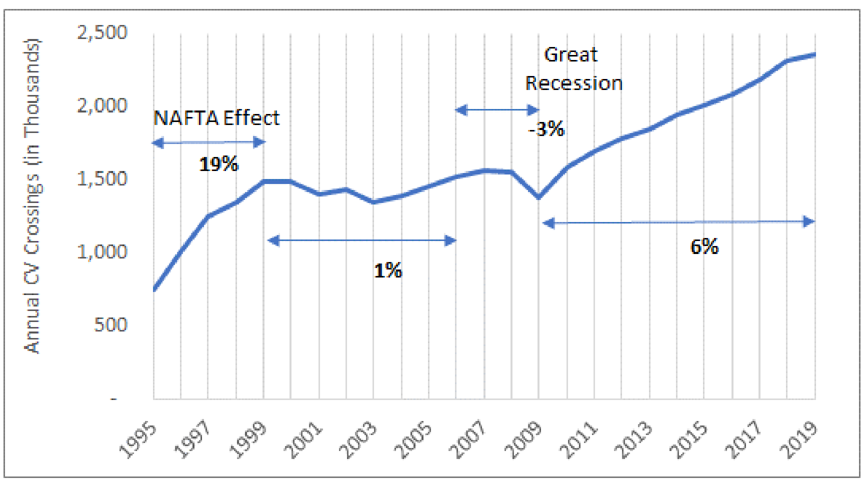


Figure 2-13. Webb County Northbound Border-Crossing Trends – Commercial Vehicles

As shown in Figure 2-14, passenger vehicles exhibit a different historical trend, with northbound crossings mainly affected by the 9/11 terrorist attacks in the United States and the subsequent changes to visa and border inspection processes. Another important factor that impacted passenger vehicle border crossings is the safety issues in Mexico from 2006 to 2012, which led to the Mexican military confronting drug cartels in the U.S./Mexico border area. Between 2014 and 2017, passenger vehicle crossings grew at a rate of 1.7 percent per year. 2017 is the third consecutive year showing a decrease in Laredo passenger vehicle border crossings. There was an increase in 2018 but it began to decrease in 2019 once again, albeit not as fast as previous years.

[1] C&M did not consider pedestrian crossings as a revenue source in this study.

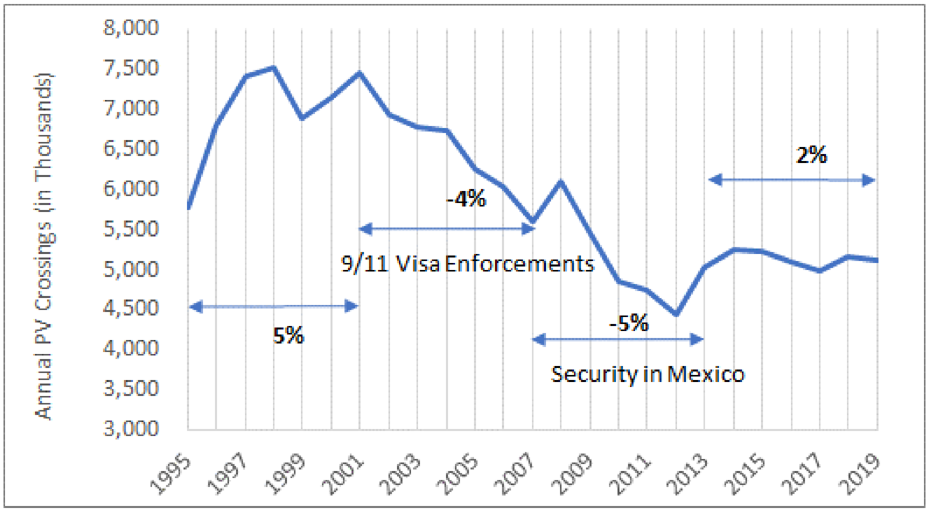


Figure 2-14. Webb County Northbound Border-Crossing Trends – Passenger Vehicles

As shown in Figure 2-15, pedestrian crossings exhibit a historical trend similar to passenger vehicles, with notable impacts from the 9/11 terrorist attacks in the United States and the subsequent changes to visa and border inspection processes. Pedestrian crossings exhibited a growth rate of -3 percent from 2001 to 2006. During the period of Mexican military confrontations with drug cartels in the U.S./Mexico border area, the growth rate decreased further to -5 percent. From 2012 to 2019, pedestrian crossings exhibited a CAGR of about 2 percent.

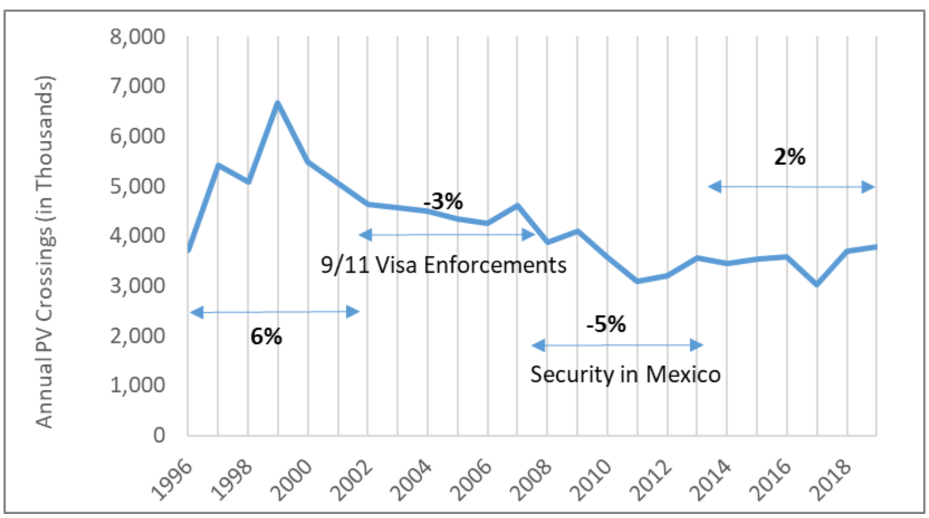


Figure 2-15. Webb County Northbound Border-Crossing Trends – Pedestrians

The seasonality of vehicle crossings into Webb County is illustrated in Figure 2-16 by vehicle type for the years 2017, 2018, and 2019. As shown, commercial vehicle traffic is slightly impacted by seasonality, with lower volumes in December and January. Passenger vehicles exhibit more notable vacation/holiday seasonal trends, with traffic fluctuating throughout the year by approximately 10 percent of the annual average.

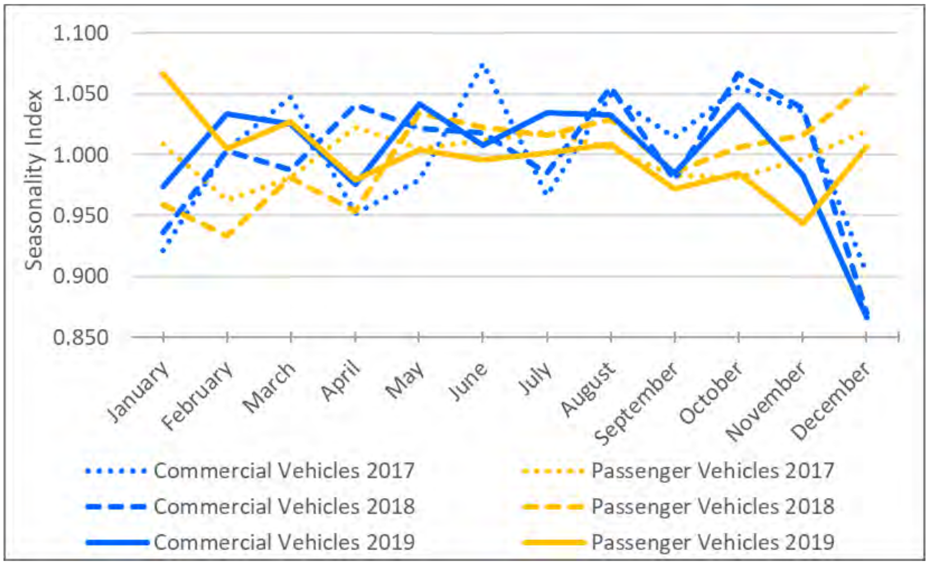


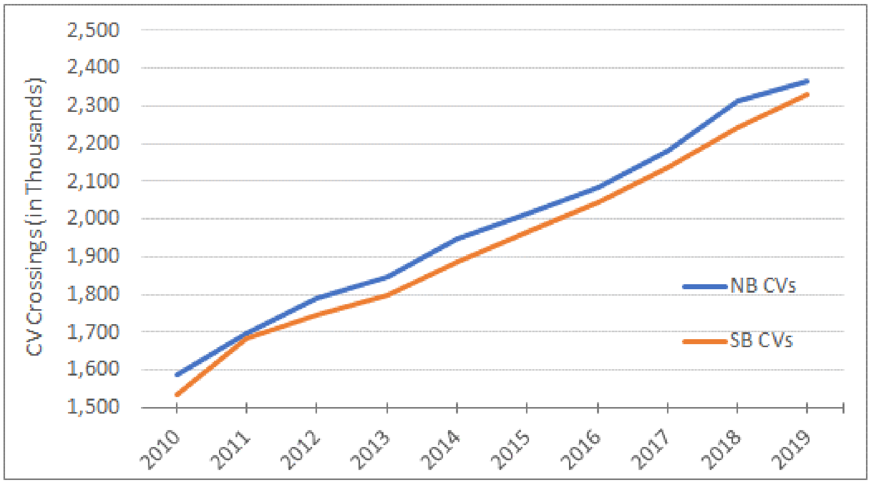
Figure 2-16. Seasonality of Northbound Vehicle Crossings to Webb County by Type

Table 2-2 presents Webb County's historical distribution of northbound commercial vehicle crossings by POE based on data from the Federal Highway Administration (FHWA).[7] Historically, the World Trade POE has served the largest share of northbound commercial vehicles among POEs within the study area, whereas the Juarez–Lincoln POE has served the largest share of northbound passenger vehicles.

Table 2-2. Northbound Webb County Traffic Shares by POE

POE	Commercial Vehicles	Passenger Vehicles
Juarez–Lincoln	0%	89%
Gateway to the Americas	0%	6%
World Trade	83%	0%
Laredo–Colombia Solidarity	17%	5%

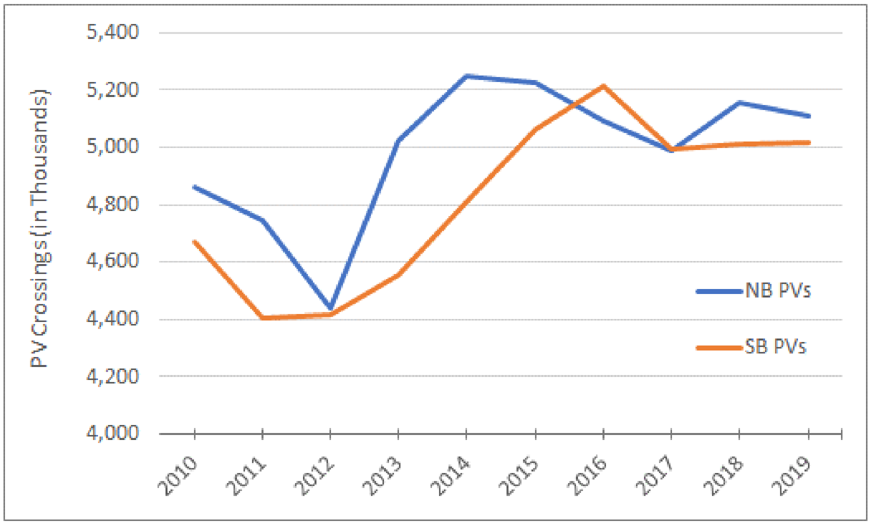
Southbound commercial vehicle traffic data from 2010 to 2019 was obtained from the City of Laredo.[8] Figure 2-17 shows that southbound commercial vehicle crossings have followed a nearly identical trend as northbound crossings (*r* = 0.99). Therefore, for the purposes of this study, S&B estimated future northbound commercial vehicle crossings with the assumption that northbound/southbound traffic trends will remain strongly correlated.



Note: NB = Northbound; SB = Southbound; CV = Commercial vehicle

Figure 2-17. Webb County Commercial Vehicle Crossings by Direction

A similar northbound/southbound traffic trend can also be observed for passenger vehicles in recent years, as shown in Figure 2-18. Over the last 2 years in particular, passenger vehicle crossings have been very similar in both directions, with a difference of less than 1 percent.



Note: PV = Passenger vehicle

Figure 2-18. Webb County Passenger Vehicle Crossings by Direction

Figure 2-19 illustrates the normalized (to the year 2000) northbound commercial vehicle border crossings of the Laredo International Bridge System compared to the State of Texas and the United States as a whole. As shown, commercial vehicle crossings on the Laredo bridges have experienced a higher growth rate in recent years compared to U.S. and Texas crossings, while the growth rates of Texas and the United States have nearly identical trends.

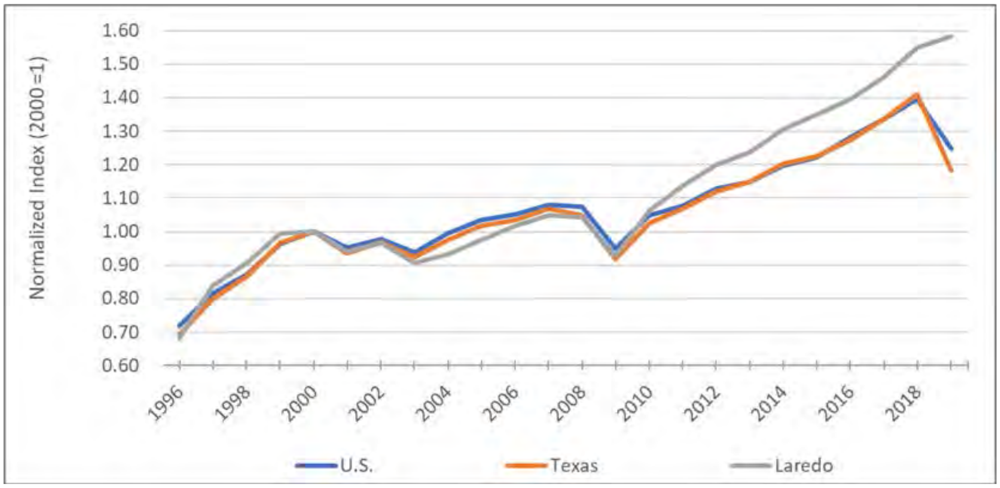


Figure 2-19. Normalized Commercial Vehicle Crossings from Mexico to the U.S., Texas, and Laredo

Figure 2-20 illustrates the normalized northbound passenger vehicle border crossings for the United States, the state of Texas, and the Laredo International Bridge System. Compared to the United States and Texas, northbound passenger vehicle crossings on the Laredo bridges have generally exhibited similar growth trends since 2000. However, the Laredo International Bridge System has recently experienced lower growth rates than the United States as a whole.

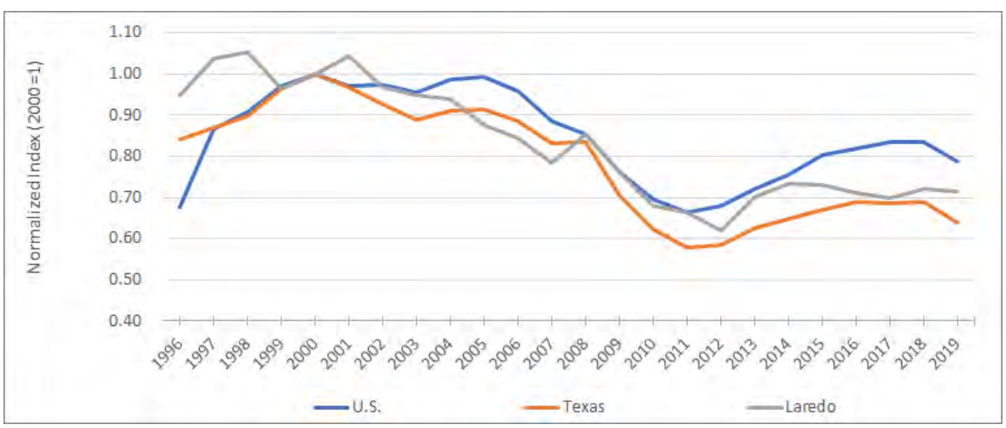


Figure 2-20. Normalized Passenger Vehicle Crossings from Mexico to the U.S., Texas, and Laredo

Figure 2-21 illustrates historical pedestrian crossings from1996 to 2019. With the signing of NAFTA in 1994, regional trade was promoted and with it the integration of the border cities of Mexico and the United States. From 1996 to 2000, international trade from Mexico to the United States grew 16.7 percent annually. Northbound pedestrian crossings grew 10.3 percent during the same period. However, the economic stagnation in the two nations in the early 2000s during the Great Recession, in addition to border restrictions due to 9/11, affected border crossings into the United States at the national level.

From 2000 to 2011, the annual drop in northbound pedestrian crossings was 5.7 percent. Events such as the Great Recession and the growing insecurity in Mexico accentuated these decreases. Likewise, from 2011 to 2019, recovery is observed in northbound crossings with a CAGR of 2.6 percent.

It should be noted that pedestrian crossings were also affected by construction and modernization efforts performed between 2016 and 2018 at the Gateway to the Americas International Bridge (i.e., Bridge I). The work performed on Bridge I included the following:

- Improved the operational efficiency of the port and reconfiguring the primary automobile inspection lanes.
- Added a dedicated bicycle inspection lane.
- Increased the number of permanent pedestrian processing lanes from 4 to 14.
- Reconfigured the interior spaces of the historic Administration building.
- Demolished the existing automobile secondary inspection canopy.
- Built a new, high-performance automobile secondary inspection canopy.

The pedestrian crossings in the southbound direction exhibited more stability than northbound crossings, with a slight negative trend from 2000 to 2019 (CAGR = -0.8%). However, in recent years (2016–2019) the annual growth has been 2.3 percent.

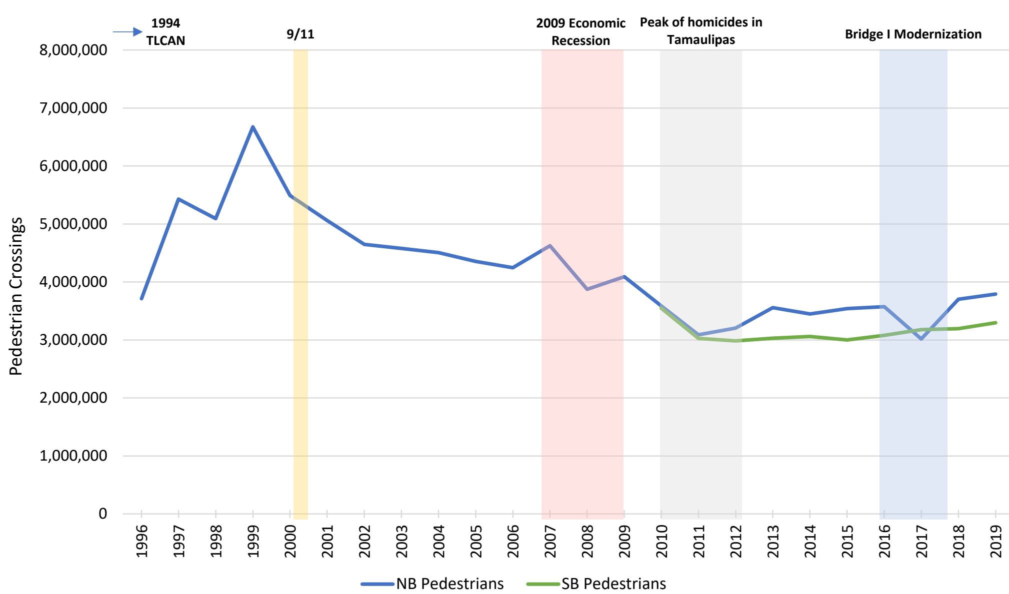


Figure 2-21. Historical Pedestrian Crossings by Direction

2.5. Mexico Customs Broker

An important element in the import/export of goods to or from Mexico are the Mexico customs brokers. According to the Mexico Service Tax Administration (SAT), there are 816 customs brokers in Mexico (last updated December 1, 2020).[9] Unlike in the United States, where U.S. customs brokers can file shipments though any POE, customs brokers in Mexico can only submit filings at four principal POEs. Each Mexican customs broker is only licensed to ship goods though four POEs, including air and seaports. In addition, most of Mexico's customs brokers specialize in particular commodities. Importers who have multiple POEs or several commodity types might rely on multiple customs brokers to clear on their behalf.

As shown in Table 2-3, the number of registered customs brokers by primary POE to carry out import/export activities for the World Trade POE is 223. Only 19 are registered for the Laredo–Colombia POE.

Table 2-3. Customs Brokers by Primary POE

Port of Entry	Customs Brokers
Laredo–Colombia	19
World Trade	223
Regional Total	242
National Total	816

2.6. Border Shipments

The S&B team has noted in previous studies and corroborated in the current study's interviews with Project stakeholders, that when forecasting commercial vehicle traffic, it is crucial to not only look at the overall growth pattern of commercial vehicle traffic but to observe the growth trends of the *goods* shipped at each POE. Along the entire U.S./Mexico border, different POEs are specialized for processing certain types of goods. This specialization affects historical growth rates as well as commercial vehicle crossing forecasts.

Figure 2-22 illustrates the study area's historical trends regarding the weight of goods (by category) imported by commercial vehicles across the World Trade POE and Laredo–Colombia POE[10]. As of 2019, the majority of Laredo POE commercial vehicle imports by weight are in the "Transportation and Mineral Products" category, followed by "Machinery."

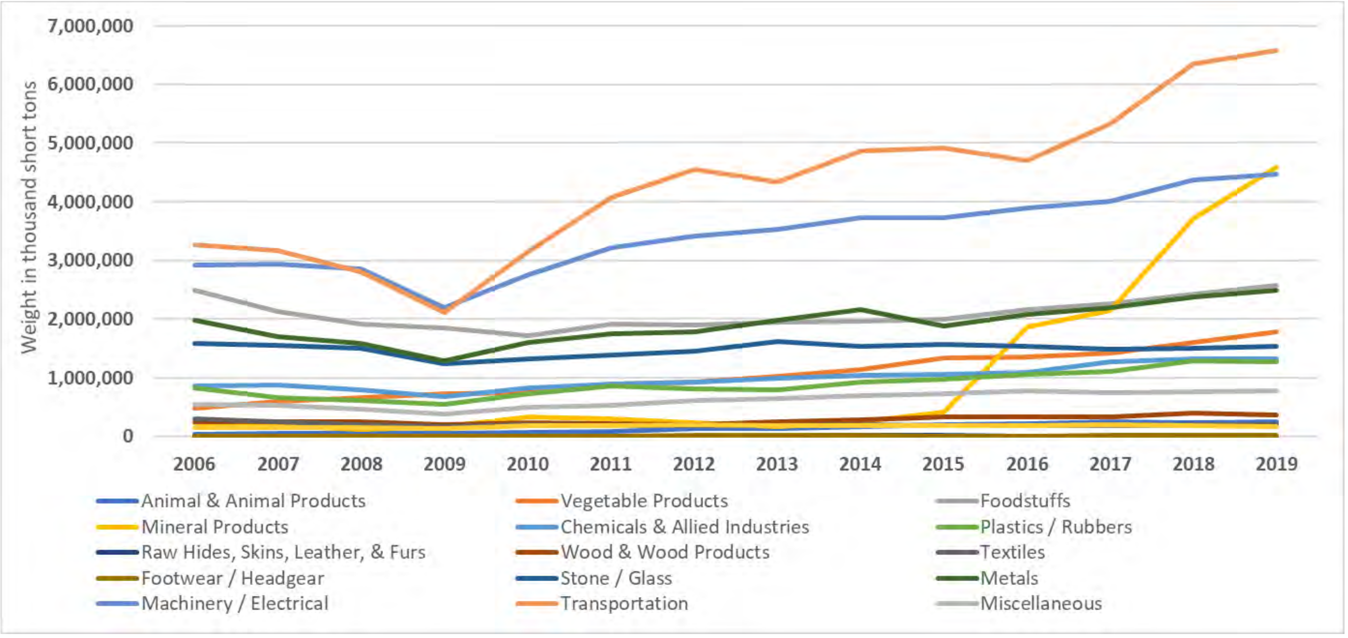


Figure 2-22. Historical Imports at Laredo POEs by Weight

Figure 2-23 illustrates the study area's historical trends regarding the monetary value of goods imported by commercial vehicle across the Webb County POEs.[10] As of 2019, the majority of imports by value are in the "Machinery" and "Transportation" (i.e., aircraft, spacecraft and parts, ships and boats, vehicles other than railway, locomotives and traffic signals) categories.

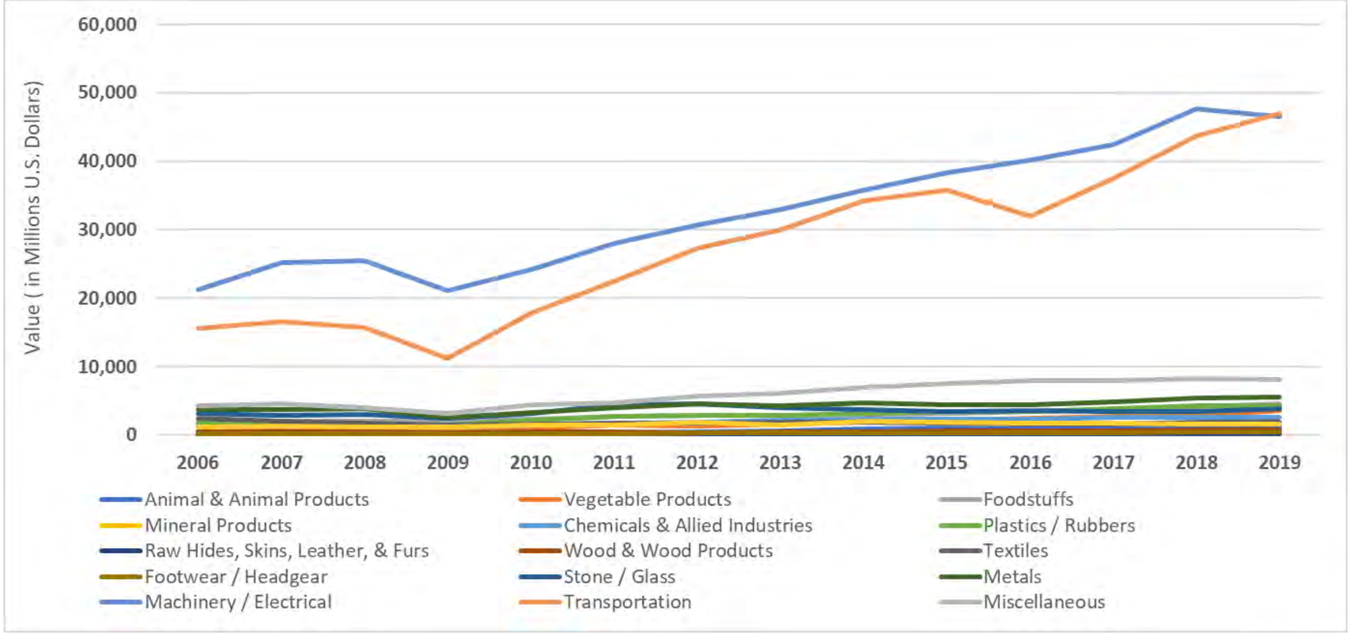


Figure 2-23. Historical Imports at Webb County POEs by Value

2.7. Border Crossing Delays

The economies of Laredo/Webb County and Nuevo Laredo are tightly linked, and long and/or unpredictable border wait times can adversely impact the overall economic growth of the region. A traveler's origin and destination (OD), as well as the cost and wait time of each POE in the region, will ultimately determine which POE the traveler uses to cross the border.

Border crossing delays are the result of delays at each step of the border inspection process. Figure 2-24 shows an example of the different inspection steps of the border crossing process for commercial vehicles.[11] The S&B team did not validate each inspection step individually, but rather the resulting total crossing time as reported and observed by different sources.

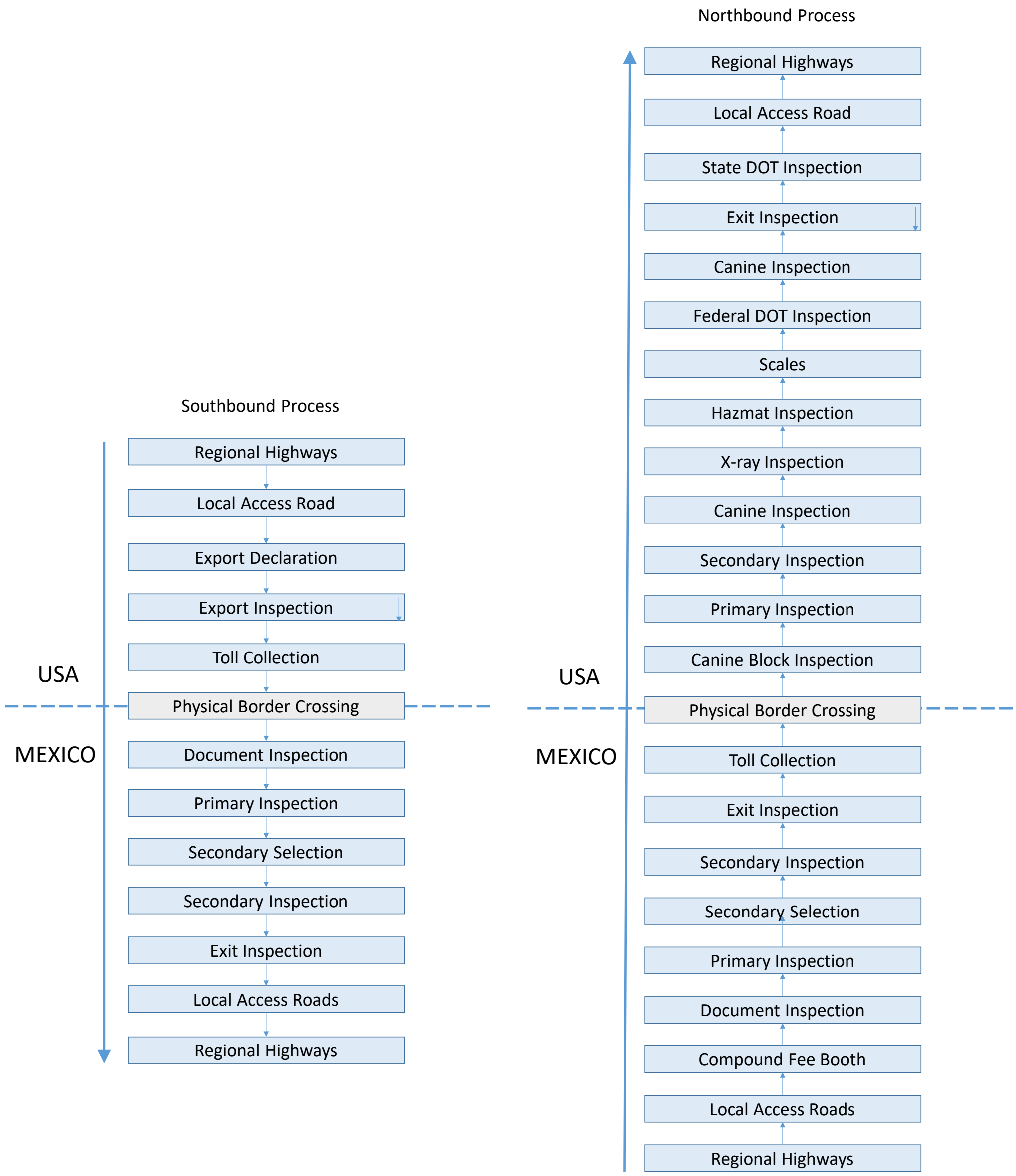


Figure 2-24. Border Inspection Process

Border-crossing delay data are available from several public sources; the wait times used to validate the present study's model results are from the Texas A&M Transportation Institute's Border Crossing Information System (BCIS) and the CBP's Border Wait Times webpage.[12,13]

When calculating border delays and wait times, the results can vary depending on one's definition (i.e., where one begins measuring), as illustrated by Figure 2-25 in the case of border commercial vehicle traffic. As shown, the *total travel time* of a border-crossing trip is the travel time between the trip's OD (e.g., from an industrial park in Mexico to a warehouse in the United States). The S&B team's Binational Assignment Model (see Chapter 5) uses this total travel time based on the trip's OD and the user-equilibrium assignment method. In contrast, the *total POE crossing time* is measured from the start of the queue to the moment the vehicle leaves the POE facility. This includes the time in the queue to reach the first Mexico/U.S. outbound inspection facility, the inspection time in the outbound facility, the wait time to cross the border to the first inbound inspection facility, the inspection time in the inbound facility (including secondary inspection and TxDOT Department of Public Safety [DPS] inspection), and the wait time to leave the POE facility.

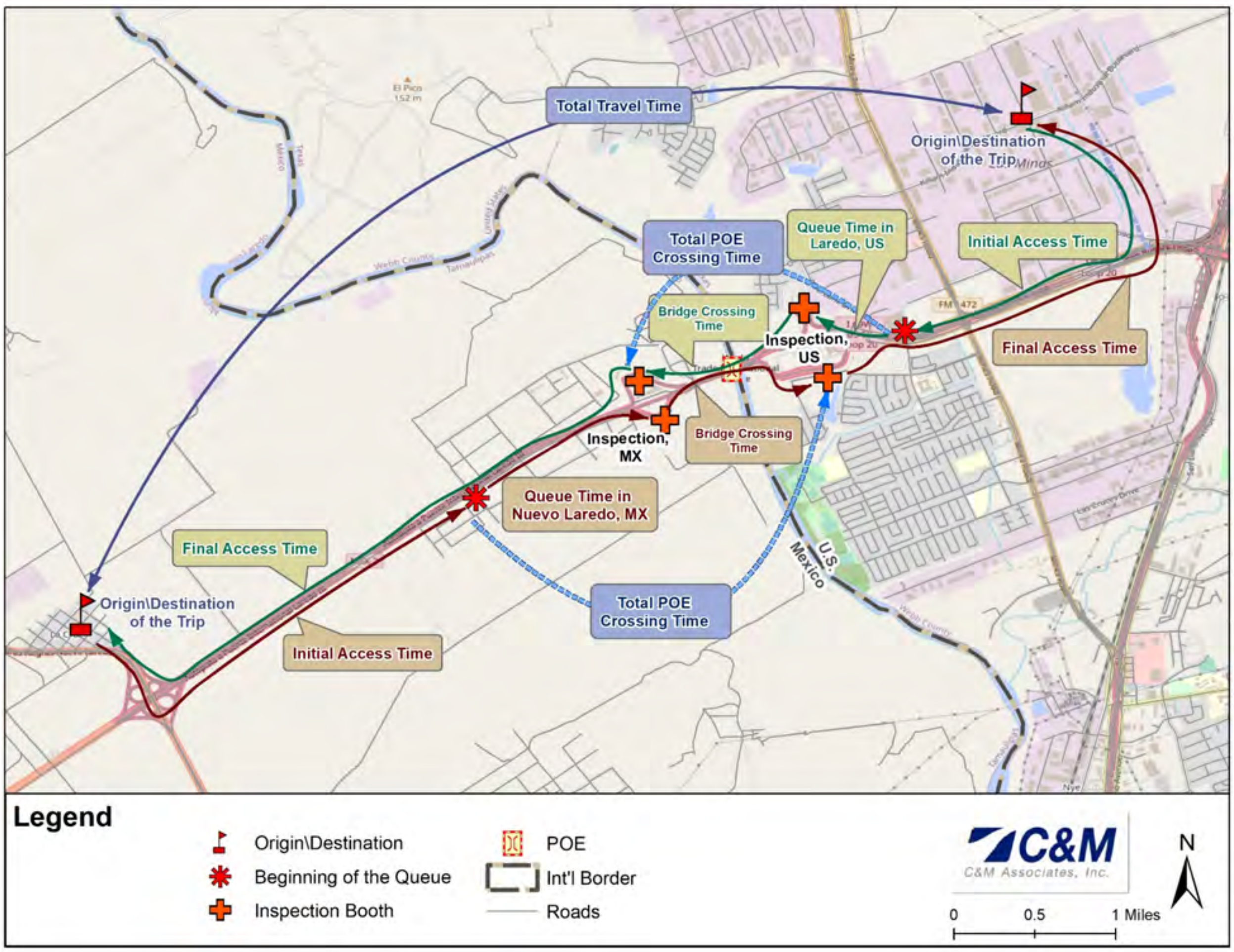


Figure 2-25. Border Crossing Delay Definitions

Figure 2-26 through Figure 2-28 summarize the BCIS and CBP hourly weekday border wait times for passenger and commercial vehicles by lane type (General, Ready, FAST, non-FAST). The wait time is the time that a driver spends in the queue before reaching the first inspection booth on the U.S. side (traveling northbound). CBP provides wait time estimates for both commercial and passenger vehicles. The reported wait times are generally lower than those reported by BCIS, mainly because CBP is reporting wait times based on the CBP officer's—or the traveler's—personal impression until the first inbound U.S. inspection.

The border crossing time from the BCIS estimates the travel time between RFID stations, which record vehicle transponder IDs. For each POE, RFID stations are generally found at the exit of toll booths in Mexico, at the CBP's primary inspection booth, and at the exit of the POE facility in the United States. If the queue extends beyond the entrance to the first RFID station (i.e., the Mexican toll booth, if traveling northbound), the actual crossing time will not be accurately estimated. Also, this method can only be used to calculate crossing times for commercial vehicles, as there are no passenger vehicle RFID stations installed on Webb County POEs.

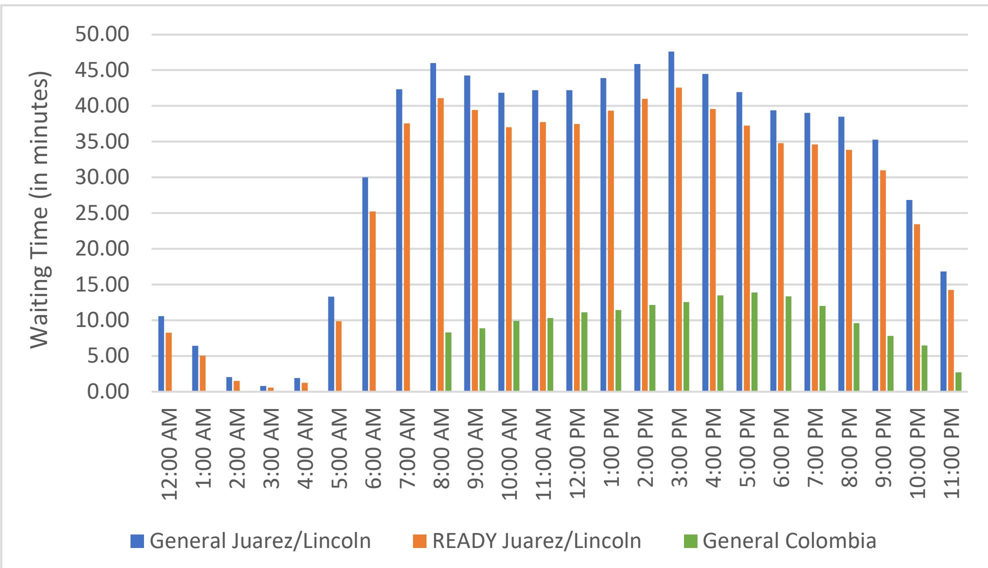


Figure 2-26. CBP Annual Average Weekday Border Wait Times – Passenger Vehicles

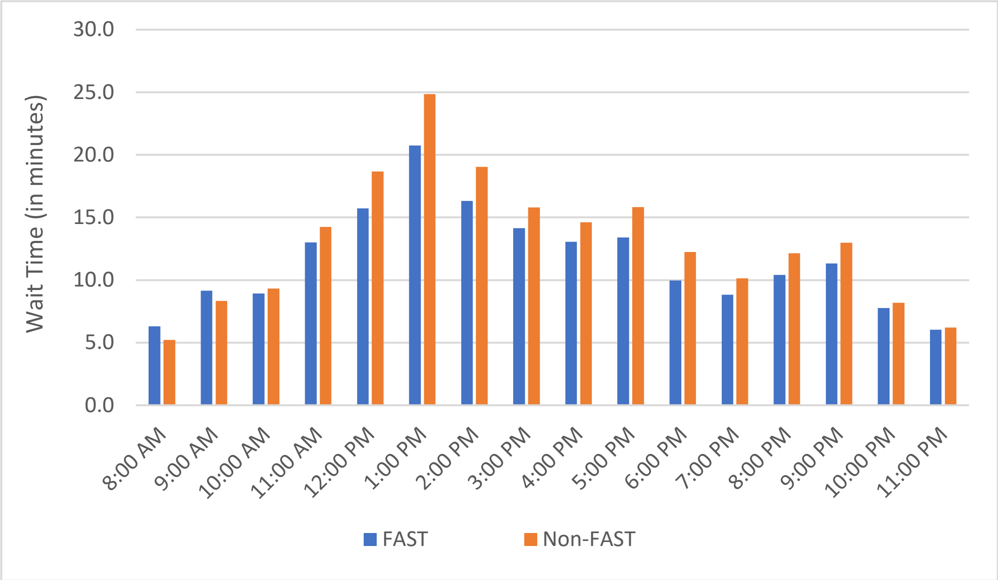


Figure 2-27. BCIS Annual Average Weekday Border Wait Times – World Trade Bridge

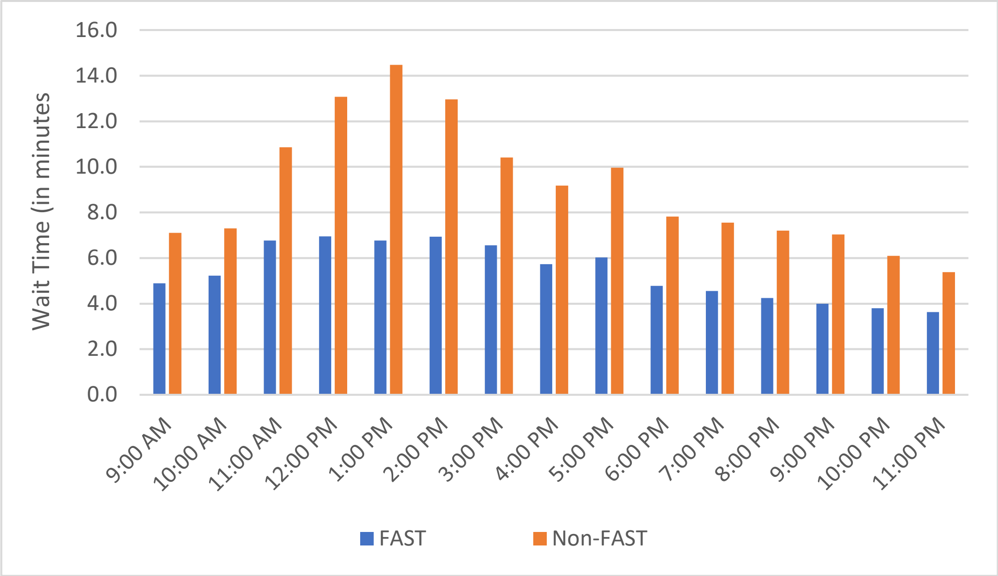


Figure 2-28. BCIS Annual Average Weekday Wait Times – Laredo–Colombia Bridge

Border crossing times are also a function of how many inspection booths are open. Crossing times can actually decrease during peak periods of demand since more booths are operational. S&B considered delay time per booth in its Binational Assignment Model to properly account for the capacity of each POE.

It should also be noted that wait times in the southbound direction are much lower than in the northbound direction. For passenger vehicles, there is only a delay when the vehicle requires a secondary inspection.

2.8. Border Economy

The composition of international trade and commercial vehicle travel patterns varies along the U.S./Mexico border. The Webb County area and the City of Laredo—in combination with the city of Nuevo Laredo—is a binational economy of regional, statewide, and national significance. International trade, education, businesses, and tourists/shopping give this region its unique traffic pattern, which necessitates an efficient border crossing system.

In this region, international trade is primarily driven by the local maquiladora trade and assembling plants. Figure 2-29 illustrates the industrial parks within the study area. The location of the industrial parks and the maquiladoras is important because these are the ODs for commercial traffic and workers crossing the border.

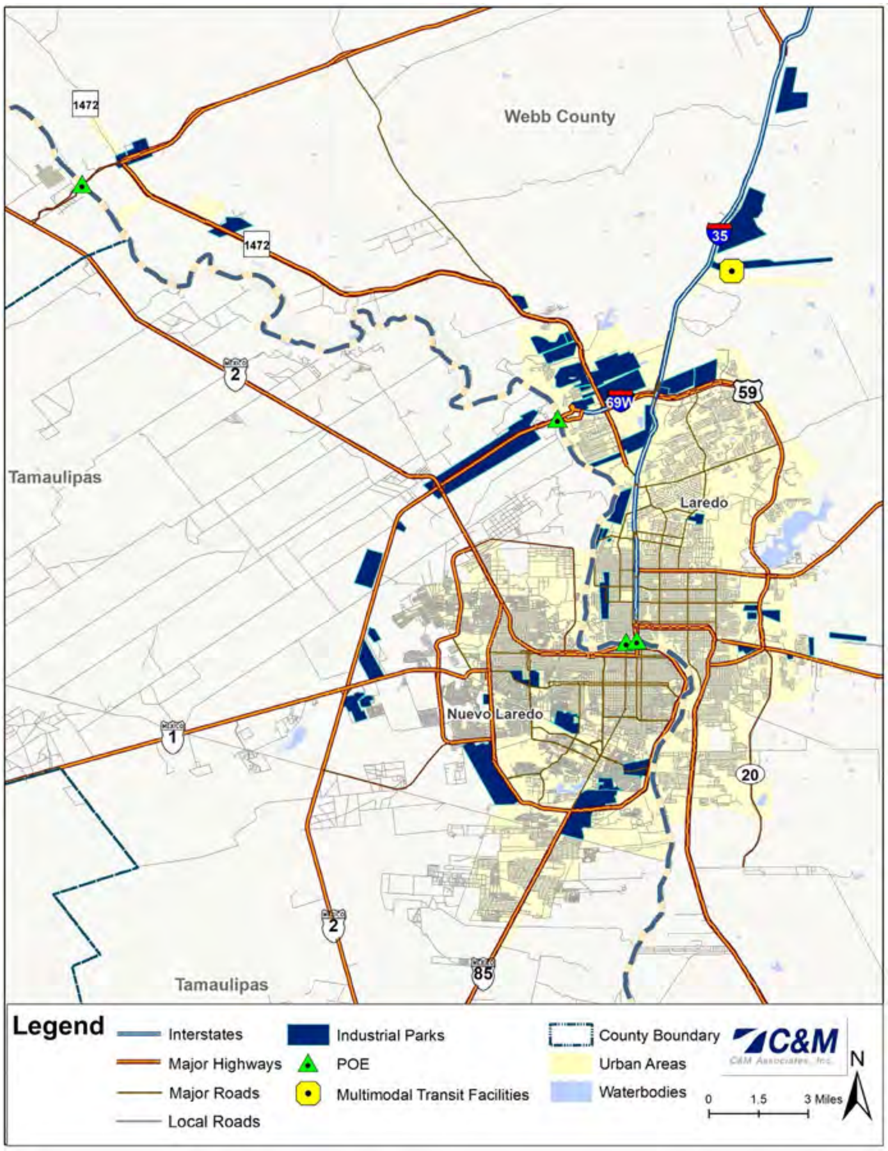


Figure 2-29. Existing Industrial Parks in the Study Area

Table 2-4. Industrial Parks

ID	Name	Area	Country
1	Millennium Park	Laredo	US
2	Pan American Business Park	Laredo	US
3	International Trade Center	Laredo	US
4	Inter-America Distribution Center	Laredo	US
5	Killam Industrial Park	Laredo	US
6	South Laredo Industrial Park	Laredo	US
7	El Portal Industrial Park	Laredo	US
8	Embarcadero	Laredo	US
9	Laredo Distribution Center	Laredo	US
10	Texas Industrial Park	Laredo	US
11	Crossroads	Laredo	US
12	Milo Distribution Center	Laredo	US
13	San Isidro East Point Center	Laredo	US
14	Paso Del Norte Industrial Park	Laredo	US
15	Octavio Salinas Industrial Park	Laredo	US
16	Modern Industrial Park	Laredo	US
17	Southern Development Industrial Park	Laredo	US
18	South Texas Oil & Gas Industrial Park	Laredo	US
19	Tex-Mex Industrial Park	Laredo	US
20	Ponderosa Industrial Park	Laredo	US
21	R.M.R Industrial Park	Laredo	US
22	Missouri Pacific Rail yards	Laredo	US
23	Unitec Industrial Park	Laredo	US
24	Roadway Express, Inc.	Laredo	US
25	Pinto Valle Industrial Park	Laredo	US
26	International Commerce Center	Laredo	US
27	Las Minas Industrial Park	Laredo	US
28	La Barranca Industrial Park	Laredo	US
29	Quivira Project	Laredo	US

30	Del Mar Industrial Park	Laredo	US
31	McPherson Acres	Laredo	US
32	Tex-Mex Switching Yard	Laredo	US
33	Pellegrino Industrial Park	Laredo	US
34	Warehouse & Storage	Laredo	US
35	Fesco Business Park	Laredo	US
36	Airport	Nuevo Laredo	Mexico
37	Auto Lineas America II	Nuevo Laredo	Mexico
38	Finsa	Nuevo Laredo	Mexico
39	Flensa	Nuevo Laredo	Mexico
40	Industrial Module of America	Nuevo Laredo	Mexico
41	Longoria Industrial Park	Nuevo Laredo	Mexico
42	Oradel Industrial Park	Nuevo Laredo	Mexico
43	Oradel Industrial Park	Nuevo Laredo	Mexico
44	Oradel Industrial Rail Center	Nuevo Laredo	Mexico
45	Pemex Plant	Nuevo Laredo	Mexico
46	Progreso Industrial Park	Nuevo Laredo	Mexico
47	Rio-Bravo	Nuevo Laredo	Mexico
48	Rio Grande Industrial Park	Nuevo Laredo	Mexico
49	World Trade Bridge	Nuevo Laredo	Mexico

Commercial vehicle travel patterns between Nuevo Laredo and Laredo are generally short haul in nature, known within the industry as “cartage” or “transfer” hauling. The less frequent long-haul movements typically originate further south in Mexico. Maquiladora trade activity is accomplished by means of short-haul movements. Typically, commercial vehicles pick up products from their origins at maquiladora plants in Nuevo Laredo and haul them across the border to interim distribution centers and surrounding areas. Conversely, commercial vehicles on the U.S. side of the border pick up components from warehouses in Laredo and deliver them to maquiladora plants in Nuevo Laredo. The same pattern of commercial vehicle traffic applies to assembly plants that are not part of the maquiladora trade.

Passenger vehicle traffic is mainly driven by three groups: workers, students, and shoppers. Within the border region, it is common for workers to live on one side of the border and work on the other. Students from the universities of both sides of the border cross the Webb County/Nuevo Laredo border on a daily basis. Lower cost of living and/or lower education costs contribute to these daily border crossings.

Figure 2-30 illustrates the major shopping malls and other points of interest in Laredo that are destinations for Mexican shoppers and tourists. Additionally, many travelers take trips from Laredo to Nuevo Laredo to visit restaurants or seek medical treatment.

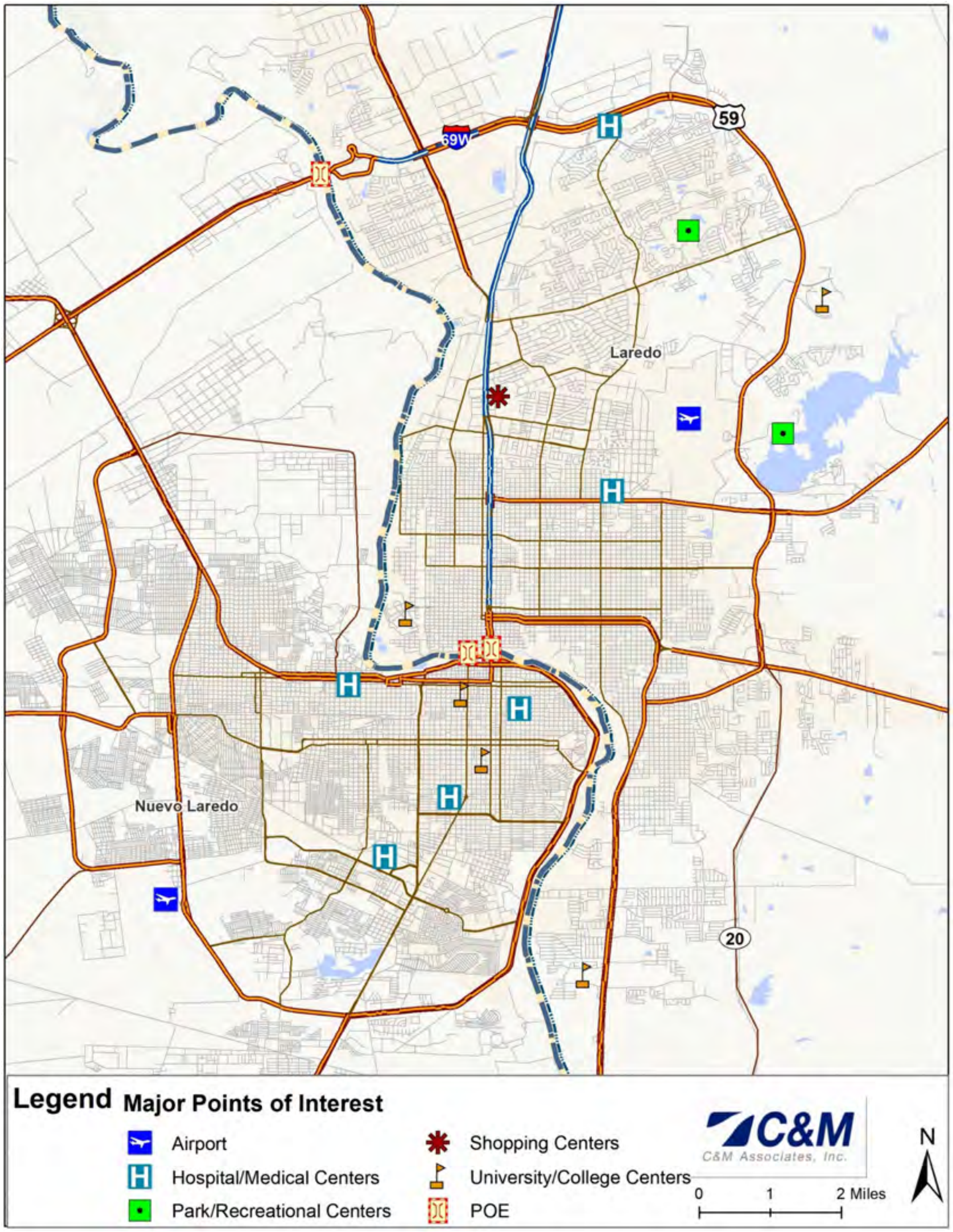


Figure 2-30. Major Shopping Malls and Points of Interest within the Study Area

The S&B team gathered information on the points of interest presented above to validate the border-crossing trip ODs within its Binational Assignment Model (see Chapter 5).

2.9. Border Crossing OD Data

The S&B team has ample experience with border traffic related projects in the City of Laredo and has previously collected a variety of field data relevant to the Laredo International Bridge System. Based on this data, the S&B team has not only developed a user profile but also gained a better understanding of traffic characteristics and travel patterns within the study area, all of which provided critical support for TDM development and calibration (see Chapter 5).

Due to the persisting COVID-19 pandemic and the related implications to the traffic pattern of the study area, the S&B team relied on its previously collected field data as well as data from existing studies in the region and other publicly available sources, with the goal of obtaining data comparable to what would have been collected in the field. The previously collected data includes the following:

- **Juarez–Lincoln International Bridge User OD Survey:** Pedestrian and passenger vehicle OD survey of the users of the Juarez–Lincoln International Bridge (Laredo Bridge II).[14]
- **World Trade International Bridge Bluetooth OD Survey:** U.S. commercial vehicle OD data from users of the World Trade International Bridge.[15]
- **Border Vehicle Intercept Survey:** Commercial and passenger vehicle OD intercept survey data at each of Laredo's international bridges.[15]
- **Mexican Customs Manifest:** Shipment manifest of each commercial vehicle crossing at the World Trade International Bridge in 2014.[16]

Juarez–Lincoln International Bridge User OD Survey

The Pedestrian and passenger OD survey was conducted by the Nuevo Laredo Institute for Competitiveness and Foreign Trade (Instituto para la Competitividad y el Comercio Exterior de Nuevo Laredo[14] [ICCE]). This survey was conducted on all users of the Juarez–Lincoln bridge heading from Nuevo Laredo to Laredo, Texas, and the interior of the United States. The survey was conducted in December 2015 for one week (Monday to Sunday) in two shifts (7:00 a.m. to 2:00 p.m. and 2:00 p.m. to 8:00 p.m.), resulting in a total sample size of 1,710 surveys.

The survey results indicate that 86 percent of respondents traveling northbound originated from Nuevo Laredo and 14 precent were visitors from the interior of Mexico. About 42 percent of respondents traveling to the United States originated from Zone III of Nuevo Laredo, as shown in Figure 2-31. The OD results by zone are presented in Table 2-5.

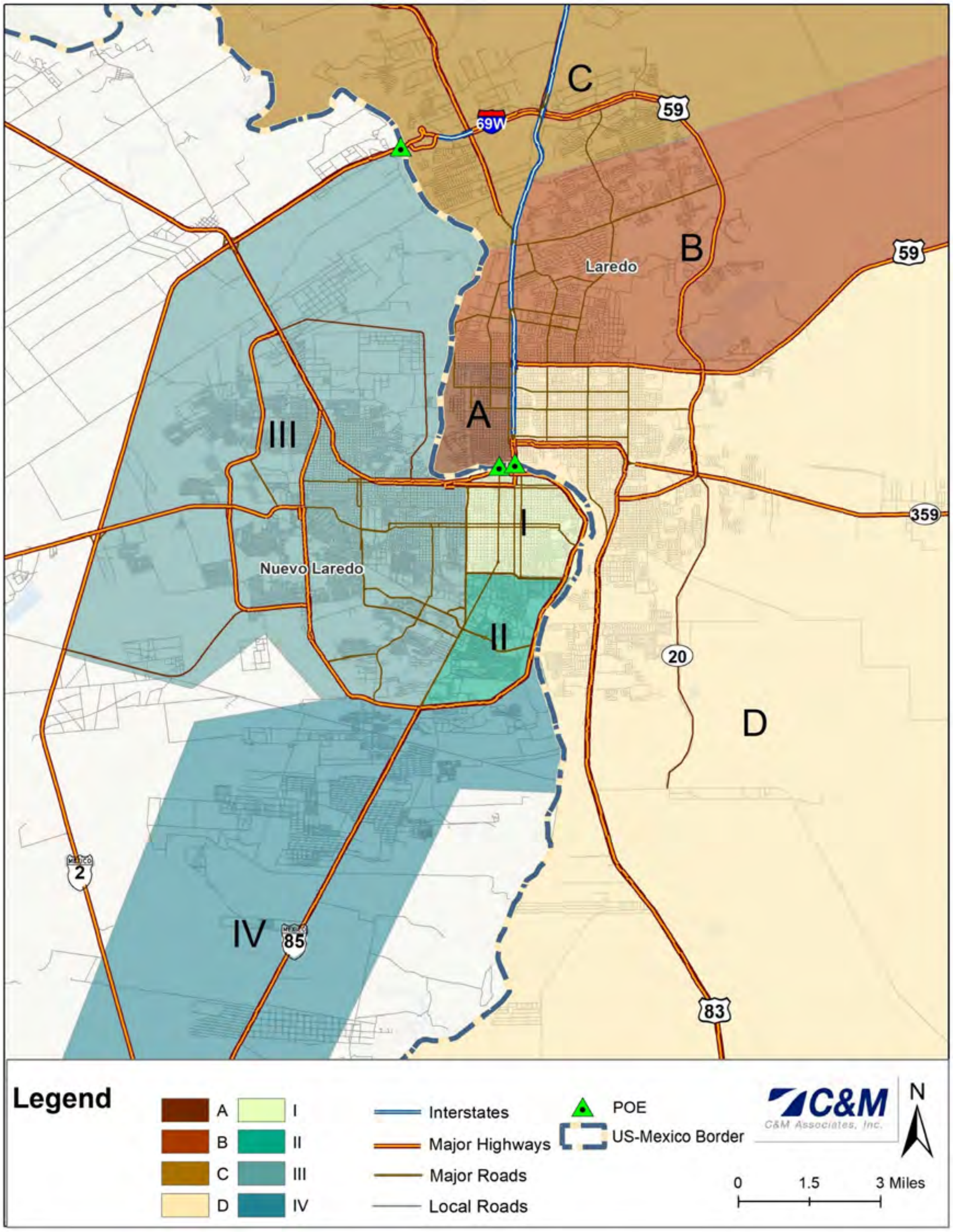


Figure 2-31. Juarez–Lincoln Bridge User OD Survey Zoning

Table 2-5 Total Trip Share by Origin and Destination

Origin Zones	Total Trip Share	Destination Zones	Total Trip Share
Zone I	17.2%	Zone A	21.3%
Zone II	21.5%	Zone B	47.7%
Zone III	42.2%	Zone C	13.2%
Zone IV	5.0%	Zone D	7.0%
Zone V	14.0%	Zone E	7.4%

In Laredo, Zone B is the most visited by people from Nuevo Laredo and the interior of Mexico with 47.7 percent of respondents, followed by Zone A with 21.3 percent. The most frequent trip origins are in Zones III and II with 42.2 and 21.5 percent, respectively. It should be noted that Zone III represents the largest area considered in the survey.

Table 2-6. OD Survey Results

Origin \ Destination	Zone A	Zone B	Zone C	Zone D	Zone E*	Undecided
Zone I	25.1%	46.1%	13.6%	7.5%	4.1%	3.7%
Zone II	20.6%	54.3%	13.4%	6.6%	2.6%	2.6%
Zone III	23.6%	48.7%	15.4%	8.5%	2.0%	1.8%
Zone IV	22.6%	42.9%	17.9%	10.7%	3.6%	2.4%
Zone V†	9.6%	39.3%	3.8%	1.3%	36.4%	9.6%

Note: * Zone E refers to the rest of the United States; † Zone V refers to the rest of Mexico.

Of the respondents who come from the interior of Mexico (Zone V), the most common destination is Zone B (39.3%) in Laredo, while 3.6 percent are heading to Zone E outside of Laredo toward the interior of the United States. From these trips, the majority (86.5%) use IH-35 in their travel to the interior United States.

World Trade Bluetooth OD Survey

In 2017, On behalf of the S&B team, CJ Hensch & Associates performed a commercial vehicle OD survey in January and February 2017 to track ODs from and to the World Trade International Bridge. The survey utilized Bluetooth technology and was performed at 17 locations, as shown in Figure 2-32. Data were collected over a three-day period during weekdays and are summarized by location in Table 2-7. The OD data were expanded and used to calibrate the Binational Assignment Model, as presented in Chapter 5.

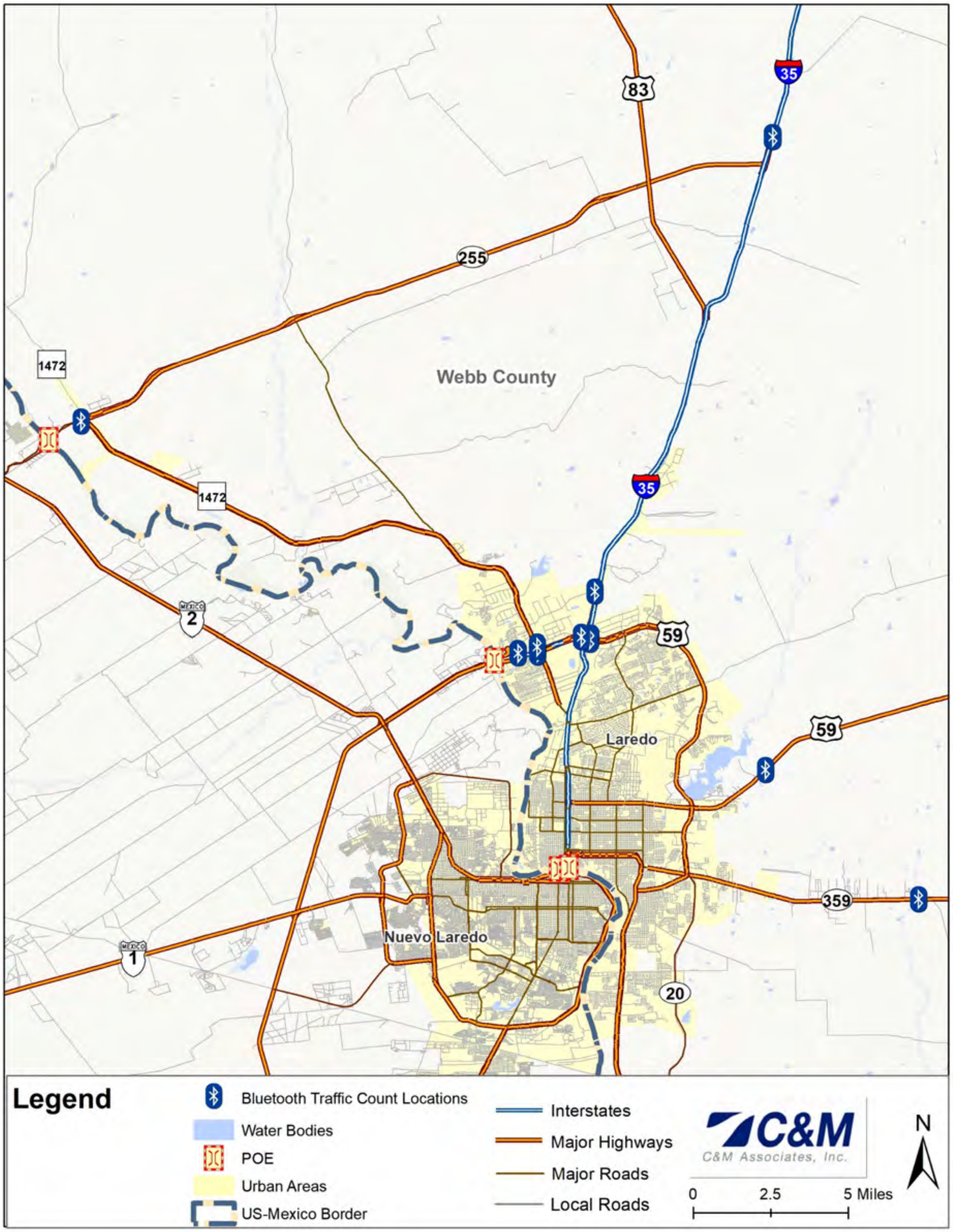


Figure 2-32. Bluetooth OD Locations

Table 2-7. Traffic Counts and Bluetooth Reads by Location

Location	Description	Traffic Count	Bluetooth Reads	Capture Rate
BTL01	WB Camino al Puente Int. Comercio Mundial 0.7 mi west of U.S./Mexico Border	9,459	1,361	14%
BTL02	I-35 Mainlane (SB) north of SH 255	7,894	4,397	56%
BTL03	WB US 59 east of I-35	18,768	2,136	11%
BTL04	EB US 59 east of I-35	21,040	2,325	11%
BTL05	I-69W Frontage Road (EB) west of Mines Rd.	13,111	888	7%
BTL06	SH 1472 north of I-69W	32,933	5,291	16%
BTL07	EB Camino al Puente Int. Comercio Mundial 0.7 mi west of U.S./Mexico Border	6,844	1,656	24%
BTL08	I-35 Mainlane (NB) north of SH 255	8,581	3,905	46%
BTL09	SH 255 (EB) SH 255 (EB)	NA	436	NA
BTL10	Killam Industrial Blvd. west of US 83	9,539	2,732	29%
BTL11	I-69W EB ramp to US 83 NB (1db)	6,720	2,771	41%
BTL12	Bob Bullock Loop (EB) east of International Blvd.	14,935	1,716	11%
BTL13	Bob Bullock Loop (WB) east of International Blvd.	15,622	1,820	12%
BTL14	US 59 (SB) east of Bob Bullock Loop	1,716	327	19%
BTL16	US 59 (NB)	1,641	344	21%
BTL17	US 59 (NB) east of SH 20	4,302	535	12%
BTL18	SH 359 (EB) east of SH 20	4,302	602	14%

Border Vehicle Intercept Survey

In collaboration with the S&B team, a border intercept survey was conducted by Cal y Mayor in August 2017 on all Webb County POEs. As part of the border vehicle intercept survey, the S&B team included questions to determine, among other things, trip purpose, the use of border programs, origin and destination, and a stated preference (SP) survey. All interviews were conducted in-person within the Mexican POE facilities.

The required sample size was determined based on the average daily annual crossings on each of the Webb County bridges from August 2016 to July 2017. The observed number of vehicles and the resulting sample size of vehicles surveyed (by vehicle type and POE) are presented in Table 2-8.

Table 2-8. Border Intercept Survey Sample Size

POE	Observed Count		Sample Size	
	PVs	CVs	PVs	CVs
Juarez-Lincoln	388	1,932	228	502
Gateway to the Americas	-	9,835	-	679
World Trade	21,379	-	1,129	-
Laredo-Colombia Solidarity	5,089	-	663	-

The results of the survey, in terms of trip purpose distributions on a typical day for passenger vehicles, are presented in Figure 2-33 and Figure 2-34. As shown, the most common trip purpose for passenger vehicles is work, as reported by 28 percent of the sample for the Juarez-Lincoln and Gateway to the Americas POEs. On the Laredo-Solidarity POE, 59 percent of survey participants reported work as their trip purpose for crossing the U.S./Mexico border. The major difference between the POEs closer to the city centers and the Laredo-Colombia Solidarity POE is fewer shopping trips reported by users of the latter.

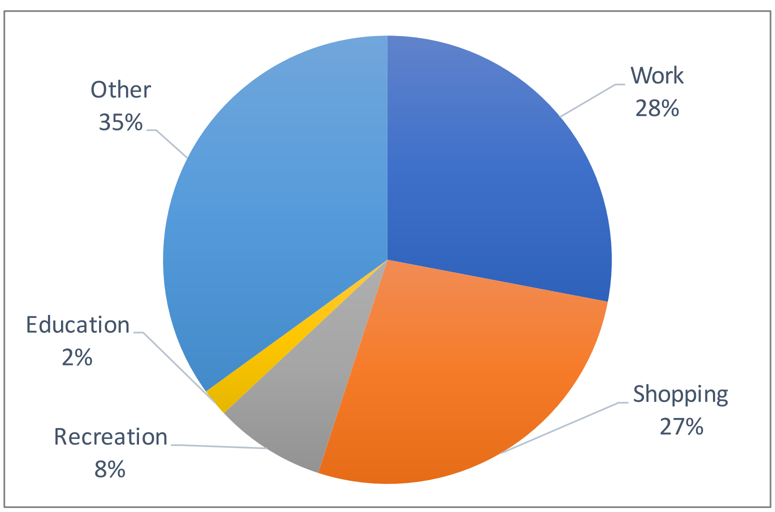


Figure 2-33. Passenger Vehicle Trip Purpose Share – Juarez-Lincoln and Gateway to the Americas POEs

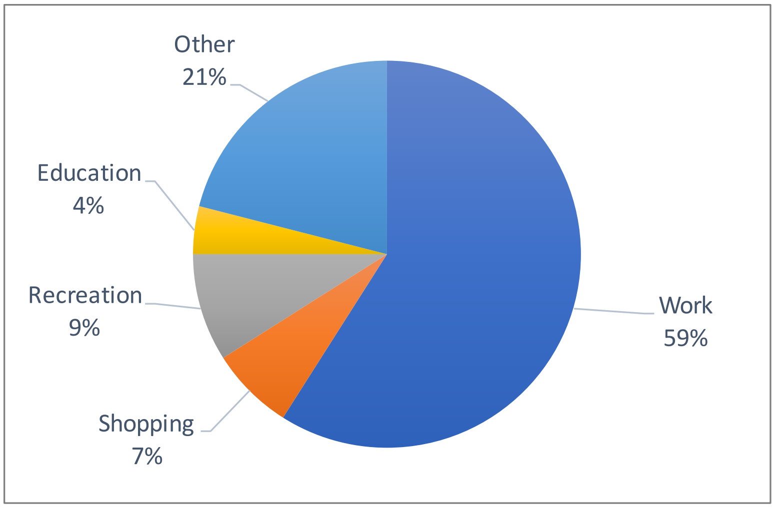


Figure 2-34. Passenger Vehicle Trip Purpose Share – Laredo-Colombia Solidarity POE

The percentage of passenger vehicle survey participants using SENTRI lanes is 26 percent on the Juarez-Lincoln POE and 5 percent on the Laredo-Colombia Solidarity POE.

For commercial vehicles, Cal y Mayor included questions to determine, among other things, who pays the tolls, the most common type of commercial vehicle, FAST program enrollment status, and trip frequency. Results indicate that almost all trucking companies pay the tolls as part of the truckers' expenses. Commercial vehicles with five axles were the most common. Twenty-five percent of respondents from the World Trade Bridge commercial vehicle survey were enrolled in the FAST program, compared to 18 percent of respondents from the Laredo-Colombia Solidarity POE.

A snapshot of the intercept survey OD data from commercial vehicles crossing the Webb County POEs is presented in Figure 2-35 to Figure 2-37 based on aggregated super zones as origins. The S&B team aggregated the super zones by land use and the number of trips generated in each of the super zones. As shown, most commercial trips cross the U.S./Mexico border from a zone in Nuevo Laredo to a zone in Laredo. However, Zone 8 (MEX 85) and Zone 11 (World Trade Bridge) represent another significant OD pair, with 250 to 500 trips a day.

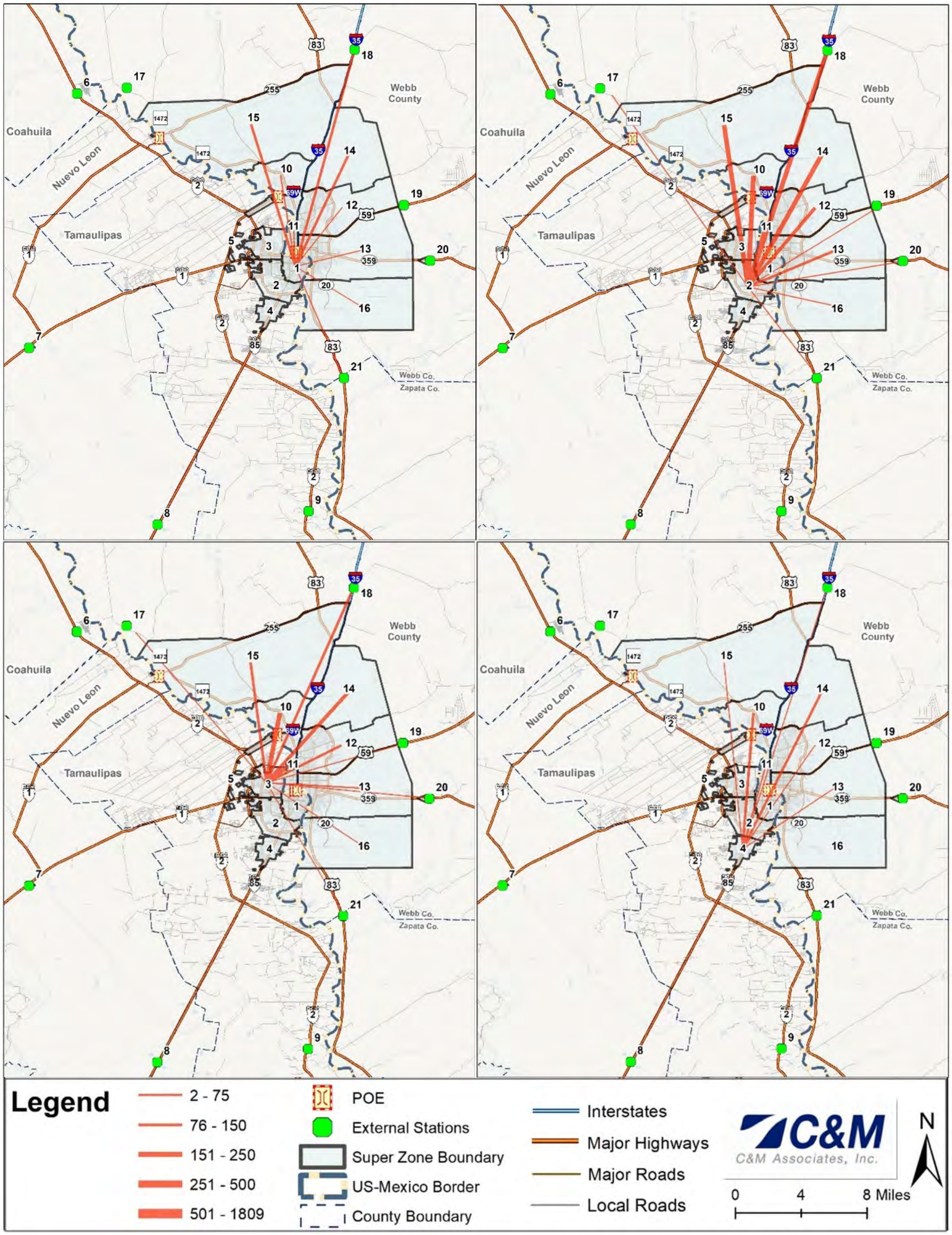


Figure 2-35. Aggregated Commercial Vehicle Intercept OD Survey (Origin 1-4)

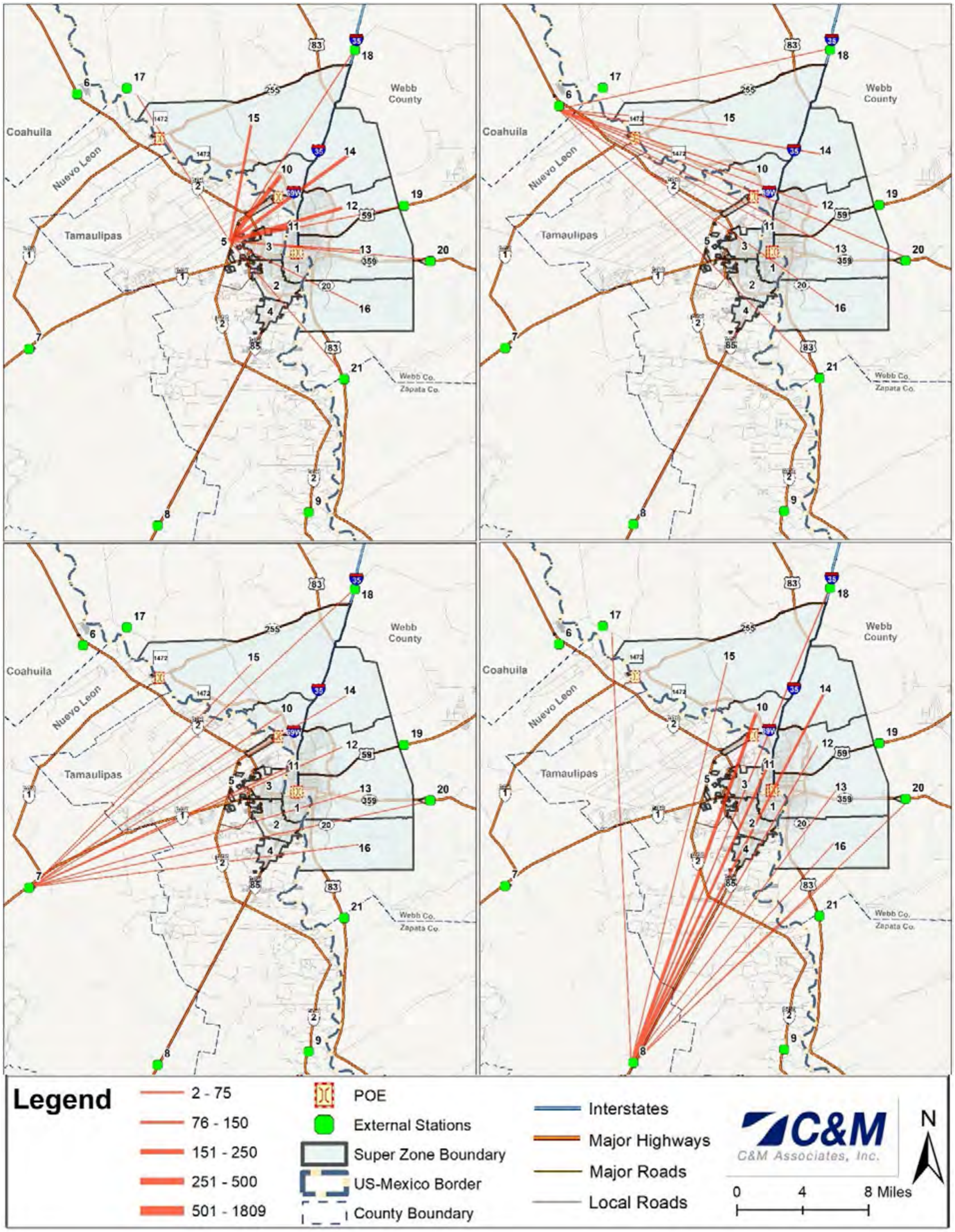


Figure 2-36. Aggregated Commercial Vehicle Intercept OD Survey (Origin 5-8)

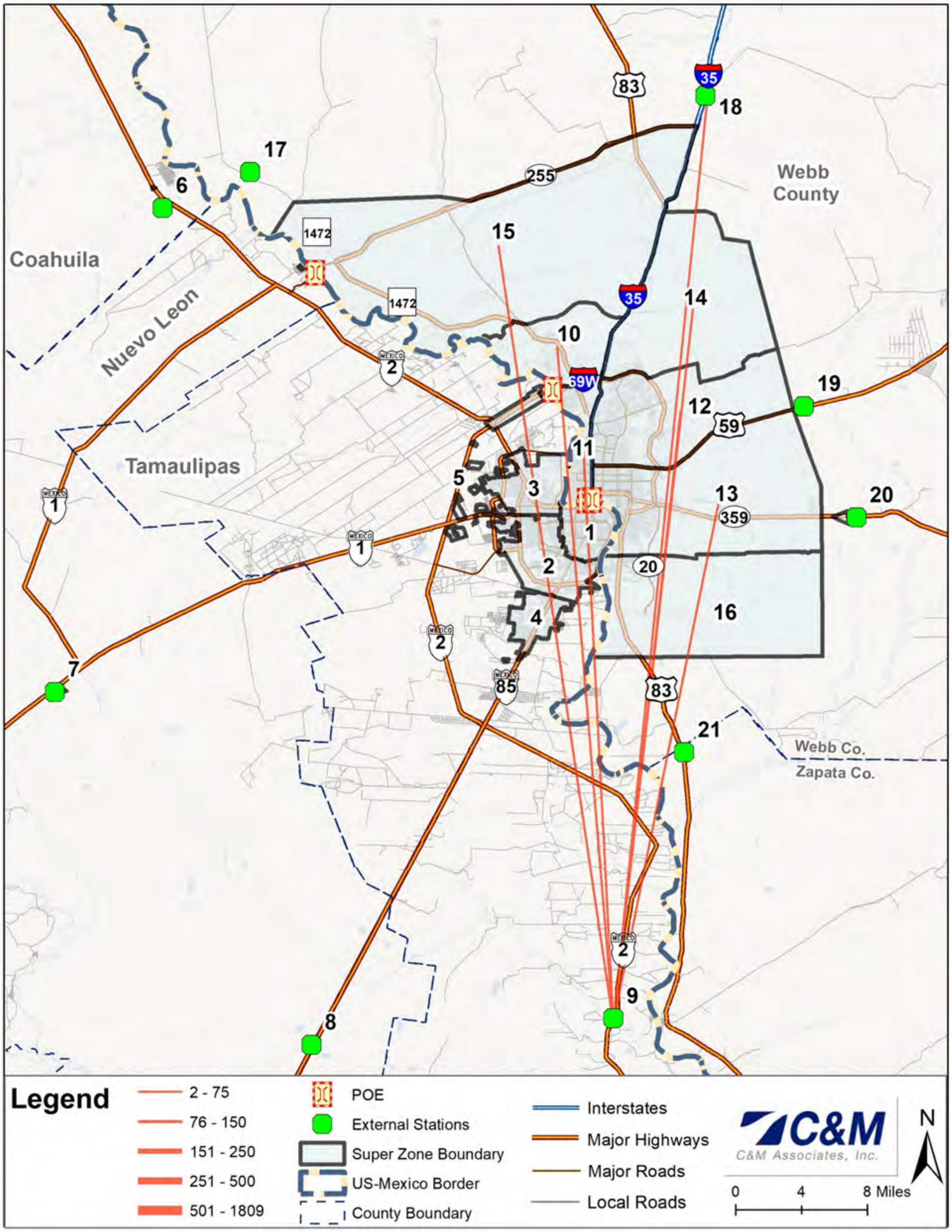


Figure 2-37. Aggregated Commercial Vehicle Intercept OD Survey (Origin 9)

Mexican Customs Manifest

The S&B team obtained the manifest of all commercial vehicles crossing the World Trade International Bridge in 2014, detailing supplier/purchaser addresses (to determine trip ODs) and commodity type/date (to determine trip frequency and seasonality). This information was compiled and analyzed to determine commercial vehicle crossing patterns such as seasonality and commodity flows.

Figure 2-38 illustrates the registered headquarters of companies in Mexico that ship cargo via the World Trade Bridge. These locations do not necessarily represent the locations where commercial vehicles start/end their trips.

Figure 2-38. Headquarters of Companies Shipping Via the World Trade Bridge (Mexico)

Figure 2-39 depicts the registered headquarters of companies in the United States that ship cargo via the World Trade Bridge. As with Mexican companies, these locations do not necessarily represent the locations where commercial vehicles start/end their trips. As shown, these companies are distributed with higher concentrations in southern, northern, and western parts of the United States. Some States, such as Texas, Georgia, Tennessee, and Ohio, have higher concentrations of companies shipping via the World Trade Bridge.

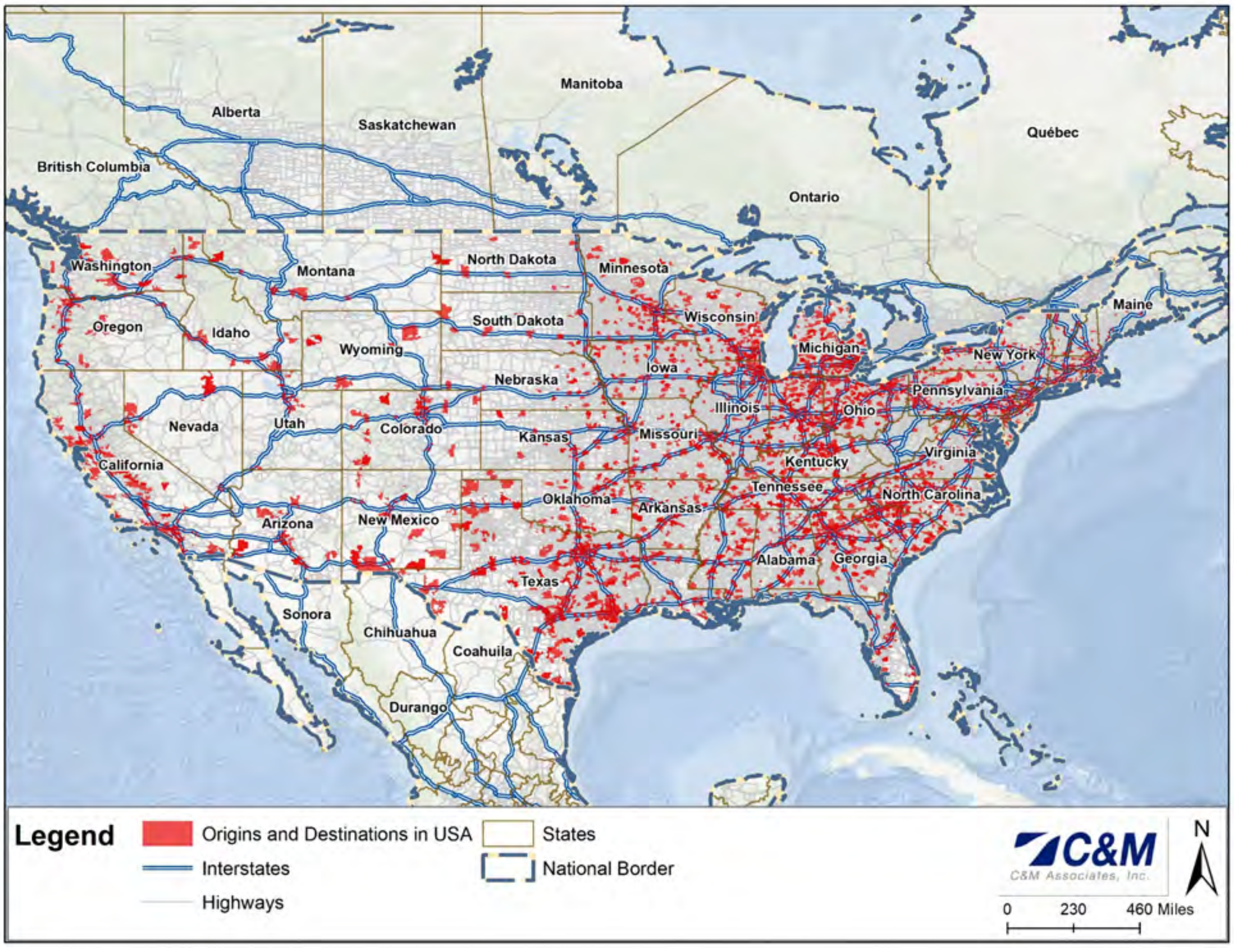


Figure 2-39. Headquarters of Companies Shipping Via the World Trade Bridge (U.S.)

2.10. Border Traffic Policies

There are several government policies that can aid in understanding additional factors that impact border crossings. These policies and their effects on border crossings are summarized in Table 2-9 and explained in detail below.

Table 2-9. Border Policies and their Effects on Border Crossings

Border Policy	Year	Effect on Border Crossings
North American Free Trade Agreement (NAFTA)	1994	Positive
Secure Electronic Network for Travelers Rapid Inspection (SENTRI)	1995	Positive
U.S. Trucking Legislation	1995	Positive
The Illegal Immigration Reform and Immigration Responsibility Act (IIRIRA)	1996	Mixed
Mexican Border Crossing Cards (Laser Visas)	1998	Positive
The Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act (USA PATRIOT)	2001	Negative
Free and Secure Trade (FAST)	2002	Positive
Mexico's Policies Against Organized Crime	2006	Mixed
The Western Hemisphere Travel Initiative (WHTI)	2007	Negative
Ready Lanes	2010	Positive
Sistema de Aforo Vehicular (SIAVE)	2011	Negative
The GSA and CTP Donations Acceptance Program (DAP)	2014	Positive
United States-Mexico-Canada Agreement (USMCA)	2020	Positive
Temporary Restriction of Travelers Crossing US-Canada and Mexico Land Borders for Non-Essential Purposes (COVID-19 Responses)	2020	Negative

North American Free Trade Agreement (NAFTA)

U.S./Mexico economic integration boomed in the 1980s and 1990s, beginning with Mexico liberalizing its economy, after decades of protectionism—and followed by a regional strategy resulting in NAFTA's implementation in 1994, eliminating duties and quantitative restrictions between the United States, Mexico, and Canada. This signature piece of legislation not only enhanced U.S./Mexico economic integration but also resulted in an annual bilateral trade growth rate of 15.9 percent (CAGR 1994-2005), the value of which doubled before the end of the decade. Since the year 2000, several regional and global factors have slowed the pace of integration, reducing the average annual increase in trade by 4.9 percent (2000–2019 CAGR). Nevertheless, data published by the BTS indicate that the *value* of U.S./Mexico trade increased by 112 percent from 2005 to 2019 (amounting to roughly $614 billion in 2019), while the value of Texas/Mexico trade increased by 88 percent over the same time period (amounting to roughly $213 billion, or 35 percent of all U.S./Mexico trade).[17] In short, NAFTA has served as a model of production sharing and cross-border investment among the three North American countries, promoting their economic interdependence.

The increased trade resulting from NAFTA has had a large impact on commercial vehicle traffic, as the majority of U.S./Mexico trade is conducted via surface modes of transportation, with commercial vehicles being the most common and surface mode. This is particularly true in Texas; the number of northbound commercial vehicle crossings at Texas POEs increased by over 41 percent from 2005 (3,169,709 crossings) to 2019 (4,396,439 crossings).[18]

Finally, with the entry of the United States-Mexico-Canada Agreement (USMCA) in July 2020, the conditions of free trade between the United States, Mexico, and Canada were renegotiated. This is expected to impact commercial border crossings positively from 2020 onward due a 3% annual growth rate.

Secure Electronic Network for Travelers Rapid Inspection (SENTRI)

The SENTRI program from the CBP provides pre-approved, low-risk travelers access to dedicated primary lanes into the United States.[19] Participants in the program wait less than those in regular lanes when entering the United States through POEs, even at the busiest times of day. Critical information required in the inspection process is provided to the officer in advance of the passenger's arrival to the inspection booth, thus reducing the inspection time. CBP's goal is for the wait time of users in these dedicated lanes to not exceed 30 minutes.

Applicants must voluntarily go through a biographical background check against criminal, law enforcement, customs, immigration, and terrorist databases, with an additional 10-fingerprint law enforcement check and a personal interview with a CBP officer. An approved SENTRI applicant will be issued an RFID card that will identify their record and status in the CBP database upon arrival at the U.S. POE. In addition to the personal identification document, a transponder is also issued to the applicant's vehicle or motorcycle. Anecdotal evidence suggests that some border crossers are reluctant to go through the detailed screening process due to privacy or residency concerns. This, in combination with the high price, serves as a barrier to higher utilization rates for this program.

U.S. Trucking Legislation

For many years, the system by which goods are shipped across the U.S./Mexico border generally has involved three types of commercial vehicles. Typically, a Mexican long-haul truck is the first vehicle involved, delivering a container of goods to a location near the U.S. border. There, a "drayage" service is employed to carry the goods in a short-haul truck across the border where, finally, a U.S.-based long-haul truck picks up the goods and delivers them to their final destination. Texas A&M University's Texas Transportation Institute (TTI) estimates the cost of drayage at between $100 and $200 per trip,[20] which, when multiplied by the 6.4 million commercial vehicles that crossed the southern U.S. border in 2019, puts the approximate cost of the drayage system at between $0.6 and $1.2 billion dollars a year.

Under the terms of NAFTA, the United States agreed to allow Mexican commercial vehicles to transport goods into the United States, starting with the border states in 1995 and extending throughout the country by the year 2000. Likewise, Mexico offered the same access to U.S. commercial vehicles. However, in 1995, President Clinton delayed implementation of those trucking provisions out of what his administration considered to be a legitimate safety concern. Clinton's action was followed in 2001 by a NAFTA arbitration panel ruling in which the United

States was declared out of compliance with its NAFTA obligations. In a renewed effort to implement cross-border trucking, President Bush took steps in 2002 to address the Clinton administration's safety concerns; however, this attempt was thwarted by a series of legal challenges, which delayed the implementation of cross-border trucking until 2007. That year, a small pilot program was launched, thereby allowing a select few Mexican trucking companies to move beyond the designated 25-mile border zone they had been accessing since before NAFTA.

In 2009, Congress put an end to the pilot program, and in March 2011, President Obama announced a breakthrough on the issue, which resulted in a new pilot plan granting U.S. access to Mexican commercial vehicles capable of meeting stringent safety standards. This pilot program lasted for 3 years, ending in October 2014. During this time, a total of 15 trucking companies were enrolled, which crossed the border over 28,000 times, traveled over 1.5 million miles in-country, and underwent over 5,500 safety inspections.[21] On January 9, 2015, the United States Department of Transportation (USDOT) announced the success of this pilot program and the decision to allow Mexican motor carriers to apply for an allowance to conduct long-haul, cross-border trucking services in the United States. Applying for long-haul allowance includes a $300 fee and requires passing a Pre-Authorization Safety Audit (PASA), as well as a drug screening. Once approved, all vehicles operating in the United States are subject to Level 1 safety inspections every 90 days for 36 consecutive months, after which inspections are required every 12 months.

Also, worth noting, officials within the U.S. and Mexican governments have pushed forward with their "21st Century Border Management" project. This project builds on the Bush administration's "Smart Border Initiative," which aimed to broaden the definition of "border" beyond the notion of a simple line to a concept of secure flows.[22]

The Illegal Immigration Reform and Immigrant Responsibility Act (IIRIRA)

In 1996, Congress began addressing the need for greater border security by passing the IIRIRA, under which border security provisions were concentrated along the U.S./Mexico border with the intent of increasing border enforcement. Additionally, IIRIRA reduced the criteria for deportable offenses, as immediate deportation was previously only triggered for offenses that could lead to 5 years or more in jail.

At the same time, to facilitate legitimate travel to the United States, IIRIRA sought to address the persistent problem of long delays at each POE by authorizing the hiring of enough inspectors in 1997 and 1998 to ensure full staffing during peak crossing hours. The act also authorized the U.S. Attorney General to formulate six inspection projects, such as constructing dedicated commuter lanes, aimed at speeding up the border-crossing process for frequent crossers paying a fee.

In an effort to stem illegal immigration, IIRIRA not only authorized the expansion of border barriers but also gave the Attorney General the authority to acquire and use all available federal equipment in the government's attempt to reduce the flow of illegal immigrants into the United States. This legislation also authorized appropriations for the nationwide expansion of the Automated Biometric Fingerprint Identification System (IDENT) program—replaced in 2013 by the Department of Homeland Security Office of Biometric Identity Management (OBIM)—in order to include the fingerprints of all illegal or criminal aliens apprehended at the border. IIRIRA also contained a first-time provision requiring biometrics as one form of identity on certain travel documents. Specifically, the act required that the Secretary of State issue border-crossing cards bearing a biometric identifier that is machinereadable; furthermore, the biometric identifier must match the biometric characteristic of the card holder for that person to be allowed entry to the United States.

Mexican Border Crossing Cards (Laser Visas)

For decades, the United States has made special accommodations for Mexican nationals who visit the country frequently and conduct business in border communities. Mexican nationals applying for admission to the United States as visitors are required to obtain a visa or possess a Mexican Border Crossing Card (BCC).[23] The first generation of BCCs were known as "laser visas." These laminated cards—roughly the size of a credit card—were produced by the now defunct Immigration and Naturalization Service from April 1, 1998 to September 30, 2008. The Department of State began producing the second generation of BCCs on October 1, 2008, though laser visas are still considered valid until their expiration date. The new BCCs are similar in size to the laser visas but are more advanced, graphically, and technologically. Like the SENTRI card, it includes an RFID chip.

The BCC is typically valid for 10 years and can be used multiple times by citizens of Mexico desiring short-term entry (up to 6 months) for business or tourism in the United States, though it does not provide eligibility for employment in the United States. Mexican citizens can obtain a BCC from the Department of State Bureau of Consular Affairs if they are otherwise admissible as B-1 (business) or B-2 (tourist) nonimmigrants.

In addition to meeting the eligibility standards of B1/B2 visas, first-time applicants are required to present a valid Mexican passport as primary evidence of their citizenship and identity. The current fee to apply for a BCC is $160 for those age 15 or older and $16 for those under age 15 (if a parent or guardian has a valid BCC or is also applying for one). The under-age BCC is valid for either 10 years or until the applicant reaches age 15, whichever is sooner.

Most Mexican entrants with BCCs are not required to obtain an I-94 arrival/departure form if CBP officers determine that they do not intend to travel more than 25 miles into the country or stay more than 30 days. If it is determined by a CBP officer that a Mexican citizen intends to exceed either limit, the entrant is then referred to a secondary inspection point at the POE, where he or she will be subject to biometric requirements and issued an I-94 form, if no grounds are found on which to deny the application.

The Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act (USA PATRIOT)

The 2001 USA PATRIOT Act called for the immediate implementation of an integrated entry and exit data system and required that the system be interoperable with other law enforcement data systems. Moreover, the act required the Attorney General and the Secretary of State to develop and certify a technology standard that could be used to verify the identity of people seeking a visa to enter the United States. The mandate to implement an integrated entry and exit data system and the requirement that travel documents contain a biometric identifier have had direct implications on most foreign nationals seeking entry into the United States at the U.S./Mexico border.

Free and Secure Trade (FAST)

The FAST program is a commercial clearance program for known low-risk shipments entering the United States from Canada or Mexico. Initiated after the events of September 11, 2001, this trusted traveler/trusted shipper program allows expedited processing for commercial carriers who have completed background checks and fulfill certain eligibility requirements. As of 2013, more than 78,000 commercial drivers have been enrolled in the FAST program nationwide.[24] The FAST program is open to enrollment by U.S., Canadian, and Mexican commercial vehicle drivers.

The FAST program was first implemented in December 2002 at U.S./Canadian POEs. The first dedicated FAST lanes on the U.S./Mexican border were implemented in El Paso, Texas. CBP officers began the initial processing of commercial vehicles through FAST lanes on October 27, 2003.

Participation in FAST requires that every link in the supply chain—from manufacturer to carrier to driver to importer—is certified under the Customs-Trade Partnership Against Terrorism (C-TPAT) program. C-TPAT is a voluntary government/private sector partnership in which companies involved in commerce destined for the United States 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. From its inception in November 2001, CTPAT continued to grow. In 2020, more than 11,400 certified partners spanning the gamut of the trade community, have been accepted into the program. The partners include U.S. importers/exporters, U.S./Canada highway carriers; U.S./Mexico highway carriers; rail and sea carriers; licensed U.S. Customs brokers; U.S. marine port authority/terminal operators; U.S. freight consolidators; ocean transportation intermediaries and non-operating common carriers; Mexican and Canadian manufacturers; and Mexican long-haul carriers, all of whom account for over 52 percent (by value) of cargo imported into the U. S[25].

The benefits of FAST membership are dedicated access lanes for a faster crossing time and greater efficiency in transporter shipment processing, a reduced number of inspections resulting in reduced delays at the border, and priority (front of the line) processing for CBP inspections.

Mexico’s Policies against Organized Crime

In 2006, Mexican President Felipe Calderon ordered 6,500 federal troops into the State of Michoacán in an effort to end the rampant drug violence there. Known as *Operation Michoacán*, this step was regarded as the first major initiative against organized crime in Mexico and, as such, was generally viewed as the starting point in the Mexican government’s push to combat drug cartels. This combat continues today and affects the border region and its citizens on a daily basis, particularly as drug cartels engage not only the Mexican government but also each other in their attempt to control trafficking routes into the United States. Violence along the border has had a detrimental effect on the entertainment and tourism industries of Mexico, as many U.S. citizens have chosen to stay away to avoid unnecessary risk.

The Western Hemisphere Travel Initiative (WHTI)

In April 2005, the U.S. Departments of State and Homeland Security unveiled their Western Hemisphere Travel Initiative (WHTI), pursuant to section 7209 of the Intelligence Reform and Terrorism Prevention Act of 2004 (the “9/11 Intelligence Bill”). As a result of this initiative, all travelers to and from the Americas—including Canada, Mexico, Central America, and South America—and to the Caribbean and Bermuda were required to possess a valid passport, or other accepted document or combination of documents, in order to enter or re-enter the United States. Phase 1 of the WHTI, which instituted passport requirements for air travel, went into effect in 2007, followed by Phase 2 on June 1, 2009, which instituted passport requirements for land and sea travel into the United States. In addition, under the terms of the WHTI, as of January 31, 2008, CBP officers ended their practice of accepting verbal declarations of citizenship from U.S. travelers at POEs and instead began requiring each traveler to produce a secure document in order to enter or depart the country. It is suspected that these measures have had a negative impact on the number of trips taken by U.S. citizens into Mexico. Indeed, according to the WHTI Final Programmatic Environmental Assessment, while 43 percent of all U.S./Mexican border crossings in 2004 were made by U.S. citizens, an estimated 68 percent of those travelers did not possess passports.[26] Cost and convenience factors may have played a role in these findings, as currently it can take approximately 6 weeks for passport applications to be processed, at a cost of $145 each, while expedited processing (3 weeks) can be purchased for an additional $60.

Ready Lanes

The Ready program, or "Ready Lane," is a dedicated primary vehicle lane for travelers entering the United States at POEs. Travelers who obtain and travel with a WHTI-compliant, RFID-enabled travel document may receive the benefits of utilizing a Ready Lane.

The Ready Lane border crossing stations can scan the card from 10–30 feet away. Travelers simply need to hold the RFID card up to the windshield while driving through the station. The CBP officer is then able to read all related information to the scanned user on a monitor, expediting the passport control process.

CBP launched the Ready Lane program in 2010 at the Ambassador Bridge POE in Detroit, Michigan. Ready Lane users experience, on average, 15–20 seconds less processing time than travelers with no RFID card. Currently, 70% of POEs on the US-Mexico border have Ready Lane, in Laredo all non-commercial vehicles POEs includes a Ready Lane[27].

Sistema de Aforo Vehicular (SIAVE)

The growing drug-related violence in Mexico has led to increased southbound inspections at many POEs, as part of the U.S. and Mexican governments' attempts to slow the shipment of firearms and money linked to illicit activities in Mexico. In addition, the Mexican government has instituted Sistema de Aforo Vehicular (SIAVE), a program by which the actual weight of a vehicle is compared against a database; when a vehicle is discovered during inspection to be outside a prescribed weight range, it becomes subject to further scrutiny. In addition, on the U.S. side of the border, CBP conducts random inspections of vehicles before they cross into Mexico in an effort to intercept firearms and fraudulent money made from the sale of illegal drugs. These individual efforts—SIAVE and random inspections conducted by CBP—not only have added stress to a system that was not meant to handle southbound inspections but have resulted in increased wait times at the border.

The CBP and GSA Donations Acceptance Program (DAP)

The DAP was established in 2014 to explore, foster, and facilitate partnerships for POE infrastructure and technology improvements. Congress authorized the CBP, in collaboration with the U.S. General Services

Administration (GSA), to conduct a 5-year pilot program permitting CBP to enter into partnerships with private sector and government entities at POEs for certain services and to accept donations. The DAP is authorized under Section 559 subsection (f) of the Consolidated Appropriations Act, 2014, (P.L. 113-76), which permits CBP and the GSA to accept donations from private and public-sector entities.

Pursuant to the Donation Acceptance Authority, CBP and GSA are authorized to accept donations of real property, personal property (including monetary donations), and non-personal services from private sector and government entities. Accepted donations may be used for activities related to the construction, alteration, operations, and maintenance of an existing CBP-owned POE, existing leased space at a CBP air or sea POE, or a new or existing GSA-owned POE. These activities may include—but are not limited to—land acquisition, design, and deploying equipment and technologies. Partnerships entered into during the pilot program may extend beyond the initial 5-year timeframe.[28]

In June 2020, CBP and the City of Laredo and General Services Administration (GSA) partnered on a small-scale infrastructure improvement project through the DAP on the World Trade Bridge (WTB). The project provides a path for commercial vehicles to travel from the bridge through a newly installed non-intrusive technology (NII) Z-Portal and around any future construction. NII Z-Portal technology assists in increasing the POEs ability to examine cargo effectively without impeding the flow of processing trade through the port.

United States-Mexico-Canada Agreement (USMCA)

The USMCA represents a replacement and modernization of the 1994 NAFTA agreement.[29] The agreement came into effect on July 1, 2020 with the objective of supporting mutually beneficial trade and leading to freer markets and robust economic growth in North America. The agreement is the result of a 2017–2018 renegotiation between the member states of the NAFTA, which informally agreed to the terms of the new agreement on September 30, 2018 and formally on October 1.

The new rules for North American foreign trade grant legal certainty to companies and governments in the region, as well as great fiscal facilities in merchandise flows. The key changes of the new trade agreement are concentrated in the regulations of the certification of origin of export products, tariff levies in the automotive industry, labor regulation and electronic commerce. The new vehicle export agreements from Mexico contemplate an increase from 62.5% to 75% in the rules of origin of the content of automobiles manufactured in the region, a gradual increase until 2023. It also obliges Mexico to 40% of the vehicle is made by workers with salaries above $ 16 an hour. This regulation represents a challenge for Mexican manufacturers since the national minimum wage is roughly 5 dollars a day and could reduce competitiveness in the short term.

Regarding the labor content, the USMCA establishes that the importation of products that are made with forced labor from any country is prohibited; this could affect the Mexican agricultural sector and exports due to the lack of regulation in some agricultural and agro-industrial subsectors. Furthermore, the inclusion of environmental regulations for agricultural and fishing production could lead to legal controversies that would undermine Mexican production.

Electronic commerce became a new market field that requires regulation to keep the treaty more up to date. It was agreed that there will be no tariffs on the trade of digital goods, such as computer programs, videos, or audios. Likewise, regulations that established a 10-year period of exclusivity to produce drugs were eliminated, allowing a rapid introduction of generics of the same drug at more accessible prices.

The negotiations on the new trade agreement generated tensions between the countries involved, generating uncertainty in the future possibilities of trade in North America. Although the agreement between the member countries and the implementation of the new treaty have helped to achieve commercial certainty and generate better future expectations of commercial exchange, its implementation is still very recent and future impacts remain to be seen. The new policies for certification of origin could be kept more restrictive and imply labor legislative changes in Mexico, which could generate negative impacts in the short term but with the potential for growth in the long term.

Temporary Restriction of Travelers Crossing US-Canada and Mexico Land Borders for Non-Essential Purposes (COVID-19 Responses)

Beginning on March 21, 2020, the governments of the United States and Mexico agreed to apply travel restrictions for border crossings along the U.S./Mexico border.[30] Travel restrictions were limited to "non-essential" trips (Individuals traveling for tourism purposes, such as sightseeing, recreation, gambling, or attending cultural events in the United States), which mainly impacted border crossings for non-commercial vehicles.

These actions were intended to help protect communities from the spread of COVID-19 and were reviewed and reiterated on a monthly basis since March 2020. It is expected that the efforts to vaccinate the population will help to reduce the spread of infections, allowing border travel restrictions to be eased or lifted in 2021.

Conclusion

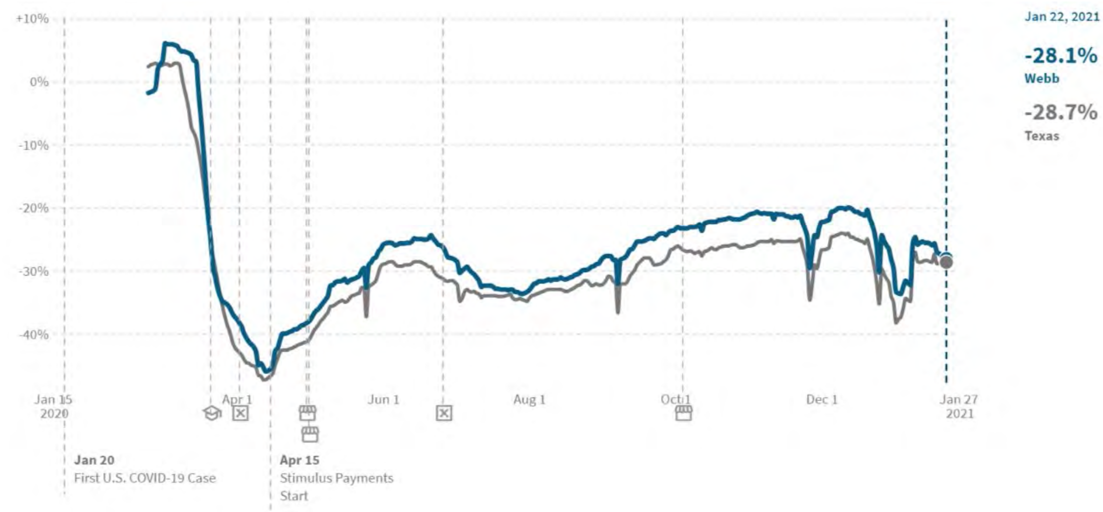
The programs, initiatives, and legislation outlined above demonstrate the lengths to which the United States and Mexican governments have gone to ensure border security in an age of international terrorism and drug trafficking. How these measures affect life and business along the U.S./Mexico border is difficult to quantify; however, acknowledging their role is vital to the task of accurately analyzing border crossing trends and making predictions about the future of this region.

2.11. COVID-19 Study Area impact

In 2020, the outbreak of the viral illness COVID-19 spread throughout the world and was defined by the World Health Organization (WHO) as a pandemic. By January 27, 2021 Webb County had 38,452 confirmed COVID-19 cases and 609 deaths.[31]

The COVID-19 outbreak is materially impacting the movement of people and, with that, traffic volumes. Due to the rising COVID-19 infection cases, people throughout the United States, including Texas and Webb County, have either been under restrictions limiting their travel (stay-at-home orders, lockdowns, quarantines) or have chosen to limit their travel and practice social distancing to reduce the virus's spread.

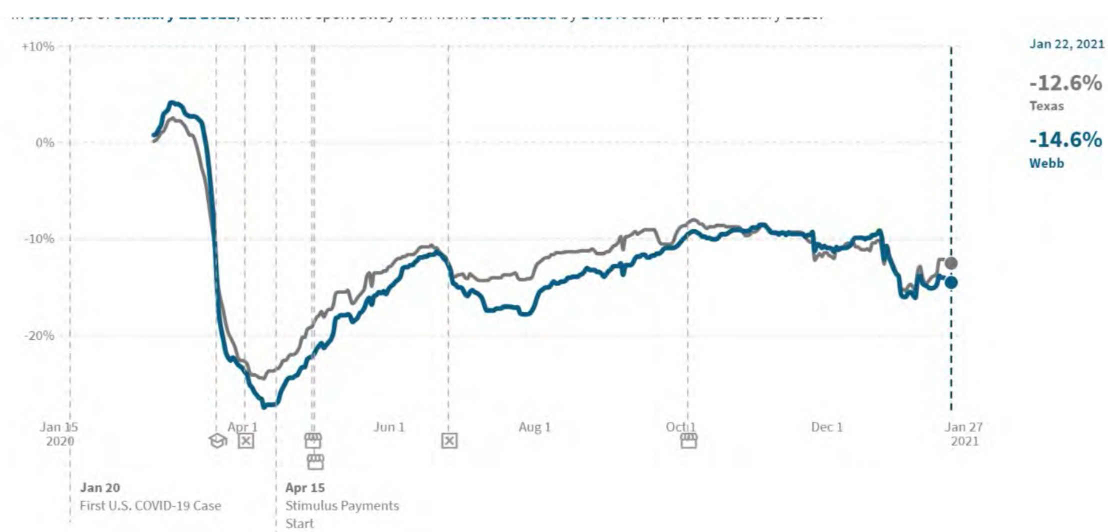
As of July 11, 2020, total time spent at workplace locations decreased by 28.1 percent in Webb County and by 28.7 percent in Texas compared to January 2020, as presented in Figure 2-40.[32]



Source: Opportunity Insights[32]

Figure 2-40. Percentage Change in Time Spent at Workplace Locations Compared to January 2020

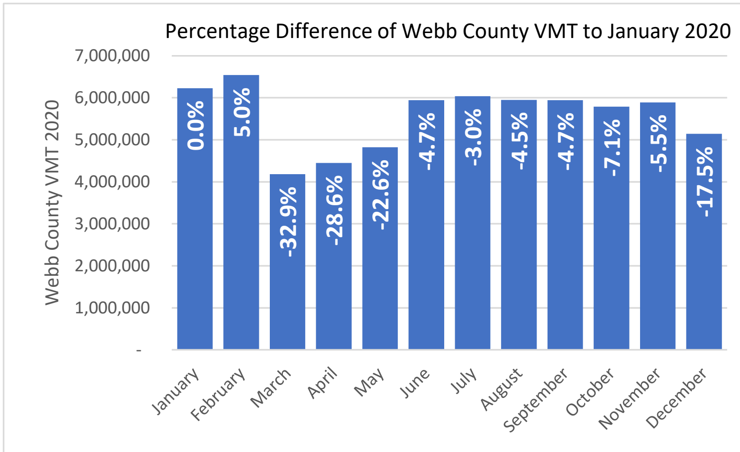
As of January 11, 2021, the total time spent away from home decreased by 14.6 percent in Hidalgo County and by 12.6 percent in Texas compared to January 2020, as shown in Figure 2-41.



Source: Opportunity Insights[32]

Figure 2-41. Percentage Change in Time Spent Away from Home Compared to January 2020

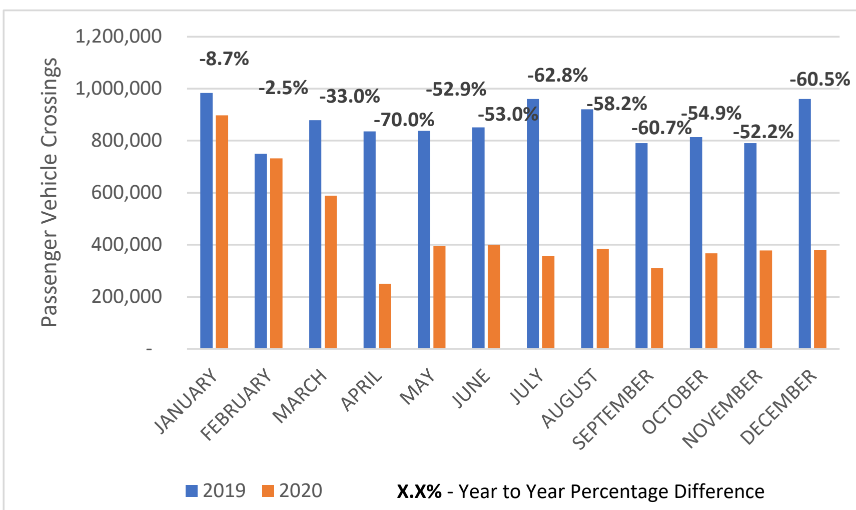
These statistics highlight the significant changes in travel demand and patterns, which result in less congestion on Webb County's road network, particularly during peak periods. The observed vehicle-miles traveled (VMT) in the first week of January was 19 percent less than what was observed in January 2020.[33] The monthly differences in Webb County VMTs throughout 2020 are presented in Figure 2-42. As in the previously shown figures, all months are compared to the VMT of January 2020 before the pandemic.



Source: StreetLight[33]

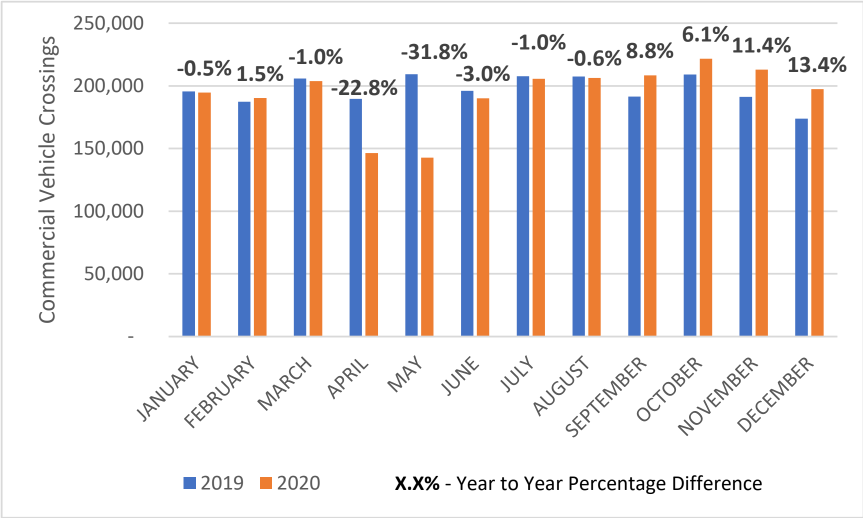
Figure 2-42. Webb County VMT in 2020

Border crossings at the U.S/Mexico border in Webb County decreased substantially due to an Executive Order restricting border-crossings to those who have essential business in the United States or in Mexico. As shown in Figure 2-43, passenger vehicle crossings in December 2020 were about 60 percent lower compared to December 2019. However, the impact on commercial vehicles crossings has been much lower; the number of the commercial vehicles crossings only reduced by 1.9 percent in 2020 compared to 2019. Since September 2020, commercial vehicle crossings have even increased, as shown in Figure 2-44. The most reduced crossing type is pedestrians, as can be observed in Figure 2-45. Since March 2020, pedestrian crossings have reduced by 65 percent on average compared to the number of monthly crossings in the previous year.



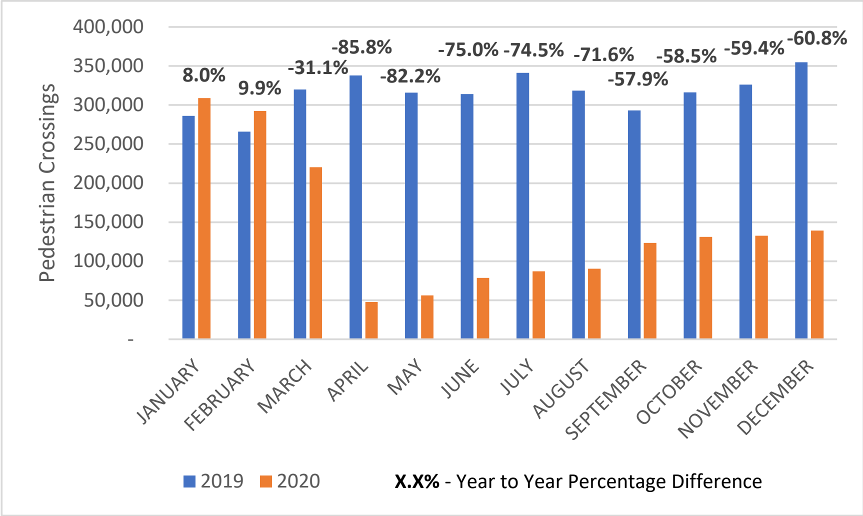
Source: USDOT, BTS[34]

Figure 2-43. Northbound Laredo International Bridge System Passenger Vehicle Border Crossings



Source: USDOT, BTS[34]

Figure 2-44. Northbound Laredo International Bridge System Commercial Vehicle Border Crossings



Source: USDOT, BTS[34]

Figure 2-45. Northbound Laredo International Bridge System Pedestrian Border Crossings

In December 2020, the City of Laredo imposed a new set of rules to protect the Laredo population from the COVID-19 threat.[35] Below is a summary of the rules imposed as of December 30 that limited the mobility of people in Laredo:

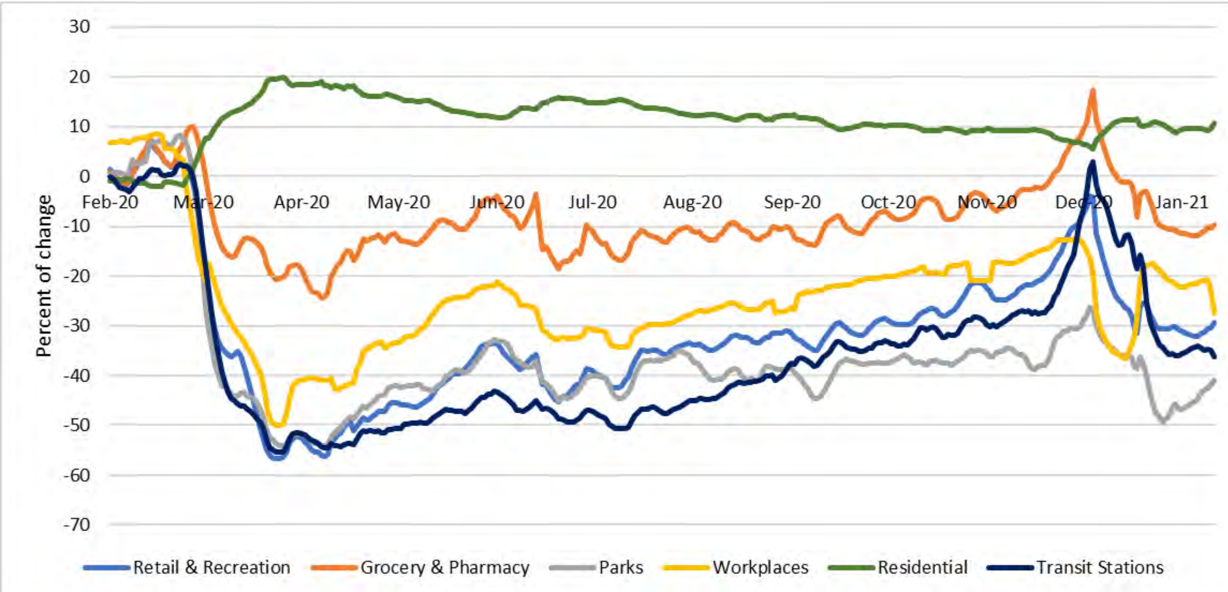
- Stay at Home Orders. Except where necessary to provide or obtain services from business establishments allowed in order to conduct essential activities, all individuals currently living within the City of Laredo should minimize social gatherings and minimize in-person contact with people who are not in the same household and, if leaving the home, implement social distancing and practice good hygiene, environmental cleanliness, and sanitation. Parents and guardians should refrain from taking minor children in while providing or obtaining services unless doing so is necessary because of a lack of alternate childcare.

- Curfew. A curfew was be imposed between the hours of 10:00 p.m. to 5:00 a.m. for all social activities not occurring at an essential or non-essential businesses. A social activity would be congregating in any area outside an individual's household other than for engaging and seeking essential activities or services as outlined in Governor Greg Abbott's Executive Order No. GA-32.
- Non-Essential Activities and Non-Essential Services Prohibited. The following are considered non-essential activities/services and are hereby prohibited in the City of Laredo until further notice:
    - Bars or similar establishments that hold a permit from the Texas Alcoholic Beverage Commission, and any other businesses where alcoholic beverages are served or made available to customers at no charge.
    - All gatherings with ten or more persons outside a single household or living unit are prohibited, unless such gatherings are special enumerated by this Order, by Executive Order GA-32, or future execution order by Governor. Nothing in this Order prohibits the gathering of members of a household or living unit.
    - In accordance with Executive Order GA-32 and consistent with that order, no individual, business, entity, promoter, or organizer shall schedule, host, or conduct any outdoor gathering anticipated to attend more than ten (10) people unless approved by the Mayor.

In Mexico, containment measures began on the last week of March 2020 as an initial response to the spread of COVID-19. The initial objective of the Mexican government was to generate a gradual spread of the virus that would improve the conditions of the hospitals and avoid overload. The measures implemented at the national level consisted of suspending activities considered "non-essential" such as school activities, events that bring people together or that involve constant displacement in public transport, and the closure of recreational sites such as movie theaters, theaters, restaurants, and bars.

The impact of the closure of school and commercial activities had an immediate impact on the mobility of people at the national and regional level. Figure 2-46 illustrates the mobility trends of Tamaulipas in relation to different sites of population agglomeration. As shown, from the last week of March 2020, the population concentration in recreational, work activities, and transit stations[2] had the greatest negative impact (-50%). In contrast, the residential area had its highest growth with respect to the base indicator (+20%). In general, the conglomeration of people in their homes remained constant throughout 2020 with a slight decreasing trend. Moreover, recreational and work activities began exhibiting a positive trend with peaks in December due to holiday celebrations.

[2] Mobility trends for places like public transport hubs such as subway, bus, and train stations.



Note: The base value (i.e., average value of each day of the week) is calculated over a period of 5 weeks (Jan. 3 to Feb. 6, 2020).
Source: Google[36]

Figure 2-46. Daily Moving Average of Covid-19 Mobility trends in Tamaulipas

As of June 2020, the restrictions on economic activities in Mexico were replaced by an epidemiological traffic light that would indicate the individual situation of each State of Mexico. The decrease in daily confirmed cases in Tamaulipas and Laredo allowed a greater opening of commercial activities and the increase in the mobility of people from August to September 2020. However, and as observed in Figure 2-47, a second wave of confirmed cases were detected at the beginning of December and in January 2021, causing new restrictions on non-essential activities and a drop in mobility as of December 2020.

Source: Government of Mexico[37]

Figure 2-47. Daily Moving Average Matamoros and Tamaulipas Daily Confirmed Covid-19 Cases

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

CHAPTER 3: SOCIOECONOMIC REVIEW

Chapter 3: Socioeconomic Review

This chapter presents the S&B team's process of socioeconomic data evaluation for its Binational Assignment Model inputs. In addition to the evaluation process, this chapter provides an in-depth review of historical and forecasted socioeconomic data within the study area, including Webb County, the Laredo Metropolitan Area, and the Nuevo Laredo Metropolitan Area. Special emphasis was placed on factors that impact transportation activities and influence border traffic demand, particularly population, household size, median household income, and employment.

3.1. Introduction

The primary purpose of this socioeconomic evaluation is to update the socioeconomic data inputs to C&M Binational Assignment Model (see Chapter 5) at the traffic analysis zone (TAZ)[3] level. The sources for the socioeconomic data inputs are the Laredo Metropolitan Planning Organization (MPO) travel demand model (TDM) at the TAZ level, the Texas Statewide Analysis Model (Texas SAM) at the TAZ level, and publicly available information from the U.S. Census at the census tract level. Additionally, the S&B team purchased State Profiles data from Woods & Poole Economics, Inc. (W&P) for counties in Texas (2019 Database). State Profiles contain historical data from 1970 (though some variables begin in 1990) and annual projections to 2050.

Like the W&P data, the S&B team also purchased Webb County forecasts from Moody's Analytics (Moody's). Moody's forecasts and alternative scenarios extend 30 years and reflect the latest socioeconomic data, including the impacts of the COVID-19 pandemic on state and county economics.

Additionally, the S&B team employed Sistema de Información Regional de México S.A. de C.V. (SIREM) to conduct a socioeconomic data review in the Nuevo Laredo Metropolitan Area due to the lack of existing socioeconomic forecasts at the Mexican census tract level. SIREM is a market leader in conducting socioeconomic analyses and provides recommendations at the federal and regional level of the Mexican economy (for the full socioeconomic report by SIREM, please see Appendix B).

In addition to the sources mentioned above, the S&B team analyzed historical and forecasted socioeconomic data from the following sources:

- U.S. Census Bureau, American Community Survey (ACS)
- U.S. Bureau of Labor Statistics (BLS)
- Instituto Nacional de Estadística y Geografía (INEGI)
- Directorio Estadístico Nacional de Unidades Económicas (DENUE)
- INEGI Censo Económico 2019
- Consejo Nacional de Población (CONAPO)
- Texas State Data Center (TSDC)

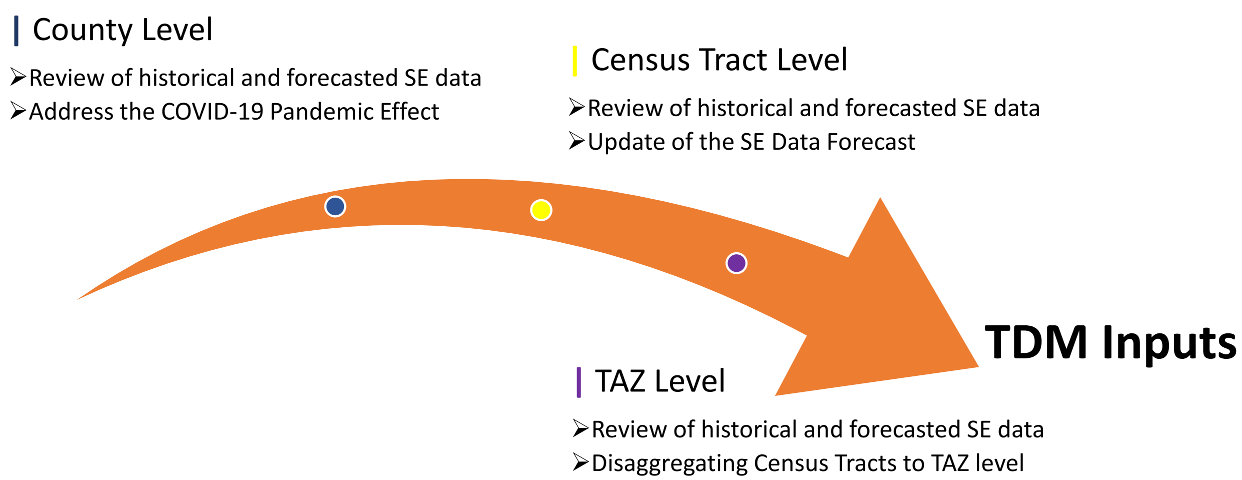
[3] TAZs are statistical entities delineated by state and/or local transportation officials for tabulating traffic-related census data, especially journey-to-work and place-of-work statistics. A TAZ usually consists of one or more census blocks, block groups, or census tracts.

- Texas Water Development Board (TWDB)

The S&B team's socioeconomic update can be summarized in the following steps:

1) Reviewed historical and forecasted socioeconomic data within the study area.
2) Determined county-wide population, employment, number of households, and median household income growth rates from 2018 to 2040, including the effects of the COVID-19 pandemic.
3) Determined population, employment, number of households, and median household income growth rates at the census tract level.
4) Disaggregated socioeconomic data inputs from the census tract level to the TAZ level.
5) Prepared TAZ–level socioeconomic data for all future model years, following the TAZ structure of the S&B team's Binational Assignment Model.

Figure 3-1 illustrates the above steps as they relate to the three geographical layers of the Binational Assignment Model. The result of this evaluation is the socioeconomic data inputs to the model.



Note: SE = socioeconomic

Figure 3-1. The S&B team Socioeconomic Data Forecast Steps by TDM Layers

The following sections summarize the results of the S&B team's socioeconomic review, beginning with population data. For each variable, the chapter first presents the historical information at the county and census tract levels followed by the projections at the county level and at the TAZ level.

3.2. Population

Historical Population Trends

Population is a key factor for transportation modeling and network simulation. The S&B team evaluated the county-level and census tract level population data of the binational study area as gathered from local, state, and federal data sources. In accordance with the established guidelines and the scope of the present study, 2018 was established as the model base year.

As shown in Table 3-1, Webb County has added 78,929 residents since 2000, which translates into a CAGR of approximately 1.9 percent from 2000 to 2018. However, the growth trend slowed down from 2013 to 2018 with a CAGR of 1.3 percent.

Similar to the population growth trends in the U.S. portion of the binational study area, the Nuevo Laredo Metropolitan Area has expanded rapidly, adding 118,012 residents since 2000 and exhibiting a 2000–2018 CAGR of approximately 1.8 percent. Overall, the growth from 2000 to 2018 between both cities has behaved in a similar way with a decreasing trend. However, the population level of Nuevo Laredo makes it more impactful; even with similar growth, it is contributing a greater amount of population to the binational study area.

Table 3-1. Historical Population Trends and Growth Rates

Year	Webb County		Laredo	
	Population	CAGR	Population	CAGR
2000	193,124	-	310,915	-
2010	240,346	2.2%	391,649	2.3%
2011	245,762	2.3%	395,819	2.3%
2012	250,320	1.9%	400,343	2.3%
2013	254,829	1.8%	404,968	2.3%
2014	259,471	1.8%	409,688	2.3%
2015	263,251	1.5%	414,461	2.3%
2016	266,006	1.0%	419,266	1.2%
2017	269,624	1.4%	424,098	1.2%
2018	272,053	0.9%	428,927	1.1%

Source: U.S. Census, INEGI, and CONAPO

Historical Population Trends at the Census Tract Level

The U.S. Census Bureau has established a system of territorial division of the country's counties. Such areas are called census tracts and are defined as geographic entities within counties (or the statistical equivalent). Therefore, Webb County is divided into 61 census tracts distributed in a total area of 3,361 squares miles, as illustrated in Figure 3-2. This initial disaggregation level allowed the S&B team to analyze the historical socioeconomic data at a sub-county level and develop a growth trend analysis to utilize in the socioeconomic projections at the TAZ level.

The S&B team analyzed the historical trends of Webb County census tracts to evaluate the disaggregated growth distribution within Webb County. As shown in Table 3-2 the census tract with the most population growth is Tract 18.06 with a 2000–2018 CAGR of 9 percent. According to the Laredo 2020–2045 MTP, this area's future land use is medium density residential.[38] Tract 17.17 exhibited the lowest growth in the county with a CAGR of -3.5 percent. This area holds the Laredo Power Plant, logistics and transportation companies, and the Modern Industrial Park.

Figure 3-3 shows the 2010–2018 population CAGR at the census tract level for Webb County. The highest growth can be observed in areas located both in the northern and southern part of Laredo, specifically Tracts 17.13, 16.02, 18.06, and 18.09. These tracts represent exclusively residential areas with the greatest potential for urban growth.

On the other hand, the tracts with the lowest population CAGR in the study area are in the central part of the city. These urban areas have large populations and urban density, with special emphasis on commercial and logistics services.

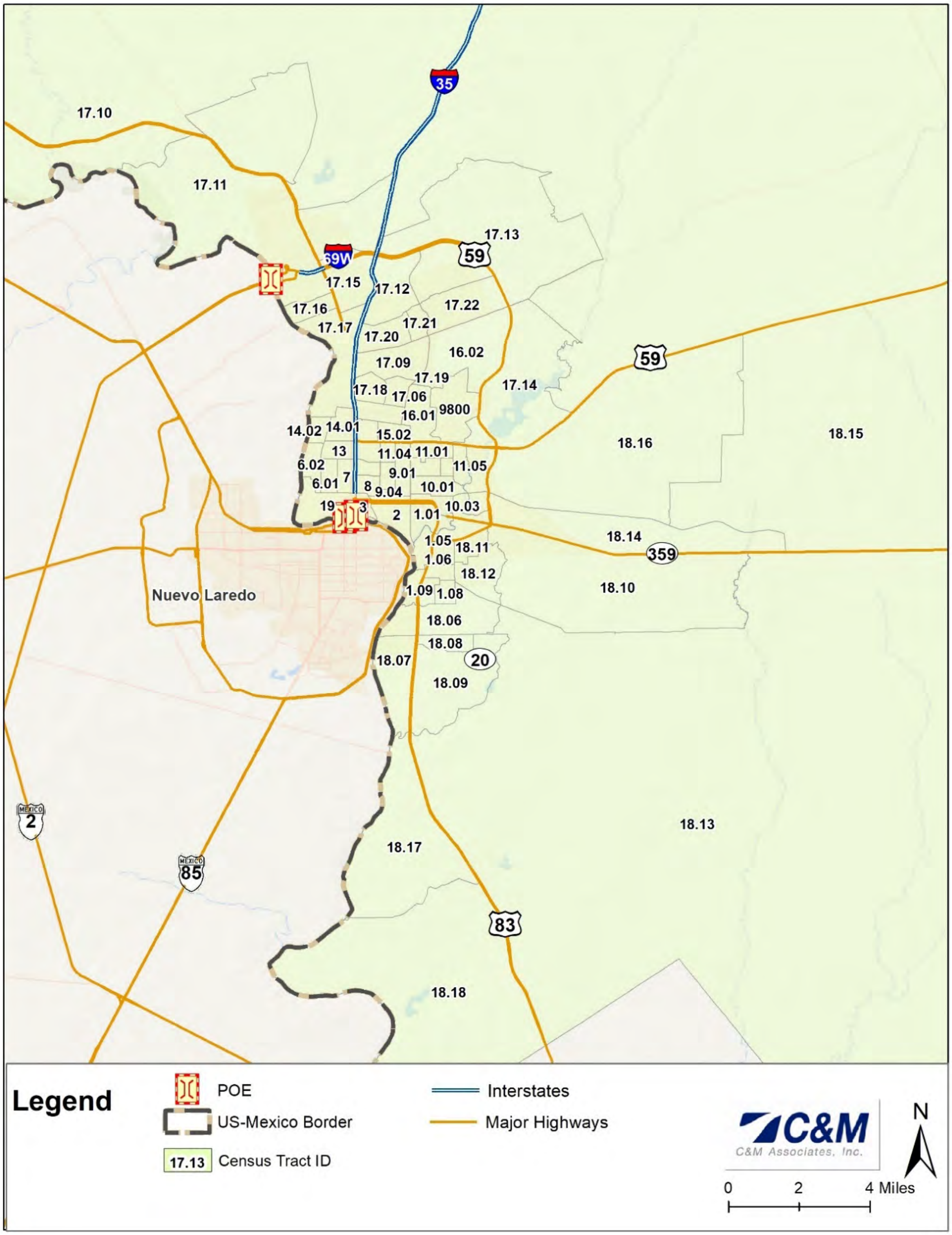


Figure 3-2. Webb County Census Tract Locations and IDs

Table 3-2. Historical Population Trends and Growth Rates – Webb County Census Tracts

Tract ID	2000	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR		
											2000-2018	2010-2018	2015-2018
1.01	4,649	4,592	4,661	4,739	4,922	4,821	4,824	4,628	4,787	4,689	**0.2%**	**0.3%**	**-0.9%**
1.05	2,722	2,274	2,277	2,477	2,681	2,931	2,990	3,154	2,931	2,571	**0.4%**	**1.5%**	**-4.9%**
1.06	4,266	4,084	4,080	4,454	4,647	4,157	3,918	3,703	3,573	3,688	**-1.0%**	**-1.3%**	**-2.0%**
1.07	3,388	3,504	3,258	3,674	3,458	3,446	3,439	3,402	3,296	3,173	**-0.2%**	**-1.2%**	**-2.6%**
1.08	3,332	3,439	3,820	4,101	3,943	3,983	4,057	4,341	3,979	3,922	**1.0%**	**1.7%**	**-1.1%**
1.09	2,567	2,219	2,091	2,104	2,153	2,333	2,448	2,500	2,608	2,180	**0.1%**	**-0.2%**	**-3.8%**
2	4,184	3,521	3,699	3,684	4,058	4,361	4,526	4,458	4,362	4,343	**0.2%**	**2.7%**	**-1.4%**
3	2,739	2,682	2,530	2,667	2,513	3,030	2,945	2,792	2,610	2,338	**-0.3%**	**-1.7%**	**-7.4%**
6.01	3,059	2,769	2,888	3,016	3,063	2,859	2,731	2,986	3,054	2,757	**0.0%**	**-0.1%**	**0.3%**
6.02	2,355	2,387	2,647	2,752	2,943	3,032	2,993	2,820	2,861	2,623	**1.1%**	**1.2%**	**-4.3%**
7	2,856	2,970	2,757	2,869	2,884	2,888	3,225	3,235	3,038	3,217	**0.3%**	**1.0%**	**-0.1%**
8	2,748	2,632	2,507	2,256	2,159	2,492	2,728	2,754	2,795	2,869	**0.1%**	**1.1%**	**1.7%**
9.01	4,901	4,567	4,859	4,190	5,097	4,553	4,868	5,075	5,297	4,953	**0.4%**	**1.0%**	**0.6%**
9.03	2,657	2,987	2,925	3,243	2,806	2,817	2,690	2,667	2,501	2,714	**-0.3%**	**-1.2%**	**0.3%**
9.04	3,301	3,200	3,370	3,154	3,327	3,265	3,019	3,148	3,405	3,731	**0.2%**	**1.9%**	**7.3%**
10.01	4,336	4,870	4,780	5,124	5,385	5,346	4,830	4,738	4,675	4,577	**0.4%**	**-0.8%**	**-1.8%**
10.03	2,510	2,404	2,405	2,581	2,438	2,525	2,743	2,801	2,922	2,975	**0.8%**	**2.7%**	**2.7%**
10.04	1,943	1,541	1,465	1,614	1,476	1,583	1,610	1,826	1,765	1,646	**-0.5%**	**0.8%**	**0.7%**
11.01	3,818	3,967	3,759	3,821	4,184	3,911	3,932	3,830	3,678	3,264	**-0.2%**	**-2.4%**	**-6.0%**
11.03	1,746	1,755	1,607	1,477	1,420	1,410	1,387	1,516	1,489	1,641	**-0.9%**	**-0.8%**	**5.8%**
11.04	3,325	3,468	3,369	3,193	3,373	3,543	3,390	3,270	3,458	3,413	**0.2%**	**-0.2%**	**0.2%**
11.05	2,009	2,601	2,854	2,887	2,901	3,025	3,010	2,953	2,887	2,778	**2.0%**	**0.8%**	**-2.6%**
12.01	3,369	2,899	2,760	2,780	2,697	2,485	2,527	2,619	2,714	2,564	**-1.2%**	**-1.5%**	**0.5%**
12.02	2,973	3,647	3,526	3,290	2,970	2,735	2,869	2,994	2,949	2,913	**0.0%**	**-2.8%**	**0.5%**
13	3,801	3,417	3,564	3,881	3,884	3,908	3,610	3,366	3,262	3,412	**-0.8%**	**0.0%**	**-1.9%**
14.01	3,886	4,240	4,498	4,195	4,187	4,554	4,468	4,266	4,211	3,754	**0.4%**	**-1.5%**	**-5.6%**
14.02	3,512	3,178	3,440	3,275	3,074	3,557	3,661	3,854	3,923	3,665	**0.6%**	**1.8%**	**0.0%**
15.01	2,866	2,985	2,972	2,940	2,856	2,882	2,856	2,800	2,774	2,726	**-0.2%**	**-1.1%**	**-1.5%**
15.02	4,931	5,091	5,059	4,619	4,549	4,641	4,593	4,702	4,560	4,806	**-0.4%**	**-0.7%**	**1.5%**
16.01	4,472	3,977	3,706	3,934	3,999	3,989	3,968	4,156	4,169	4,150	**-0.4%**	**0.5%**	**1.5%**
16.02	338	3,671	4,157	4,392	4,508	4,712	5,074	5,126	5,573	5,961	**16.8%**	**6.2%**	**5.5%**
17.06	4,925	5,346	5,503	5,454	5,455	5,010	4,777	4,513	4,427	4,291	**-0.6%**	**-2.7%**	**-3.5%**
17.09	5,979	6,202	6,194	6,360	6,201	6,132	5,815	5,490	5,766	5,795	**-0.2%**	**-0.8%**	**-0.1%**
17.1	1,216	2,064	1,680	1,324	1,603	1,737	1,480	1,961	2,145	2,294	**3.2%**	**1.3%**	**15.7%**
17.11	2,219	5,242	5,335	5,427	5,574	5,950	6,108	6,466	6,934	7,103	**6.5%**	**3.9%**	**5.2%**
17.12	2,831	5,921	6,241	7,119	6,894	6,733	7,345	7,358	7,751	6,954	**5.8%**	**2.0%**	**-1.8%**
17.13	4,182	10,673	11,541	12,846	14,271	15,331	15,874	16,289	16,575	18,703	**8.0%**	**7.3%**	**5.6%**
17.14	1,093	3,211	3,596	3,496	3,461	3,758	4,030	4,174	4,240	4,915	**7.8%**	**5.5%**	**6.8%**
17.15	1,933	5,720	6,290	6,700	6,938	7,079	7,062	7,378	7,490	7,353	**7.8%**	**3.2%**	**1.4%**
17.16	5,572	6,283	5,848	5,977	6,029	6,286	6,360	6,555	6,468	6,095	**0.8%**	**-0.4%**	**-1.4%**
17.17	3,225	4,359	3,433	3,513	3,166	3,235	3,093	3,201	3,177	3,271	**-0.1%**	**-3.5%**	**1.9%**
17.18	2,539	2,332	2,280	2,230	2,199	2,094	2,128	2,171	2,412	2,546	**-0.3%**	**1.1%**	**6.2%**
17.19	3,636	3,646	3,254	3,293	3,609	3,276	3,262	3,340	3,552	3,564	**-0.1%**	**-0.3%**	**3.0%**
17.2	3,781	5,695	5,677	5,328	5,536	5,492	5,300	5,752	5,850	5,683	**2.5%**	**0.0%**	**2.4%**
17.21	2,520	2,329	2,697	2,669	2,680	2,844	2,847	2,410	2,440	2,250	**-0.2%**	**-0.4%**	**-7.5%**

Table 3-2. Historical Population Trends and Growth Rates – Webb County Census Tracts (Cont'd.)

Tract ID	2000	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR		
											2000-2018	2010-2018	2015-2018
17.22	3,827	6,162	6,290	6,225	6,130	6,620	6,932	7,289	7,644	8,008	**3.9%**	**3.3%**	**4.9%**
18.06	307	3,188	4,119	4,839	4,220	4,766	4,919	5,275	5,473	6,348	**17.4%**	**9.0%**	**8.9%**
18.07	5,988	8,835	8,883	7,430	8,008	8,124	8,833	8,822	8,222	7,889	**1.8%**	**-1.4%**	**-3.7%**
18.08	6,571	7,158	7,290	6,937	6,901	7,007	6,884	6,647	6,843	6,807	**0.2%**	**-0.6%**	**-0.4%**
18.09	2,533	5,194	5,136	5,978	6,352	6,882	7,577	8,239	8,638	10,189	**7.1%**	**8.8%**	**10.4%**
18.1	1,614	4,017	4,422	4,870	5,066	5,466	5,780	6,000	5,946	5,769	**7.5%**	**4.6%**	**-0.1%**
18.11	3,548	4,841	4,578	4,356	4,418	4,526	4,383	4,367	4,580	4,469	**1.4%**	**-1.0%**	**0.6%**
18.12	2,460	6,558	7,592	8,092	8,170	8,271	8,910	8,925	9,224	9,029	**7.6%**	**4.1%**	**0.4%**
18.13	1,297	839	943	963	908	918	1,020	994	831	698	**-2.4%**	**-2.3%**	**-11.9%**
18.14	3,148	5,593	6,368	7,093	7,500	7,520	7,657	7,452	7,915	8,579	**5.3%**	**5.5%**	**3.9%**
18.15	1,365	1,831	2,031	1,919	1,849	1,718	1,693	1,483	1,479	1,537	**0.4%**	**-2.2%**	**-3.2%**
18.16	2,051	3,886	3,819	3,920	4,497	4,132	4,289	4,154	4,757	5,062	**4.8%**	**3.4%**	**5.7%**
18.17	5,609	5,025	5,480	5,831	5,974	6,314	6,472	6,285	6,136	6,186	**0.5%**	**2.6%**	**-1.5%**
18.18	3,581	3,331	3,327	3,310	3,296	3,302	3,307	3,282	3,277	3,248	**-0.5%**	**-0.3%**	**-0.6%**
19	4,015	3,327	3,625	3,438	3,369	3,174	3,185	3,254	3,298	3,370	**-1.1%**	**0.2%**	**1.9%**
9800	0	0	0	0	0	0	0	0	28	35			

Source: U.S. Census

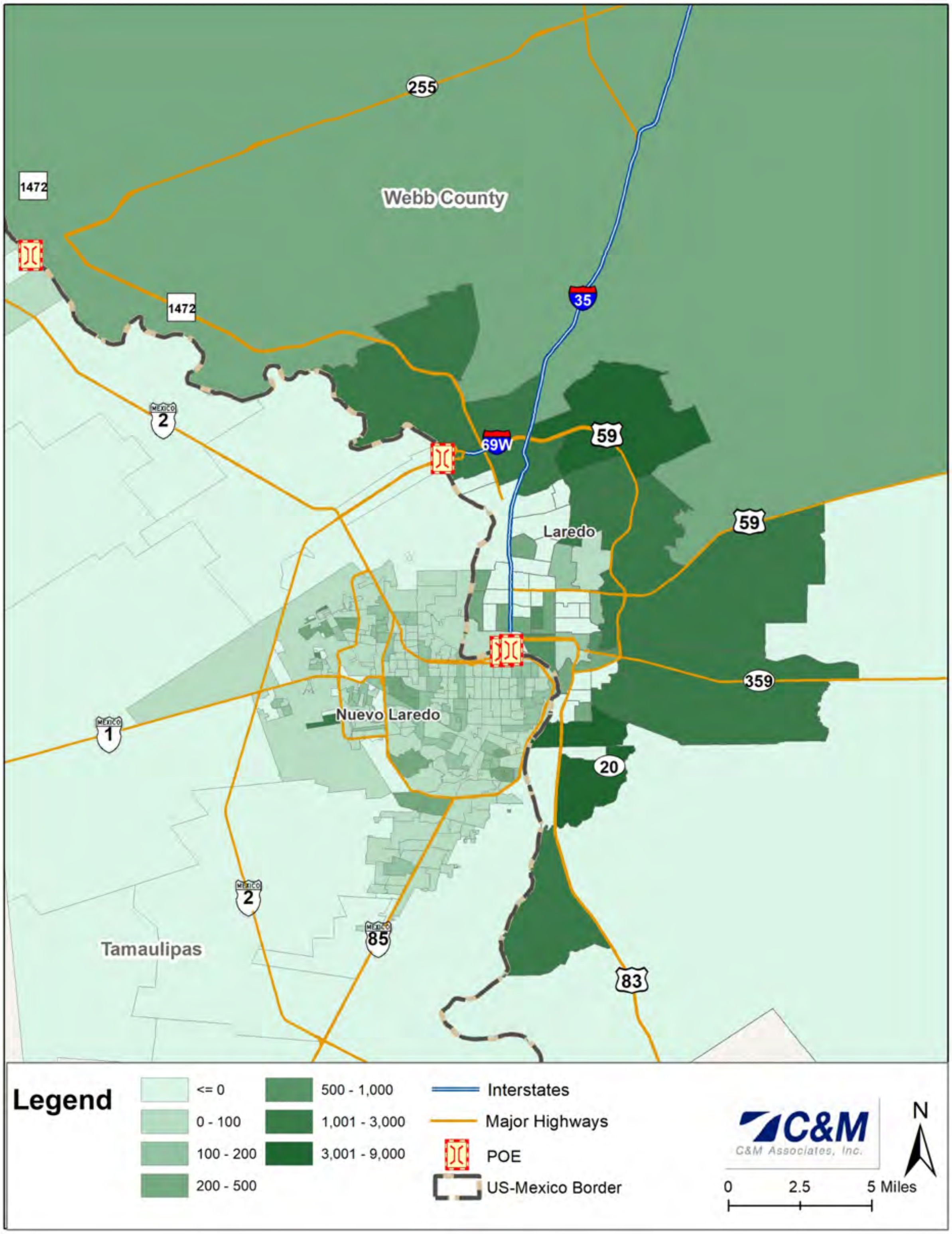


Figure 3-3. Historical Population Change at the Census Tract Level (2010–2018)

Population Projections

The S&B team reviewed several public sources of population projections and growth rates for the binational study area, including the Laredo TDM, the TSDC, and the TWDB. To obtain a binational panorama of socioeconomic activity, the S&B team also purchased projections of the Nuevo Laredo Metropolitan Area at the TAZ level from SIREM, taking into consideration the disaggregation of the MPO TDM, historical trends, and the effects of COVID-19 on the predicted variables. The forecasts by source are presented in Table 3-3.

The forecasts for planning purposes—i.e., the Laredo MPO TDM and the Texas SAM—estimate higher growth rates than other sources. Overall, Moody's forecast is very close to the TSDC, following a similar growth pattern but with a more optimistic long-term forecast than the TSDC.

On the Mexican side, CONAPO estimates population until 2030 and forecasts a steady trend from 2018 to 2050. In addition, estimates by SIREM predict lower growth over time with an initial rate of 0.6 percent from 2018 to 2025 for Nuevo Laredo and 0.2 percent from 2045 to 2050. These trends reflect pre- and post-COVID conditions for the area.

It is crucial to point out that Moody's projections are the only projections on the U.S. side of the study area that include the socioeconomic impact of the COVID-19 pandemic. Likewise, in the case of Mexico's projections, SIREM includes the effects of the pandemic in their short-term and long-term forecasts. As a result, the S&B team employed these two forecasts for the overall population growth parameters in its Binational Assignment Model.

Table 3-3. Population Projections by Source

Region	Source	Population				
		2018	2020	2025	2035	2040
Webb County	Laredo MPO TDM	276,235	286,216	312,775	373,515	408,174
	CAGR	-	1.8%	1.8%	1.8%	1.8%
	Texas SAM	292,262	307,487	349,110	443,347	493,570
	CAGR	-	2.6%	2.6%	2.4%	2.2%
	W&P	278,853	286,907	307,616	349,824	370,669
	CAGR	-	1.4%	1.4%	1.3%	1.2%
	TSDC	270,758	276,183	288,160	305,249	308,783
	CAGR	-	1.0%	0.9%	0.6%	0.2%
	U.S. Census	272,053	NA	NA	NA	NA
	TWDB	306,175	318,028	349,706	422,842	464,960
	CAGR	-	1.9%	1.9%	1.9%	1.9%
	Moody's	275,120	278,757	286,361	306,294	315,393
	CAGR	-	0.7%	0.5%	0.7%	0.6%
Nuevo Laredo	CONAPO	415,949	421,295	432,553	444,112	455,980
	CAGR	-	0.6%	0.5%	0.5%	0.5%
	SIREM	407,269	412,504	423,527	441,942	449,303
	CAGR	-	0.6%	0.5%	0.4%	0.3%

Note: Missing data were calculated based on linear interpolation between forecast years.

Figure 3-4 and Figure 3-5 illustrate the Binational Assignment Model's forecasted change in population from 2018 to 2040 at the census tract level and TAZ level, respectively. The S&B team disaggregated the population projections to the TAZ level in Laredo based on the Laredo MPO TDM and the Texas SAM. The S&B team identified TAZs with population growth potential based on aerial photos, the Laredo MPO 2020–2045 MTP, and urban planning plans and programs.[39]

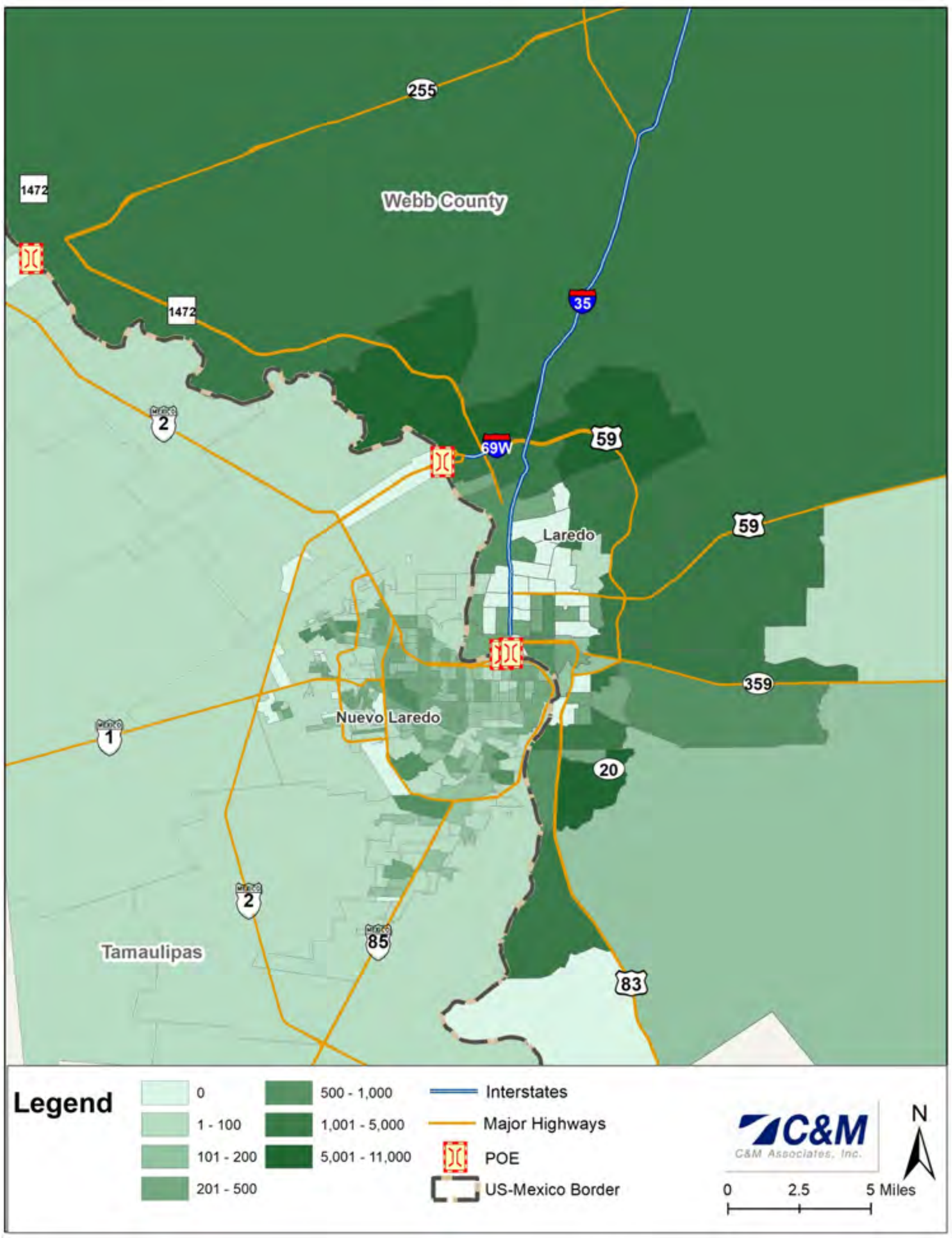


Figure 3-4. Forecasted Population Change at the Census Tract Level (2018–2040)

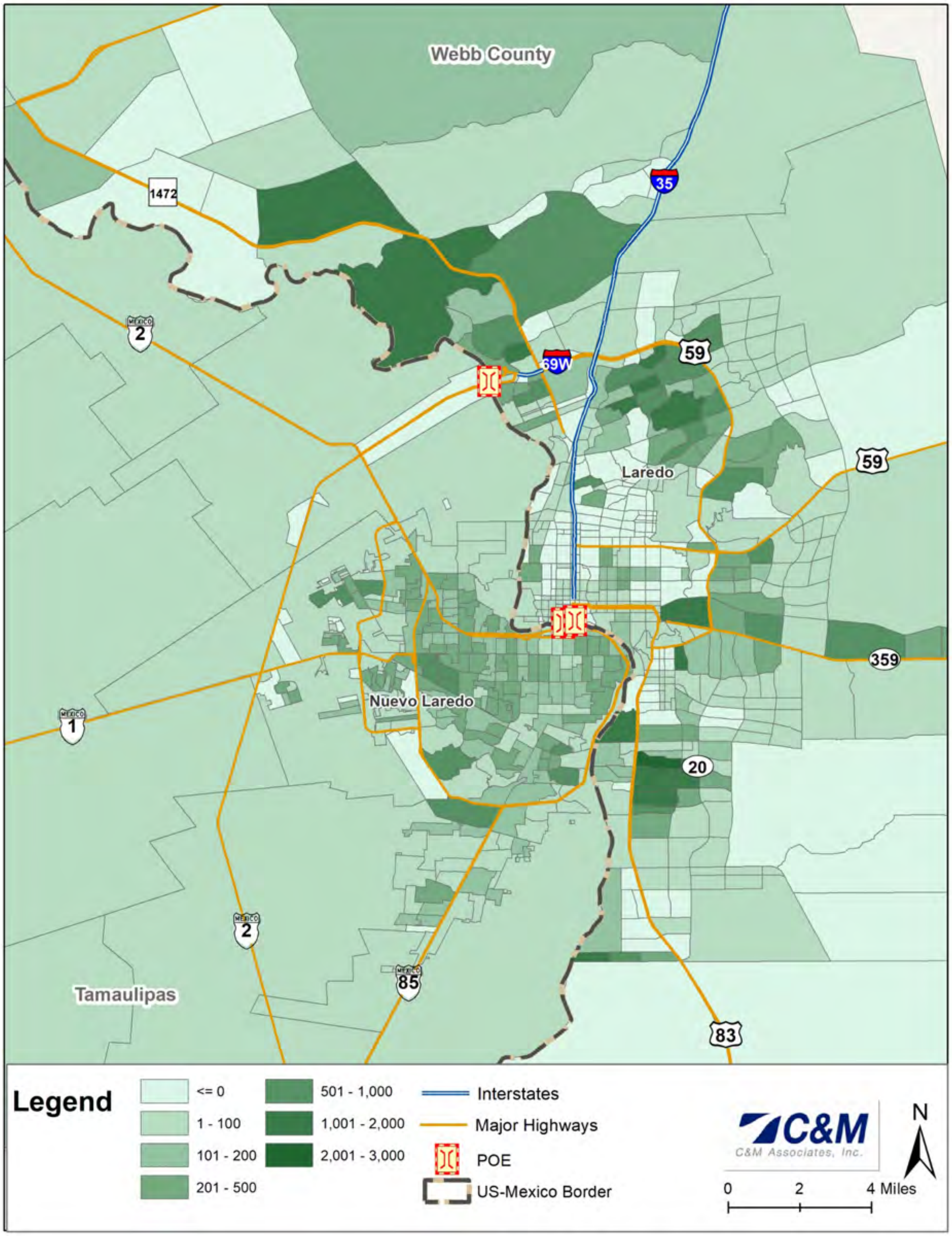


Figure 3-5. Forecasted Population Change at the TAZ Level (2018–2040)

3.3. Number of Households

Historical Households Trends

The household growth in the study area is slightly different from the historical growth rate observed for population, exhibiting lower growth in the earlier years and higher growth in later years, which is related to the demographic composition of Webb County. Overall, as shown in Table 3-4, the total number of households In Webb County increased by 18,450 from 2000 to 2018.

The historical information available for the Mexican portion of the study area indicates a higher household CAGR from 2010 to 2015 in Nuevo Laredo compared to Laredo and Webb County. The CAGR on the Mexican side was 2.7 percent from 2010 to 2015 and 2.5 percent from 2000 to 2015. Higher growth rates are observed in the city of Nuevo Laredo, consistent with population growth.

Table 3-4. Historical Household Trends and Growth Rates

Year	Webb County		Laredo	
	HH	CAGR	HH	CAGR
2000	55,209	-	74,389	-
2010	64,714	1.6%	94,402	2.4%
2011	65,796	1.7%	NA	NA
2012	67,003	1.8%	NA	NA
2013	67,372	0.6%	NA	NA
2014	68,502	1.7%	NA	NA
2015	69,668	1.7%	107,889	2.7%
2016	71,092	2.0%	NA	NA
2017	72,379	1.8%	NA	NA
2018	73,659	1.8%	NA	NA

Note: HH = Households
Source: U.S. Census, INEGI

Historical Households Trends at the Census Tract Level

Based on data from the U.S. Census, the S&B team compiled and analyzed the historical number of households at the census tract level. In the case of Nuevo Laredo, the forecasts were developed directly at the TAZ level through SIREM.

As presented in Table 3-5, the census tracts with the highest growth are Tracts 18.06 and 18.09 with 2010–2018 CAGRs of 8.3 percent and 6.7 percent, respectively. These zones correspond to the southern zone of Laredo located in the vicinity of Laredo Community College and other schools. In contrast, the census tract with the lowest growth is Tract 18.13 in southeast Laredo, with an annual decrease of 2.3 percent. This tract represents a low residential density area with only 219 households in 2018.

Table 3-5. Historical Household Trends and Growth Rates – Webb County Census Tracts

Tract ID	2000	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR		
											2000-2018	2010-2018	2015-2018
1.01	1,257	1,372	1,370	1,330	1,345	1,353	1,322	1,320	1,392	1,334	0.3%	-0.4%	0.3%
1.05	666	601	572	592	568	657	632	663	675	668	0.0%	1.3%	1.9%
1.06	937	938	940	937	1,015	945	942	946	951	927	-0.1%	-0.1%	-0.5%
1.07	715	812	777	777	784	768	789	814	796	741	0.2%	-1.1%	-2.1%
1.08	720	824	769	808	850	858	849	921	904	861	1.0%	0.6%	0.5%
1.09	513	507	505	530	569	589	619	626	687	531	0.2%	0.6%	-5.0%
2	1,273	1,075	1,147	1,145	1,166	1,191	1,149	1,172	1,133	1,167	-0.5%	1.0%	0.5%
3	844	730	695	695	682	752	723	725	691	673	-1.2%	-1.0%	-2.4%
6.01	837	755	791	805	801	777	768	783	766	773	-0.4%	0.3%	0.2%
6.02	532	631	654	665	647	633	619	614	613	604	0.7%	-0.5%	-0.8%
7	837	840	755	782	790	768	823	833	813	830	0.0%	-0.1%	0.3%
8	812	760	765	704	661	698	749	712	712	738	-0.5%	-0.4%	-0.5%
9.01	1,413	1,366	1,372	1,299	1,311	1,353	1,367	1,393	1,383	1,388	-0.1%	0.2%	0.5%
9.03	680	749	727	741	725	724	701	687	680	725	0.4%	-0.4%	1.1%
9.04	936	891	969	943	924	926	923	898	876	944	0.0%	0.7%	0.8%
10.01	1,333	1,407	1,477	1,470	1,445	1,472	1,425	1,426	1,456	1,429	0.4%	0.2%	0.1%
10.03	568	674	677	694	690	688	758	841	905	971	3.0%	4.7%	8.6%
10.04	521	545	528	544	506	538	508	546	563	557	0.4%	0.3%	3.1%
11.01	1,201	1,093	1,147	1,180	1,199	1,082	1,104	1,090	1,092	1,093	-0.5%	0.0%	-0.3%
11.03	494	511	523	511	493	466	488	480	498	522	0.3%	0.3%	2.3%
11.04	987	1,081	1,030	1,039	1,033	1,060	1,042	1,035	1,021	999	0.1%	-1.0%	-1.4%
11.05	520	735	759	755	729	728	740	748	742	752	2.1%	0.3%	0.5%
12.01	936	960	963	943	983	945	907	910	889	864	-0.4%	-1.3%	-1.6%
12.02	835	900	896	887	847	825	816	812	829	868	0.2%	-0.5%	2.1%
13	1,002	959	956	988	968	998	960	995	902	928	-0.4%	-0.4%	-1.1%
14.01	1,087	1,127	1,089	1,087	1,129	1,193	1,159	1,150	1,156	1,122	0.2%	-0.1%	-1.1%
14.02	759	674	709	741	736	827	808	820	860	809	0.4%	2.3%	0.0%
15.01	735	876	835	826	824	817	791	775	768	773	0.3%	-1.6%	-0.8%
15.02	1,457	1,539	1,526	1,483	1,462	1,455	1,443	1,525	1,542	1,536	0.3%	0.0%	2.1%
16.01	1,179	1,297	1,281	1,281	1,252	1,261	1,236	1,264	1,269	1,254	0.3%	-0.4%	0.5%
16.02	94	1,262	1,333	1,411	1,413	1,469	1,528	1,613	1,723	1,857	18.0%	4.9%	6.7%
17.06	1,495	1,656	1,661	1,596	1,578	1,519	1,534	1,547	1,500	1,455	-0.2%	-1.6%	-1.7%
17.09	1,768	1,970	2,001	2,012	1,973	1,981	2,018	1,940	1,930	2,015	0.7%	0.3%	0.0%
17.1	514	539	475	406	426	443	364	493	603	622	1.1%	1.8%	19.6%
17.11	594	1,398	1,462	1,497	1,479	1,531	1,570	1,630	1,685	1,693	6.0%	2.4%	2.5%
17.12	827	1,824	1,807	2,051	2,123	2,069	2,270	2,472	2,626	2,432	6.2%	3.7%	2.3%
17.13	1,066	3,175	3,418	3,790	3,975	4,236	4,450	4,646	4,708	5,139	9.1%	6.2%	4.9%
17.14	209	701	773	733	775	853	915	964	1,026	1,107	9.7%	5.9%	6.6%
17.15	496	1,371	1,524	1,704	1,754	1,850	1,903	1,993	2,128	2,082	8.3%	5.4%	3.0%
17.16	1,420	1,693	1,563	1,577	1,574	1,550	1,620	1,621	1,614	1,564	0.5%	-1.0%	-1.2%
17.17	808	927	853	868	801	826	872	864	859	926	0.8%	0.0%	2.0%
17.18	757	749	748	747	738	709	742	723	786	788	0.2%	0.6%	2.0%
17.19	1,044	1,085	1,038	1,047	995	930	956	982	977	1,053	0.0%	-0.4%	3.3%
17.2	994	1,581	1,514	1,468	1,473	1,425	1,445	1,531	1,557	1,582	2.6%	0.0%	3.1%
17.21	630	740	754	756	732	743	773	788	852	740	0.9%	0.0%	-1.4%

Table 3-5. Historical Household Trends and Growth Rates – Webb County Census Tracts (Cont'd.)

Tract ID	2000	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR		
											2000-2018	2010-2018	2015-2018
17.22	1,018	1,762	1,849	1,980	1,953	1,961	2,080	2,144	2,256	2,462	5.0%	4.3%	5.8%
18.06	71	744	975	1,000	1,057	1,126	1,176	1,197	1,207	1,410	18.1%	8.3%	6.2%
18.07	1,224	1,867	1,891	1,862	1,870	1,897	2,033	2,170	2,093	2,024	2.8%	1.0%	-0.1%
18.08	1,384	1,516	1,539	1,467	1,478	1,515	1,532	1,613	1,612	1,610	0.8%	0.8%	1.7%
18.09	549	1,169	1,152	1,297	1,364	1,445	1,617	1,683	1,730	1,963	7.3%	6.7%	6.7%
18.1	391	1,052	1,150	1,221	1,252	1,332	1,372	1,389	1,464	1,451	7.6%	4.1%	1.9%
18.11	807	1,071	1,053	1,068	1,066	1,080	1,122	1,110	1,124	1,117	1.8%	0.5%	-0.1%
18.12	538	1,669	1,857	1,923	1,882	1,940	1,911	1,909	1,997	2,072	7.8%	2.7%	2.7%
18.13	496	263	264	236	222	221	239	257	242	219	-4.4%	-2.3%	-2.9%
18.14	819	1,312	1,451	1,606	1,674	1,738	1,729	1,741	1,890	2,124	5.4%	6.2%	7.1%
18.15	552	480	468	466	455	472	431	426	440	432	-1.4%	-1.3%	0.1%
18.16	499	879	930	989	1,090	1,156	1,169	1,058	1,085	1,138	4.7%	3.3%	-0.9%
18.17	1,254	1,202	1,200	1,179	1,181	1,214	1,235	1,193	1,173	1,214	-0.2%	0.1%	-0.6%
18.18	759	741	763	771	747	758	716	702	713	785	0.2%	0.7%	3.1%
19	1,130	1,087	1,126	1,093	1,138	1,166	1,186	1,169	1,206	1,190	0.3%	1.1%	0.1%
9800	1	0	0	0	0	0	0	0	9	12	-	-	-

Source: U.S. Census

Figure 3-6 and Figure 3-7 illustrated historical change in number of households at the census tract level in the U.S. portion of the study area and the TAZ level in the Mexican portion. In line with population growth, the dynamic nature of household growth was observed both in the northern part of Laredo and in some southern areas. The central metropolitan area near the border has exhibited a consistent average annual decrease.

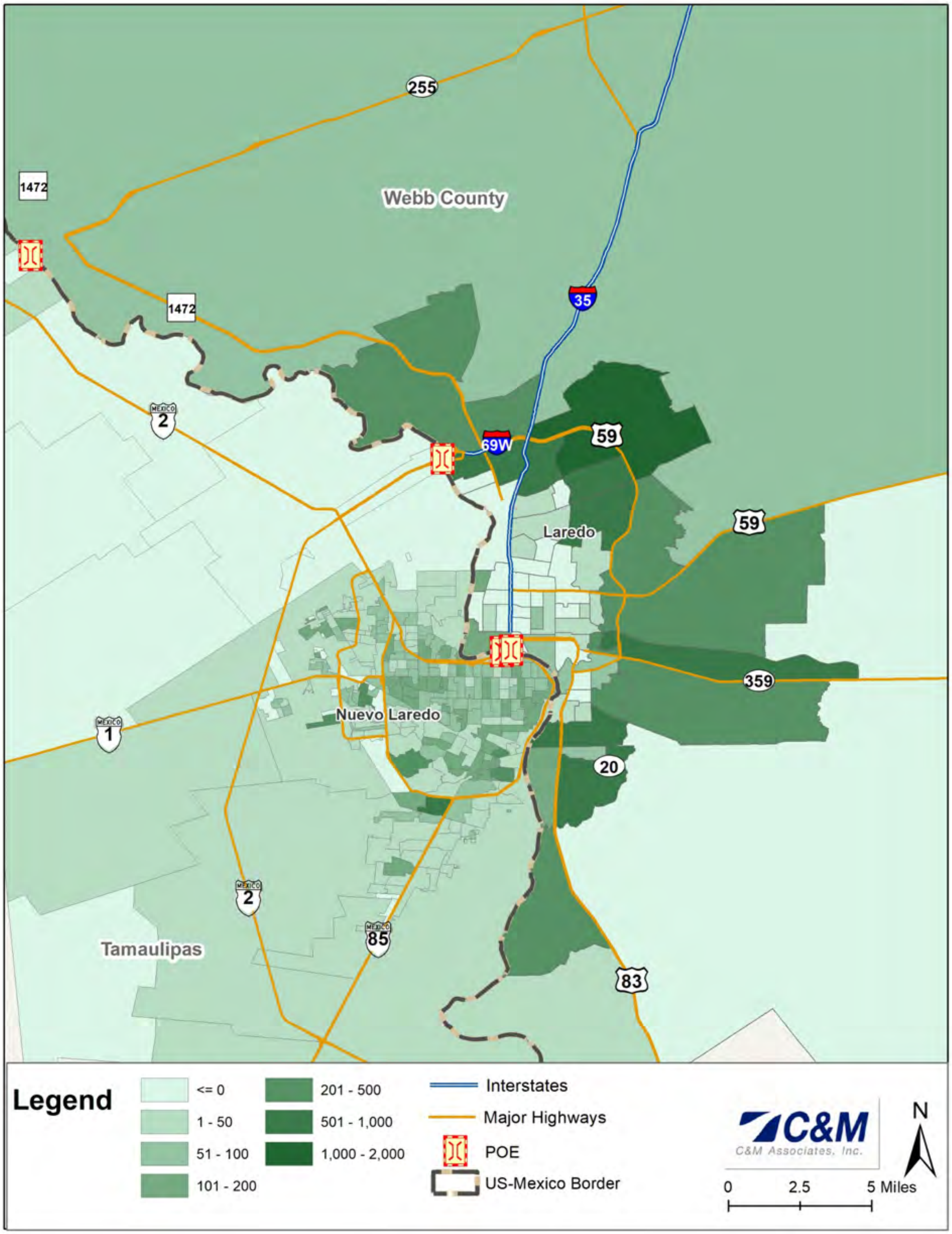


Figure 3-6. Historical Household Change at the Census Tract Level (2010–2018)

Household Projections

Similar to population, the S&B team reviewed historical trend information at the census tract level as well as household projections from Moody's and the Texas SAM. For household projections at the TAZ level, the S&B team obtained Webb County household control totals from Moody's and disaggregated them to the Laredo MPO TDM's TAZ structure based on historical census tract growth rates and future projections from the Texas SAM and Laredo TDM.

As shown in the Table 3-6, the Laredo MPO TDM and the Texas SAM estimate the most optimistic household projections in both the short term and long term. Likewise, both forecast a 2018–2040 CAGR of 2.3 percent. It should be noted that the Texas SAM maintains a trend of reduced growth over time in its forecast. In contrast, Moody's has a more conservative projection with a 2018–2040 CAGR of 0.6 percent.

Table 3-6. Webb County Household Projections

Source	Number of Households				
	2018	2020	2025	2035	2040
Laredo MPO TDM	77,883	81,490	91,256	114,439	128,153
CAGR	-	2.3%	2.3%	2.3%	2.3%
Texas SAM	78,141	82,768	95,570	107,126	119,820
CAGR	-	2.9%	2.9%	2.3%	2.3%
W&P	83,981	87,664	95,103	107,149	112,683
CAGR	-	2.2%	1.6%	1.2%	1.0%
U.S. Census	73,659	-	-	-	-
Moody's	76,793	78,044	80,263	86,176	88,402
CAGR	-	0.8%	0.6%	0.7%	0.5%

Note: Missing data were calculated based on linear interpolation between forecast years.

Figure 3-7 and Figure 3-8 illustrate the Binational Assignment Model's forecasted change in number of households at the census tract and TAZ level, respectively. In its review of the TAZ-level number of households, the S&B team accounted for the group quarters population and adjusted the relationship between population, households, and their growth accordingly. As shown, a larger increase in number of households is forecasted in the suburban areas of the cities of Laredo and Nuevo Laredo. In addition, number of households is estimated to increase more to the west of Nuevo Laredo compared to the central and southeastern areas.

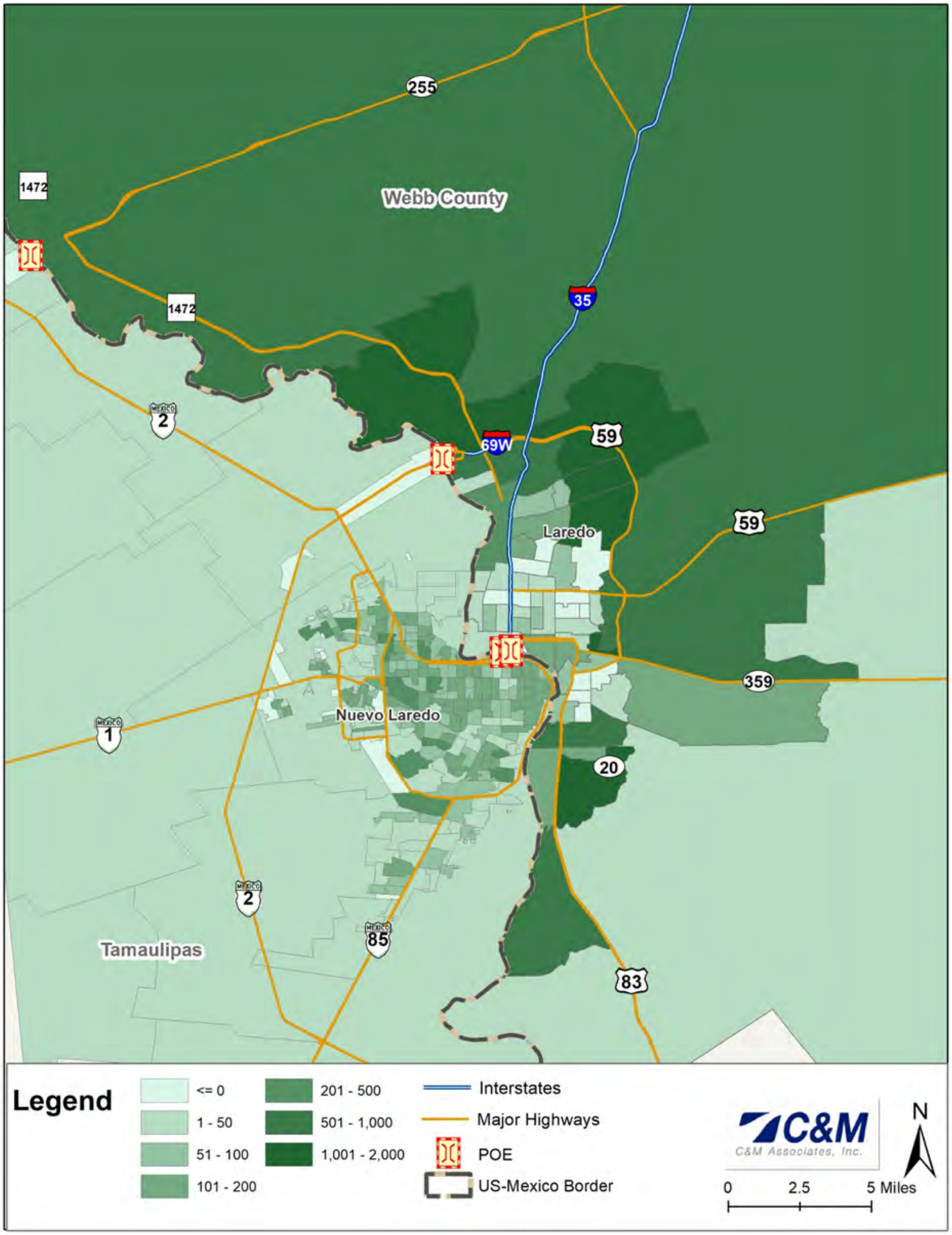


Figure 3-7. Forecasted Household Change at the Census Tract Level (2018–2040)

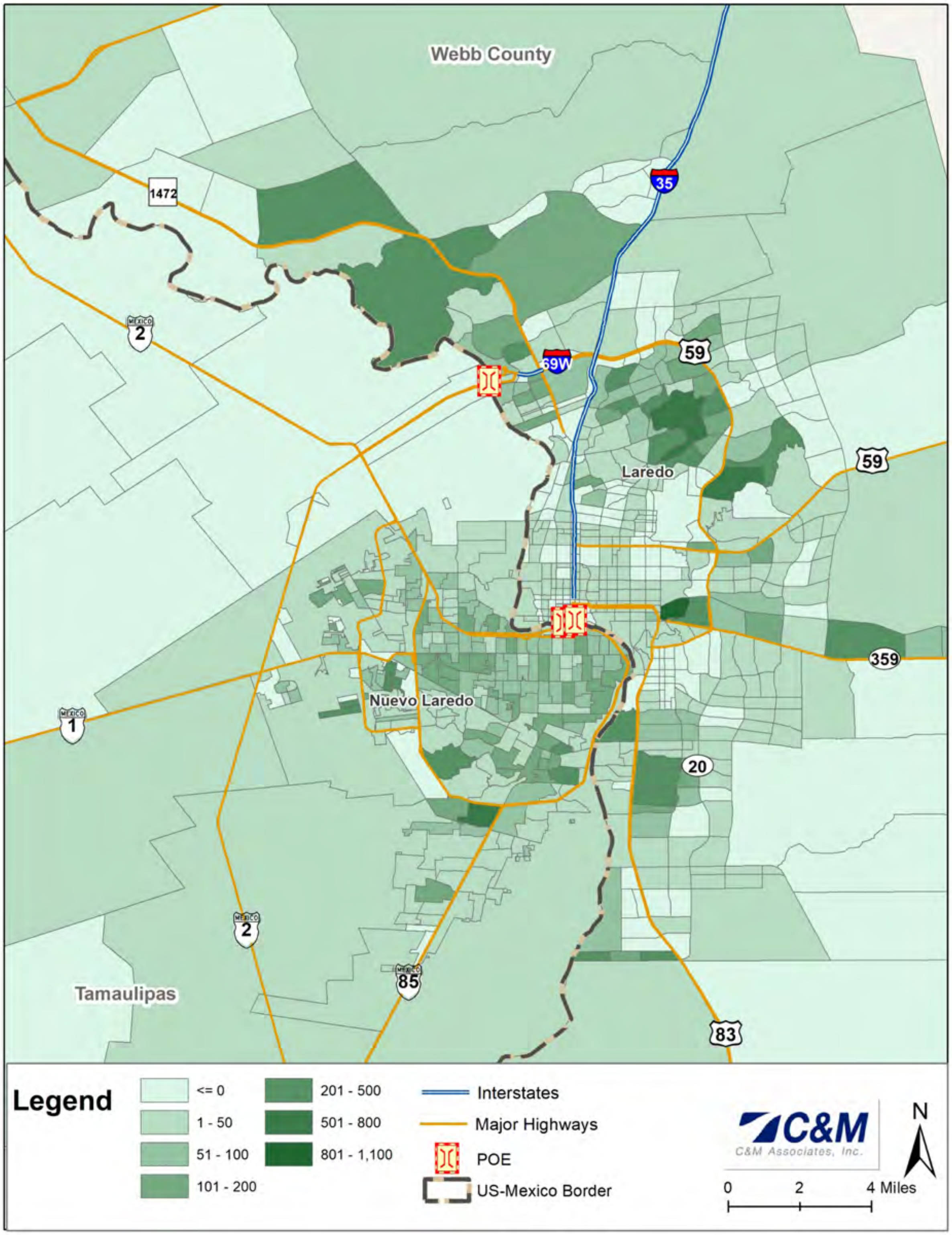


Figure 3-8. Forecasted Household Change at the TAZ Level (2018–2040)

3.4. Median Household Income

Historical Median Household Income Trends

The median household income in the state of Texas was $60,629 in 2018. As shown in Table 3-7, median household income in Webb County registered below the States at $46,862 in 2018 and exhibited a 2010–2018 CAGR of 3.1 percent. It is noteworthy that during the analysis period, median household income growth exhibited an unstable trend with estimated decreases in income in 2011, 2014, and 2016.

Table 3-7. Webb County Historical Median Household Income Trends and Growth Rates

Year	Median HH Income	CAGR
2010	$35,770	-
2011	$36,132	-1.5%
2012	$36,624	1.4%
2013	$39,991	9.2%
2014	$38,312	-4.2%
2015	$39,774	3.8%
2016	$35,659	-10.3%
2017	$43,408	21.7%
2018	$46,862	8.0%

Source: U.S. Census

Historical Median Household Income Trends at the Census Tract Level

As presented in Table 3-8, the analysis at the census tract level shows that the area with the highest median household income growth is located in Tract 18.14, which represents a medium residential zone with a population growth of 5.5 percent from 2010 to 2018. In contrast, the area with the largest decrease in median household income is Tract 12.02, which represents a high-density residential area near downtown Laredo and IH-35.

Table 3-8. Historical Median Household Income Trends and Growth Rates – Webb County Census Tracts

Tract ID	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR 2010-2018	CAGR 2015-2018
1.01	24,444	25,417	27,660	25,572	23,291	21,055	16,579	20,735	23,243	**-0.6%**	**3.4%**
1.05	22,052	22,708	25,000	24,800	26,791	32,679	29,181	26,365	26,782	**2.5%**	**-6.4%**
1.06	30,625	30,456	30,861	28,375	28,844	22,455	26,786	27,188	33,301	**1.1%**	**14.0%**
1.07	17,132	19,918	24,829	23,454	26,838	29,826	25,083	23,631	24,094	**4.4%**	**-6.9%**
1.08	26,288	34,063	33,176	34,688	37,125	33,832	29,943	29,013	36,432	**4.2%**	**2.5%**
1.09	27,672	22,596	22,917	18,883	23,523	19,785	22,381	19,803	29,821	**0.9%**	**14.7%**
2	30,114	27,760	25,745	26,105	25,085	26,015	25,797	28,281	26,908	**-1.4%**	**1.1%**
3	19,682	21,042	24,519	17,393	17,339	10,710	13,631	12,413	13,750	**-4.4%**	**8.7%**
6.01	36,921	37,543	31,839	27,396	24,974	23,081	22,957	30,306	28,958	**-3.0%**	**7.9%**
6.02	30,362	30,100	29,909	30,365	31,612	30,304	30,170	24,375	24,342	**-2.7%**	**-7.0%**
7	17,925	20,699	21,895	21,364	22,756	23,102	23,021	25,274	22,418	**2.8%**	**-1.0%**
8	19,891	21,186	24,198	20,759	20,129	20,863	20,068	19,788	20,417	**0.3%**	**-0.7%**
9.01	31,375	26,065	20,550	26,635	24,102	27,917	30,653	31,066	32,424	**0.4%**	**5.1%**
9.03	14,233	12,721	14,210	14,905	16,406	18,264	23,750	30,461	23,750	**6.6%**	**9.1%**
9.04	29,173	31,161	34,417	32,644	32,500	25,675	25,085	23,068	28,010	**-0.5%**	**2.9%**
10.01	35,515	34,199	32,151	32,473	35,929	38,125	39,535	40,294	44,081	**2.7%**	**5.0%**
10.03	27,917	26,635	25,167	24,167	25,135	28,776	31,172	40,786	40,948	**4.9%**	**12.5%**
10.04	27,538	27,717	28,065	24,219	16,935	21,522	24,236	24,321	33,287	**2.4%**	**15.6%**
11.01	40,607	40,469	39,211	38,585	38,281	39,259	31,792	26,655	30,054	**-3.7%**	**-8.5%**
11.03	24,063	22,165	33,363	25,664	27,308	26,563	28,971	27,237	29,951	**2.8%**	**4.1%**
11.04	43,720	40,000	30,240	32,151	29,286	28,333	30,736	31,166	33,620	**-3.2%**	**5.9%**
11.05	31,528	39,375	34,375	38,245	38,850	38,525	33,594	34,271	31,129	**-0.2%**	**-6.9%**
12.01	17,418	17,829	17,604	19,234	17,054	16,554	17,687	19,438	18,654	**0.9%**	**4.1%**
12.02	20,707	20,862	19,229	17,792	14,583	15,000	15,549	16,050	14,138	**-4.7%**	**-2.0%**
13	18,288	20,243	20,583	25,204	30,125	33,019	33,053	33,718	27,500	**5.2%**	**-5.9%**
14.01	25,386	26,643	23,068	16,892	16,776	17,487	19,477	24,211	27,908	**1.2%**	**16.9%**
14.02	28,088	27,384	32,448	39,167	36,875	31,389	27,054	27,303	35,240	**2.9%**	**3.9%**
15.01	26,234	27,668	27,135	27,173	26,358	25,096	24,323	18,500	25,497	**-0.4%**	**0.5%**
15.02	32,884	33,980	33,417	32,826	25,762	24,261	23,295	22,467	24,848	**-3.4%**	**0.8%**
16.01	40,739	37,569	39,896	42,782	40,855	43,704	44,567	49,507	46,048	**1.5%**	**1.8%**
16.02	56,563	57,316	59,356	62,153	69,883	63,287	64,236	73,854	80,341	**4.5%**	**8.3%**
17.06	36,660	38,605	38,098	29,815	24,717	24,253	25,316	26,906	38,808	**0.7%**	**17.0%**
17.09	65,536	64,614	61,111	58,309	57,130	57,880	62,643	66,237	69,799	**0.8%**	**6.4%**
17.1	46,291	42,463	43,984	41,563	38,144	32,000	37,344	50,721	58,500	**3.0%**	**22.3%**
17.11	46,875	44,402	43,653	47,757	50,164	51,076	56,782	56,582	57,626	**2.6%**	**4.1%**
17.12	57,234	54,248	57,605	56,075	56,597	60,802	62,773	58,851	58,095	**0.2%**	**-1.5%**
17.13	74,292	72,742	75,929	80,952	76,653	76,118	74,921	77,386	80,111	**0.9%**	**1.7%**
17.14	94,583	96,484	76,875	76,691	78,398	72,690	77,667	86,351	101,917	**0.9%**	**11.9%**
17.15	49,221	51,394	52,363	52,029	54,648	51,550	50,935	52,981	54,198	**1.2%**	**1.7%**
17.16	45,239	46,758	47,046	50,722	46,775	46,903	49,743	54,051	52,383	**1.8%**	**3.8%**
17.17	39,622	37,702	34,679	32,896	31,124	30,260	28,707	31,150	27,813	**-4.3%**	**-2.8%**
17.18	42,446	51,250	47,019	46,333	62,098	59,712	56,847	56,557	59,592	**4.3%**	**-0.1%**
17.19	59,710	51,196	46,991	52,098	49,744	49,022	49,500	50,375	52,974	**-1.5%**	**2.6%**
17.2	54,497	53,715	57,250	58,393	59,861	72,266	72,721	69,063	64,693	**2.2%**	**-3.6%**
17.21	68,488	77,442	79,063	79,884	78,935	81,033	95,250	95,603	88,458	**3.3%**	**3.0%**

Table 3-8. Historical Median Household Income Trends and Growth Rates – Webb County Census Tracts (Cont'd.)

Tract ID	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR	
										2010-2018	2015-2018
17.22	103,654	104,782	100,714	94,837	95,543	97,184	120,319	126,274	125,976	**2.5%**	**9.0%**
18.06	36,127	32,230	32,018	31,223	26,094	28,364	30,473	32,426	33,591	**-0.9%**	**5.8%**
18.07	31,714	32,388	31,151	35,462	34,602	34,347	36,606	33,741	35,702	**1.5%**	**1.3%**
18.08	27,257	33,848	33,300	32,799	35,528	33,269	26,440	28,065	30,616	**1.5%**	**-2.7%**
18.09	34,740	36,024	37,305	38,657	40,024	39,732	34,019	33,376	34,918	**0.1%**	**-4.2%**
18.1	41,000	43,203	49,583	43,571	43,895	48,870	49,232	51,836	57,703	**4.4%**	**5.7%**
18.11	47,807	42,410	41,563	43,761	42,047	43,255	44,151	44,266	45,641	**-0.6%**	**1.8%**
18.12	40,997	45,432	45,459	42,323	41,979	50,880	53,648	49,371	51,505	**2.9%**	**0.4%**
18.13	30,982	43,333	31,786	38,750	32,454	29,792	27,750	26,136	22,563	**-3.9%**	**-8.8%**
18.14	25,215	27,027	27,944	33,107	27,917	28,528	32,031	48,279	46,071	**7.8%**	**17.3%**
18.15	28,654	23,875	26,400	26,917	20,750	28,795	30,769	26,711	31,324	**1.1%**	**2.8%**
18.16	39,956	41,220	44,089	46,327	45,036	42,940	44,896	48,559	52,850	**3.6%**	**7.2%**
18.17	26,641	27,723	28,042	26,603	28,838	25,574	27,795	26,148	23,929	**-1.3%**	**-2.2%**
18.18	20,129	20,781	21,479	21,134	21,205	20,929	21,307	21,250	20,417	**0.2%**	**-0.8%**
19	16,599	13,894	13,612	14,211	14,942	16,439	18,242	19,891	19,286	**1.9%**	**5.5%**
9800	0	0	0	0	0	0	0	0	0	-	-

Source: U.S. Census

Figure 3-9 illustrates the historical change in median household income from 2010 to 2018. The observed income growth is more homogeneous than population and number of households. However, significant growth is also shown in the northern zone of Laredo and, to a lesser extent, in the central and southern zones.

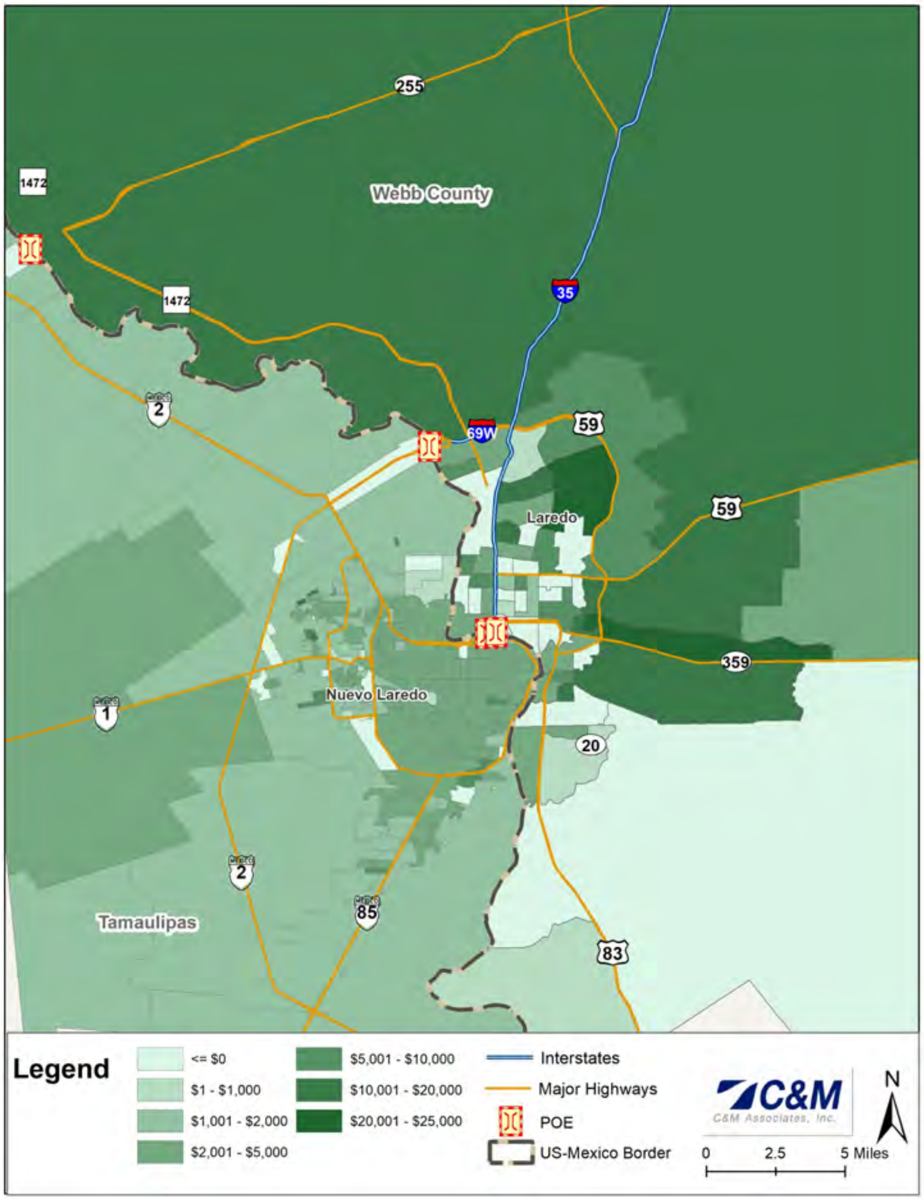


Figure 3-9. Historical Median Household Income Change at the Census Tract Level (2010–2018)

Median Household Income Projections

For the Binational Assignment Model, the S&B team adjusted the Laredo MPO TDM forecasts to the Texas SAM estimates for future modeling years based on historical median household income information at the census tract level in Webb County and the fact that the Texas SAM provides one of the most up-to-date estimates among the sources considered.

As shown in Table 3-9, the Laredo TDM forecasts growth of 0.5 percent for the entire study period, whereas the Texas SAM forecasts higher growth for the year 2020 and 2025 and a growth rate of 0.6 percent for 2035. Overall, the Texas SAM forecasts 0.7 percent annual growth from 2018 to 2040.

At the TAZ level, there is no public information on median household income for Nuevo Laredo; therefore, the S&B team estimated median household income at the TAZ level based on 2018 median household income data provided by SIREM. The Gross Value Added (GVA) was used as an indicator of Nuevo Laredo's economic growth and, therefore, of the median household income in each TAZ.

Table 3-9. Median Household Income Projections

Region	Source	Median Household Income				
		2018	2020	2025	2035	2040
Webb County	Laredo MPO TDM	$27,799	$28,098	$28,859	$30,442	$31,267
	CAGR	-	0.5%	0.5%	0.5%	0.5%
	Texas SAM	$34,658	$35,709	$38,477	$39,570	$40,698
	CAGR	-	1.5%	1.5%	0.6%	0.6%
	U.S. Census	$46,862	-	-	-	-
Nuevo Laredo	Laredo MPO TDM	$11,459	$10,331	$11,594	$13,518	$14,767
	CAGR	-	-5.0%	2.3%	1.5%	1.8%

Note: Missing data were calculated based on linear interpolation between forecast years.

Figure 3-10 and Figure 3-11 illustrate the Binational Assignment Model's forecasted change in median household income at the census track and TAZ levels, respectively. The income differences between Mexico and the United States limit the utility of directly comparing them; nevertheless, the forecast indicates areas in Mexico with a higher relative change in median household income on the outskirts of both Laredo and Nuevo Laredo.

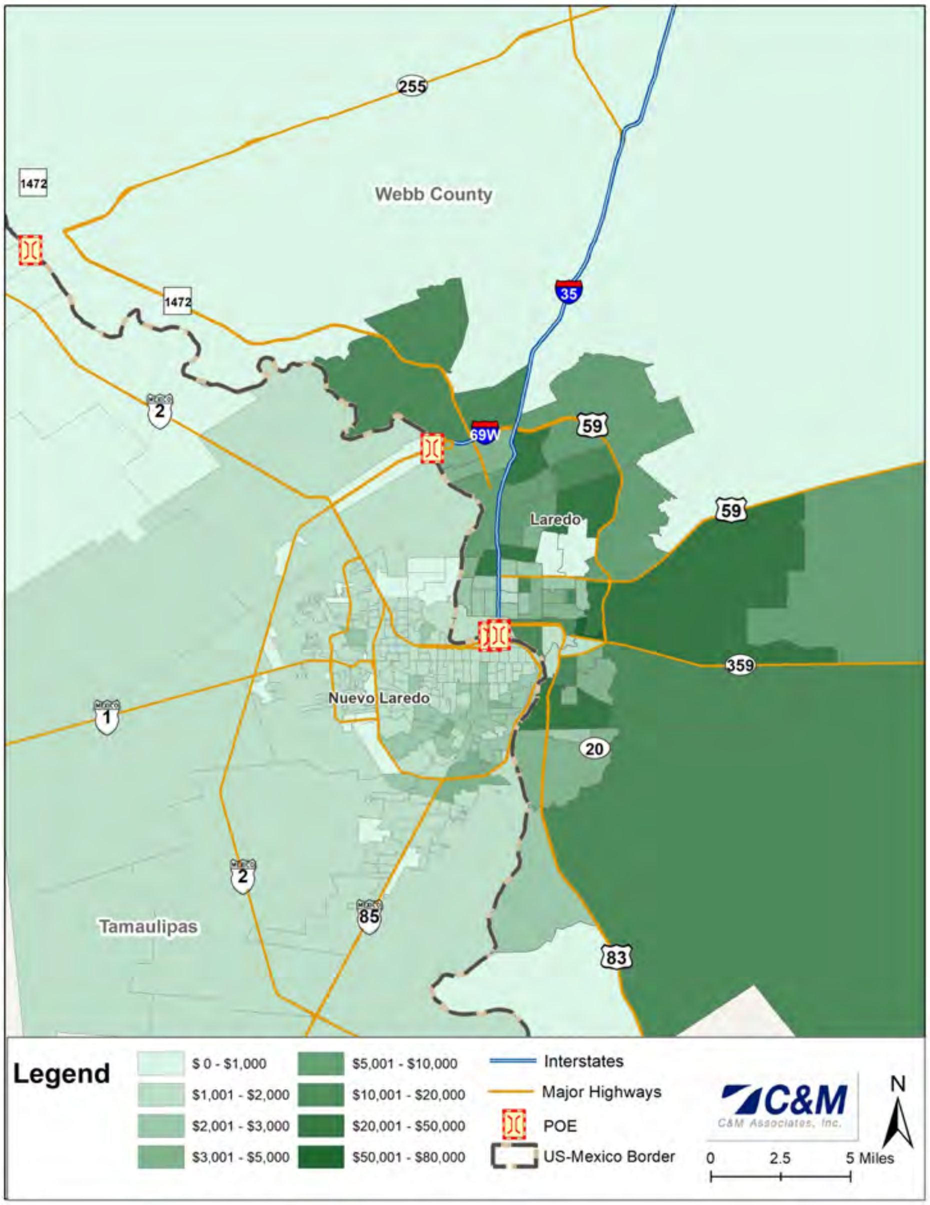


Figure 3-10. Forecasted Median Household Income Change at the Census Tract Level (2018–2040)

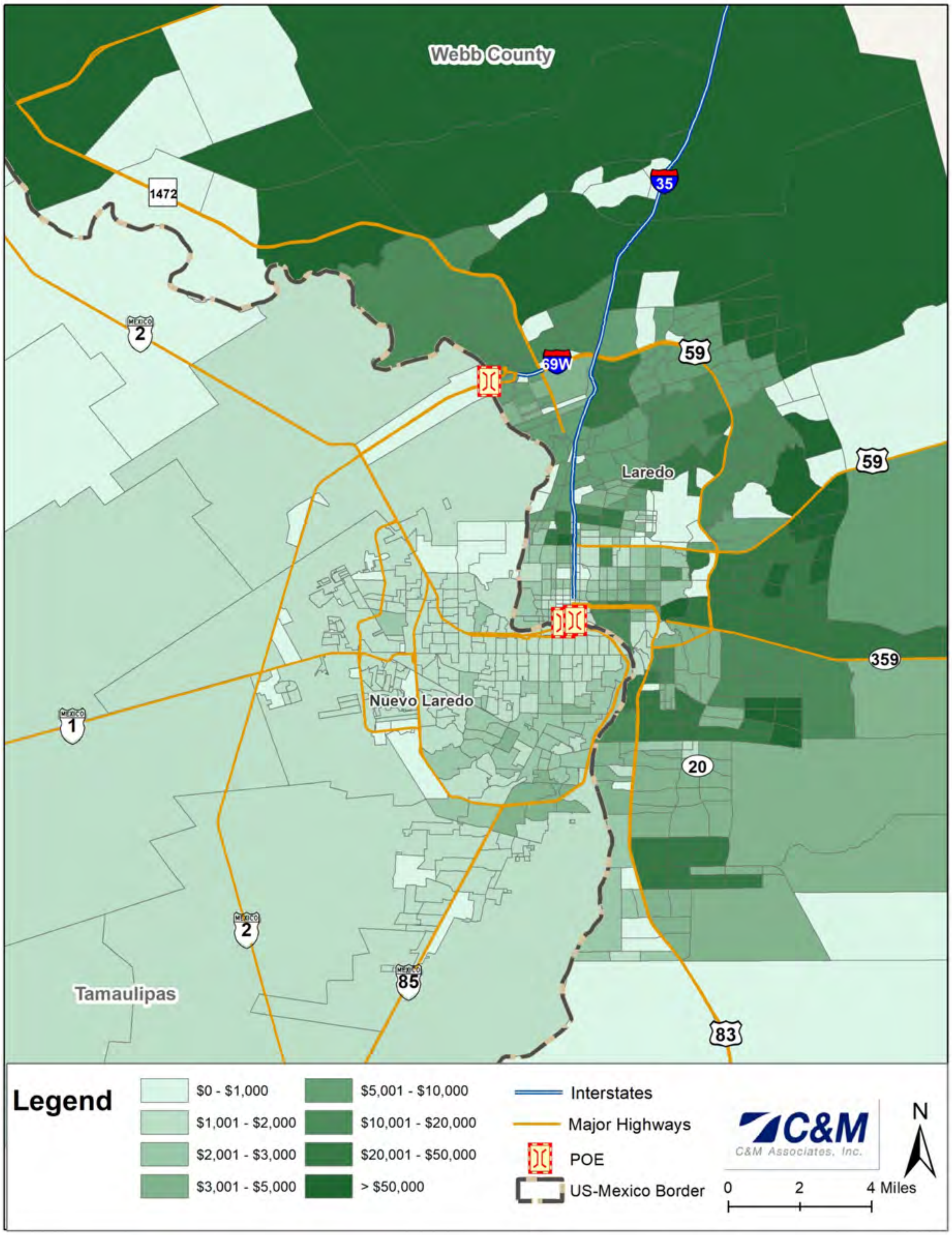


Figure 3-11. Forecasted Median Household Income Change at the TAZ Level (2018–2040)

3.5. Employment

From a transportation-planning perspective, workplace-based employment data from Webb County and the Nuevo Laredo Metropolitan Area provides a useful picture of trip destinations, not just for work trips but also for shopping trips that cross the U.S./Mexico border. To develop such a picture for future border crossings, the S&B team studied and evaluated the binational study area's current job market, the area's employment history, and available projections.

Historical Employment Trends

The S&B team collected and analyzed county and city data pertaining to employment within the binational study area. Additional employment information was then gathered from local, state, and federal sources.

As shown in Table 3-10, both metropolitan areas show a positive trend in their annual growth rates. The Nuevo Laredo Metropolitan Area generally exhibits moderate growth from 2010 to 2018 with CAGRs of roughly 2 to 4 percent, though lower growth is exhibited in 2014 (0.3%) and 2016 (0.5%). On the U.S. side, Webb County showed consecutive decreases in employment in 2012 and 2013 with rates of -0.7 and -0.4 percent, respectively. However, 2017 and 2018 exhibited marked growth with rates above 3 percent.

Table 3-10. Historical Employment Trends and Growth Rates

Year	Webb County		Laredo	
	Employment	CAGR	Population	CAGR
2010	93,763	-	85,607	-
2011	94,770	1.1%	89,218	4.2%
2012	94,110	-0.7%	91,889	3.0%
2013	93,729	-0.4%	94,334	2.7%
2014	94,835	1.2%	94,603	0.3%
2015	96,567	1.8%	98,273	3.9%
2016	97,579	1.0%	98,743	0.5%
2017	100,860	3.4%	100,786	2.1%
2018	104,987	4.1%	102,459	1.7%

Source: U.S. Census

Historical Employment Trends at the Census Tract Level

As shown in Table 3-11 and Figure 3-12, the main areas of employment growth in the region are observed to the north of Laredo. In 2018, the area with the highest number of jobs is Tract 16.01, which is a neighboring area of the Laredo International Airport and the location of the Laredo Medical Center, logistics companies, and government buildings. Another important area in terms of employment growth is Tract 17.11, which includes industrial parks and the World Trade International Bridge. Finally, in the central area of the city, Tract 19 also stands out for including the Juarez–Lincoln International Bridge as well as shopping malls for retail sale.

Table 3-11. Employment Trends and Growth Rates – Webb County Census Tracts

Tract	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR	
										2010-2018	2015-2018
1.01	1,765	1,743	1,650	1,520	1,424	1,347	1,181	1,405	1,440	**-2.5%**	**2.3%**
1.05	1,110	994	1,003	1,134	1,168	1,058	1,073	943	821	**-3.7%**	**-8.1%**
1.06	1,575	1,486	1,455	1,391	1,261	1,446	1,422	1,390	1,549	**-0.2%**	**2.3%**
1.07	761	819	960	821	925	925	854	830	827	**1.0%**	**-3.7%**
1.08	1,311	1,418	1,524	1,376	1,416	1,386	1,400	1,237	1,426	**1.1%**	**1.0%**
1.09	707	650	673	671	707	725	726	795	758	**0.9%**	**1.5%**
2	1,369	1,284	1,180	1,157	1,279	1,422	1,468	1,433	1,584	**1.8%**	**3.7%**
3	878	718	715	620	681	584	609	540	548	**-5.7%**	**-2.1%**
6.01	919	885	772	780	718	703	759	1,020	976	**0.8%**	**11.6%**
6.02	863	921	916	875	886	880	870	824	816	**-0.7%**	**-2.5%**
7	902	848	866	820	878	905	1,006	997	978	**1.0%**	**2.6%**
8	649	667	641	682	793	855	855	888	880	**3.9%**	**1.0%**
9.01	1,551	1,594	1,108	1,294	1,397	1,531	1,621	1,672	1,630	**0.6%**	**2.1%**
9.03	866	866	864	736	764	724	722	768	842	**-0.4%**	**5.2%**
9.04	1,175	1,218	1,337	1,316	1,118	1,058	1,055	1,010	1,301	**1.3%**	**7.1%**
10.01	1,870	1,911	1,885	1,922	1,898	1,795	1,707	1,826	1,828	**-0.3%**	**0.6%**
10.03	869	830	861	804	807	1,033	1,195	1,357	1,481	**6.9%**	**12.8%**
10.04	690	642	556	522	489	487	630	671	773	**1.4%**	**16.6%**
11.01	1,585	1,461	1,499	1,519	1,385	1,465	1,352	1,260	1,254	**-2.9%**	**-5.1%**
11.03	783	681	703	618	642	580	582	607	757	**-0.4%**	**9.3%**
11.04	1,504	1,317	1,211	1,065	1,125	1,009	1,083	1,026	1,025	**-4.7%**	**0.5%**
11.05	1,051	1,289	1,180	1,201	1,179	1,100	1,038	1,065	1,112	**0.7%**	**0.4%**
12.01	859	785	861	847	722	806	813	837	795	**-1.0%**	**-0.5%**
12.02	1,257	1,148	1,029	883	803	756	776	767	745	**-6.3%**	**-0.5%**
13	1,354	1,228	1,305	1,314	1,484	1,336	1,262	1,084	924	**-4.7%**	**-11.6%**
14.01	1,171	1,406	1,226	1,201	1,347	1,241	1,123	1,053	1,201	**0.3%**	**-1.1%**
14.02	1,218	1,237	1,242	1,232	1,428	1,303	1,146	1,256	1,298	**0.8%**	**-0.1%**
15.01	1,122	1,075	1,017	930	910	791	794	800	853	**-3.4%**	**2.5%**
15.02	2,157	2,000	1,819	1,750	1,395	1,407	1,476	1,571	1,663	**-3.2%**	**5.7%**
16.01	1,726	1,620	1,829	1,668	1,714	1,753	1,769	1,917	1,886	**1.1%**	**2.5%**
16.02	1,853	1,866	2,007	2,080	2,166	2,317	2,434	2,673	2,798	**5.3%**	**6.5%**
17.06	2,385	2,485	2,415	2,186	1,979	1,835	1,662	1,750	2,004	**-2.2%**	**3.0%**
17.09	2,848	2,816	2,780	2,721	2,722	2,783	2,785	2,892	2,763	**-0.4%**	**-0.2%**
17.1	903	743	556	592	560	418	598	719	810	**-1.3%**	**24.7%**
17.11	2,367	2,345	2,346	2,484	2,448	2,469	2,573	2,720	2,799	**2.1%**	**4.3%**
17.12	2,813	2,757	3,201	3,229	3,297	3,655	3,860	3,902	3,538	**2.9%**	**-1.1%**
17.13	5,058	5,306	5,887	6,277	6,830	7,230	7,546	7,795	8,647	**6.9%**	**6.1%**
17.14	1,217	1,517	1,277	1,269	1,453	1,559	1,612	1,726	2,068	**6.9%**	**9.9%**
17.15	2,285	2,458	2,630	2,678	2,760	2,872	3,042	3,335	3,512	**5.5%**	**6.9%**
17.16	2,860	2,513	2,464	2,609	2,698	2,915	3,033	3,155	3,040	**0.8%**	**1.4%**

Table 3-11. Employment Trends and Growth Rates – Webb County Census Tracts (Cont'd.)

Tract	2010	2011	2012	2013	2014	2015	2016	2017	2018	CAGR	
										2010-2018	2015-2018
17.17	2,002	1,765	1,735	1,645	1,611	1,484	1,450	1,388	1,321	**-5.1%**	**-3.8%**
17.18	865	891	786	755	878	905	880	1,031	1,129	**3.4%**	**7.7%**
17.19	1,768	1,643	1,579	1,504	1,279	1,181	1,304	1,442	1,446	**-2.5%**	**7.0%**
17.2	2,705	2,583	2,486	2,574	2,456	2,502	2,645	2,584	2,450	**-1.2%**	**-0.7%**
17.21	1,133	1,361	1,311	1,333	1,449	1,412	1,350	1,363	1,202	**0.7%**	**-5.2%**
17.22	2,857	2,686	2,709	2,655	2,814	3,079	3,496	3,728	4,346	**5.4%**	**12.2%**
18.06	1,385	1,760	1,684	1,595	1,498	1,418	1,404	1,516	1,789	**3.3%**	**8.1%**
18.07	2,921	2,947	2,689	2,733	2,703	2,872	3,103	2,849	3,176	**1.1%**	**3.4%**
18.08	2,373	2,705	2,567	2,418	2,332	2,162	2,031	2,210	2,269	**-0.6%**	**1.6%**
18.09	1,864	1,865	1,947	2,138	2,518	2,634	2,474	2,636	2,927	**5.8%**	**3.6%**
18.1	1,599	1,784	1,936	1,937	2,055	2,198	2,241	2,392	2,327	**4.8%**	**1.9%**
18.11	1,793	1,876	1,745	1,751	1,643	1,650	1,626	1,653	1,557	**-1.7%**	**-1.9%**
18.12	2,680	3,381	3,721	3,562	3,460	3,591	3,231	3,281	3,208	**2.3%**	**-3.7%**
18.13	326	382	304	312	283	279	255	217	145	**-9.6%**	**-19.6%**
18.14	1,658	1,945	1,911	2,260	2,389	2,757	2,666	3,085	3,388	**9.3%**	**7.1%**
18.15	569	510	527	524	495	491	496	494	543	**-0.6%**	**3.4%**
18.16	1,604	1,631	1,560	1,949	1,999	2,001	1,964	2,028	2,192	**4.0%**	**3.1%**
18.17	1,571	1,534	1,577	1,503	1,475	1,428	1,423	1,403	1,510	**-0.5%**	**1.9%**
18.18	969	1,026	998	887	913	947	897	929	973	**0.1%**	**0.9%**
19	915	948	888	900	929	1,112	1,131	1,106	1,128	**2.7%**	**0.5%**
9800	0	0	0	0	0	0	0	9	11	**-**	**-**

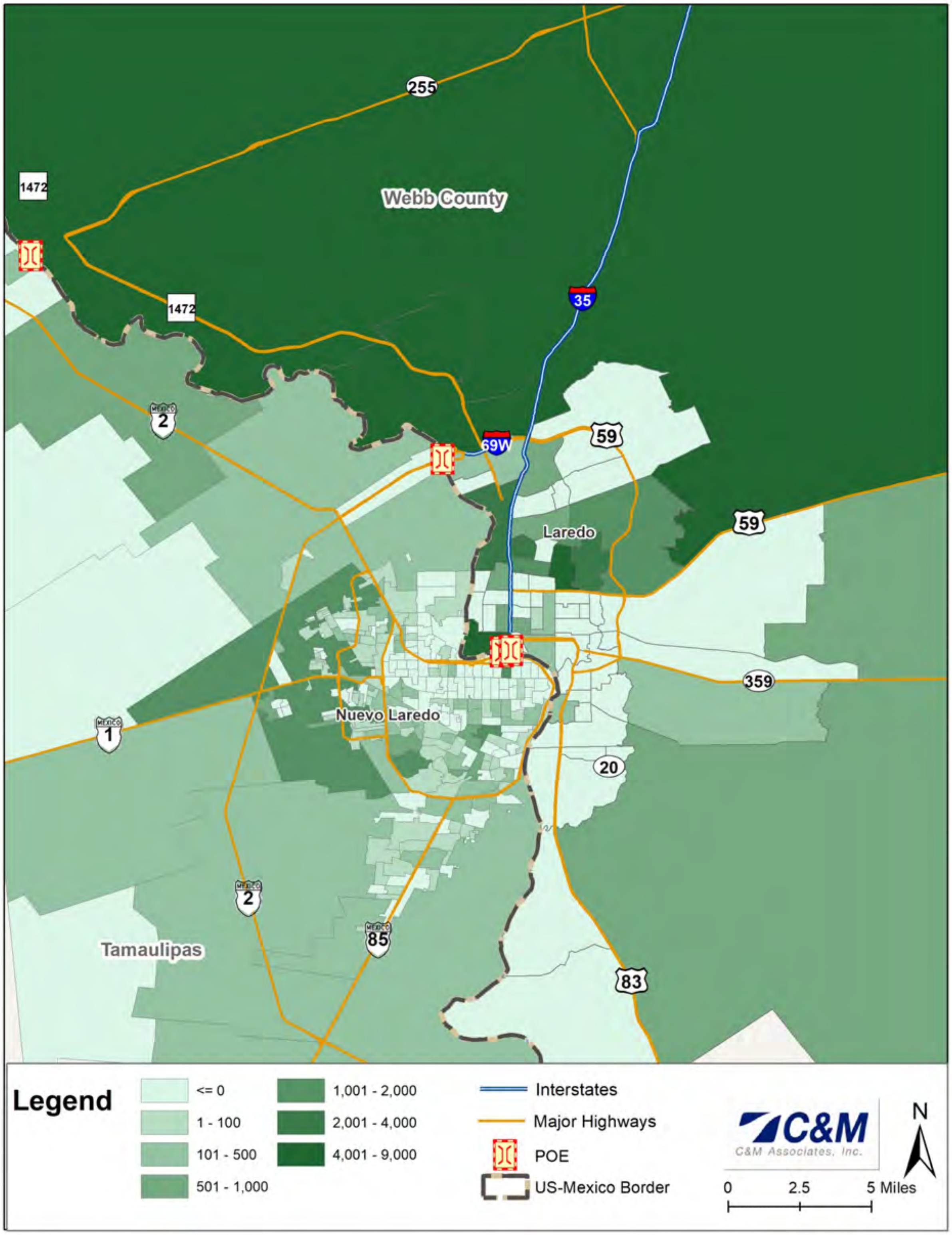


Figure 3-12. Historical Employment at the Census Tract Level (2010–2018)

Employment Projections

The S&B team reviewed employment projections from Moody's, W&P, the Laredo MPO TDM, and the Texas SAM, as shown in Table 3-12. For the Binational Assignment Model, the S&B team incorporated the growth rates of the Texas SAM into the historical census data in addition to considering disaggregation to the Laredo TDM's TAZ structure.

The historical employment data of Webb County included the most recent years and the effects of the COVID-19 pandemic. The forecasts by Moody's and W&P differ from one another not only in terms of their projected growth rates over time but in terms of their base year (2018) values. These differences are primarily due to the different definitions of employment used by each source, as they may exclude/include particular employment categories (e.g., seasonal employment, self-employment, non-farm, etc.).

As in the previous sections, the growth expected by the Laredo MPO TDM and the Texas SAM coincide in terms of short-term employment growth, with CAGRs above 2 percent until 2015. In the long term (2040–2050), the Texas SAM estimates lower growth than the Laredo MPO TDM, with a CAGR close to 1.9 percent until 2050. This trend is very similar to that proposed by W&P, which estimates a CAGR of close to 2 percent in the short term and 1.5 percent in the long term (2050). Finally, Moody's employment forecast includes the pandemic's effect in the short term, with a decrease in employment by 2020 and a corresponding CAGR of -1.8 percent. Moody's estimates a prompt recovery by the year 2025 with a CAGR of 2.5 percent and a deceleration in growth in 2035 with a CAGR slightly below 1 percent.

The employment projections for Nuevo Laredo are equally affected by the current effects of COVID-19; the projected growth rates assume an employment decrease of 6.8 percent annually from 2018 to 2020. Recovery of employment is evident in 2025 with a CAGR of 2.6 percent. In the long term, employment in Nuevo Laredo tends towards stability with CAGRs of 1.7 percent in 2035 and 1.4 percent by 2050.

Table 3-12. Employment Projections by Source

Region	Source	Employment				
		2018	2020	2025	2035	2040
Webb County	Laredo MPO TDM	109,495	114,417	127,715	159,125	177,618
	CAGR	-	2.2%	2.2%	2.2%	1.1%
	Texas SAM	102,376	107,141	120,044	133,794	146,392
	CAGR	-	2.3%	2.3%	2.2%	1.8%
	W&P	144,910	151,130	166,979	201,211	218,581
	CAGR	-	2.1%	2.0%	1.9%	1.7%
	U.S. Census	104,987	-	-	-	-
	Moody's	105,300	101,454	114,660	125,050	129,209
	CAGR	-	-1.8%	2.5%	0.9%	0.3%
Nuevo Laredo	SIREM	102,459	89,012	101,141	119,848	131,593
	CAGR	-	-6.8%	2.6%	1.7%	1.9%

Figure 3-13 and Figure 3-14 illustrate the Binational Assignment Model's forecasted change in employment from 2018 to 2040 at the census tract level and TAZ level, respectively. In Nuevo Laredo, higher employment growth is expected in the downtown area near the border bridges as well as in the industrial zones. In the United States, the largest change in absolute numbers is observed north of the downtown area near Laredo International Airport.

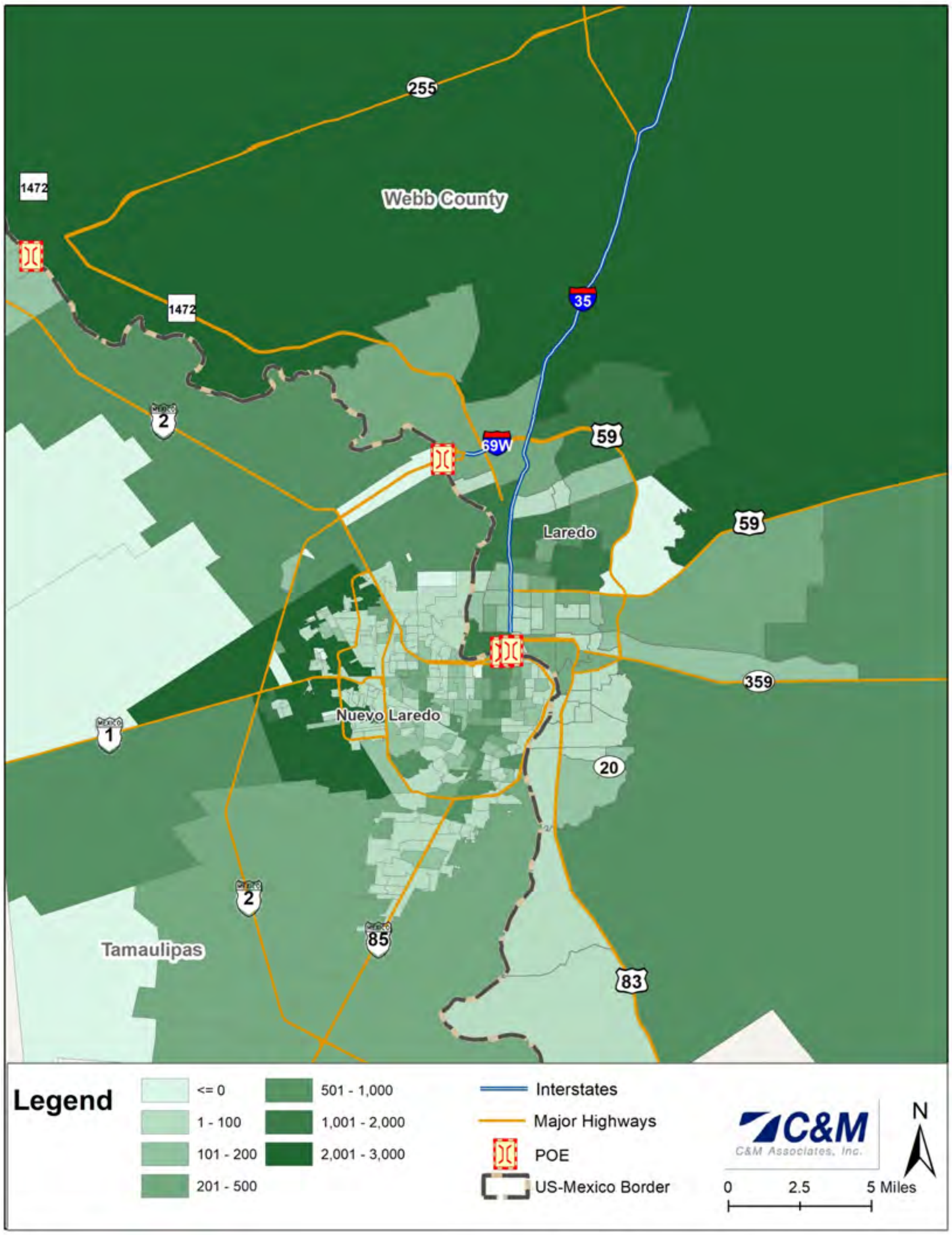


Figure 3-13. Forecasted Employment Change at the Census Tract Level (2018–2040)

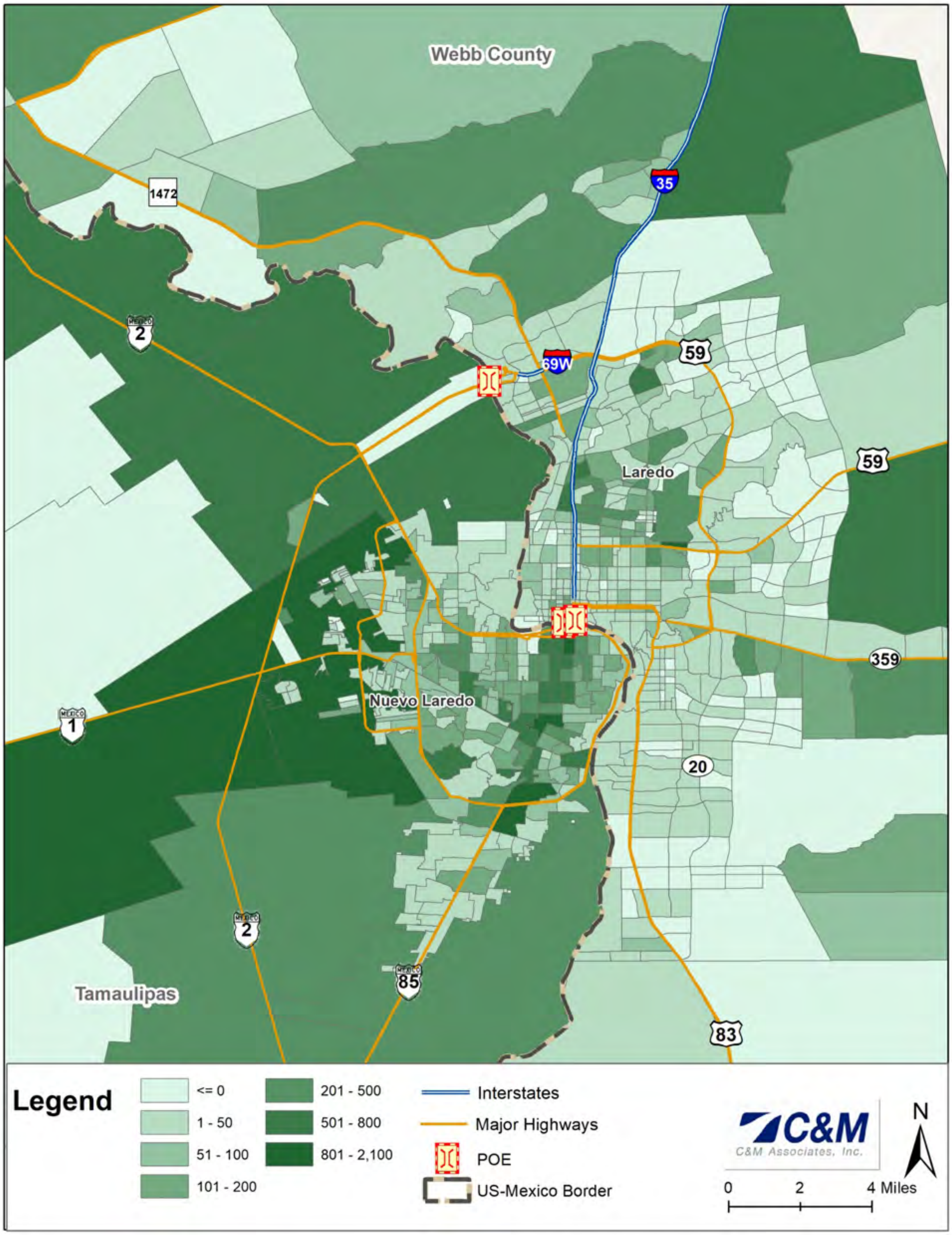


Figure 3-14. Forecasted Employment Change at the TAZ Level (2018–2040)

CHAPTER 4: DEMAND FORECASTING

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

Chapter 4: Demand Forecasting

This chapter outlines the S&B team's efforts to update the border crossing demand forecast. For this study, the S&B team employed an econometric modeling approach to estimate the future demand of passenger vehicles and pedestrians using the Laredo International Bridge System. Based on the socioeconomic data trend analysis and historical border crossing demand trends, the S&B team evaluated the socioeconomic variables that best explained historical border crossing demand and estimated future demand forecasts via econometric models.

The S&B team engaged Mercator International, LLC (Mercator) to forecast commercial vehicle demand and assess the opportunity that nearshoring of manufacturing could mean for the region considering U.S.–China disputes and supply chain weaknesses exposed by the COVID-19 pandemic. Mercator also used their maritime port and commodity flow expertise to estimate the commercial vehicle border crossing forecast.

The following sections describe existing border demand crossing forecasts, followed by a description of the available regional socioeconomic variables, the S&B team's travel border demand forecast methodology, and the forecast results for passenger vehicle, pedestrian, and commercial vehicle border crossings on the Laredo International Bridge System.

Existing Border-Crossing Forecasts

Prior to estimating the border-crossing demand forecast, the S&B team reviewed the latest versions of existing forecasts within the study area developed by other entities—including public sources from the federal and state governments as well as private consultant studies. These estimates—especially the estimates that have been updated with the latest data—served as a reference point for the present study. The key findings from this review include the applied growth rates of the border-crossing forecasts and comparisons of forecasted values to actual crossings, when possible.

Texas–Mexico Border Transportation Master Plan

TxDOT, in collaboration and partnership with the Border Trade Advisory Committee, is working with U.S. and Mexico agencies and stakeholders to develop the Border Transportation Master Plan (BTMP).[40] Originally scheduled for approval in late 2020, the final draft is under review and is expected to be approved in the first quarter of 2021.

The S&B team reviewed the estimates and projections expected for border crossings in the study region. The BTMP estimates approximately 112.4 million people crossing the Texas/Mexico border in 2050, an increase of 26.1 million (30%) from 86.3 million in 2019. The El Paso POE has the greatest number of forecasted passenger vehicle movements with 27.6 million in 2050, followed by the Laredo POEs with 13 million in 2050. Forecasts for pedestrian crossings in Laredo estimate growth from 3.8 million in 2019 to 4.2 in 2050 with a CAGR of 0.9 percent. The Brownsville POE's passenger vehicle CAGR is estimated to be 1 percent per year and pedestrians and bicycles are estimated to exhibit a CAGR of 0.7 percent from 2019 to 2050. Total commercial vehicle border crossings are estimated to grow at a CAGR of 3.2 percent from 2019 to 2050.

In the Laredo region, growth is estimated to be 3.3 percent per year, being the region with the highest estimated crossings in 2050 with 7.1 million. The World Trade Bridge, which exhibited the most commercial vehicle border crossings in 2019 (2.0 million), is estimated to grow to 5.1 million crossings with a 2019–2050 CAGR of 3.1 percent.

Laredo MPO Regional TDM

The S&B team received the Laredo MPO TDM (see Chapter 4) and extracted the traffic volumes assigned to the Laredo POEs. The Laredo MPO TDM is a planning tool for the 2035 Metropolitan Transportation Plan (MTP); it estimates a 2008–2030 CAGR of 2.1 percent for total crossings on the World Trade Bridge and 3.4 percent for the IH-35 corridor. IH-35 is the only Interstate connecting to Laredo, making it a good indicator of economic development in the Webb County/Laredo region.

The Laredo MPO TDM, as received by the S&B team, did not consider the proposed Bridge 4/5 POE in its trip tables or its traffic assignment. The trip tables were provided as total volumes with no separation between passenger and commercial vehicles.

Texas Statewide Analysis Model (Texas SAM)

TxDOT developed and maintains the Texas SAM, which considers different passenger and freight modes and the interaction between these modes. The Texas SAM was developed based on the Texas Truck Highway System and a zone structure built from census tracts. The Texas SAM forecasts statewide traffic volumes for passenger vehicles and freight and is capable of forecasting mode. Modeling of the various modes is done by coordination between the Traffic Analysis Section and the Transportation Systems Planning Section of TxDOT's Transportation Planning and Programming Division.

The Texas SAM provides several useful forecast datasets; the S&B team focused on the inputs of the model to extract the estimated growth rates for commercial vehicles at the U.S./Mexico border. The Texas SAM's trip table CAGRs for truck units crossing the U.S./Mexico border in Webb County are 4.1 percent from 2010 to 2040 and 2.9 percent from 2020 to 2040.

Texas Freight Mobility Plan

TxDOT's 2018 Freight Mobility Plan identifies challenges, investment strategies, policies, and data needed to enhance freight safety and mobility across all modes, to provide efficient, reliable, and safe freight transportation, and to improve the state's economic competitiveness.[41] TxDOT's 2016 Freight Mobility Plan was the first comprehensive multimodal transportation plan developed by TxDOT. The Texas Freight Mobility Plan 2018 enhanced and expanded on the 2016 and the 2017 freight plans. The 2018 Freight Mobility Plan reaffirms and enhances the framework for Texas's comprehensive freight planning program and decision-making.

According to the 2018 Freight Mobility Plan, the average daily inbound heavy truck volume at the Texas border is expected to increase from 10,900 to 25,000 by 2045, which is a 130 percent increase. Total inbound truck tonnage at the Texas border is projected to increase from 34 million to 111 million tons per year. The Hidalgo County POEs and Cameron County POEs had 1,600 and 600 inbound daily truck crossings in 2016, respectively. By 2045, they are projected to handle 6,800 and 2,800 daily commercial vehicles, respectively. This translates to a CAGR of 5.1 percent in Hidalgo County and 5.5 percent in Cameron County.

The Laredo POEs are predicted to remain the largest and most significant international trade gateway to Texas. In 2016, there were more than 5,700 daily truck crossings from Mexico into Texas, and it was the top commercial border POE in the United States. Total daily cross-border truck traffic in Laredo is projected to increase to 8,340 by 2045.

Federal Highway Administration's (FHWA)/Bureau of Transportation Statistics (BTS) Freight Analysis Framework Version 4 (FAF4)

The FHWA's FAF estimates freight movement among states and major metropolitan areas by all modes of transportation. Starting with data from the 2012 Commodity Flow Survey and international trade data from the U.S. Census Bureau, the FAF incorporates data from agriculture, extraction, utility, construction, service, and other sectors. The FAF4 provides estimates for tonnage by OD regions, commodity type, and mode as well as state-to-state vehicle flows to the highway network from 2020 through 2045 in 5-year intervals.[42]

In 2018, the FAF4 reports that the largest imports (in tons) from Mexico that pass-through Laredo by truck are motorized vehicles including parts (18% share) and estimates a CAGR of 2.5 percent from 2018-2045. On the other hand, the main exports to Mexico are plastic products (14% share) with an estimated CAGR of 3.9 percent. The FAF4 estimates Laredo freight import flows (truck tons) to grow at a CAGR of 3.7 percent from 2018 to 2045, while freight export flows (truck tons) are estimated to grow at a CAGR of 2.9 percent.

4.1. Border-Crossing Demand Forecasts

The S&B team tested several forecasting methods to estimate passenger vehicle and pedestrian traffic demand for existing POEs within the study area, including non-seasonal methods (single moving average, single exponential smoothing, double moving average, double exponential smoothing, damped trend) and seasonal methods (Holt-Winters' additive/multiplicative, damped trend additive/multiplicative, autoregressive integrated moving average). After testing these methods, the S&B team chose multiple linear regression, which produced the most statistically significant results in terms of Root Mean Square error (RMSE) among other statistical goodness of fit measures.

The S&B team developed, validated, and implemented econometric multiple linear regression models to forecast passenger and pedestrian demand. The econometric models' independent variables, the details of the models, and the demand forecast results are presented below.

Independent Variables

The S&B team analyzed the following demographic and economic indicators related to Laredo border demand, including 2020 data:

Webb County, Texas, and USA:

- Total population
- Total employment
- Utilities employment
- Manufacturing employment
- Wholesale trade employment
- Retail trade employment

- Transportation and warehousing employment
- Other services, excluding public administration employment
- Federal government civilian employment
- Total earnings
- Manufacturing earnings
- Wholesale trade earnings
- Retail trade earnings
- Transportation and warehousing earnings
- Finance and insurance earnings
- Management of companies and enterprise earnings
- Total personal income
- Net earnings
- Total personal income per capita
- Woods & Poole Economics, Inc. (W&P) wealth index
- Gross Regional Product (GRP)
- Total retail sales per household
- Mean household total personal income
- Total number of households
- Total retail sales, including eating and drinking establishment sales
- Gasoline stations retail sales
- Farm employment
- Forestry, fishing, related activities, and other employment
- Mining employment
- Construction employment
- Information employment
- Finance and insurance employment
- Real estate and rental and lease employment
- Professional and technical services employment
- Management of companies and enterprises employment
- Administrative and waste services employment
- Educational services employment
- Health care and social assistance employment
- Arts, entertainment, and recreation employment
- Accommodation and food services employment
- Total government employment
- Federal military employment
- State and local government employment
- Farm earnings
- Forestry, fishing, related activities, and other earnings
- Mining earnings
- Utilities earnings
- Construction earnings
- Information earnings
- Real estate and rental and lease earnings
- Professional and technical services earnings
- Administrative and waste services earnings
- Educational services earnings
- Health care and social assistance earnings
- Arts, entertainment, and recreation earnings
- Accommodation and food services earnings
- Other services, except public administration earnings
- Federal civilian government earnings
- Federal military earnings
- State and local government earnings
- Motor vehicles and parts dealers retail sales
- Furniture and home furnishing stores retail sales

- Electronics and appliance stores retail sales
- Building materials and garden equipment and supplies dealers retail sales
- Food and beverage stores retail sales
- Health and personal care retail sales
- Clothing and clothing accessories stores retail sales
- Sporting goods, hobby, book, and music stores retail sales
- General merchandise stores retail sales
- Miscellaneous store retail sales
- Non-store retailers retail sales

Nuevo Laredo, Tamaulipas, and México:

- Population
- Gross Domestic Product (GDP)
- Employment

These variables were tested to determine their explanatory power regarding the dependent variables: northbound/southbound pedestrian and passenger vehicle crossings. Although most sources provided historical data from 1996 onwards, some data were available only for later years.

Independent Variable Estimation

Most of the independent variables considered in this analysis—and all the variables used by the S&B team in the final demand forecasts—were obtained from Woods & Poole Economics, Inc. (W&P), an independent corporation that specializes in long-term county economic and demographic projections. W&P used a regional model to produce projections for the variables considered in this study.[43]

W&P's methodology for developing the county projections comprises four stages:

1. Develop forecasts to 2050 of total United States personal income, earnings by industry, employment by industry, population, inflation, and other variables.
2. Divide the country into 179 Economic Areas (EAs) as defined by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). For each EA, a projection is made for employment using an "export-base" approach;[4] in some cases, the export-based approach is modified using historical changes in employment by sector to forecast employment; employment projections are sometimes adjusted to reflect the results of individual EA models or exogenous information and assumptions about the EA economy. The employment projection for each EA is then used to estimate earnings in each EA. Employment and historical change are the principal explanatory variables used to estimate population and number of households in each EA.
3. Forecast population by age, sex, and race for each EA on the basis of projected net migration rates. For stages 2 and 3, the U.S. projection is the control total for the EA projections.

[4] This approach requires dividing the industrial sector, at the regional level, into two classes: basic and non-basic products. The basic industries produce output that is not consumed locally but is "exported" from the region for national or international consumption. This assumption allows these sectors to be linked closely to the national economy and follow national trends in productivity and output growth. In contrast, the growth of the "non-basic" sectors depends largely on the growth of the "basic" sectors that form the basis of the region's economy.

4. Replicate stages 2 and 3 at the county level using the EAs as the control total for the county projections. The projection for each county in the United States is done simultaneously so that changes in one county will affect growth or decline in other counties.

The regional projection methods are revised year to year to reflect new computational techniques and new sources of regional economic and demographic information. Each year, new projections are produced based on an updated historical database and revised assumptions.

Most of the historical data in W&P's regional databases are obtained from the BEA. Historical data are subject to revision from time to time; for example, historical employment and income data from the BEA are revised on a regular basis.

Furthermore, for the final demand forecast, the S&B team also obtained and analyzed socioeconomic variables provided by Moody's Analytics (Moody's).[44] In contrast to W&P, Moody's includes short-term projections regarding the impact of the COVID-19 pandemic on its socioeconomic variables. These estimates indicate a negative impact in 2020 with recovery scenarios in 2021 and 2022.

4.2. COVID-19 Border Crossing Restrictions

As presented in Chapter 2, beginning on March 21, 2020, the governments of the United States and Mexico agreed to apply travel restrictions for border crossings along the U.S./Mexico border. Travel restrictions were limited to "non-essential" trips (Individuals traveling for tourism purposes, such as sightseeing, recreation, gambling, or attending cultural events in the United States), which mainly impacted border crossings for non-commercial vehicles.

The S&B team analyzed the monthly historical behavior of border crossings and estimated different impact and recovery scenarios due to border crossing restrictions. The recovery scenarios are related to the probabilities of eliminating crossing restrictions based on the trend of daily infections and vaccination prospects. At the end of 2020, the first vaccine received FDA approval in the United States. However, border crossing restrictions were maintained throughout the year due to new peaks registered in both the United States and Mexico since October 2020. The effects of the application of vaccines are expected to contribute to the removal of restrictions in 2021. Figure 4-1 and Figure 4-2 present the S&B team's recovery scenarios for Laredo POE passenger vehicle and pedestrian border crossings, respectively.

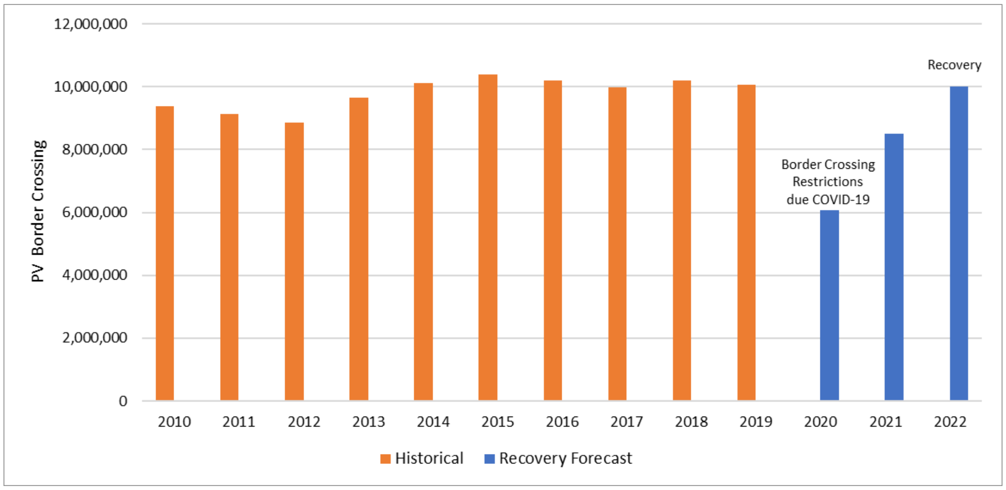


Figure 4-1. Passenger Vehicle Border Crossing Recovery Forecast Laredo POE

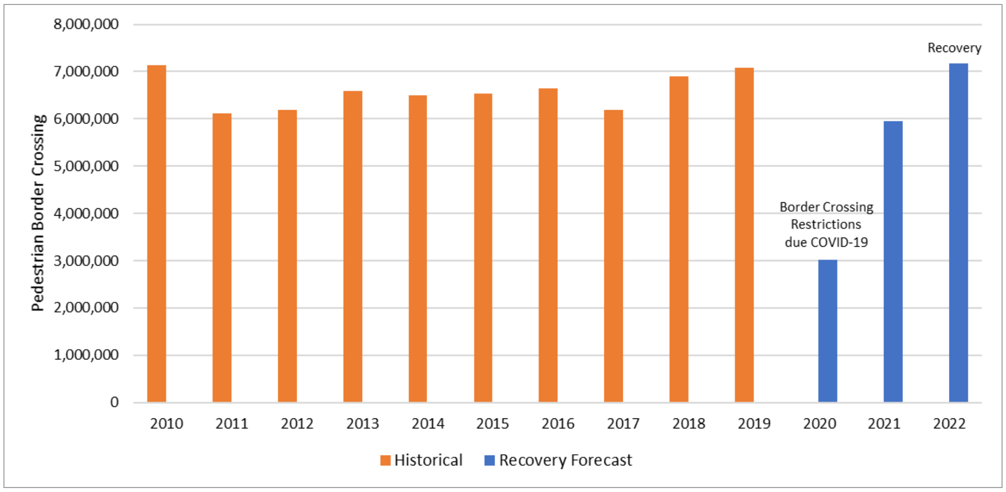


Figure 4-2. Pedestrian Border Crossing Recovery Forecast Laredo POE

The COVID-19 pandemic has impacted commercial vehicle border crossings less than passenger vehicles and pedestrians. In 2020, commercial vehicle border crossings decreased 1.9 percent overall, with the largest decreases in April and May (-23% and -32%, respectively) due to travel restrictions. Unlike passenger vehicles and pedestrians, commercial vehicle crossings recovered quickly, achieving 9 percent growth in the September 2020 compared to September 2019. At the end of December 2020, commercial vehicle crossings grew 13 percent compared to 2019. Figure 4-3 presents the S&B team's recovery scenario for commercial vehicle border crossings.

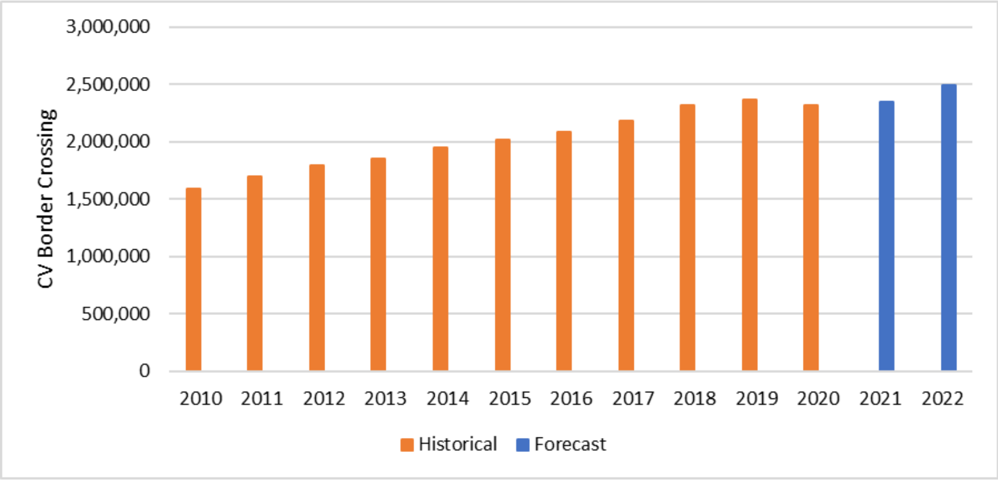


Figure 4-3. Commercial Vehicle Border Crossing Forecast Recovery

4.3. Econometric Model Methodology

The S&B team used the latest available data to develop the econometric demand forecast. The S&B team tested all previously mentioned variables independently as well as combinations of explanatory variables to search for significant correlations. Since each tested variable measures a different quantity (people, dollars, jobs, etc.), all feature-scaled values were given a value between 0 and 1 before being used in the econometric model.

Passenger Vehicle Border Crossings

The following explanatory variables were used to estimate northbound passenger vehicle traffic:

- Laredo – Total retail trade employment
- Texas – Total Gross Regional Product (GRP)

Additionally, a dummy variable was included to capture the presence or absence of economic conjunctural effects, such as the Great Recession.

The regression model is represented by the following equation:

$$POE\_PVCrossings\_t = Constant + \beta_1 * (LAR\_TRE) + \beta_2 * (TX\_GRP\_t) + \beta_3 * (Dummy)$$

Where:

POE_PVCrossings_t = Feature-scaled Laredo passenger vehicle crossings in time period *t*

LAR_TRE = Feature-scaled total Laredo – Total retail trade employment in time period *t*

TX_GRP_t = Feature-scaled total Texas – Total Gross Regional Product in time period *t*

Dummy = Economic cycle dummy variable

Table 4-1 presents the results of the analysis for passenger vehicle crossings. As shown, the model is statistically significant and explains 85 percent of the variation in passenger vehicle demand (R^2 = 0.85, p < .05). Furthermore, the Durbin-Watson statistic indicates the absence of autocorrelation between the variables.

Table 4-1. Passenger Vehicle Econometric Model Coefficients

Variable	Coefficient	R^2	p
Constant	-0.78	0.85	< .05
Laredo Retail Employment	0.73		
Texas Gross Regional Product	1.01		
Dummy	-0.49		

Note: Durbin-Watson statistic = 1.5

Demand Forecast Results: the S&B team used the econometric model described above to estimate demand for passenger vehicles at the existing Laredo POEs beginning in 2020. To assess the model's accuracy in relation to historical border crossings, Figure 4-4 compares observed and "backcasted" northbound passenger vehicle crossings from 2010 to 2019.

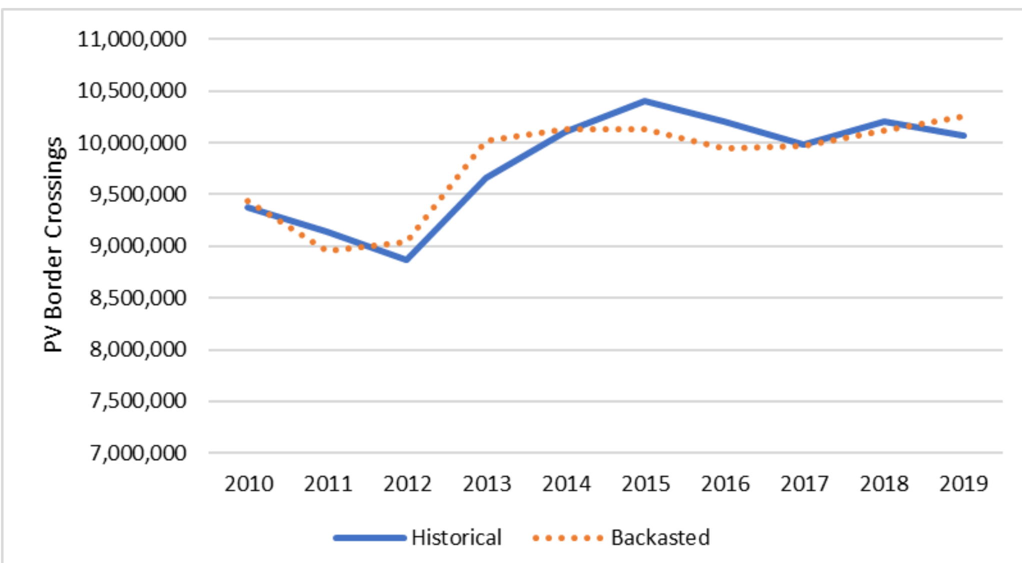


Figure 4-4. Passenger Vehicle Border Crossings at Laredo POEs: Historical vs. Backcasted

Figure 4-5 illustrates the growth forecast for passenger vehicles border crossings at existing Laredo POEs and the chosen explanatory variables. The resulting model provides the coefficients that relate passenger vehicle growth with the growth of the explanatory variables.

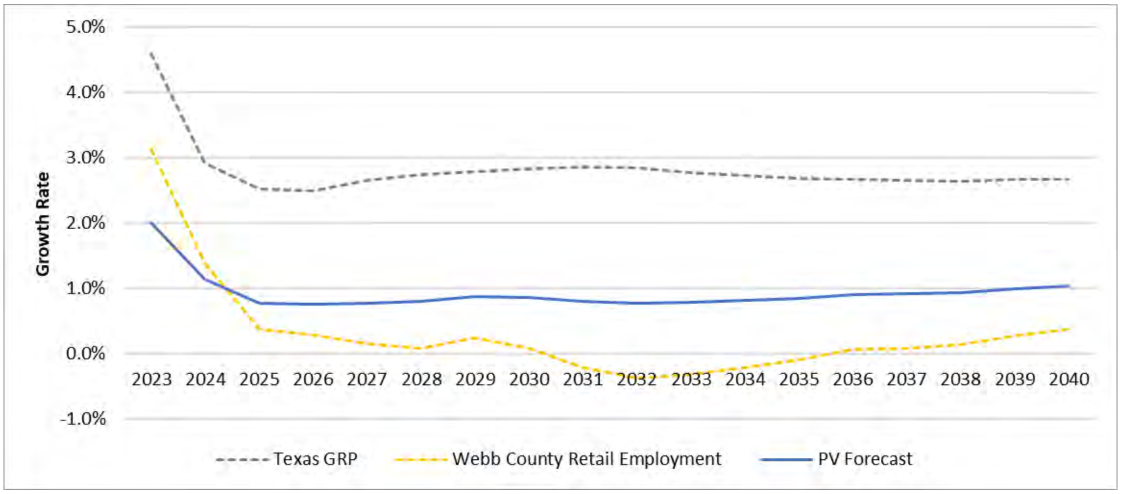


Figure 4-5. Passenger Vehicle Border Crossings and Explanatory Variable Growth

Finally, the S&B team developed a Monte Carlo simulation to develop High and Low scenarios for the passenger vehicle forecast. The general approach of the simulation gathers the independent variables of the econometric model and simulates probabilistic random events based on a mean (i.e., the expected value) and a standard deviation. Figure 4-6 illustrates the complete series of historical, forecasted, and Monte Carlo scenarios for passenger vehicle demand for Laredo area POEs. According to this model, passenger vehicle crossings are expected to increase from over 10.07 million in 2019 to about 11.8 million in 2040, with a CAGR of 0.7 percent (Base Case).

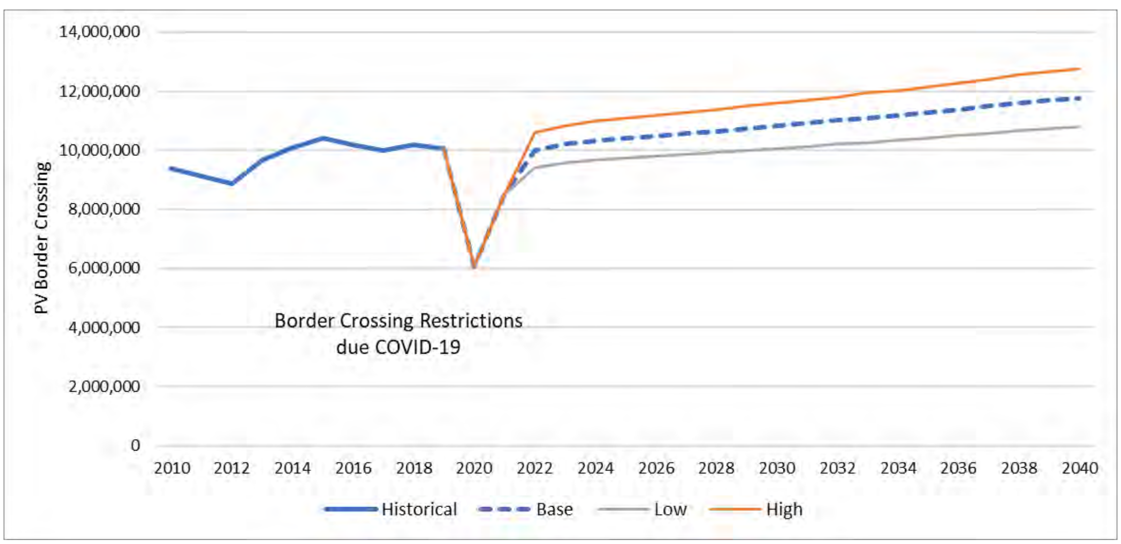


Figure 4-6. Passenger Vehicle Border Crossings: Historical and Forecasted Scenarios

Pedestrian Border Crossings

The following explanatory variables were used to estimate pedestrian border crossings:

- Laredo, TX – Retail trade sales
- Texas – Retail trade employment

The regression model is represented by the following equation:

$$POE\_PEDCrossings\_t = Constant + \beta_1 * (LAR\_RTS) + \beta_2 * (TX\_RTE) + \beta_3 * (Dummy)$$

Where:

POE_PEDCrossings_t = Feature-scaled Laredo pedestrians crossings in time period *t*

LAR_RTS = Feature-scaled total Laredo – Total retail trade sales in time period *t*

TX_RTE = Feature-scaled total Texas – Total Retail trade employment in time period *t*

Dummy = Economic cycle dummy variable

Table 4-2 presents the results of the analysis for pedestrian crossings. As shown, the model is statistically significant and explains 94 percent of the variation in pedestrian crossings ($R^2 = 0.94$, $p < .01$). Like the passenger vehicle model, the Durbin-Watson statistic is within an acceptable range to indicate a lack of autocorrelation.

Table 4-2. Pedestrian Econometric Model Coefficients

Variable	Coefficient	R^2	p
Laredo Retail Sales	0.50	0.94	< .01
Texas Retail Employment	0.19		
Dummy	-0.52		

Note: Durbin-Watson statistic = 1.2

Demand Forecast Results: the S&B team used the econometric model described above to estimate demand for pedestrian crossings at the existing Laredo area POEs beginning in 2019. To assess the model's accuracy in relation to historical border crossings, Figure 4-7 compares observed and backcasted pedestrian crossings from 2006 to 2018.

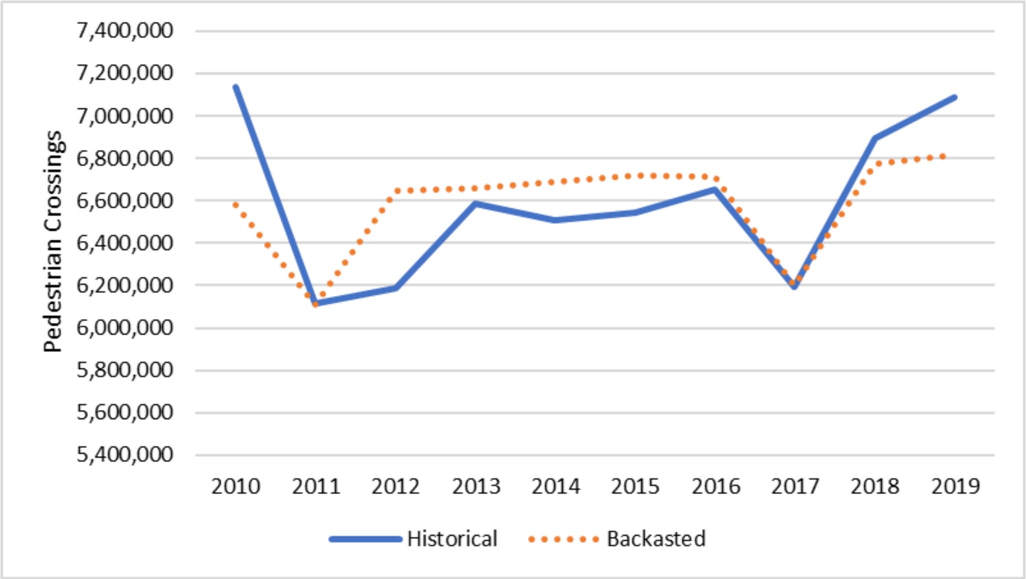


Figure 4-7. Pedestrian Border Crossings at Laredo POEs: Historical vs. Backcasted

As presented for the passenger vehicles forecast, Figure 4-8 illustrates the growth forecasts for pedestrian border crossings at existing Laredo POEs and the chosen explanatory variables. The resulting model provides the coefficients that relate pedestrians growth with the growth of the explanatory variables.

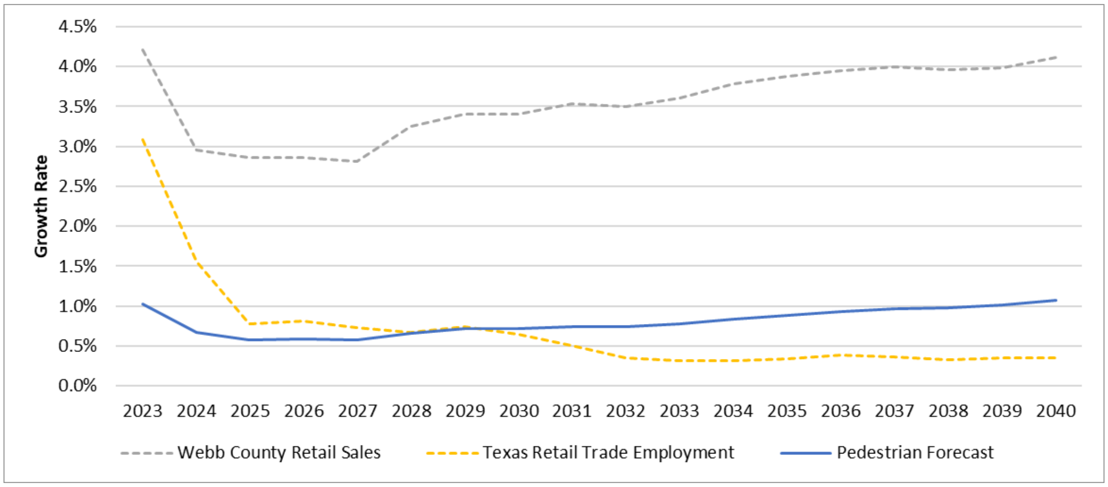


Figure 4-8. Pedestrian Border Crossings and Explanatory Variable Growth

Figure 4-9 illustrates the complete series of historical and forecasted pedestrian demand for existing Laredo POEs along with High and Low scenarios developed via Monte Carlo simulation. According to this model, pedestrian crossings are expected to increase from over 7.08 million in 2019 to about 8.2 million in 2040, with a CAGR of 0.7 percent (Base case).

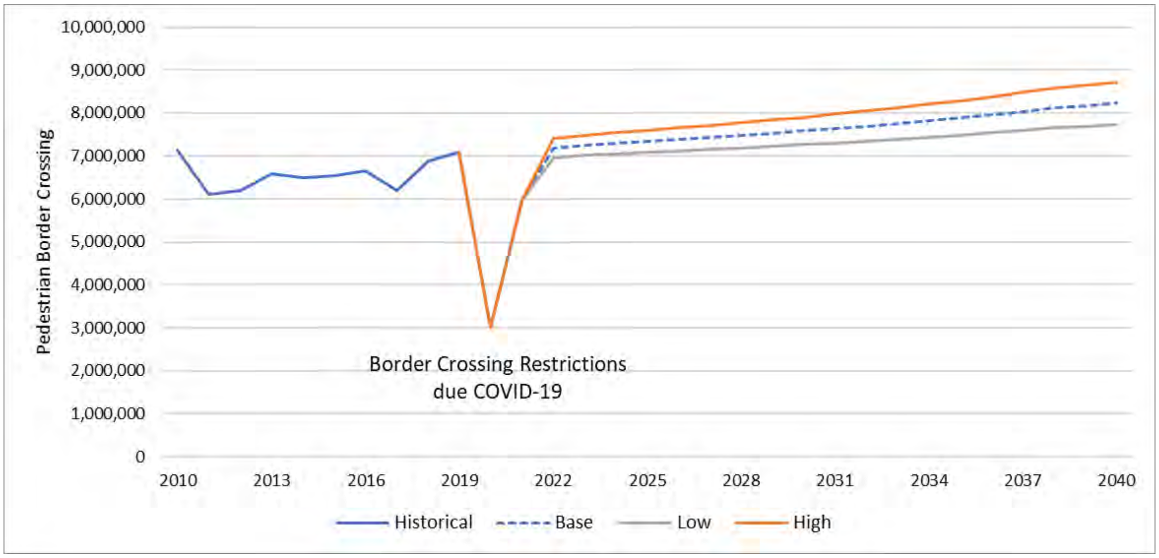


Figure 4-9. Pedestrian Border Crossings: Historical and Forecasted Scenarios

Commercial Vehicle Crossings

The S&B team engaged Mercator International, LLC (Mercator) to forecast commercial vehicle demand and assess the impact that nearshoring of manufacturing could have on the region, considering U.S./China disputes and supply chain weaknesses exposed by the COVID-19 pandemic. Mercator also used their maritime port and commodity flow expertise to estimate the commercial vehicle border crossings forecast.

Mercator is a global specialist advisory firm serving public and private sector clients in the global logistics and freight transportation domains, with particular focus on transportation infrastructure, market research, financial and economic analyses, transaction due diligence, commercial strategies, and operational improvements. Mercator has significant experience evaluating cargo operations in the transportation sector, including specific experience analyzing and evaluating investments in transportation assets serving the movement of U.S. freight imports and exports.

Mercator's approach to forecasting commercial vehicles includes an overview of transportation corridors, historical analysis of POEs in Laredo, their competition with other POEs in the region, the macroeconomic context, and trade war and pandemic impacts. A summary of the commercial vehicle border crossing analysis is presented below (for the full report from Mercator, please see Appendix C):

- Over 30 percent of northbound U.S. imports by volume are destined for Texas, and a similar volume is destined for states along the IH-69 corridor, with significant volumes destined for Illinois, Michigan, and Ohio. Another 12 percent is destined for states along the I-81 corridor serving the Northeast states, and an equal share is destined for the Southeastern states along the I-20 corridor.
- In Mexico, trucking is the most widely used mode of distribution, given the flexibility it gives to shippers in terms of delivery speed and enabling door-to-door delivery. The 370,000 km of Mexican toll roads allow connectivity between almost all locations in the country, taking advantage of intermodal logistics channels, which has been a priority for Mexico over the last 20 years.

- The Laredo–Nuevo Laredo region has a geographic advantage for cross-border supply chains, linking Mexico's industrial and logistics clusters to 75 percent of the U.S. population and the major manufacturing centers in the Midwest and Southeast United States.
- As a result of the U.S./China trade war in 2018, Mexico provided 45 percent of the imports of vegetables and fruit to the United States. Mexico's share increased to 48 percent in 2019. In contrast, China's share fell 2 percentage points (from 5% to 3%) over the same period.
- U.S. imports, the main driver of both northbound and southbound crossings, are tightly correlated with U.S. GDP. Imports expressed as a percentage of U.S. GDP have been flat.
- The shares of U.S. imports coming from each of the major trade regions have been flat since the United States recovered from the global financial crisis and the Great Recession, and this should remain the case if the U.S./China trade dispute is resolved; if it is not resolved, we should expect Asia to lose share and Mexico to gain share.
- The United States has maintained a relatively constant trade deficit with Mexico on a dollar basis since 2011, but northbound and southbound truck tonnage is well balanced.
- Tonnage per northbound truckload has shown very little deviation around the long-term average.
- Texas's share of the total northbound truck crossings has remained flat, as has Laredo's share of the number of northbound crossings over the Texas border.
- The rail/truck split for northbound cargo has similarly remained flat since 2011, as has the ratio of loaded to empty northbound containers.
- Loaded northbound truck crossings are highly correlated to U.S. imports; loaded northbound and southbound commercial vehicles should grow at the same rate.
- Empty commercial vehicles should grow at the same rate as loaded commercial vehicles.

Mercator's analysis considered the COVID-19 pandemic's disruptions to trade, not only through impacts at the level of economic activity (real GDP and total employment levels) but also through impacting the sources of imports and personal consumption expenditure patterns. Seasonally adjusted real GDP decreased 9.1 percent on a year-over-year basis in the second quarter of 2020, and total non-farm employment decreased by more than 15 percent from 152 million to 130 million.

The trade war, pandemic, and economic contraction introduce a significant amount of uncertainty to forecasting. Mercator addressed this uncertainty by first developing a set of scenarios centered around expectations of economic performance and trade behavior. Second, Monte Carlo simulation was used to provide a statistical distribution of likely outcomes, which, in Mercator's analysis, is annual cross-border commercial vehicle crossings over the forecast period.

Finally, Mercator developed an econometric model that related the growth of U.S. real GDP and U.S. real commodity imports to establish a relationship between U.S./Mexico trade and the number of border crossings expected. Monte Carlo simulations were carried out to determine future scenarios of uncertainty. Each of the independent variables driving the model was sampled from a defined parameter such that after a statistically significant number of iterations of the model were run, the distribution of values of the independent variables would match the distribution that was defined for each of the input variables.

Figure 4-10 presents the results of Mercator's commercial vehicle border crossing forecast as well as Low and High scenarios estimated via Monte Carlo simulation. The forecast estimates a 2019–2040 CAGR of 3 percent (Base case).

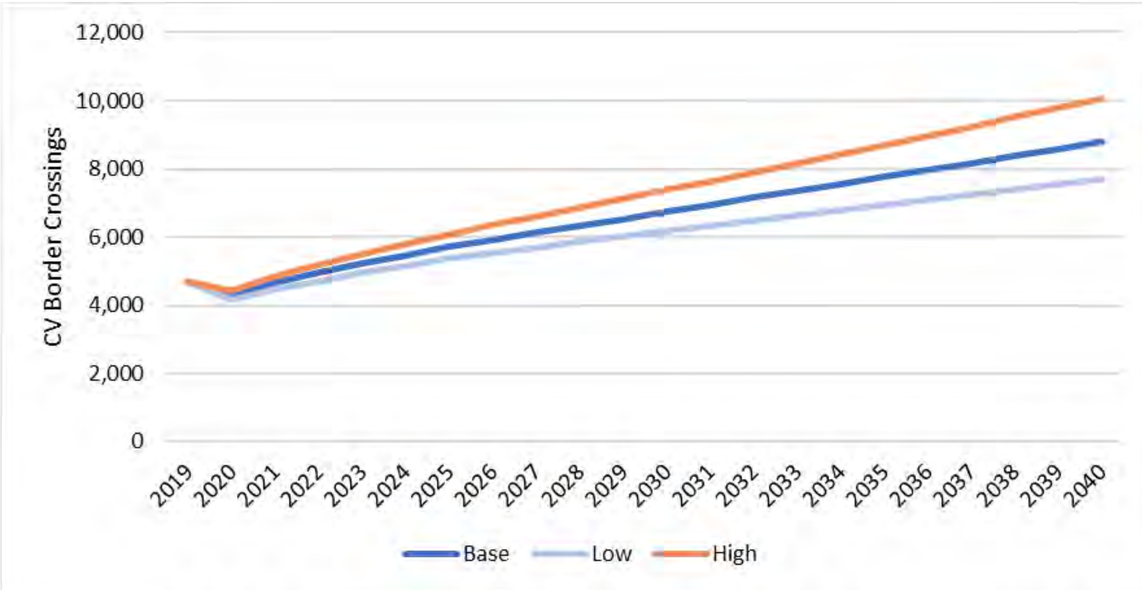


Figure 4-10. Commercial Vehicle Border Crossing Forecast by Scenario

CHAPTER 5: MODELING APPROACH

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

Chapter 5: Modeling Approach

This chapter outlines the S&B team's efforts to model the Laredo International Bridge System's travel demand on each side of the U.S./Mexico border. For this study, the S&B team developed a four-step travel demand model (TDM) for the City of Nuevo Laredo and used it in combination with an existing TDM for the Laredo MPO area to develop the Binational Assignment Model in the TransCAD 7.0 Build 12390 platform. The S&B team developed and evaluated all four steps of the employed TDMs based on transportation data, observed traffic patterns within the study area, and expected future road network improvements. The Binational Assignment Model was calibrated to 2018 traffic conditions within the study area and subsequently used to develop future traffic forecasts for the future model years 2025, 2030, and 2040.

For the U.S. side of the border, the S&B team acquired, reviewed, and adopted the existing Laredo MPO regional TDM, which covers the urbanized area of Webb County, Texas. The S&B team received the latest version of Laredo TDM on October 29, 2020 from TxDOT. For the Mexican side of the border, the S&B team developed the Nuevo Laredo TDM (NL-TDM), which covers Nuevo Laredo, parts of MEX 2 and MEX 85, and the Laredo International bridge system.

The following sections describe the S&B team's travel demand modeling methodology, the details of the U.S.-based and Mexico-based TDMs, and the development, validation, and calibration of the Binational Assignment Model.

5.1 Binational Assignment Methodology

The border-crossing volumes for each model year were estimated based on the S&B team's binational traffic assignment component. Figure 5-1 illustrates the iterative process of the binational assignment. In each iteration, the model assigns three different trip tables (i.e., matrices that display the number of trips going from each origin TAZ to each destination TAZ) to the binational network: the two trip tables corresponding to each side of the U.S./Mexico border and a trip table for vehicles crossing the border. Based on the congestion of the four Laredo POEs and the study area road network, the assignment step distributes border-crossing trips to each of the POEs by reaching a user equilibrium. The assignment not only considers the travel times of the road network but also the queuing and inspection time at each POE.

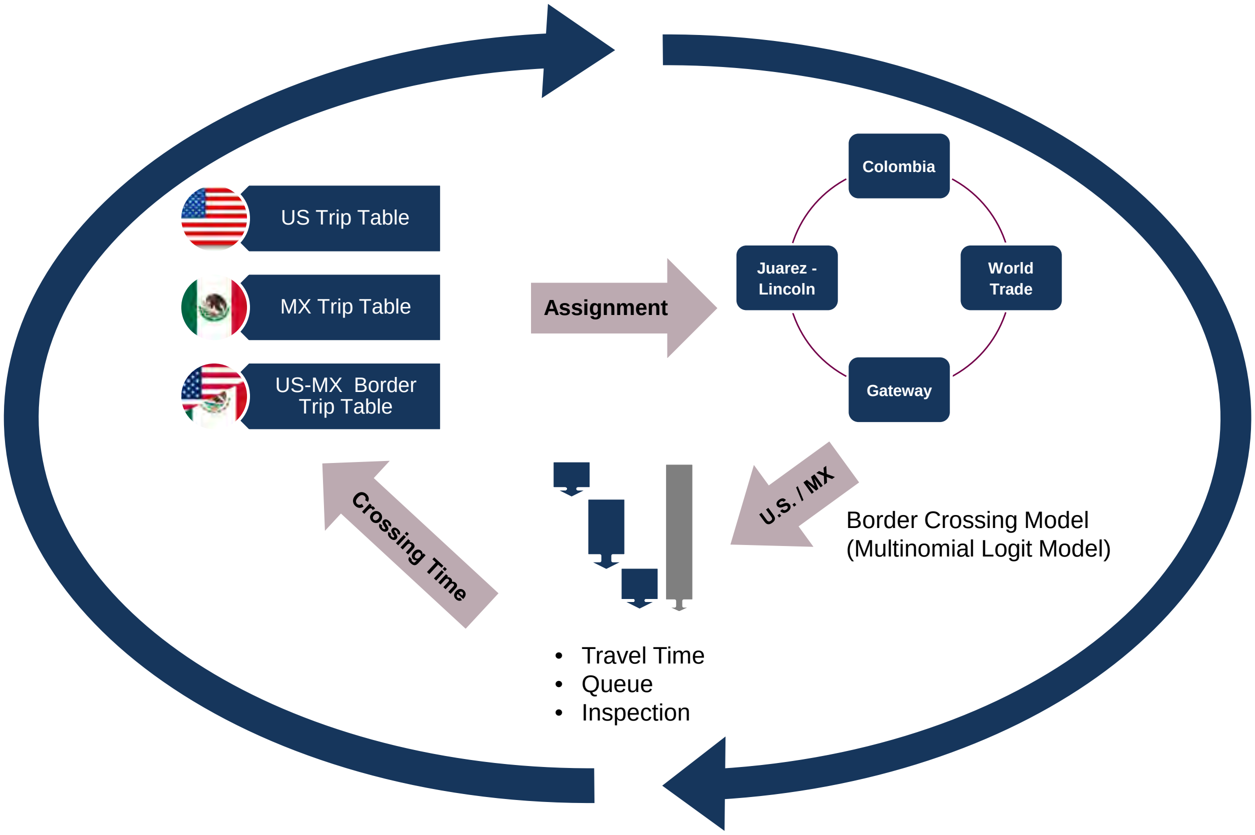


Figure 5-1. S&B Binational Assignment Process

The U.S. networks were adopted from the Laredo MPO TDM, whereas the Mexico networks were developed by the S&B team from scratch. Figure 5-2 presents an overview of the development of the TDM for each side of the international study area. The flow chart shows the general four-step modeling methodology and its components. Components that were used or developed in the Binational Assignment Model process are colored. The light blue boxes of the Laredo TDM flow-chart represent the existing elements that the S&B team used to develop the Binational Assignment Model, including the trip tables (obtained using TRIPCAL® and ATOM2 software), networks, network attributes, volume delay functions (VDF), and future projects. The dark blue boxes of the Nuevo Laredo TDM flow-chart represent elements that the S&B team developed for the Mexican portion of the study area.

The S&B team developed a simplified TDM for Nuevo Laredo including the trip generation, trip distribution, and traffic assignment steps and their corresponding components. Mode choice, which is the third step in a traditional four-step TDM, was instead replaced by basic assumptions—in part because Nuevo Laredo mode choice survey data were not available, and primarily because the study area does not have mass-public transportation infrastructure. Nevertheless, based on previous experience and the available data, the S&B team was able to develop a reliable TDM for the Nuevo Laredo area, as presented in this chapter.

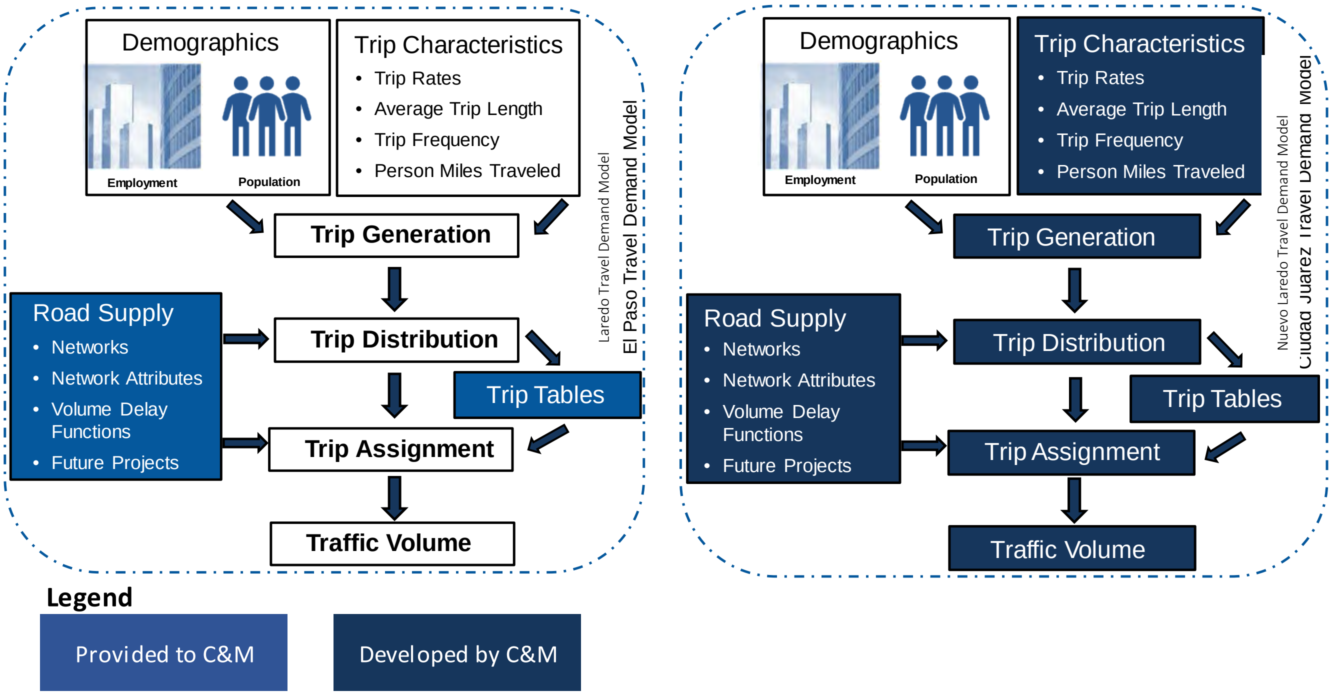


Figure 5-2. U.S. and Mexico TDM Methodologies

5.2 The Laredo MPO Regional TDM

As mentioned earlier, the U.S. portion of the Binational Assignment Model was developed by using the Laredo MPO's regional TDM. The Laredo MPO TDM supports the development of the region's long-range Metropolitan Transportation Plan (MTP) 2020–2045 and is used to identify transportation system deficiencies and evaluate potential improvements. The Laredo TDM also provides future design traffic for the Laredo metropolitan area.

The S&B team reviewed the received 2008 base year and 2040 future year model inputs and results from the Laredo MPO. The MPO provided all inputs and results of the Laredo TDM, including socioeconomic data, model networks, trip tables, and assigned traffic volumes.

The latest version of the Laredo TDM is a daily model using a traditional four-step modeling methodology, including trip generation, trip distribution, and assignment steps. The mode choice step is simplified due to trip generation directly generating auto trips.

Laredo MPO TDM Base Year Network

To develop a 2018 base year network, the S&B team reviewed the Laredo MPO TDM's 2008 base year network and compared it to available GIS and Google Earth (aerial and street view photos) data from 2018. The 2018 base year network is remarkably similar to the existing conditions of Webb County's road network. The new the S&B team base year network includes much more detail in terms of the number of road network links and the network attributes provided by the MPO.

The Laredo TDM's roadway links are represented by eight functional classifications, which are separated into a total of 16 functional types based on their individual functions within the transportation network. Every functional type has its own free-flow speed and daily capacity per lane depending on the roadway link's location.

Figure 5-3 illustrates the link functional classifications and the external stations of the base year network. **Error! Reference source not found.** presents the speed and daily capacity per lane for each functional class.

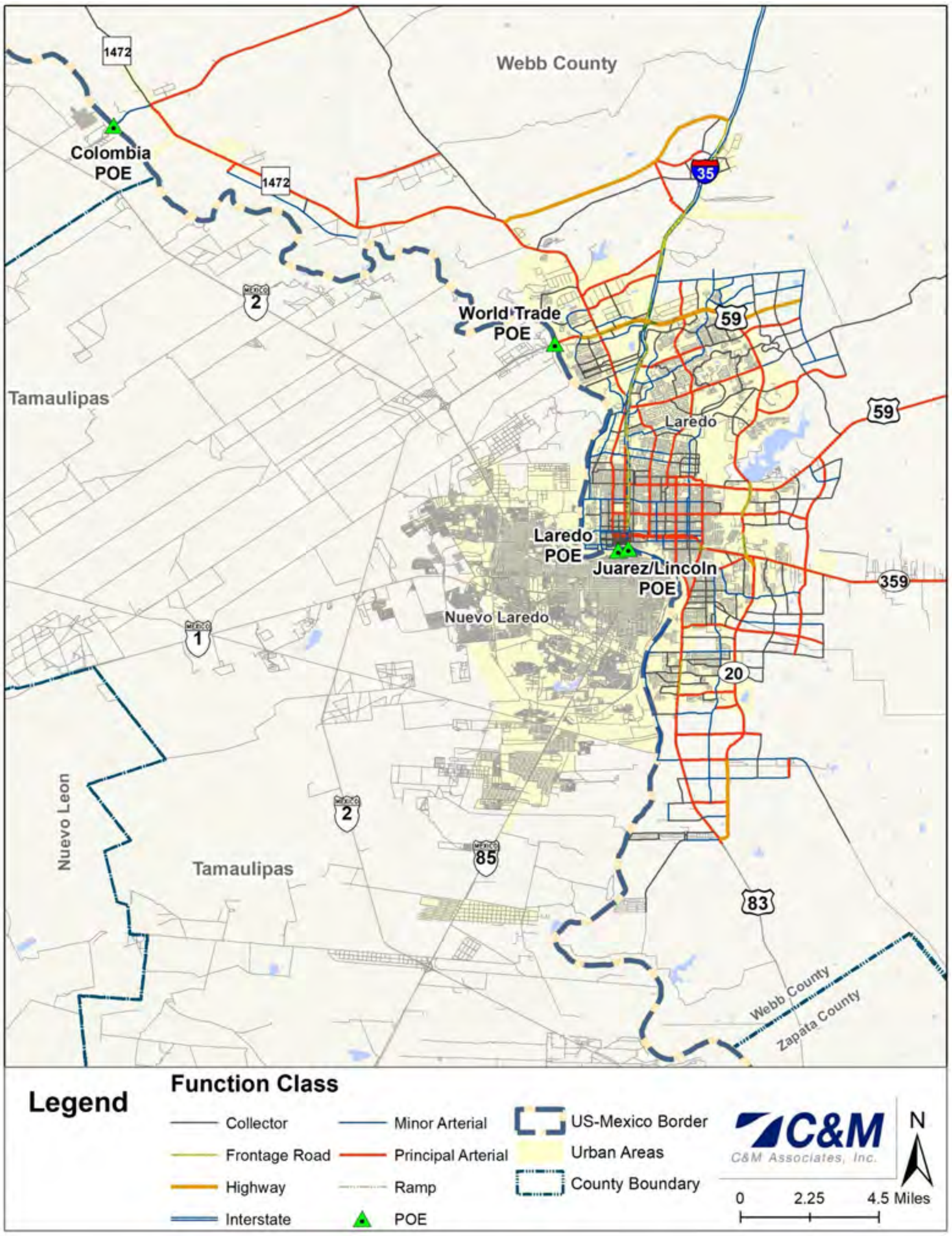


Figure 5-3. Laredo MPO TDM 2018 Base Year Road Network Structure

Table 5-1. Daily Capacity and Speed of Laredo MPO TDM Roadway Links

Functional Class		Functional Type		# of Links	Length (miles)	Area Type							
						1 - CBD		2 -Urban		3 - Sub urban		4 - Rural	
ID	Description	ID	Description			Speed (mph)	Capacity	Speed (mph)	Capacity	Speed (mph)	Capacity	Speed (mph)	Capacity
1	Interstate Freeways	1	Radial Interstate Freeways - Mainlanes Only	71	47.01	NA	NA	52.0	19,000	54.0	17,200	61.3	14,000
2	Other Freeways	5	Radial Other Freeways - Mainlanes Only	0	0.00	NA	NA	NA	NA	NA	NA	NA	NA
		6	Radial Other Freeways - Mainlanes & Frontage Roads	0	0.00	NA	NA	NA	NA	NA	NA	NA	NA
		7	Circumferential Other Freeways (Loop) - Mainlanes Only	0	0.00	NA	NA	NA	NA	NA	NA	NA	NA
3	Other Highways	10	Highways - Mainlanes Only	34	20.39	NA	NA	47.3	10,800	50.0	9,900	57.5	8,700
4	Principal Arterials	11	Principal Arterial - Divided	303	61.11	29.1	8,300	34 - 35.16	7,900	42.9	6,700	50.8	5,800
		12	Principal Arterial - Continuous Left Turn-Lanes	154	31.77	NA	NA	34.5	7,900	42.6	6,700	47.9	5,800
		13	Principal Arterial - Undivided	226	90.47	27.8	6,800	34.0	6,600	42.4	5,600	45.6	4,700
5	Minor Arterials	14	Minor Arterial - Divided	98	12.07	28.5	7,300	34.6	7,400	42.4	6,400	49.1	5,400
		15	Minor Arterial - Continuous Left Turn-Lanes	30	6.79	NA	NA	34.3	7,400	42.2	6,400	NA	NA
		16	Minor Arterial - Undivided	303	81.41	27.0	6,300	33.9	6,100	41.8	5,400	45.5	4,500
6	Collectors	17	Collector Arterial - Divided	125	9.21	28.1	7,100	33.9	5,900	37.0	5,200	45.8	5,400
		18	Collector Arterial - Continuous Left Turn-Lanes	20	4.89	NA	NA	31.7	5,900	36.0	5,200	45.4	4,300
		19	Collector Arterial - Undivided	690	168.42	26.6	5,200	31.3	4,300	32.3	3,800	44.2	2,900
7	Frontage Roads	20	Frontage Road	267	55.20	NA	NA	36.0	7,600	42.3	6,700	48.8	5,000
8	Ramps	21	Ramp (Between Frontage Road and Mainlanes)	80	12.70	NA	NA	23.0	20,850	24.0	19,550	33.5	14,100
		22	Interchange Ramp (Freeway-to-Freeway Interchange Ramps)	14	9.47	NA	NA	40.1	26,300	42.0	24,650	NA	NA

Laredo MPO TDM Adoption

The S&B team evaluated the Laredo MPO TDM's available inputs and results to validate the Laredo MPO's approach to modeling traffic within the study area. The S&B team maintained the zonal structure of the Laredo TDM and adopted the TDM to the S&B team's specific project needs. The number of external stations remained as they were considered in the original model; however, the external stations that represent the Webb County POEs were excluded to combine the Laredo TDM with the Mexican part of the S&B team's binational model.

To support time-of-day (TOD) modeling efforts, the S&B team implemented four time periods in the adopted Laredo TDM: morning peak (AM), Midday (MD), afternoon peak (PM), and Nighttime (NT). Table 5-2 shows the hours that represent the four model time periods.

Table 5-2. Laredo MPO TDM Time Periods

Time Period	Time of Day
Morning Peak (AM)	7:00 AM - 9:00 AM (2 hrs.)
Midday (MD)	9:00 AM - 3:00 PM (6 hrs.)
Afternoon Peak (PM)	3:00 PM - 7:00 PM (4 hrs.)
Nighttime (NT)	7:00 PM - 7:00 AM (12 hrs.)

Trip Generation: This is the first step in a traditional four-step TDM. Trip generation predicts trip productions and attractions—i.e., the number of trips originating in or destined for a particular TAZ. The trip purposes considered in the Laredo TDM comprise Home-Based Work Auto (HBW), Home-Based Non-Work Auto (HNW), Non-Home-Based Auto (NHB), and Internal Commercial vehicles .

TRIPCAL5 was used to develop the zonal trip generation estimates for the Laredo TDM, employing information about income level, car ownership, and household size in cross-classification models.[45] This method is based on the estimated number of trips as a function of household information. In this sense, two-way cross-classification production and attraction models are used in the TDM, employing production rates per household, and expected average attractions per employee or household.

Population, total number of households, average household size, income, and employment data by TAZ were used in the Laredo TDM for the production model. The socioeconomic variables for the attraction model comprise the following employment categories:

- Basic employment
- Retail employment
- Service employment
- Education employment

Additionally, TRIPCAL5 allows the input of special generators such us airports, hospitals, stadiums, universities, etc. The special generators considered are shown in Table 5-3.

Table 5-3. Laredo-TDM TAZs with Special Generators

TAZ	Description	TAZ	Description
11	Convent Bridge ICE	263	Trucking Warehouse
12	Juarez Lincoln Bridge ICE	264	Trucking Warehouse
17	Laredo National Bank	265	Trucking Warehouse
20	Intermodal Transit Center 326,783/yr bus transfers	266	Trucking Warehouse
26	Laredo Community College	269	Trucking Warehouse
30	Federal Courthouse	286	Free Trade Bridge ICE
31	Main Post Office	288	Trucking Warehouse
32	City & County Courthouse	290	Trucking Warehouse
33	Laredo National Bank 130 employees	292	Trucking Warehouse
45	Library & City & County Offices	294	Trucking Warehouse
60	Laredo Civic Center 1979 seat aud. 1200 cap ballroom 55 Employees & M	303	Trucking Warehouse
92	Trucking Warehouse	304	Trucking Warehouse
94	Trucking Warehouse	306	Trucking Warehouse
95	Trucking Warehouse	307	Trucking Warehouse
98	Trucking Warehouse	308	Trucking Warehouse
115	Mall del Norte 1000000 annual visitors 2918 Employees	310	Trucking Warehouse
152	Laredo Medical Center 495 employees 326 beds	312	Trucking Warehouse
155	Nixon High School	339	Texas A&M International University
171	St Augustine schools	347	Lake Casa Blanca Park / Webb Co 371 ac. park 1650 ac. Lake
203	Trucking Warehouse	400	United South High School
218	Walmart Super Center	419	Cigarroa High School
221	Webb County Tax Appraisal	427	Walmart Super Center
227	Airport 101780 deplaning passengers and Trucking Warehouse	442	Laredo Community College South
230	Laredo Entertainment Center: 8065(sports), 9622(events)	444	Johnson High School
235	Alexander High School	492	Uniroyal Test Track and Trucking Warehouse
242	United High School Freshmen	501	Trucking Warehouse
260	HEB Plus	518	Estimation of growth in TRTX control total
261	Doctor's Hospital 2007 employees 176 beds	523	Estimation of the NHB visitors Trips

The S&B team reviewed and ultimately retained the Laredo MPO TDM´s trip rates by trip purpose, whereas the TDM's socioeconomic data inputs were changed based on the S&B team's socioeconomic review (see Chapter 3).

The S&B team validated the trip generation results with the following available guidelines: the National Cooperative Highway Research Program (NCHRP) Report 365[46] and a series of benchmarks of trip generation outputs. Table 5-4 presents the updated TDM´s base year person-trip share by trip purpose, with benchmarks and NCHRP trip share guidelines for comparison. As shown, the updated TDM´s trip generation results are in line with the ranges suggested by the NCHRP and within the range of industry standards.

Table 5-4. Laredo TDM Trip Share by Purpose vs. Benchmarks

Trip Purpose	Trip Share (Updated TDM)	Benchmark		NCHRP
		Low	High	
NHB	38%	23%	42%	22%
HBW	21%	16%	21%	22%
HNW	41%	40%	61%	56%

In terms of trip rates, the S&B team evaluated the average person trips per person, person trips per household, and average person trips by HBW purpose and compared them to the Florida Standard Urban Transportation Modeling System (FSUTMS)[47] and NCHRP trip generation output guidelines. As shown in Table 5-5, the Laredo TDM´s trip generation outputs are mostly within the range of industry standards. However, the person trips/person measure (2.42) deviates from these benchmarks; this is attributed to the unique characteristics of the model area, where 2017 National Household Travel Survey (NHTS) data indicate a person trips/person rate of 3.499, including internal and external trips.

Table 5-5. Laredo TDM Trip Generation Statistics vs. Benchmarks

Statistic	Laredo TDM	FSUTMS		NCHRP	
		Low	High	Low	High
HBW Person Trips/Employee	1.28	-	-	1.29	1.40
Person trips/Person	2.42	3	4	-	-
Person trips/Household	8.96	8	10	6.80	12.40

In addition to the three passenger vehicle trip purposes, internal commercial vehicle trips were generated with the TRIPCAL procedure as part of the calibration process.

Trip Distribution: Trip distribution is the second step of the four step TDM. It is used to estimate the total number of trips and to represent the trip pattern in a trip matrix, where rows and columns represent the origins and destinations (OD) of each trip. Afterwards, the production and attraction vectors from trip generation models are read into the trip distribution models.

The Laredo MPO TDM's trip distribution is developed with ATOM2 software, which is a trip distribution program that distributes trips calculated by a trip generation program. In this sense, the data required is the output obtained by TRIPCAL5 regarding productions and attractions for each zone and trip purpose. The trip distribution modeling approach uses a gravity model with the assumption that travel occurs between zones treated as smaller spatial units (atom areas). This is executed in TransCAD, and the procedure is similar to most other Texas MPO TDMs.

As previously mentioned, the TDM´s trip generation procedure results in a dataset containing records with productions and attractions for each TAZ by trip purpose. Trip matrices are produced mainly for internal trips. Figure 5-4 presents the trip length distributions from the adopted TDM.

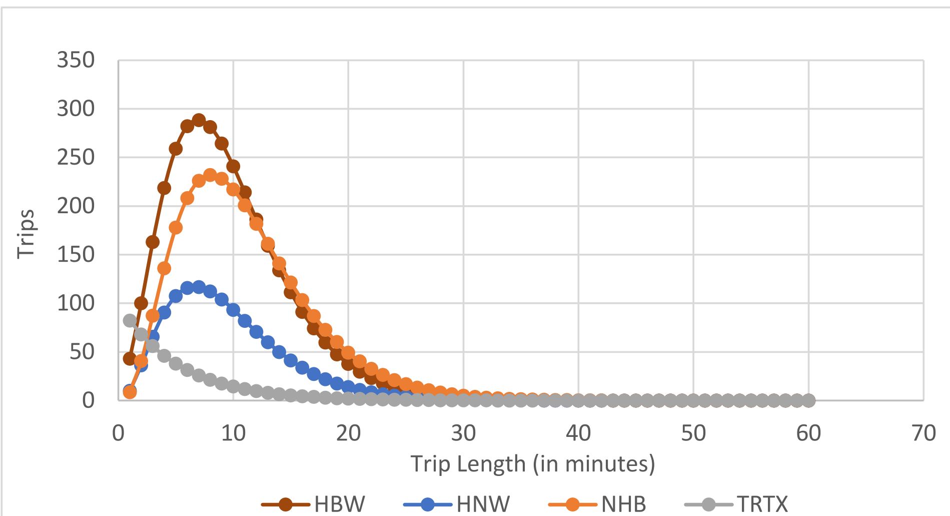


Figure 5-4. Laredo TDM Trip Length Distributions by Trip Purpose

The calibrated function parameters present a satisfactory result. Table 5-6 shows the adopted Laredo TDM's trip lengths by trip purpose and compares it to commonly used trip distribution benchmarks.

Table 5-6. Laredo-TDM Average Trip Length Benchmarks

Trip Purpose	Avg. Trip Length Benchmark		Laredo TDM (2018)
	Low	High	
HBW	12	35	13
HNW	8	20	12
NHB	6	19	13

Note: The average trip length benchmark purpose is Home-Based Other

Mode Choice: Mode choice is the third component of a traditional four-step TDM. The S&B team used the same assumptions for mode choice as the original Laredo MPO TDM, which uses a simplified mode choice step due to trip generation directly generating passenger vehicle trips. The overall lack of public mass transit in the area justifies this approach.

Traffic Assignment: Traffic assignment is the final component of the four-step travel demand modeling process, and it determines the selection of routes between ODs in the transportation network. For the purpose of travel forecasting, the traffic assignment step estimates which routes will be used by travelers within a variety of network paths. The assignment methodology iteratively defines the link impedance between the assignment iterations due to the capacity and the volume of each link. The "user equilibrium" is reached when each of the trips obtains their optimum route through the network.

The S&B team used its proprietary toll diversion assignment model for the TDM's trip assignment. The input for the assignment program includes the model networks previously described and the trip tables obtained from the adopted Laredo TDM.

To estimate external trips, the S&B team did not use the Laredo MPO TDM's methodology because it artificially generates external trips based on the gravity model of the trip generation software rather than estimating them based on observed traffic counts. The S&B team used TxDOT's existing and historical traffic counts (STARS II)[48] to develop the base year model volumes of the external stations. As described in Chapter 2, The S&B team employed observed OD data as key inputs to its estimates for the external stations.

The future growth rate of each external station was determined by applying several time series forecast methodologies, including the use of the following parameters:

- Historical traffic growth rate at each external station.
- Historical and projected growth rates of socioeconomic parameters such as population, employment, and maquiladora industry production from Texas, Hidalgo County, Cameron County, and Reynosa.
- Historical and projected growth of manufactured goods shipments.
- Historical and projected GDP and GRP growth.
- Projected external station traffic growth rate of the Laredo MPO TDM.

5.3 The Nuevo Laredo TDM

Nuevo Laredo TDM Base Year Network

The base year (2018) network of the S&B team's NL-TDM was developed from external sources such as "OpenStreetMap" and the S&B team's database. The network attributes were then updated to current conditions using Google-based aerial images and travel time information. The S&B team implemented a series of modifications and adjustments to the external sources to accurately reflect current conditions and suit the purposes of the present study. These changes vary from updating the geographical representation of the network to modifying attributes (e.g., speed, capacity). Through this process, the S&B team implemented six network link functional classes in the NL-TDM, as presented in Table 5-7.

Table 5-7. NL-TDM Network Function Classes

Functional Class ID	Description	# of Links	Length (miles)
3	Interstate Freeways	196	224.6
4	Principal Arterials	316	43.5
5	Minor Arterials	275	51.0
6	Collectors/Local Streets	1,923	130.8
7	Frontage Roads	108	9.6
8	Ramps	281	17.5

Table 5-8 presents speeds and capacities (vehicles per day per lane) by functional class and area type. The base year network attributes for speeds and capacities are similar to the Laredo MPO TDM network to ensure similar input data for the Binational Assignment Model. Figure 5-5 illustrates the NL-TDM's 2018 base year network and its functional classes.

Table 5-8. NL-TDM Speeds and Capacities by Function Class and Area Type

Functional Class		Area Type									
		1 - CBD		2 -Outer bussines		3 - Urban		4 - Sub urban		5 - Rural	
ID	Description	Speed (mph)	Capacity	Speed (mph)	Capacity	Speed (mph)	Capacity	Speed (mph)	Capacity	Speed (mph)	Capacity
3	Highway	NA	NA	NA	NA	50	19,000	50	17,500	65	14,500
4	Principal Arterial	NA	NA	35	8,500	35	8,000	40	7,000	50	5,000
5	Minor Arterial	NA	NA	30	7,500	35	7,000	40	6,000	40-45	4,500
6	Collector	20	6,000	25	5,500	25	5,000	30	4,500	30-35	3,500
7	Frontage Road	NA	NA	35	7,500	35	7,000	40	6,000	45	4,500
8	Ramp	15	20,000	15	20,000	15	20,000	15	20,000	15	20,000

Note: NA = Not Applicable

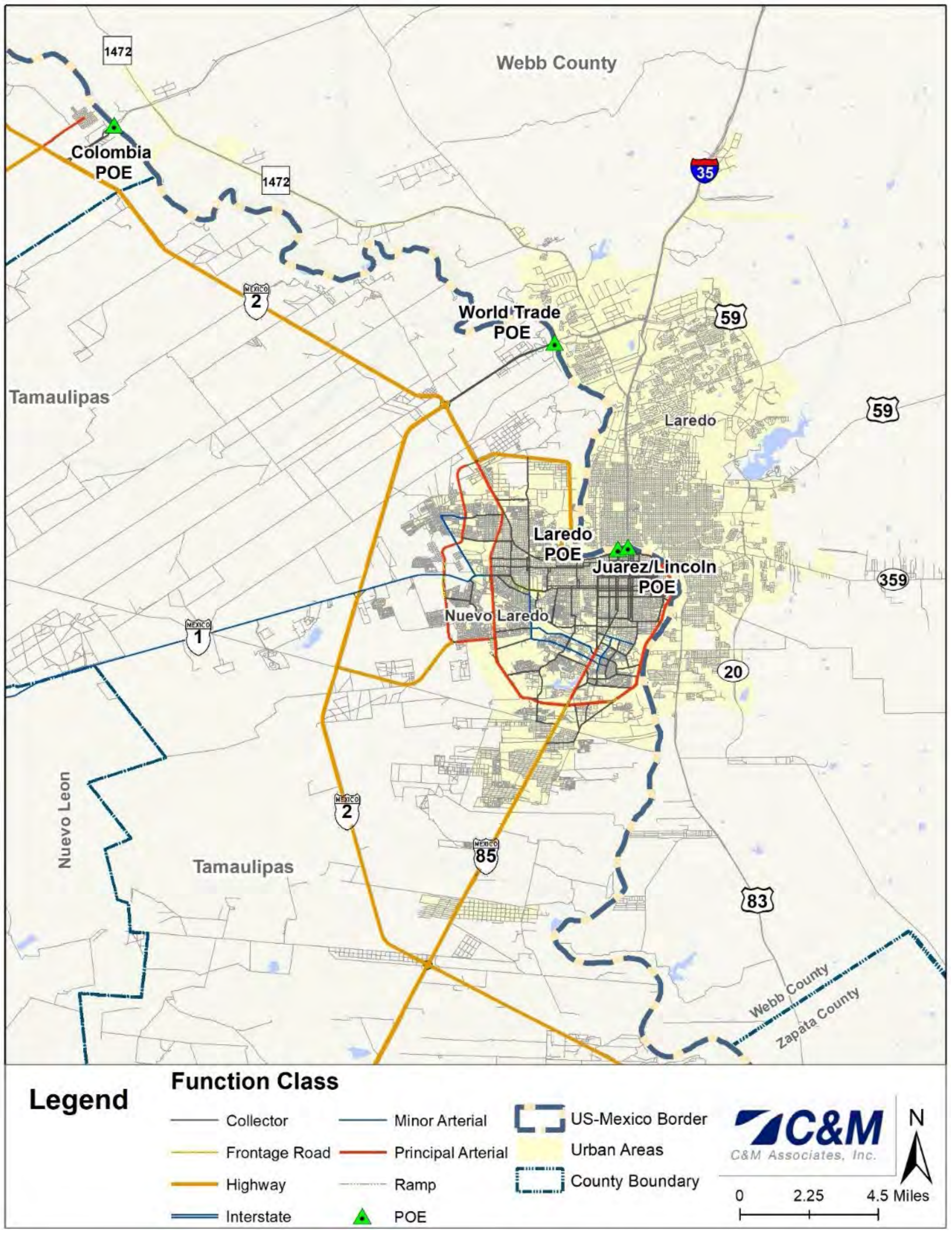


Figure 5-5. NL-TDM Base Year 2018 Network

Nuevo Laredo TDM Development

The NL–TDM is a simplified four-step TDM. This section describes the development and function of the NL-TDM, including the definition of Project-relevant TAZs, development of the base year network attributes, trip generation, trip distribution, trip tables, traffic assignment, and model calibration results.

Trip Generation: The NL-TDM area covers the entirety of Nuevo Laredo and portions of Nuevo Leon and Tamaulipas. This area consists of 288 TAZs (284 internal, 4 external). Consistent with the Laredo MPO TDM, the NL-TDM includes three trip purposes for passenger vehicle: HBW, HNW, and NHB.

The 284 internal TAZs were derived from the 2010 Mexican census tract (i.e., Área Geoestadística Básica [AGEB]) structure by INEGI, the official Mexican institution for gathering demographic information and statistics. The TAZ boundaries within the study area correspond to the census tract boundaries. In addition to the census tracts, important industrial parks in Nuevo Laredo were added to the TAZ layer.[49] In total, 12 industrial park areas were considered in the TAZ layer. These industrial parks serve as generators for commercial traffic.

TripCAL5 was used to develop the zonal trip generation. A production model utilizing the two-way cross-classification analysis method was implemented to develop trip productions and attractions based on socioeconomic data and average trip rates for each TAZ. For the production model, households were stratified by average household size, median household income, and auto availability per household. The attraction model (for all trip purposes) utilized a cross-classification regression model considering employment by classification type.

Socioeconomic data were obtained from INEGI and from CONAPO. The following socioeconomic data were considered for each TAZ:

- Population
- Number of households
- Median household income
- Employment (Basic, Retail, and Service)

The variables used to develop the NL-TDM's trip generation component are summarized in Table 5-9.

Table 5-9. NL-TDM Trip Generation Variables and Sources

Variable	Level of Detail	Source/Link
Population	AGEB	2010 Census, INEGI
Number of Households	AGEB	2010 Census, INEGI
Employment	Exact Location	DENUE, INEGI
AGEB Layer	AGEB	2010 Census, INEGI 2010 Census, INEGI
Population Projections	Localities	CONAPO

The cross-classification method generates trip productions by using the socioeconomic data of each TAZ and the related trip rates. The trip attractions are then balanced to the trip productions. This process was repeated for each trip purpose. Trip productions are typically from residential areas that produce trips, whereas workplaces and points of interest are considered trip attractions. Trips can start or end at either production or attraction points, depending on the trip purpose (e.g., going to work or returning home).

The trip rates used in the trip generation process were obtained from the S&B team's Mexico household survey database considering income level, trip purpose, household size, and vehicle availability per household. All trip rates are for passenger vehicle (i.e., auto) trips only. The income categories are based on a national survey (ENIGH 2018) conducted in cities in northern Mexico's La Laguna Metropolitan Statistical Area (MSA). The median household income categories considered are listed in Table 5-10.

Table 5-10. NL-TDM Trip Generation Household Income Segmentation

Income Segment	Household Income ($)
1	<= $5,300
2	$5,300 - $10,600
3	$10,601 - $21,200
4	$21,201 - $31,800
5	$31,801 - $299,999
6	>= $300,000

Table 5-11 presents the NL-TDM's daily number of trips per household resulting from the trip generation process.

Table 5-11. NL-TDM Trip Generation Outputs and Shares by Trip Purpose

Trip Purpose	Trips	Trip Shares
HBW	91,513	33%
HNW	124,694	45%
NHB	58,157	21%

A useful statistic for validating trip generation models is the percentage of trips by purpose. Table 5-12 presents the comparative results based on available census data and household surveys. Based on the comparison, the model results are considered reasonable.

Table 5-12. NL-TDM Average Trip Rate Share from Generation Model

Trip Purpose	NL-TDM Trip Share	PV Trips from Household OD Survey		
		La Laguna MSA (2011)	Mexico City (2017)	Puebla City (2011)
NHB	21%	16%	6%	11%
HBW	33%	27%	26%	27%
HNW	45%	57%	68%	63%

Likewise, Table 5-13 presents the NL-TDM's average trips rates compared to the data sources from the OD household surveys and census from Mexican cities. The comparison indicates the model is reasonably accurate and reliable.

Table 5-13. NL-TDM TDM Trip Generation Statistics Comparison

Statistic	NL-TDM (2018)	La Laguna MSA (2011)	Tijuana City (2010)
HBW Person Trips/Employee	0.87	0.55	0.77
Person Trips/Person	0.67	0.72	0.78
Person Trips/HH	2.44	2.84	2.85

In addition to the three passenger vehicle trip purposes, internal commercial vehicle trips were generated with ATOM2 and reviewed with guidance from the Quick Response Freight Manual.[50] As part of the calibration process, the final internal commercial vehicle trip table was adjusted to reproduce the observed commercial vehicle traffic counts (see Chapter 2) by adjusting the trip volumes between OD pairs.

The NL-TDM has four external stations. The external trip volumes for passenger vehicles and commercial vehicles are based on SCT's AADT maps. External stations receive external–external trips (i.e., trips between the external stations) and external–internal trips (i.e., trips from the internal model TAZs to the external stations).

The ODs between external–external and external–internal trips were distributed based on the following data and assumptions:

- OD survey at the Juarez–Lincoln Bridge and border crossing counts at the two POEs located in Nuevo Laredo, Tamaulipas (see Chapter 2).
- Traffic count data: 2018 AADT from SCT
- Historical border crossings: Total 2018 Laredo border crossings (northbound) from USDOT
- External—internal commercial vehicle traffic: External station count volumes were distributed to the industrial park area in Nuevo Laredo according to the size of each industrial park and the number of single Maquiladora plants in each TAZ.
- External—internal passenger vehicle traffic: External station count volumes were distributed based on 2018 population shares by TAZ.
- External–external traffic: A small portion of the external zone trips are external–external; they are assumed to be less than 5 percent of external trips, depending on the volume at each external station.

The considered external station volumes are presented in Table 5-14. An important commercial vehicle distributer is MEX 85 from Nuevo Laredo to Monterrey, representing almost 35 percent of external commercial vehicles.

Table 5-14. External Station Base Year (2018) Volumes

Location	Average Daily Traffic - Both Directions		
	Passenger Vehicles	Commercial Vehicles	Total
MEX 85 (To Monterrey)	5,787	9,042	14,829
MEX 2 (To Reynosa)	359	271	630
NL-001-TAM (To Anahuac)	1,408	639	2,047
MEX 2 (To Piedras Negras)	585	354	939

Trip Distribution: As mentioned previously, the trip distribution step simulates travelers' ODs to develop a trip table. The trips between each pair of TAZs are a function of the trip production in the origin TAZ, the trip attraction in the destination TAZ, and the travel impedance between these TAZ's. For the NL-TDM, the S&B team used the ATOM2 trip distribution program, which requires input from the trip generation model, trip lengths, and friction factors for each trip purpose. A gravity model then determines the internal trip distribution.

Friction factors represent the effect of travel time on the number of trips traveling between two zones, with lower values representing longer travel times and, consequently, a lower likelihood of trips. For the present study, friction factors were estimated using a gamma function and applied to the trip distribution model to replicate the observed trip length distribution and average trip length.

The gamma function used to develop the friction factors can be expressed as follows:

$$C_{ij}^{-\propto} \exp\left(-BC_{ij}\right)$$

Where:

C_{ij}= Time function from zone *i* to zone *j*

$\exp$= Exponential function

B= Parameter

$\propto$= Parameter

The exponential form of the gamma function was used to estimate the friction factors. The parameters adopted in this function are different for each trip purpose. The friction factors were estimated considering the S&B team's Mexican household survey databank, with the aim of replicating observed travel behavior. The criterion used to judge a reasonable estimation of an average trip length was the trip length frequency distribution curve obtained from the household travel survey. Figure 5-6 illustrates the final "deterrence function" (i.e., gamma function), which represents the travel impendence based on travel time.

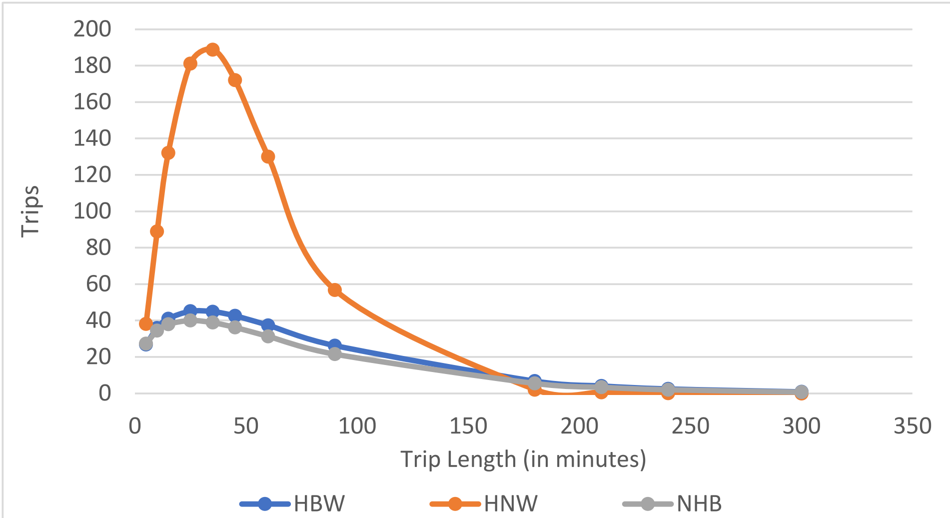


Figure 5-6. NL-TDM Function Distribution

Across all trip purposes, the most frequent trip lengths range from 15 to 45 minutes. The average travel times by trip purpose are all within or reasonably close to the ranges of commonly accepted benchmarks for trip distribution, as shown in Table 5-15. The FSUTMS trip distribution benchmarks were gathered from model validation studies, model guidance documents, the National Household Travel Survey (NHTS), and Census Journey-to-Work.[51] As shown, all NL-TDM trip purposes are within the suggested benchmark ranges.

Table 5-15. NL-TDM Average Trip Length Distribution vs. Benchmarks

Trip Purpose	FSUTMS		NL-TDM
	Low	High	Daily
HBW	12	35	20
HNW	8	20	17
NHB	6	19	15

Mode Choice: the S&B team did not develop a mode choice component for the NL-TDM. Since trip rates within the trip generation step were for passenger vehicles only, this step was not necessary. Therefore, mode changes are not reflected in the TDM but are also not very likely given the lack of public mass transit and infrastructure on both sides of the border within the study area.

Traffic Assignment: Traffic assignment is the final component of the four-step travel demand modeling process, and it determines the selection of routes between ODs in the transportation network. For the purpose of travel forecasting, the traffic assignment step estimates which routes will be used by travelers among a variety of network paths. The NL-TDM's assignment step was performed within the Binational Assignment Model, as explained in Section 5.4.

5.4 Binational Assignment Model

The S&B team's Binational Assignment Model joins the two previously described national TDMs—the adopted Laredo MPO TDM and the NL-TDM developed by the S&B team—with mode choice and assignment steps.

The selection of routes between ODs in the transportation network is a function of congested travel time, which depends on the volume and capacity of each road network link. This is done by using a volume delay function (VDF). The Binational Assignment Model's VDF is a Bureau of Public Roads (BPR) function. The resulting congested speed by functional class is a product of the posted free-flow speed, the volume-to-capacity (V/C) ratio, and the parameters of the BPR function.

The S&B team modeled congestion at the Laredo POEs by employing a discrete event simulation (DES), which defines a set of logically separate events (i.e., processes) that simulate the operation of the POE system. Each event occurs at a particular instant, and the resulting crossing time at each POE is included in the binational network and considered in the assignment process. The crossing time is estimated considering the operational characteristic of each POE such as number of booths on the Mexican and U.S. side, inspection times, number of lanes, etc. Crossing time and the number of vehicles were calibrated for each POE to replicate existing POE traffic flows for the base (2018) model. This procedure is explained in more detail in Chapter 6.

The Binational Assignment Model is a combination of the two national TDMs previously described, but it also includes an additional component: international border-crossing trips for passenger vehicles and commercial vehicles. Drivers of these vehicle types can choose between the available POEs in accordance with a multinomial logit model considering the current cost and time. To develop the international border-crossing trip table, the S&B team implemented the OD data from the U.S. Bluetooth and intercept surveys conducted in Mexico (see Chapter 2). The results of this OD data merge were expanded to the total observed daily border-crossing volumes. The resulting border-crossing trip tables for passenger and commercial vehicles were then implemented in the Binational Assignment Model. The total international border crossings from the 2018 model were calibrated to traffic counts (passenger and commercial vehicles) crossing the U.S./Mexico border. The future growth rates of border-crossing demand were determined by means of an econometric model, as described in Chapter 3.

Base Year Network

To build the Binational Assignment Model's network for base year 2018, the S&B team used a binational road network. The binational road network is a combination of the two national road networks previously described. The binational network includes an additional component: international border-crossing roads for passenger vehicles and commercial vehicles. Drivers of these vehicle types have the option to choose between the available POEs.

The Binational Assignment Model's newly developed roadway links comprise seven functional classes based on their unique functions within the transportation network. Figure 5-7 illustrates the functional classes of links in the 2018 base year network. Each major arterial or highway crossing the study area's boundary is represented by an external station.

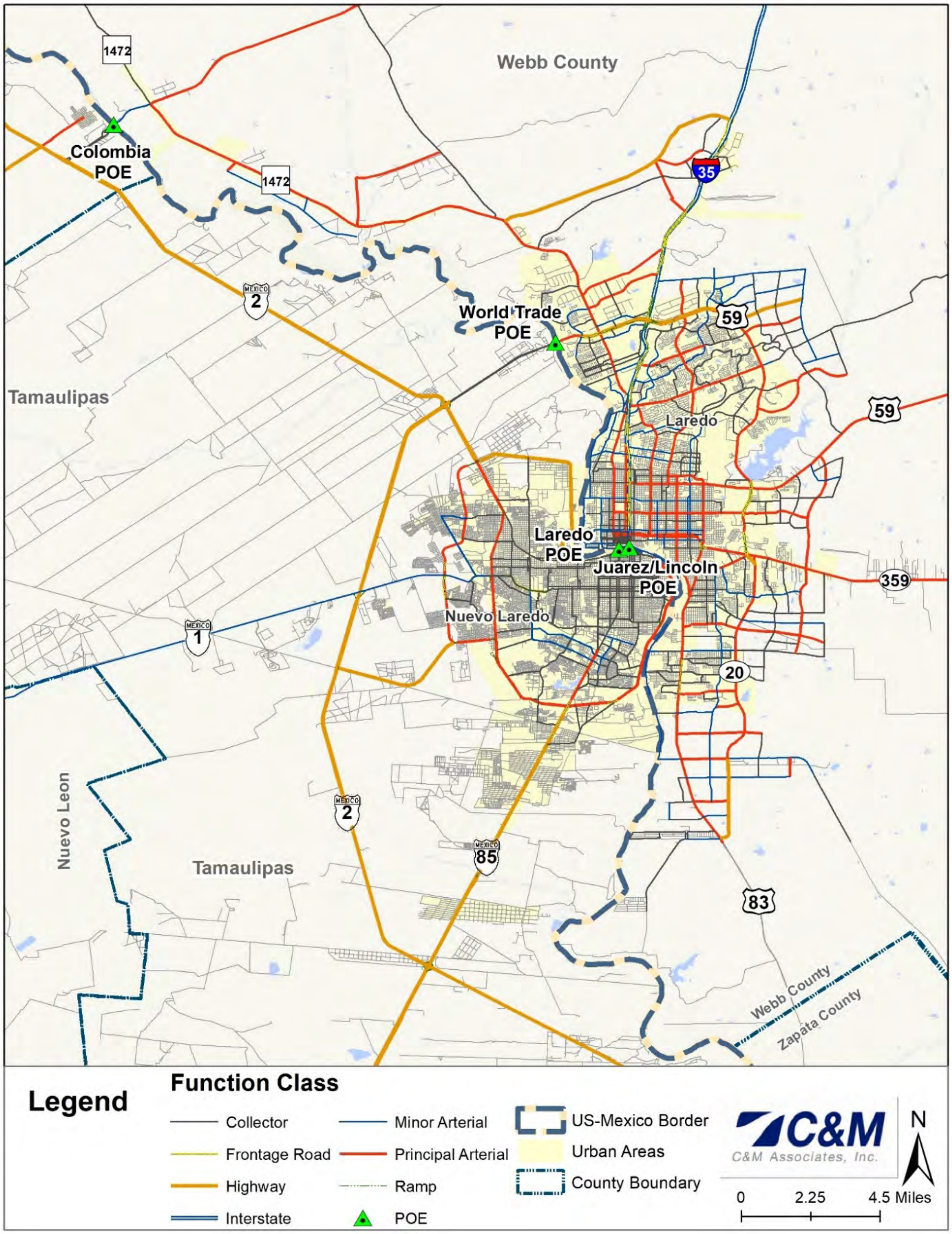


Figure 5-7. Binational Assignment Model Base Year Roadway Network

The attributes of each link are defined not only by their functional class but also by the area type of the TAZ in which the link is located. The TAZs in the Binational Assignment Model were classified according to land use, per common industry standards. Based on the area type definitions used by TxDOT, they were classified as either Rural, Suburban, Urban Central, Urban Intense, or Business District.[52] The area type classification is calculated from the activity density of each TAZ as follows:

$DENFAC_i = POPD_i + B * EMPD_i$

$POPD_i = POP_i / AREA_i$

$EMPD_i = EMP_i / AREA_i$

Where:

$DENFAC_i$ = Density factor of zone i

$POPD_i$ = Population density in zone i

B = Regional population-to-employment ratio (constant for all forecast years, B = 1.63)

$EMPD_i$ = Employment density in zone i

POP_i = Population in zone i

$AREA_i$ = Area of zone i, in acres

EMP_i = Employment in zone i

The Binational Assignment Model's area types and their corresponding ranges are presented in Table 5-16 and illustrated in Figure 5-8. The link attributes considered for the 2018 binational road network (i.e., free-flow speeds and daily capacities per lane) are the same as those presented in the national networks for each side of the border.

Table 5-16. Binational Assignment Model Area Types and Density Ranges

Area Type	Description	Density Range (D)
1	Business District	D ≥ 54/acre
2	Urban Intense	54 > D ≥ 18 /acre
3	Urban Central	18 > D ≥ 6 /acre
4	Suburban	6 > D ≥ 2/acre
5	Rural	D < 2/acre

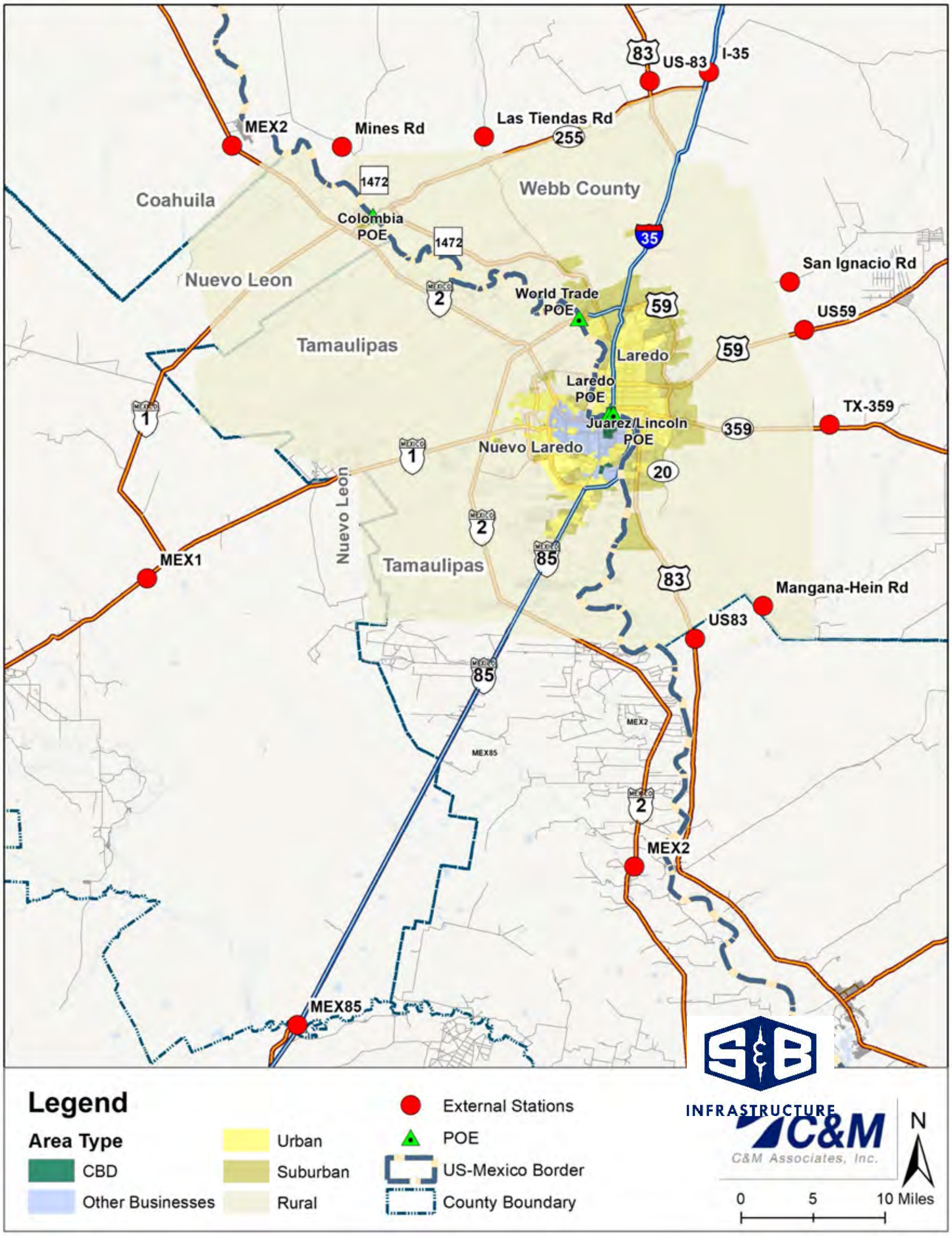


Figure 5-8. Binational Assignment Model Area Type Structure

Future Year Networks

The S&B team developed model roadway networks for opening year 2025 and horizon years 2030 and 2045, taking into consideration the Laredo MPO's 2045 Long-Range MTP and the Transportation Improvement Program (TIP) outlined in the MTP for the fiscal period of 2020–2045.[53,54] All assumed network improvements inside the Nuevo Laredo model area were determined through coordination with SCT and the City of Nuevo Laredo. Figure 5-9 illustrates the future projects included in the network.

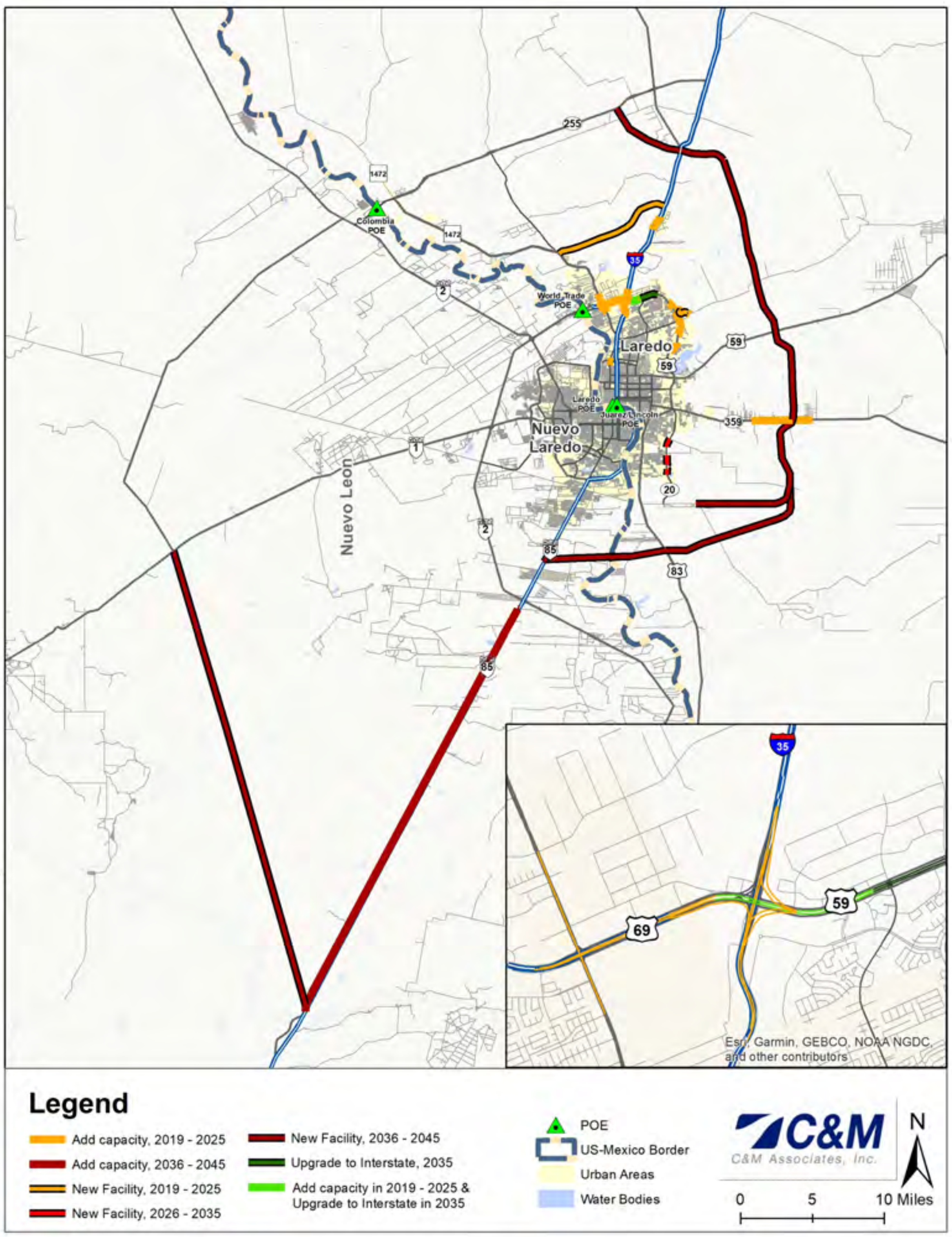


Figure 5-9. Binational Assignment Model Future Network Improvements 2025–2045

5.5 Binational Model Demand Projections

For the U.S. portion of the Binational Assignment Model, future demand was taken directly from the adopted Laredo TDM's trip generation model. For the Mexican portion of the model, growth rates for population and employment were estimated with currently available socioeconomic data due to a lack of disaggregated future forecasts. Detailed information was implemented in the model for particular areas in Mexico based on availability. Figure 5-10 illustrates the resulting 2018–2045 CAGRs for each TAZ in the Binational Assignment Model.

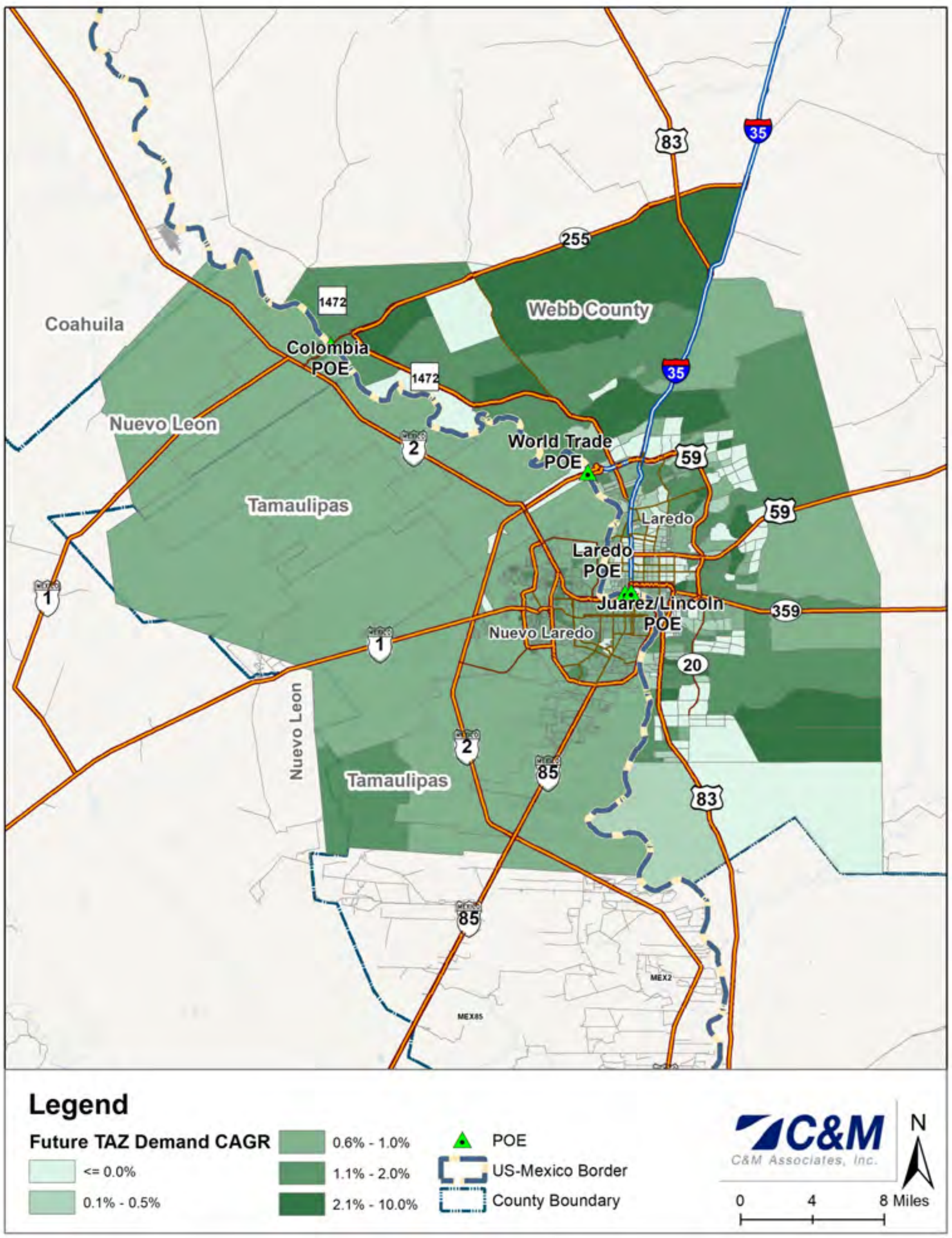


Figure 5-10. Binational Assignment Model TAZ Demand (2018–2045 CAGR)

5.6 Binational Assignment Model Calibration

The U.S. portion of the Binational Assignment Model was calibrated to base year 2018 using the study area screen lines shown in Figure 5-11. The screen lines are strategically positioned to accurately represent the trips and travel behaviors related to the Laredo POEs. For the Mexican portion of the model, the S&B team calibrated the model traffic volumes to single count stations on the main roads connecting the POEs.

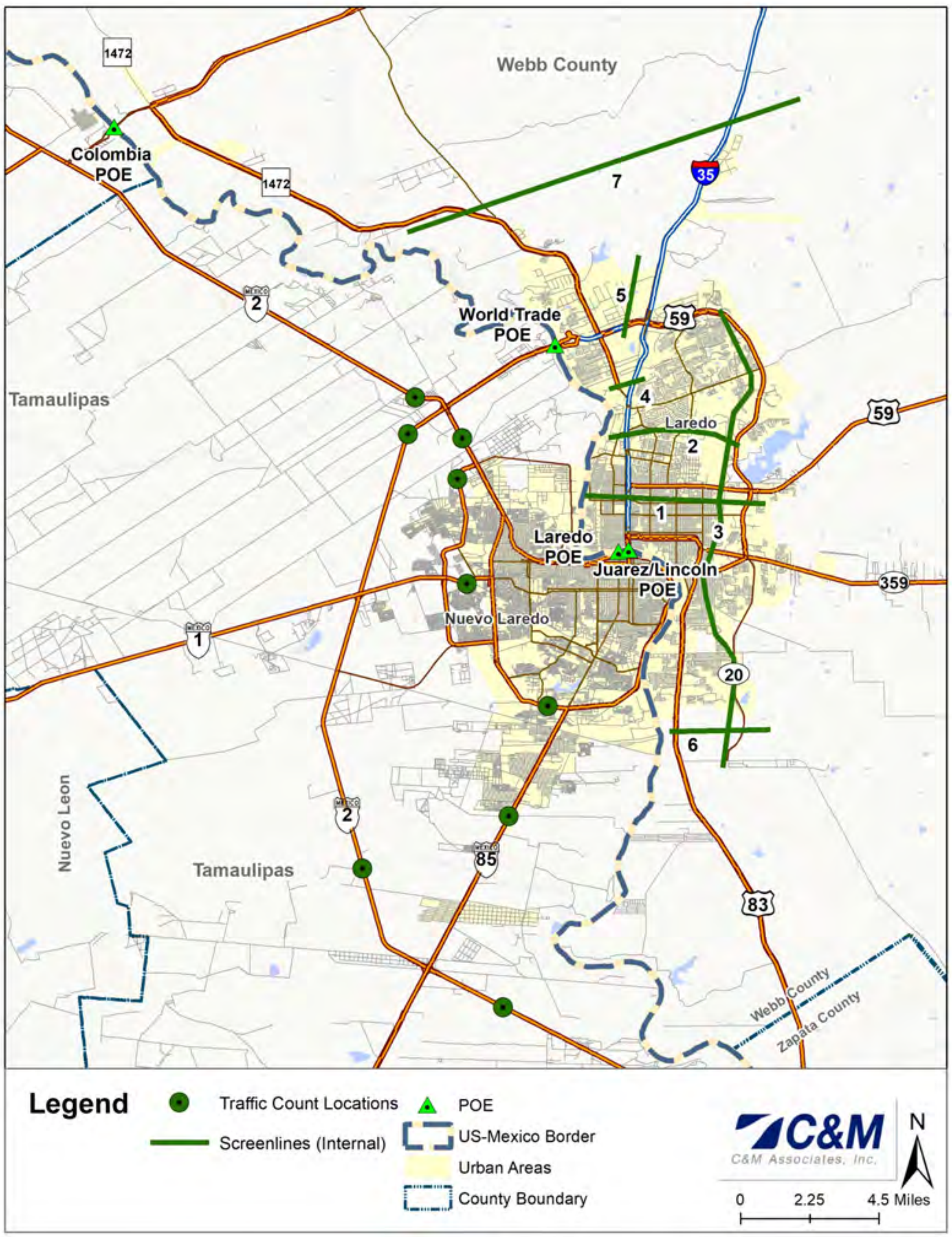


Figure 5-11. 2018 Screen lines and Single Count Locations

Table 5-17 and Table 5-18 present the calibrated screen line model volumes compared to the corresponding traffic counts by vehicle type and time period, respectively. The calibration results indicate that the Binational Assignment Model replicates existing traffic conditions within an acceptable margin of error.

Table 5-17. 2018 Binational Assignment Model Calibration Results

Area	SL	Passenger Vehicles			Commercial Vehicles			Total Vehicles		
		Counts	Model	% Diff.	Counts	Model	% Diff.	Counts	Model	% Diff.
U.S. Internal	1	187,466	182,178	-2.8%	8,333	8,753	5.0%	195,799	190,931	-2.5%
	2	230,902	217,885	-5.6%	15,869	14,712	-7.3%	246,771	232,597	-5.7%
	3	184,479	169,510	-8.1%	14,352	12,534	-12.7%	198,831	182,044	-8.4%
	4	89,915	87,189	-3.0%	9,829	9,694	-1.4%	99,744	96,883	-2.9%
	5	39,651	37,040	-6.6%	22,454	21,169	-5.7%	62,105	58,209	-6.3%
	6	14,203	14,671	3.3%	1,354	1,354	0.0%	15,557	16,025	3.0%
	7	19,824	20,244	2.1%	15,755	16,504	4.8%	35,579	36,748	3.3%
MX Internal		78,067	79,020	1.2%	43,710	46,442	6.3%	121,777	125,462	3.0%
U.S. External		32,150	32,141	0.0%	17,981	17,985	0.0%	50,131	50,126	0.0%
MX External		8,196	8,128	-0.8%	10,335	10,308	-0.3%	18,530	18,436	-0.5%

Note: SL = Screen line

Table 5-18. 2018 Binational Assignment Model Calibration Results by Time Period

Area	SL	AM			MD			PM			NT		
		Counts	Model	% Diff.	Counts	Model	% Diff.	Counts	Model	% Diff.	Counts	Model	% Diff.
US_Internal	1	26,852	26,990	0.5%	64,317	63,446	-1.4%	58,910	54,660	-7.2%	45,720	45,835	0.3%
	2	31,208	30,122	-3.5%	85,962	84,729	-1.4%	73,019	62,569	-14.3%	56,581	55,177	-2.5%
	3	28,449	26,252	-7.7%	64,162	63,030	-1.8%	59,275	47,063	-20.6%	46,945	45,699	-2.7%
	4	13,622	12,487	-8.3%	34,608	32,853	-5.1%	27,158	28,259	4.1%	23,356	23,284	-0.3%
	5	7,282	7,103	-2.5%	23,161	23,265	0.4%	17,054	14,319	-16.0%	14,608	13,522	-7.4%
	6	2,257	2,110	-6.5%	5,041	5,000	-0.8%	4,308	5,052	17.3%	3,951	3,863	-2.2%
	7	3,395	3,558	4.8%	12,324	13,303	7.9%	9,469	9,796	3.4%	10,391	10,091	-2.9%
MX_Internal		13,843	14,901	7.6%	42,671	43,761	2.6%	31,703	32,938	3.9%	38,614	37,845	-2.0%
US_External		5,646	5,689	0.8%	17,558	17,589	0.2%	13,217	13,278	0.5%	13,710	13,570	-1.0%
MX_External		1,907	1,954	2.5%	5,810	5,946	2.3%	4,330	4,467	3.2%	6,398	6,069	-5.1%

Figure 5-12 and Figure 5-13 illustrate the calibration results of the 2018 model, in terms of screen line volume and single count volume deviations from observed volumes, respectively. As shown, the results are well below the NCHRP's recommended thresholds for deviations.[55]

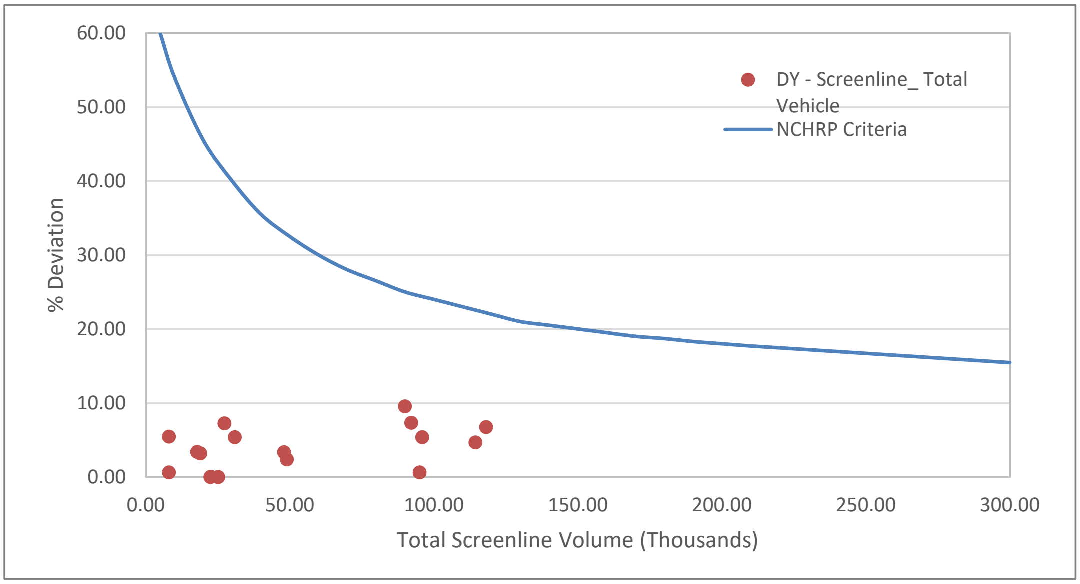


Figure 5-12. Comparison of Screen line Counts with Maximum Desirable Deviation – U.S. Side

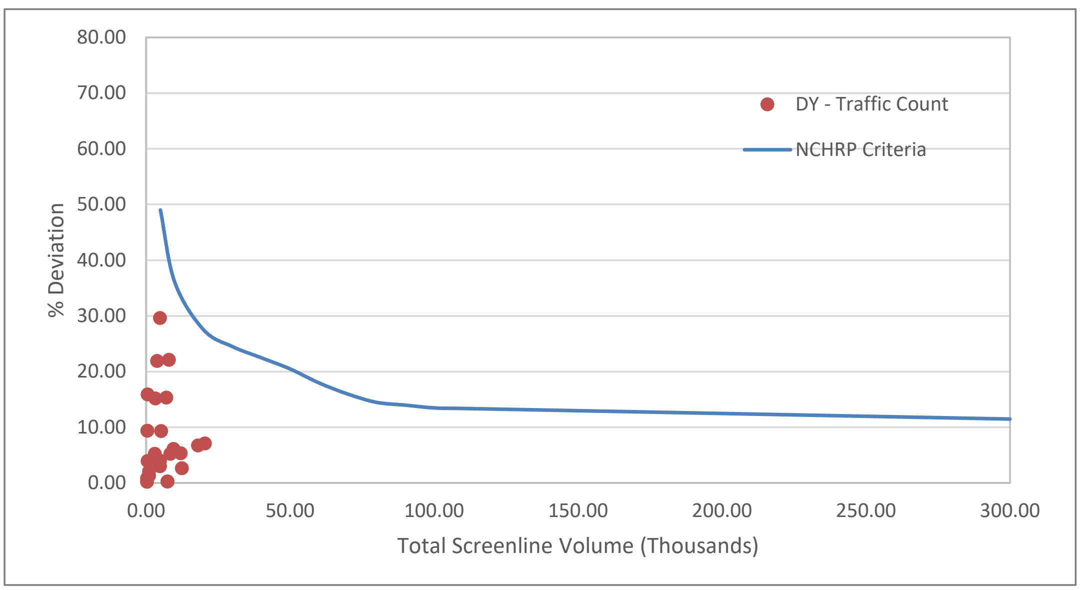


Figure 5-13. Comparison of Counts with Maximum Desirable Deviation – Mexican Side

To further test model calibration, the S&B team calculated Root Mean Square Error (RMSE), which measures the standard deviation of the difference between observed and predicted estimations. The RMSE results for the Binational Assignment Model by time period are presented in Table 5-19. In comparison with accepted accuracy standards from the Florida Department of Transportation (FDOT), the Binational Assignment Model's RMSE results are acceptable.[56]

Table 5-19. Binational Model Calibration – RMSE by Time Period

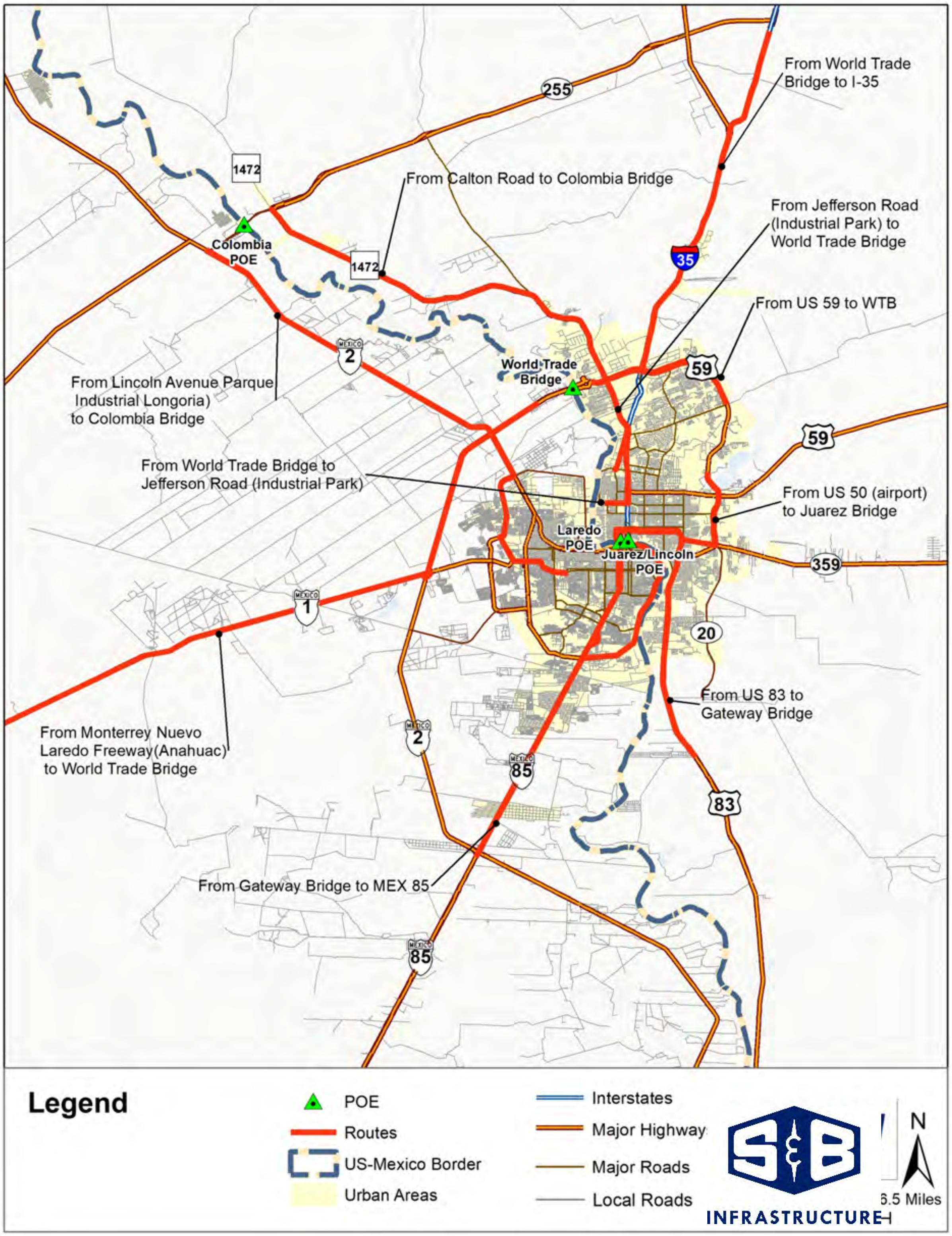
Area	AM	MD	PM	NT	Daily
United States	7%	3%	20%	4%	8%
Mexico	29%	15%	29%	20%	12%

Table 5-20 presents the absolute comparison of the model results and the observed counts by functional class. As expected, the results are acceptable based on the presented guidelines from the FHWA and Michigan DOT.

Table 5-20. Binational Model Assignment by Functional Class

Functional Class	Total Percentage		Guidelines	
	U.S. Area	MX Area	FHWA % Error	Michigan DOT % Error
Freeways	-1%	-3%	+/-7%	+/-6%
Principal Arterials	2%	-3%	+/-10%	+/-7%
Minor Arterials	-1%	3%	+/-15%	+/-10%
Collectors/ Local St.	2%	-	+/-25%	+/-20%
Frontage Roads	-10%	-	+/-25%	-----

Furthermore, the travel times from the Binational Assignment Model were compared to real travel times extracted from Google Maps. As shown in Figure 5-14, the S&B team selected routes that include the principal roads connecting commercial and passenger vehicle to the Laredo POEs.

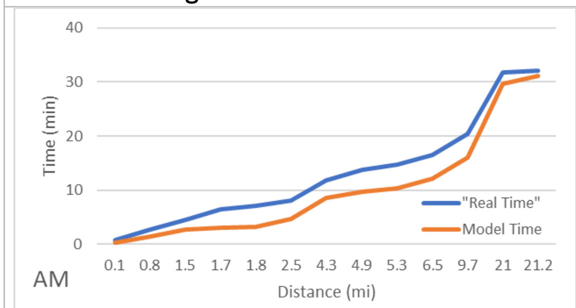


Note: The map only illustrates one direction of travel.

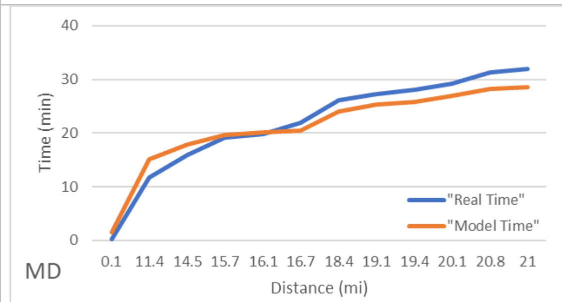
Figure 5-14. Travel Time Routes

For all routes, travel times in both directions were examined for each time period. As shown in Figure 5-15, the model reasonably replicates the travel times of the important routes. The major reason for travel time differences is the delay times at intersections and informal commerce and parking located in the area next to the POEs used by passenger vehicles as well as pedestrians, which are not directly considered in the TDM.

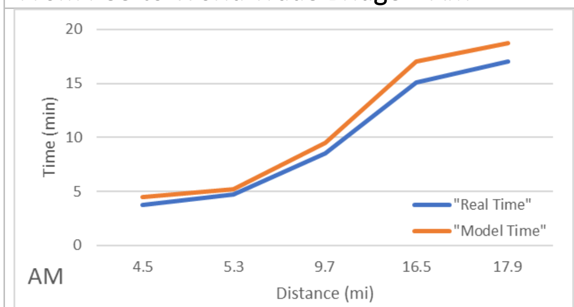
From Calton Road (Industrial Park Zone) to Colombia Bridge – AM



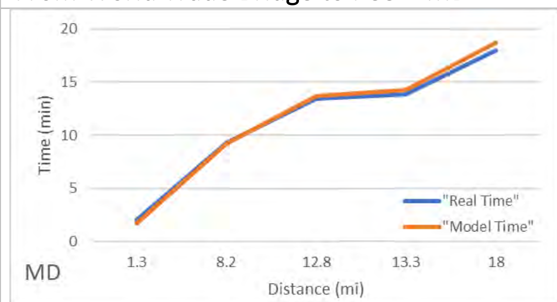
From Colombia Bridge to Calton Road – MD



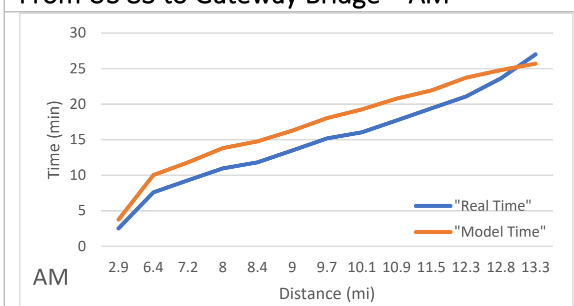
From I-35 to World Trade Bridge – AM



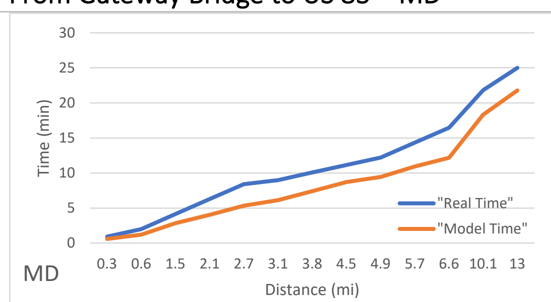
From World Trade Bridge to I-35 – MD



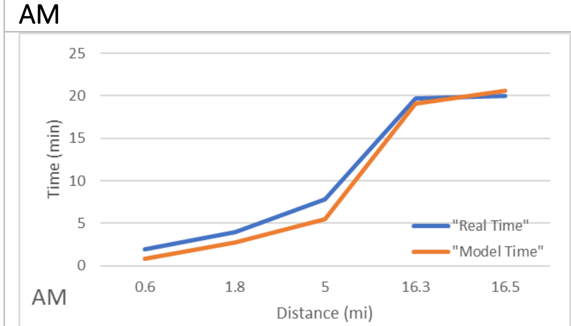
From US 83 to Gateway Bridge – AM



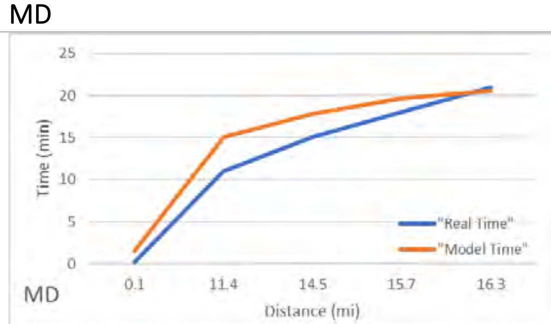
From Gateway Bridge to US 83 – MD



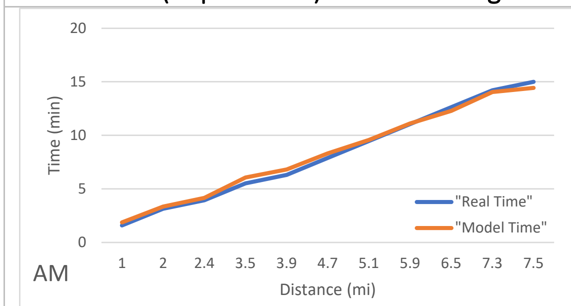
From Killam Industrial Blvd to Colombia Bridge – AM



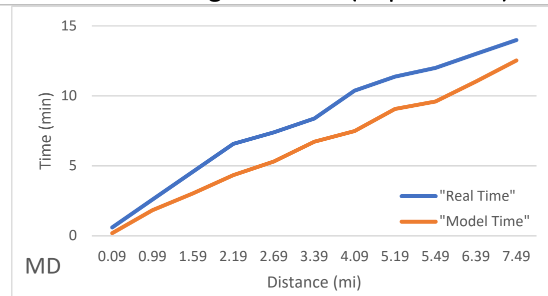
From Colombia Bridge to Killam Industrial Blvd – MD



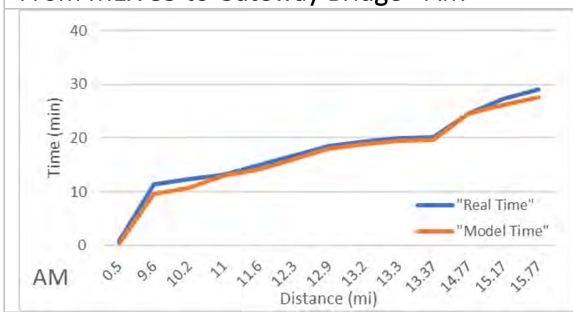
From US 59 (airport zone) to Juarez Bridge – AM



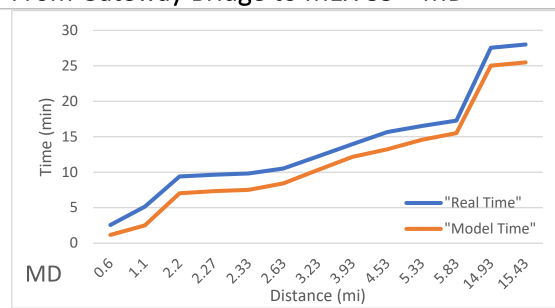
From Juarez Bridge to US 59 (airport zone) – MD



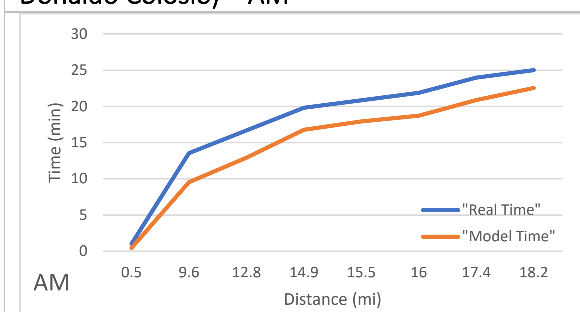
From MEX 85 to Gateway Bridge - AM



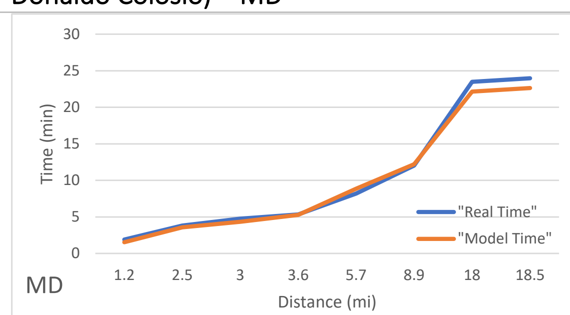
From Gateway Bridge to MEX 85 – MD



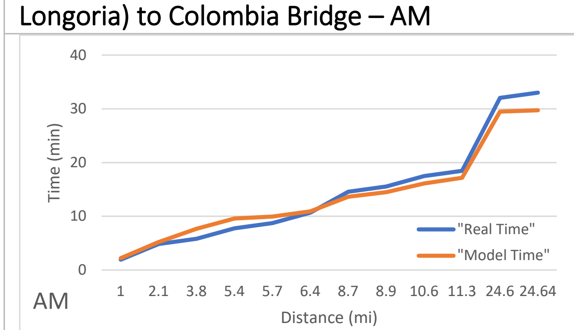
From MEX 85 to Juarez Bridge (by Blvd Luis Donaldo Colosio) – AM



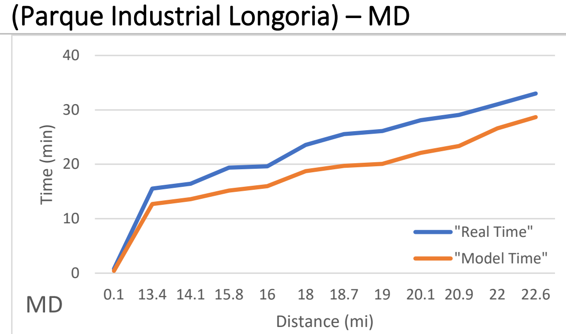
From Juarez Bridge to MEX 85 (by Blvd Luis Donaldo Colosio) – MD



From Lincoln Avenue (Parque Industrial Longoria) to Colombia Bridge – AM



From Colombia Bridge to Lincoln Avenue (Parque Industrial Longoria) – MD



From Monterrey Nuevo Laredo Freeway (Anahuac) to World Trade Bride – AM

From World Trade Bridge to Monterrey Nuevo Laredo Freeway (Anahuac) – MD

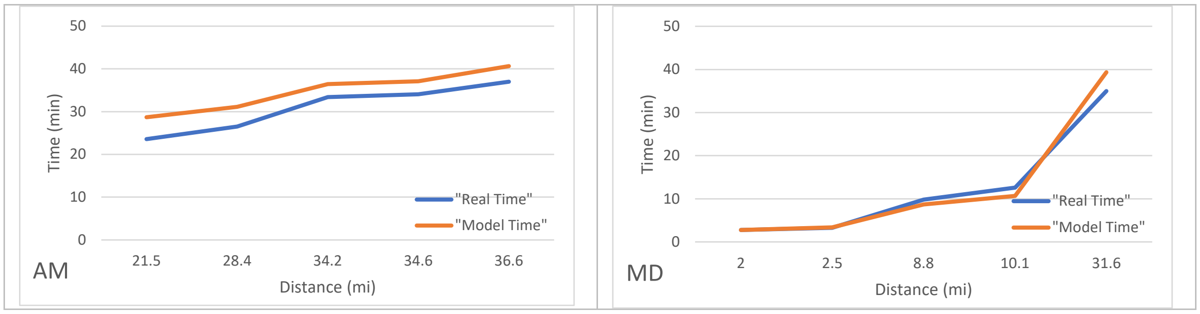


Figure 5-15. Observed vs. Modeled Travel Times

Additionally, the S&B team calibrated the base year daily border crossings with a multinomial route choice model. The results of this calibration are presented by POE in Table 5-21. Similarly, Table 5-22 shows the calibration results by time period.

Table 5-21. POE Daily Calibration Results (2018)

Bridge	Vehicle	Count	Volume	%Diff.
Bridge 1: Gateway	Passenger	6,808	6,689	-1.7%
Bridge 2: Juarez-Lincoln	Passenger	20,959	21,028	0.3%
Bridge 3: Laredo-Colombia	Passenger	546	593	8.6%
	Commercial	1,820	1,784	-2.0%
Bridge 4: World Trade	Commercial	14,852	14,885	0.2%

Table 5-22. POE Calibration Result by Period of Time

POE	AM			MD			PM			NT		
	Count	Model	% Diff.	Count	Model	% Diff.	Count	Model	% Diff.	Count	Model	% Diff.
Passenger Vehicles												
Bridge1: Gateway	937	937	0.0%	2,416	2,394	-0.9%	1,914	1,841	-3.8%	1,541	1,517	-1.6%
Bridge2: Juarez-Lincoln	2,900	2,890	-0.3%	7,527	7,534	0.1%	5,765	5,822	1.0%	4,767	4,782	0.3%
Bridge3: Laredo-Colombia	75	85	-11.8%	204	217	-6.0%	147	163	-9.8%	120	128	-6.3%
Commercial Vehicles												
Bridge3: Laredo-Colombia	131	126	4.0%	704	655	7.5%	539	602	-10.5%	446	401	11.2%
Bridge4: World Trade	1,350	1,355	0.4%	5,753	5,799	0.8%	4,323	4,260	-1.5%	3,426	3,471	1.3%

The POE calibration model results in terms of RMSE are presented in Table 5-23; the results indicate an acceptable level of prediction error.

Table 5-23. POE Calibration – RMSE Results

Time Period	Passenger Vehicles	Commercial Vehicles
AM	3.0%	2.5%
MD	2.3%	2.8%
PM	4.4%	3.1%
NT	2.1%	2.7%
Daily	1.0%	1.1%

The Binational Assignment Model was calibrated so that the model estimates link volumes at a sufficient approximation to the observed count data. The daily OD patterns for passenger vehicles and commercial vehicles are shown in Figure 5-16, illustrating the traffic flows from the 2018 base year within the study area.

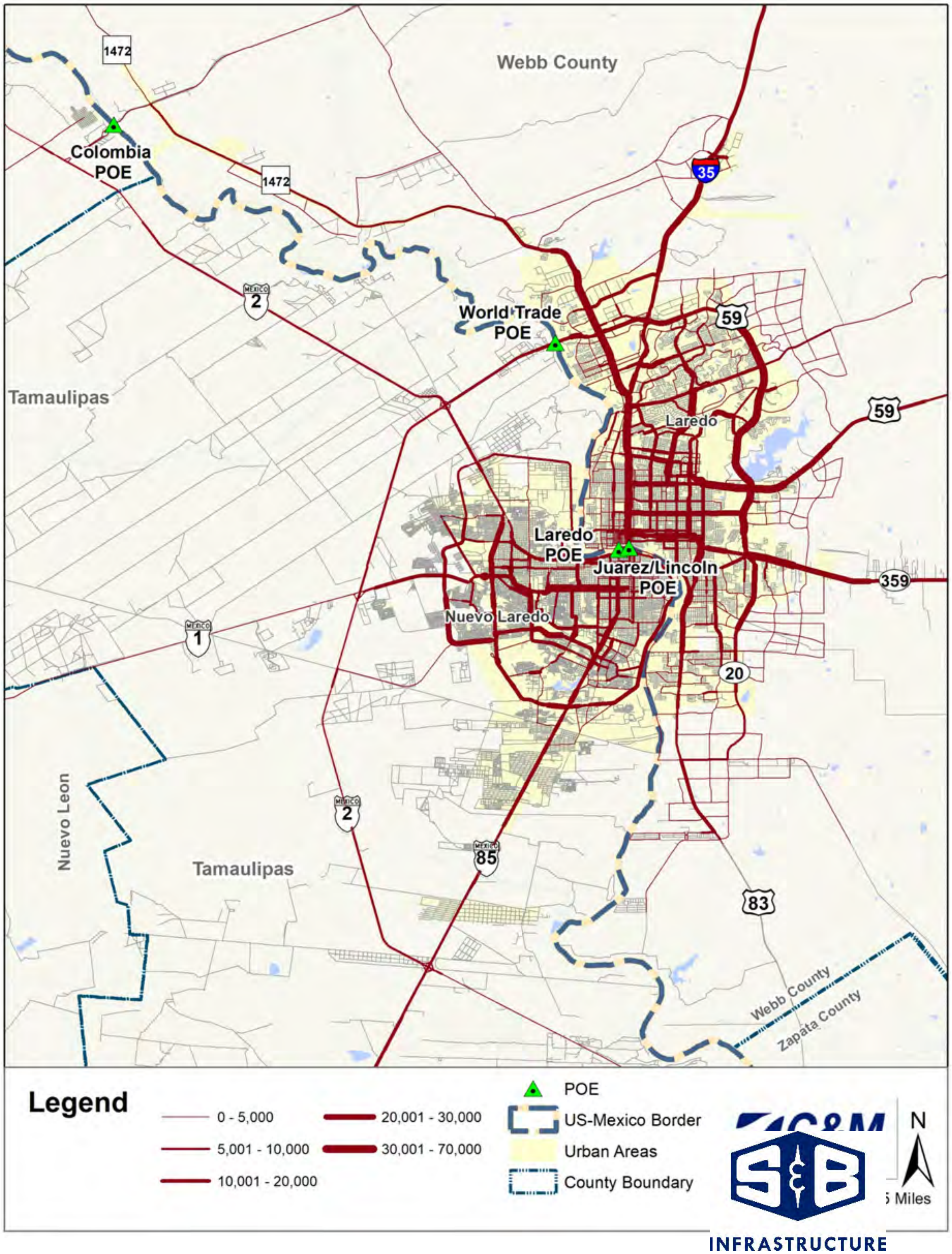


Figure 5-16. 2018 Base Year Traffic Assignment Result

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

CHAPTER 6: POE OPERATIONAL SIMULATION

Chapter 6: POE Operational Simulation

This chapter outlines the S&B team's efforts to develop the passenger and commercial vehicle border-crossing simulation and its subsequent integration with the Binational Assignment Model. The S&B team developed a discrete event simulation (DES) model of vehicle border crossings (on both sides of the border) for each of the Laredo POEs. The model was estimated with the observed border crossing data presented in Chapter 2 and waiting times reported by U.S. CBP and the Texas Transportation Institute (TTI).

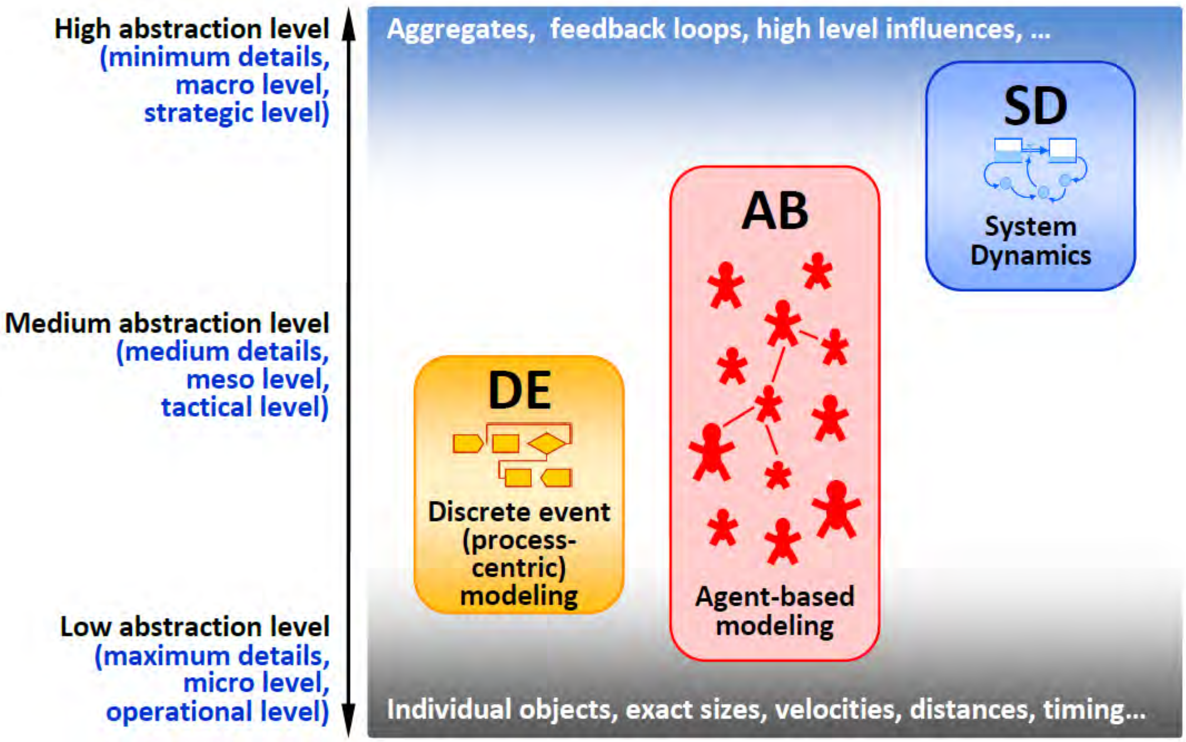
The following sections describe the simulation scope and methodology, the relevant existing data and border-crossing process, the border crossing simulation development, the results of the simulation—i.e., total crossing time and queue length—and model validation and verification.

6.1. Overview of Discrete Event Simulation

With advances in technology such as faster processing times and the ability to analyze greater levels of complexity, modeling is an increasingly attractive method for analyzing real-world problems. Analytical models can concisely describe a problem and provide a closed series of solutions. They also provide a tool to assess the impact caused by changes in model inputs while offering the possibility of reaching an optimal solution.

Simulation models can describe highly complex systems and can be used to experiment with both hypothetical and existing systems. As shown in Figure 6-1, modern simulation modeling comprises three methods, with each method best serving a particular level of abstraction and detail:

- System Dynamics operates at a high level of abstraction and is mostly used for strategic modeling.
- Discrete Event Simulation, with its underlying process-centric approach, supports medium and medium-low levels of abstraction.
- Agent-Based Modeling can range from the very detailed (in which physical objects are modeled) to the highly abstract.



Source: Borshchev (2015)[57]

Figure 6-1. Simulation Methods

With the DES method, the modeler considers the system being modeled as a sequence of operations being performed across entities. The operations can include factors such as delays, services by various resources, choosing the process branch, splitting, combining, and others. As entities compete for resources and can be delayed, queues are present in virtually any DES model.

Service times—as well as entity arrival times—are usually stochastic and drawn from a probability distribution. Therefore, DES models are stochastic themselves. This means that the model must run for a certain length of time and/or reach a certain number of replications before producing meaningful output.

The typical outputs expected from a DES model include:

- Utilization of resources
- Time spent in the system
- Waiting times
- Queue length

Simulation Methodology

The S&B team's simulation modeling methodology is illustrated in Figure 6-2 and can be summarized in the following steps:

1. **Data collection and analysis:** This step involves the collection of the data needed to cover the proposed study objective, followed by statistical analysis to determine trends and relationships between variables. Proper sampling techniques are necessary to ensure representative samples are obtained. For the present study, the S&B team relied on the aforementioned border crossing data.
2. **Probability distribution fitting:** Because the input data collected are random in nature (i.e., the processing times and arrival times follow a probability distribution with expected—but not unique—values), it is necessary to carry out a probability distribution fitting. This typically involves using a sophisticated statistical analysis technique such as Chi-Square or Kolmogorov-Smirnov tests.
3. **Simulation program development:** This step refers to programming all the components of the simulation such as the process activities, process resources, processing times, maximum queue lengths, etc. Depending on the aim of the model, a programming language such as R or Python— or specific simulation software such as Promodel, Anylogic, or Simio—can be used to develop and lay out all the components.
4. **Validation and verification:** These are activities that are carried out alongside the simulation model development. Validation is the process of determining that the DES model is an accurate representation of the system being simulated. An ideal way to validate a model is to compare its outputs to that of the base system (e.g., observed delay and queue lengths compared to the simulated delay and queue lengths). Verification refers to the proper operational of the simulation program and entails the use of an interactive run controller, or debugger (e.g., when a simulation model is performed in some software or programming language, usually the result of the verification process is a report listing any errors in the code).
5. **Production runs:** For each simulated scenario, decisions need to be made concerning the length of the simulation run, the number of runs (i.e., replications), and the manner of initialization. Analyzing the simulation's mean squared prediction error (MSPE) trend over time makes it possible to determine the total model noise in each moment of the simulation time and, therefore, the point at which this noise is reduced to an acceptable level.
6. **Output data analysis and documentation**: The results of all the analyses are presented clearly and concisely in a final report. This enables one to review the data, the alternatives that were addressed, the criteria by which the alternatives were compared, the results of the analyses, and the analyst's recommendations.

The remainder of this chapter presents the execution and results of the above methodology as it was implemented by the S&B team for the present study, beginning with the existing data that served as inputs to the modeling procedure.

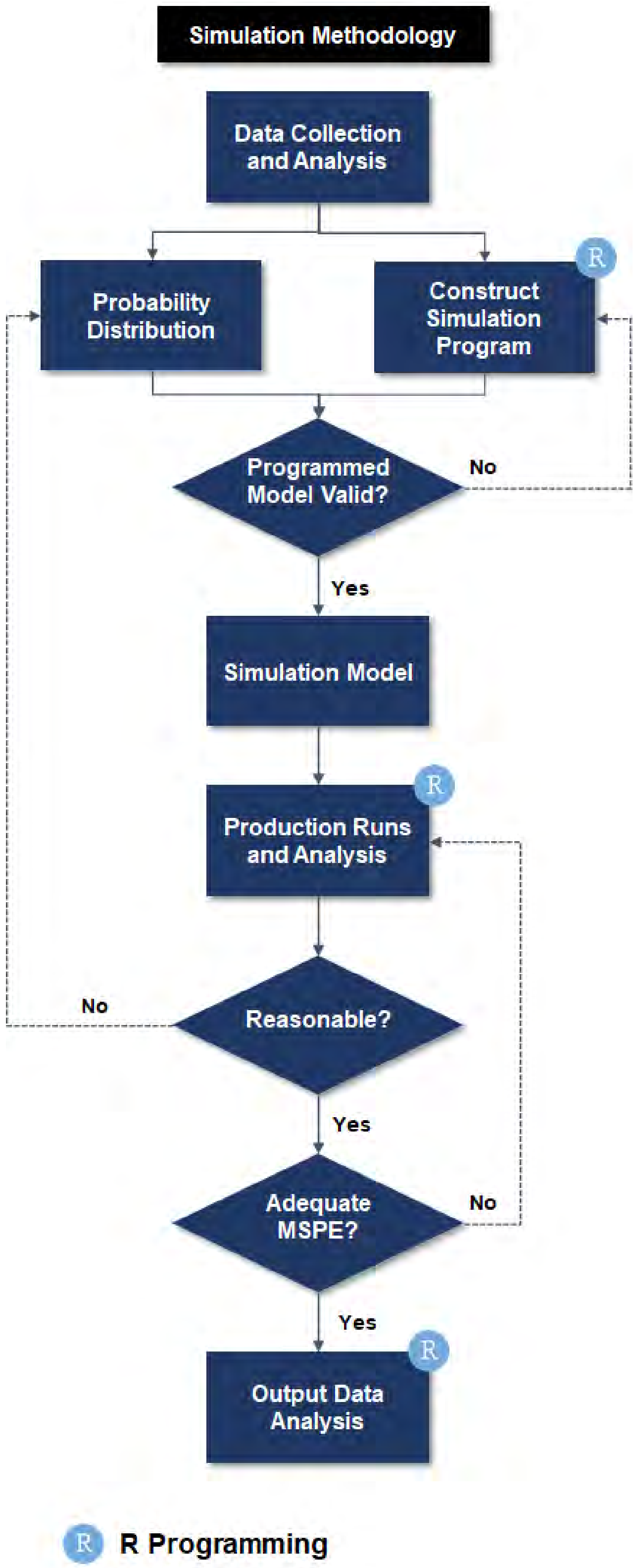


Figure 6-2. Simulation Methodology

6.2. Existing Border Crossing Time Data

This section presents a review of the existing data from the CBP, a description of Laredo border crossings for passenger and commercial vehicles, and reference studies along the U.S./Mexico border.

The reference values used in the simulation, which served to validate the model output data (i.e., to replicate the waiting times obtained from the CBP), are shown in the border crossing descriptions (see Sections 0 and 0). The main reference for the processing time values used in each process come from a 2014 border study in Laredo.[58] These values served as a starting point for the calibration process of the waiting times in the bridge system.

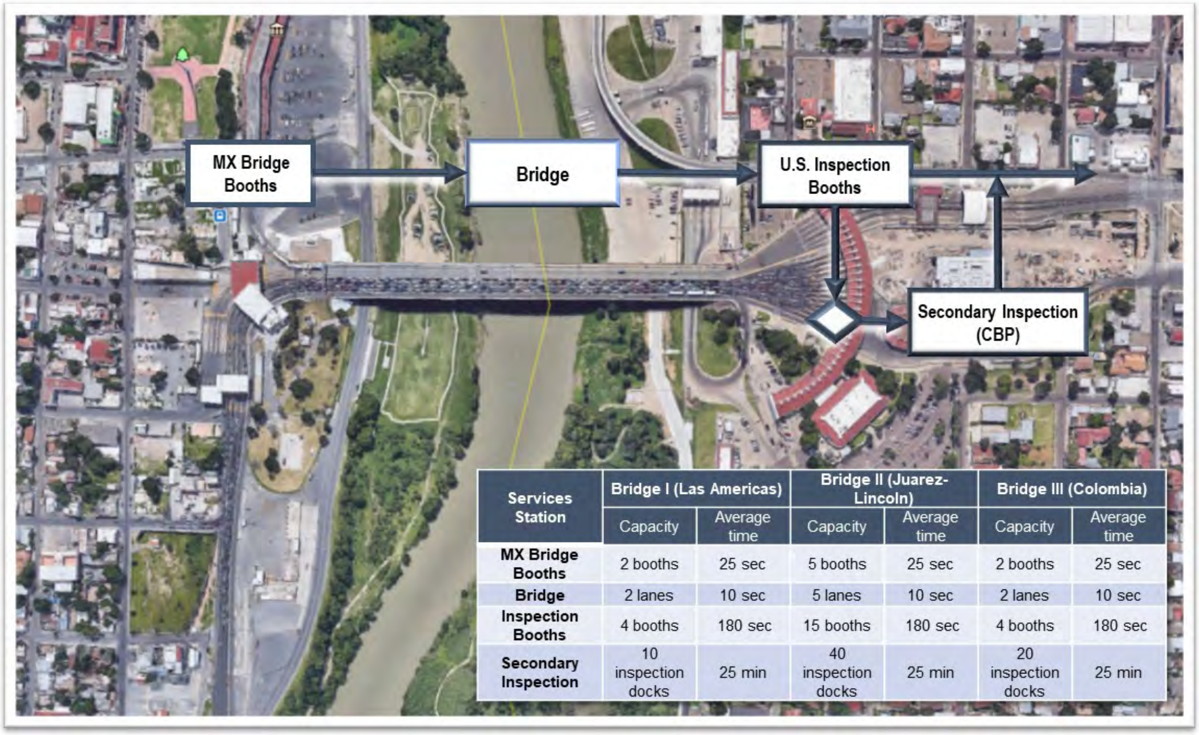
Passenger Vehicles Border Crossing Process

The Laredo International Bridge System passenger vehicle border crossing process is summarized below in terms of the bridge/POE stations considered in the simulation model:

1. **Bridge Booths:** This entails bridge access and the booths where tolls are normally collected. Depending on the technology implemented, the process may take 15 to 40 seconds. The model considers a mean time of 25 seconds with a standard deviation of 15 seconds for this portion of the border crossing process.
2. **Bridge:** This involves traversing the bridge from the Mexican side to the merge area on the U.S. side. The model considers a mean time of 10 seconds with a standard deviation of 5 seconds for this portion of the process.
3. **Inspection Booths:** This is the main process for the passenger vehicles; this entails a review of documentation, behavioral observation, visual inspection of the vehicle and ID/License capture and/or check. The model considers a mean of 3 minutes and standard deviation of 2 minutes for this portion of the process.
4. **Secondary Inspection:** Sometimes a secondary inspection is carried out, depending on the behavioral observation or as a random selection. This entails a physical inspection of the vehicle, K-9-unit, trace detection, x-ray, and scrutiny interrogation. The model considers a mean of 25 minutes and a standard deviation of 15 minutes for this process when applicable.

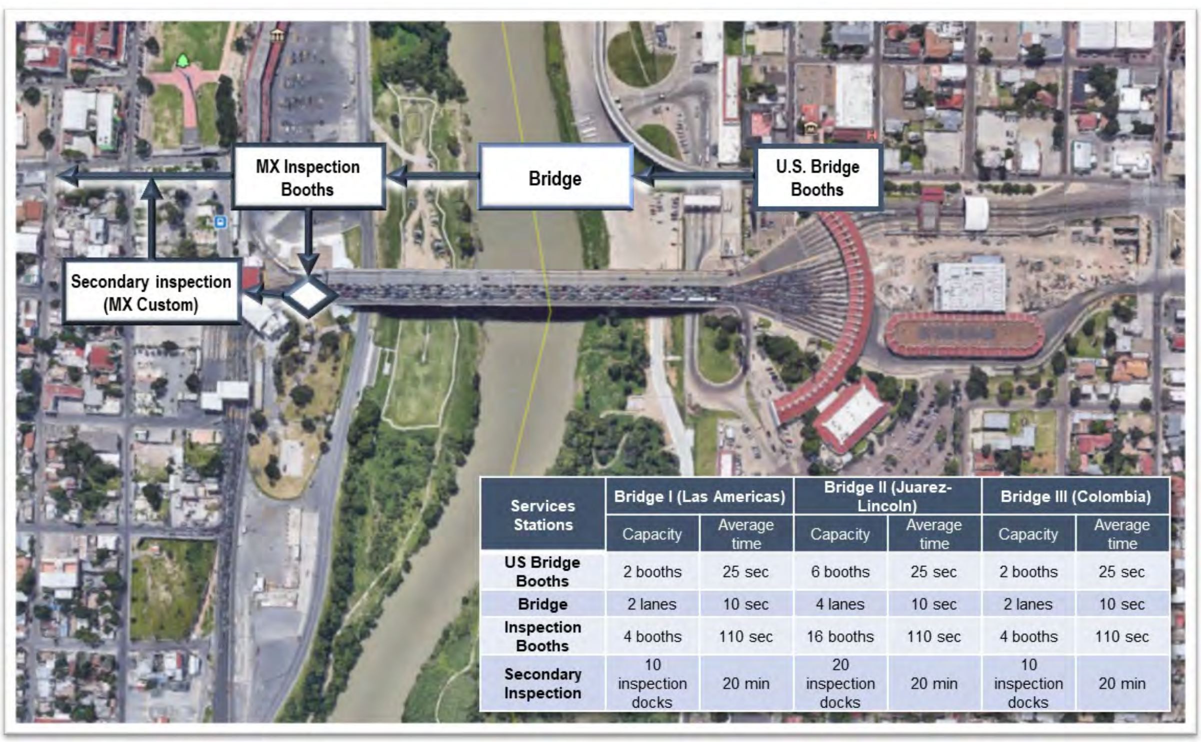
Figure 6-3 and Figure 6-4 show a summary of the statistics used in the simulation as well as a diagram of the process for both northbound and southbound directions. The main assumption for the southbound direction (US–MX) was that the process usually takes 80 percent of the time required for the northbound (MX–US) process.

Another parameter used in the passenger vehicle simulation is the percentage of secondary inspection considered, which ranges from 10 to 20 percent of the total traffic.



Services Station	Bridge I (Las Americas)		Bridge II (Juarez-Lincoln)		Bridge III (Colombia)	
	Capacity	Average time	Capacity	Average time	Capacity	Average time
MX Bridge Booths	2 booths	25 sec	5 booths	25 sec	2 booths	25 sec
Bridge	2 lanes	10 sec	5 lanes	10 sec	2 lanes	10 sec
Inspection Booths	4 booths	180 sec	15 booths	180 sec	4 booths	180 sec
Secondary Inspection	10 inspection docks	25 min	40 inspection docks	25 min	20 inspection docks	25 min

Figure 6-3. Passenger Vehicles Border Crossing Process – Mexico to the U.S.



Services Stations	Bridge I (Las Americas)		Bridge II (Juarez-Lincoln)		Bridge III (Colombia)	
	Capacity	Average time	Capacity	Average time	Capacity	Average time
US Bridge Booths	2 booths	25 sec	6 booths	25 sec	2 booths	25 sec
Bridge	2 lanes	10 sec	4 lanes	10 sec	2 lanes	10 sec
Inspection Booths	4 booths	110 sec	16 booths	110 sec	4 booths	110 sec
Secondary Inspection	10 inspection docks	20 min	20 inspection docks	20 min	10 inspection docks	20 min

Figure 6-4. Passenger Vehicles Border Crossing Process – U.S. to Mexico

Passenger Vehicles Waiting Times

The S&B team analyzed the passenger vehicle waiting times based on publicly available CBP border waiting times, which provide hourly average weekday waiting times for 24-hour periods.[59] For this analysis, the Bridge II (Juarez-Lincoln) 2019 waiting times were used due to other bridges having inconsistent and/or missed values along the 24-hour time series.

The monthly waiting times were analyzed with a Box and Whisker graph. In this type of graph, the values between the first and the second quartile are represented by the box along with the median (line) and the mean (cross). The lines beyond the box reflect the maximum and minimum values, and any points outside those ranges represents outliers.

Figure 6-5 and Figure 6-6 illustrate the analysis for the Juarez-Lincoln POE's general lanes and Ready Lanes, respectively. As depicted, January through July exhibit higher values and greater variability in comparison to the rest of the year. August through November exhibit the lowest values with a rebound in December. The main peaks occur in April, July, and December, corresponding to the main vacation periods in Mexico.

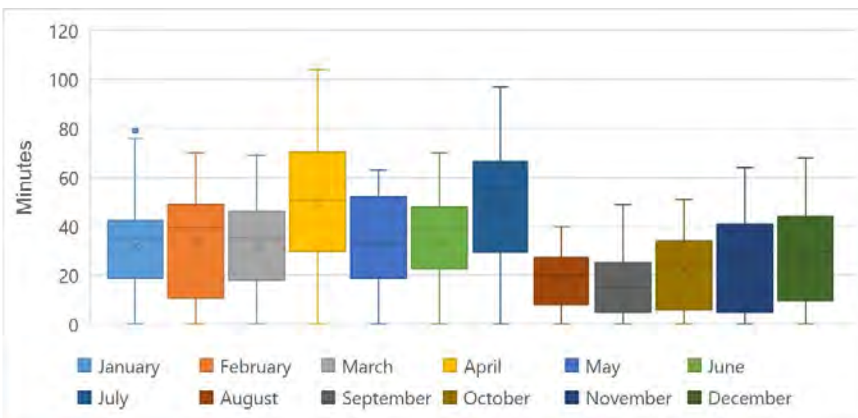


Figure 6-5. Monthly Waiting Time, Juarez–Lincoln POE – General Lanes (2019)

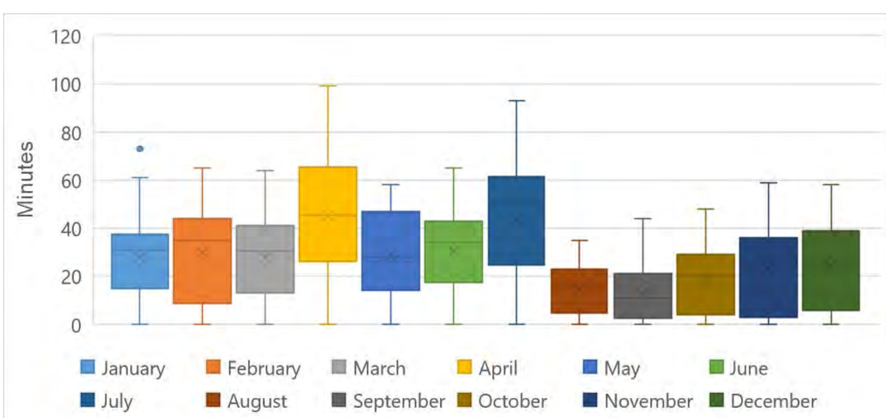


Figure 6-6. Monthly Waiting Time, Juarez–Lincoln POE – Ready Lane (2019)

Figure 6-7 and Figure 6-8 illustrate the weekly waiting times at the Juarez-Lincoln POE for general lanes and Ready Lanes, respectively. As depicted, Monday exhibits the highest waiting time mean but also the least variability (i.e., the smallest box size) for both lane types. Friday shows a similar mean to Monday but exhibits more variability.

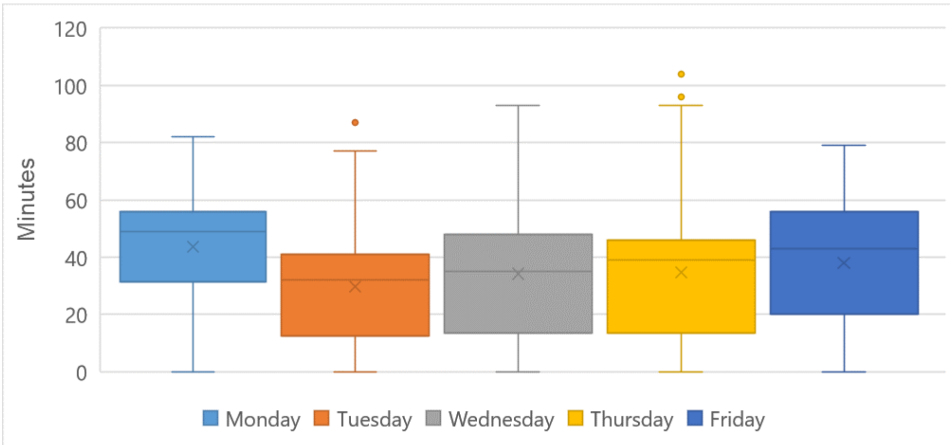


Figure 6-7. Weekly Waiting Time, Juarez–Lincoln POE – General Lanes

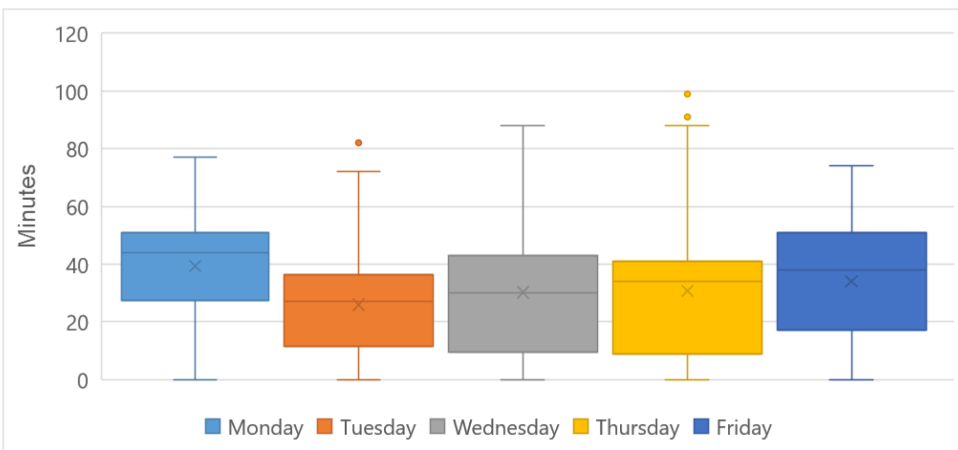


Figure 6-8. Weekly Waiting Time, Juarez–Lincoln POE – Ready Lane

The TDM's assignment is based on average weekday traffic. Below is the analysis of the waiting times for all 24 hours of an average weekday. Figure 6-9 and Figure 6-10 show the waiting time profile for general lanes and Ready Lanes, respectively.

As depicted, both waiting times are similar, but the general lane presents around 13% more waiting time than the ready lane. Furthermore, the variability of the morning period (5:00- 8:59) is less than the rest of the day,

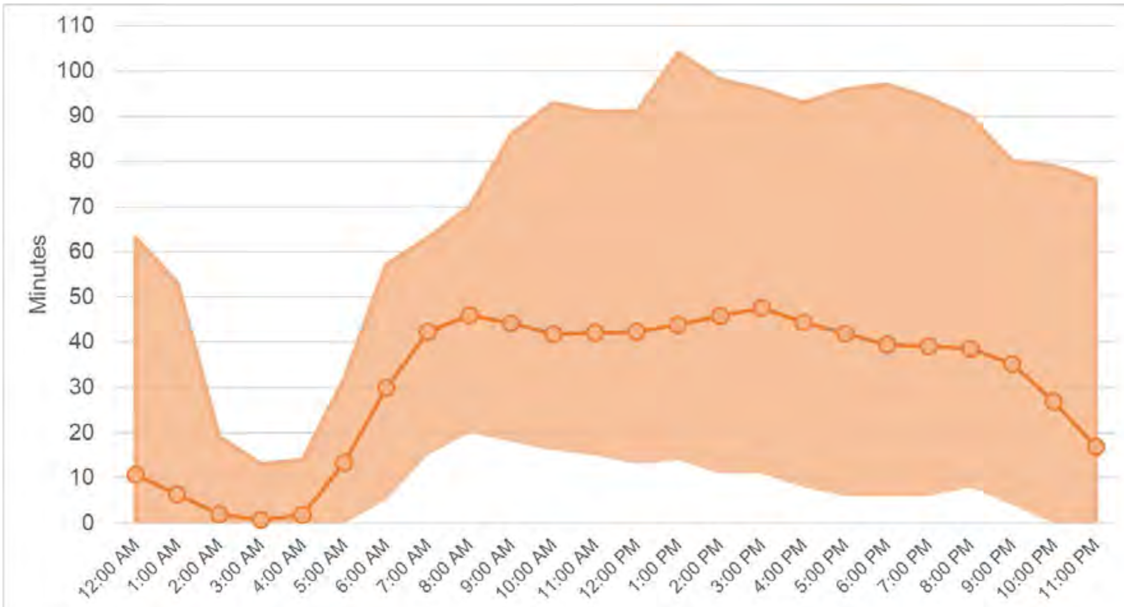


Figure 6-9. Average Waiting Time, Juarez–Lincoln POE – General Lanes

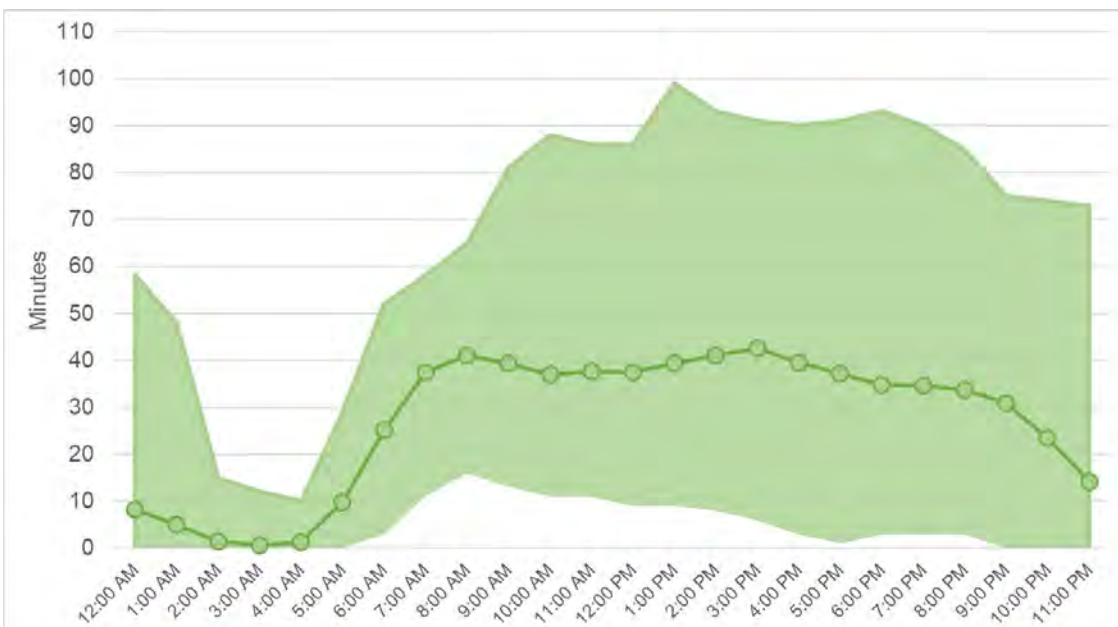


Figure 6-10. Average Waiting Time, Juarez–Lincoln POE – Ready Lane

Figure 6-11 shows the distribution of weekly waiting times for the Juarez–Lincoln's general lanes and Ready Lane. As depicted, around 5 percent of the waiting times take 0 to 5 minutes and correspond to the early morning demand. The remainder is distributed with the highest probability between 25 to 50 minutes, which corresponds to around 52 percent of demand.

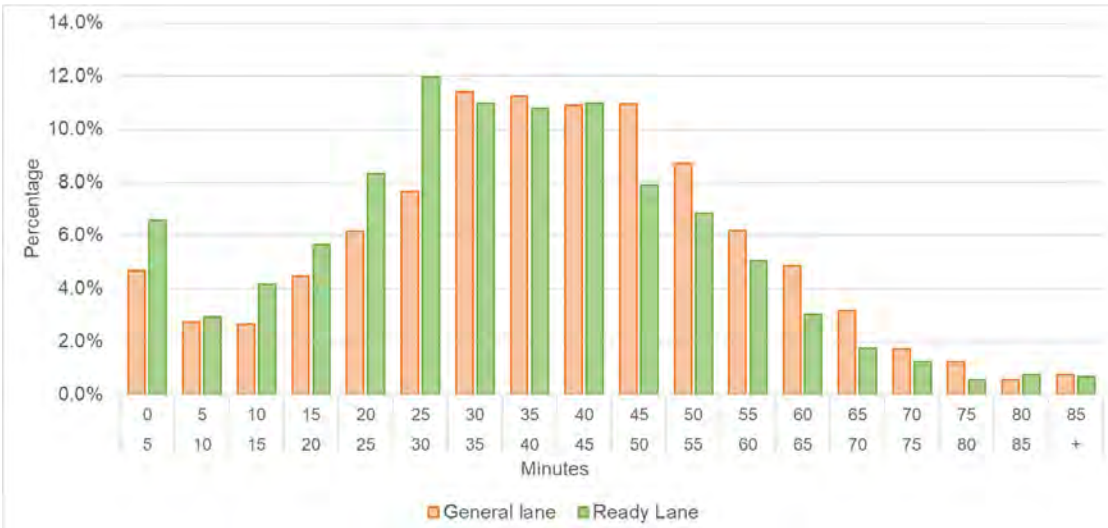


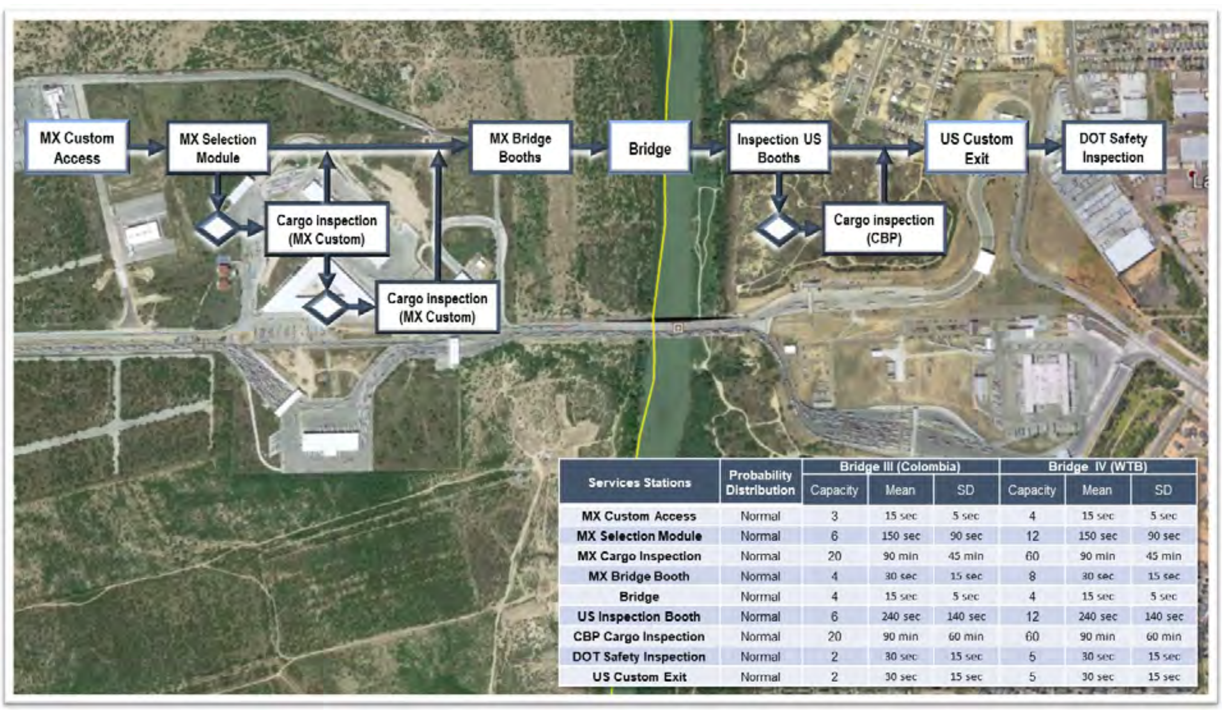
Figure 6-11. Waiting Time Distribution, Juarez–Lincoln POE

Commercial Vehicles Border Crossing Process

The commercial vehicle process, in terms of the services stations considered in the simulation model, is described below:

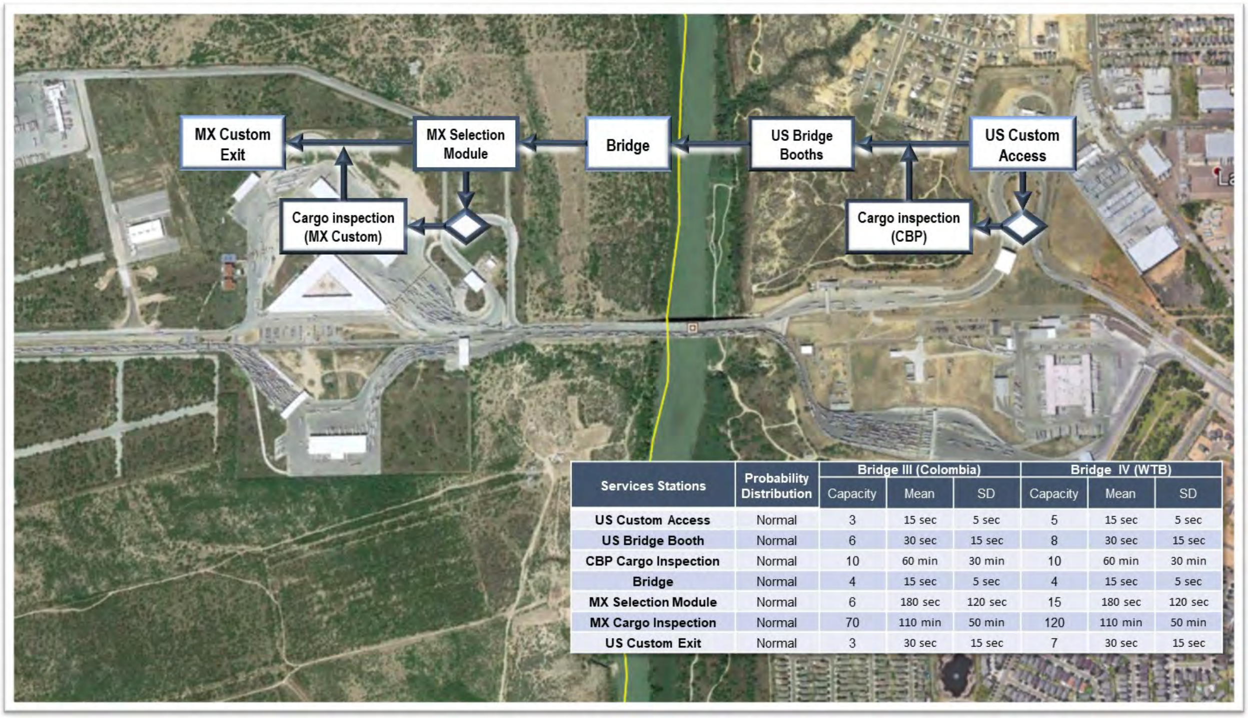
1. **Custom Access:** The access time made through the access road. The model considers a mean of 15 seconds and a standard deviation of 5 seconds for this process.
2. **Selection Module:** This entails the booths where the Mexican custom facility checked the export declaration against the electronic form and also where the driver has to push a button that notifies the driver that the cargo should go to the Mexican cargo inspection. The model considers a mean of 150 seconds and a standard deviation of 90 seconds for this process.
3. **Cargo Inspection:** If the traffic light turns red, the cargo inspection is carried out after the selection module. This entails a physical inspection of the vehicle and an interrogation. However, once submitted to the cargo inspection, the selected vehicle must again push the button of the traffic light for a second inspection. The model considers a mean of 90 minutes and a standard deviation of 45 minutes for this process.
4. **Bridge Booths:** If the traffic light turns green, the vehicle crosses the border and continues to the bridge booths where normally the toll is collected. The model considers a mean of 30 seconds and a standard deviation of 15 seconds for this process.
5. **Bridge:** This involves the bridge crossing from the Mexican side to the merge area on the U.S. side. The model considers a mean of 15 seconds and a standard deviation of 5 seconds for this process.

6. **Inspection Booths:** Once the commercial vehicles exit the bridge, they continue to the U.S. customs primary inspection booth. This phase represents the main bottleneck of the international bridge crossing process. This phase involves a commercial vehicle driver given a series of questions regarding the nature of the goods they are carrying. They are also asked to submit documents (identification, a copy of the Inward Cargo Manifest, and the commercial invoice) to the U.S. Customs officials. The model considers a mean of 240 seconds and a standard deviation of 140 seconds for this process.
7. **Cargo Inspection (CBP):** Based on the questioning process, visual commercial vehicle inspection, and a crosscheck using the Automated Targeting System (ATS) results, officials decide if a secondary cargo inspection is required. It is usually conducted by personnel from CBP, and the cargo is either unloaded or the commercial vehicle is processed through non-intrusive inspection equipment. Inside the POE area, the Food and Drug Administration (FDA), the Federal Motor Carrier Safety Administration (FMCSA). The model considers a mean of 90 minutes and a standard deviation of 60 minutes for this process.
8. **Custom Exit:** After carrying out the primary and/or secondary inspection as required, the commercial vehicle continues to the U.S. customs' final checkpoint, where all the paperwork is submitted, and the commercial vehicle exits the POE facility. The model considers a mean of 30 seconds and a standard deviation of 15 seconds for this process.
9. **DOT Safety Inspection:** After exiting the customs facility, commercial vehicles have to pass the TxDOT safety inspection. State police inspect conveyances to determine whether they are following U.S. safety standards and regulations. If their initial visual inspection finds any violation, they direct the commercial vehicle to proceed to a more detailed inspection at a special facility. The simulation model does not consider this activity because it is typically conducted outside of the bridge facility, but the average crossing time of the DOT Safety inspection is approximately 15 minutes with a standard deviation of 3 minutes.



Services Stations	Probability Distribution	Bridge III (Colombia)			Bridge IV (WTB)		
		Capacity	Mean	SD	Capacity	Mean	SD
MX Custom Access	Normal	3	15 sec	5 sec	4	15 sec	5 sec
MX Selection Module	Normal	6	150 sec	90 sec	12	150 sec	90 sec
MX Cargo Inspection	Normal	20	90 min	45 min	60	90 min	45 min
MX Bridge Booth	Normal	4	30 sec	15 sec	8	30 sec	15 sec
Bridge	Normal	4	15 sec	5 sec	4	15 sec	5 sec
US Inspection Booth	Normal	6	240 sec	140 sec	12	240 sec	140 sec
CBP Cargo Inspection	Normal	20	90 min	60 min	60	90 min	60 min
DOT Safety Inspection	Normal	2	30 sec	15 sec	5	30 sec	15 sec
US Custom Exit	Normal	2	30 sec	15 sec	5	30 sec	15 sec

Figure 6-12. Commercial Vehicles Border Crossing Process – Mexico to U.S.



Services Stations	Probability Distribution	Bridge III (Colombia)			Bridge IV (WTB)		
		Capacity	Mean	SD	Capacity	Mean	SD
US Custom Access	Normal	3	15 sec	5 sec	5	15 sec	5 sec
US Bridge Booth	Normal	6	30 sec	15 sec	8	30 sec	15 sec
CBP Cargo Inspection	Normal	10	60 min	30 min	10	60 min	30 min
Bridge	Normal	4	15 sec	5 sec	4	15 sec	5 sec
MX Selection Module	Normal	6	180 sec	120 sec	15	180 sec	120 sec
MX Cargo Inspection	Normal	70	110 min	50 min	120	110 min	50 min
US Custom Exit	Normal	3	30 sec	15 sec	7	30 sec	15 sec

Figure 6-13. Commercial Vehicles Border Crossing Process – U.S. to Mexico

Another important parameter used in the commercial vehicle simulation is the percentage of the inspected commercial vehicles on both sides of the border. On the Mexican side, the percentage range is between 5–10 percent of total traffic depending on whether it is the first or second inspection. On the U.S. side, the percentage ranges between 10–15 percent of the total traffic depending on lane type.

Commercial Vehicles Total Crossing Times

The analysis carried out with the available commercial vehicles waiting time data is presented below. The main source is the Border Crossing Information System (BCIS), which provides the crossing and waiting times over 24 hours.[60] For the analysis, the Bridge IV (World Trade Bridge) 2018–2019 waiting times were used due the Laredo–Colombia POE's inconsistent and missing values along the 24-hour time series.

Unlike passenger vehicles, where the crossing time is not representative of the total border crossing time, the commercial vehicles analysis presented next is based on the sum of the queue time (waiting time) and the crossing time (inspection booth time, cargo inspection, transfer inspection, etc.) reported by BCIS.

Figure 6-14 and Figure 6-15 show the analysis for the World Trade POE's Non-FAST and FAST lanes, respectively. As depicted, the total crossing time decreased in January, June, and December—the months that correspond to the main vacation periods. The variability remains the same in both lanes throughout the year, with values above 3 hours representing commercial vehicles in the intrusive cargo inspection.

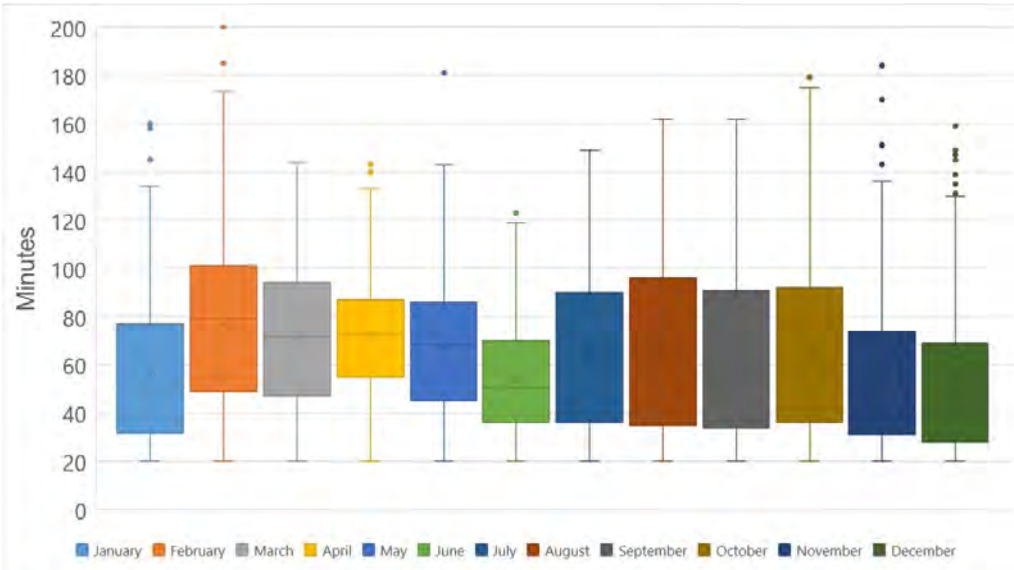


Figure 6-14. Monthly Total Crossing Time, World Trade POE – Non-FAST Lane

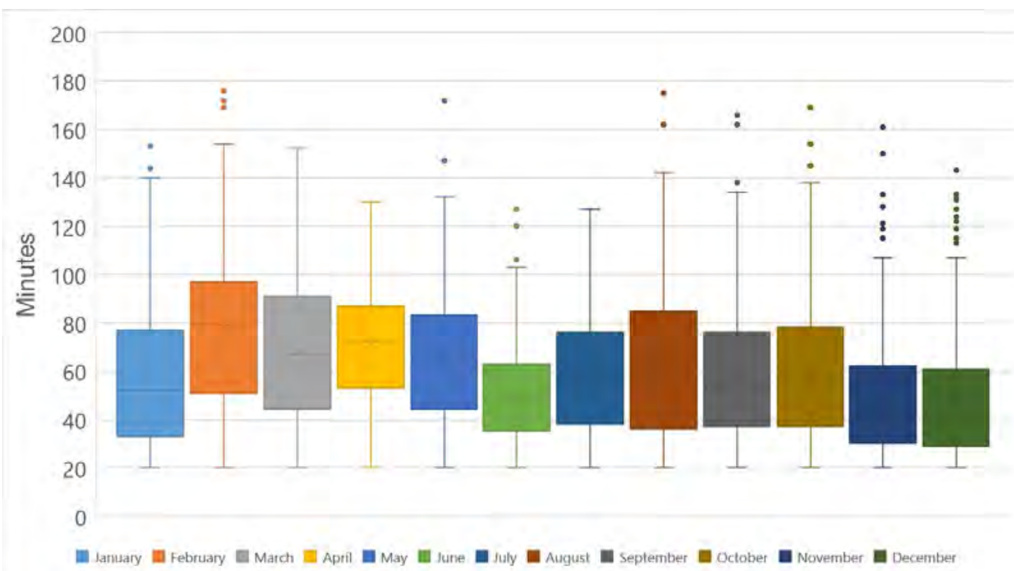


Figure 6-15. Monthly Total Crossing Time, World Trade POE – FAST Lane

The TDM traffic results are based on average weekday traffic. Figure 6-16 and Figure 6-17 illustrate total weekly crossing times for non-FAST and FAST lanes, respectively. As depicted, Monday exhibits the lowest average times on both lanes. Comparing the variability on both lanes, the standard lanes exhibit greater variability.

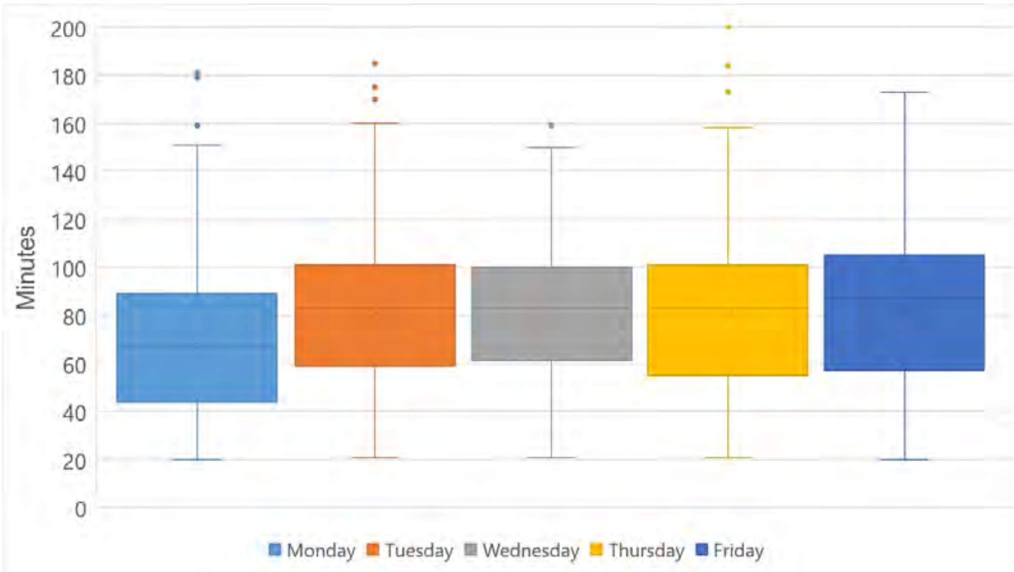


Figure 6-16. Weekly Total Crossing Time, World Trade POE – Non-FAST Lane

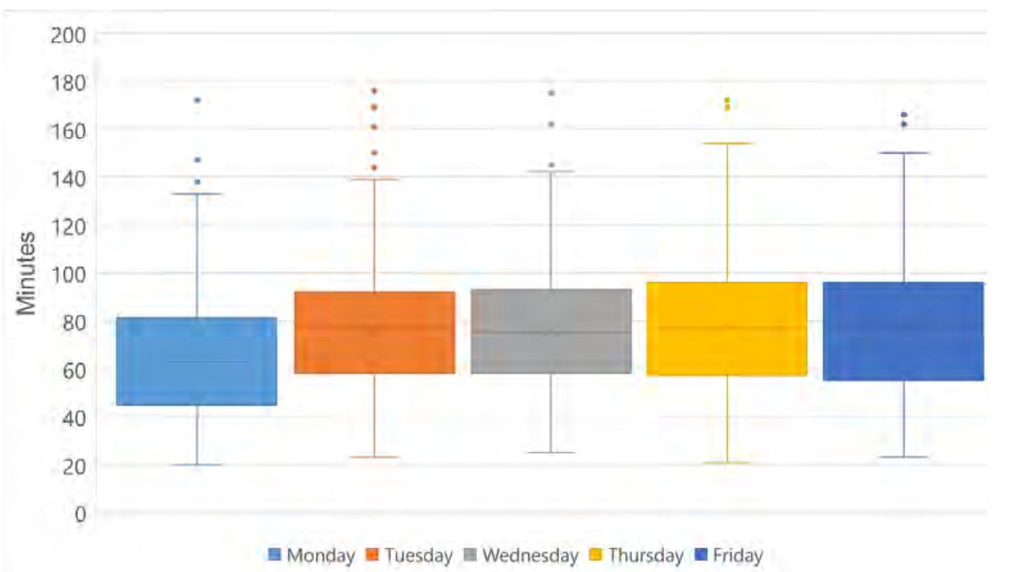


Figure 6-17. Weekly Total Crossing Time, World Trade POE – FAST Lane

Figure 6-18 and Figure 6-19 show the World Trade POE's total crossing time profile for standard and FAST lanes, respectively. As shown, both total crossing times are similar; however, the standard lane presents higher variability than the FAST lane, especially during midday (12:00 – 1:59 p.m.), during the afternoon (5:00 pm), and at night (8:00 – 11:59 p.m.).

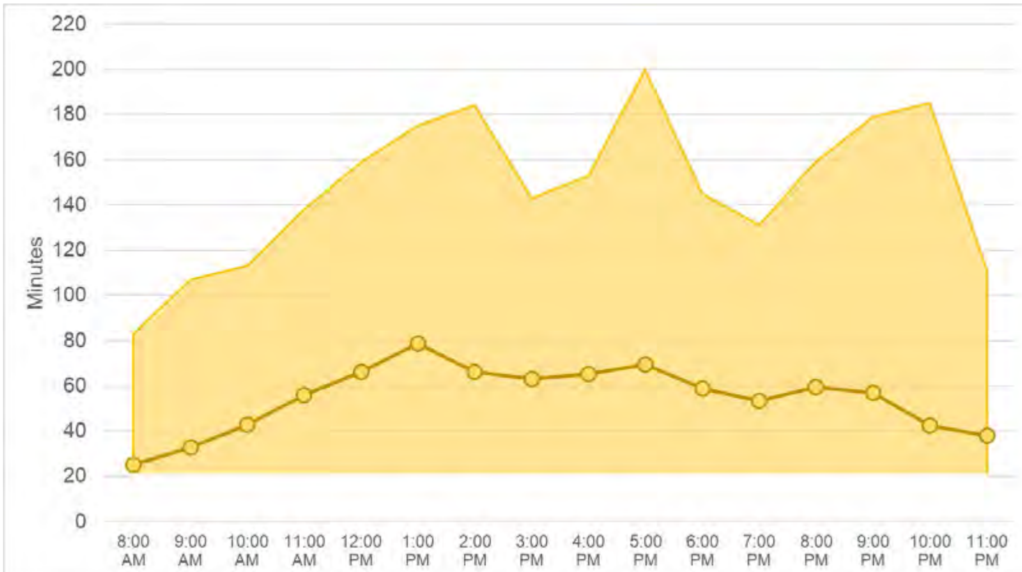


Figure 6-18. Average Total Crossing Time, Bridge IV (World Trade Bridge) – Non-FAST Lanes

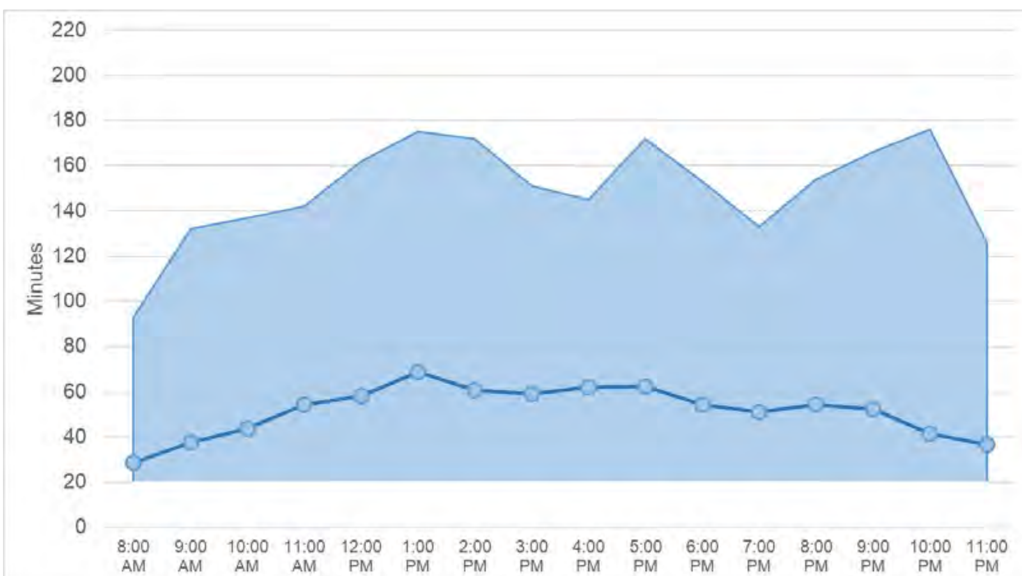


Figure 6-19. Average Total Crossing Time, Bridge IV (World Trade Bridge) – FAST Lane

Figure 6-20 shows the distribution of weekly waiting times for non-FAST and FAST lanes. As shown, the FAST lane exhibits higher waiting times than non-FAST lanes in the 30–70-minute range, but non-FAST lanes exhibit higher waiting times when the time exceeds 70 minutes, which suggests that the non-FAST lane users spend more time in cargo inspection than FAST lane users.

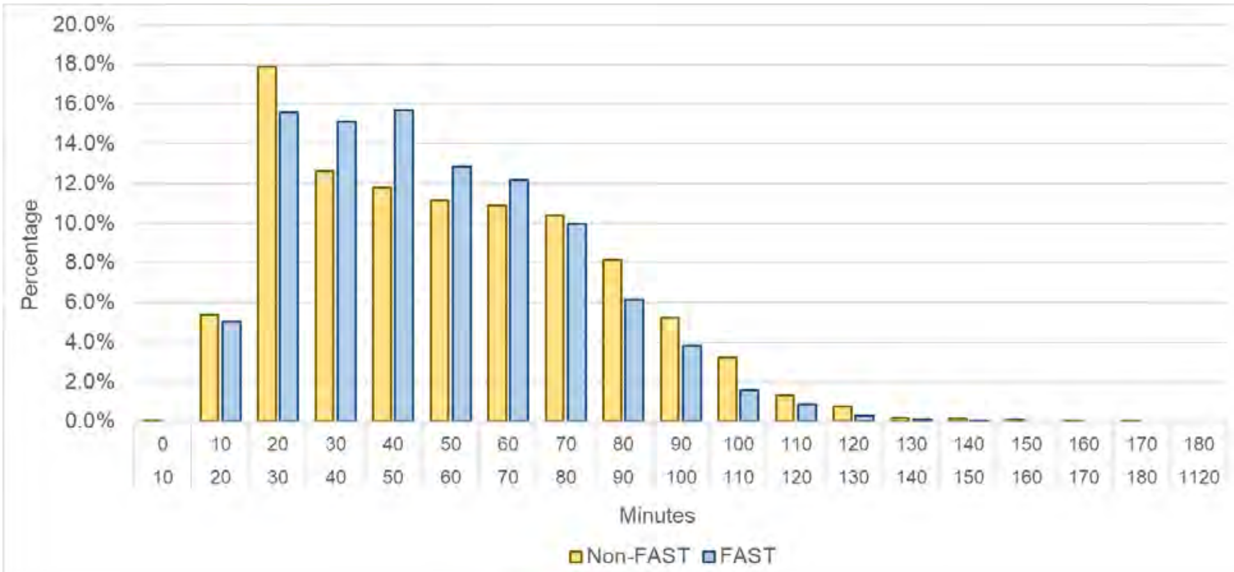


Figure 6-20. Total Crossing Time Distribution, Bridge IV (World Trade Bridge)

6.3. Border-Crossing Simulation

This section presents the review of the simulation, the validation and verification process, and the results obtained in terms of the queue length and the total border crossing time on each POE system.

Simulation Procedure

With the available data and the simulation objective to estimate the TDM's border crossing times, the process implemented by the S&B team for the border crossing simulation can be summarized as follows:

1. **Input Database:** Due the fact that no field work was carried out, a systematic review of available sources such as reports, and academic articles was carried out. The review included not only the available data for Laredo POEs but also other bridges such as the Otay Mesa POE as references.
2. **Calibration Process:** This process entails adjusting the total crossing time reported by CBP and the BCIS for passenger and commercial vehicles, respectively. In addition, the number of replications (i.e., runs) was determined based on the MSPE of the total time crossing.
3. **Output Analysis:** Lastly, the queue length and total time crossing was analyzed for each Laredo POE.

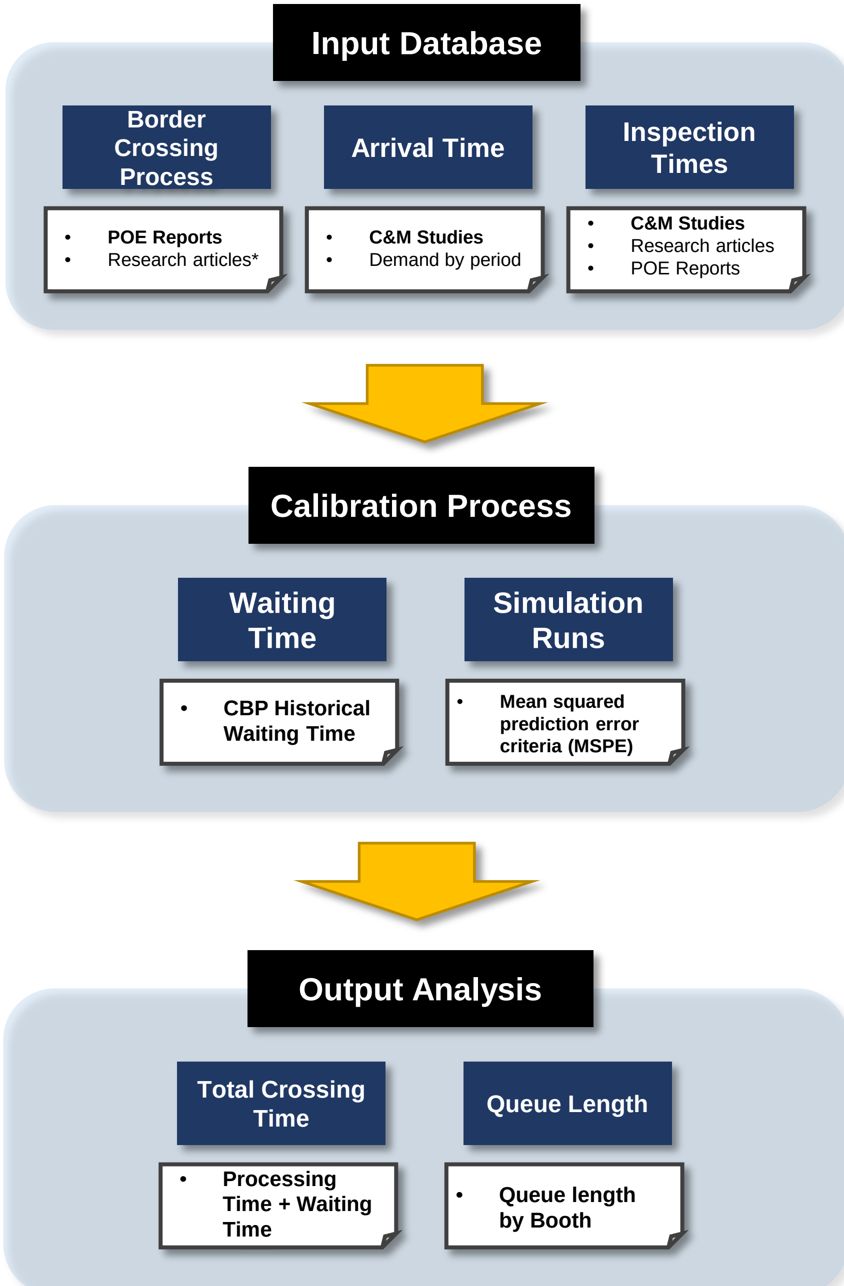


Figure 6-21. Border Crossing Simulation

Looking at the simulation process as a whole, there is one process that differs from the traditional simulation methodology. The input data analysis and distribution fitting were reduced only to the review and analysis of existing data—i.e., no statistical adjustment of probability distributions was performed due to a lack of field data collection. However, the S&B team conducted a comprehensive review of the border crossing data from similar projects such as Otay Mesa and previous data from the World Trade and Juarez-Lincoln bridges.

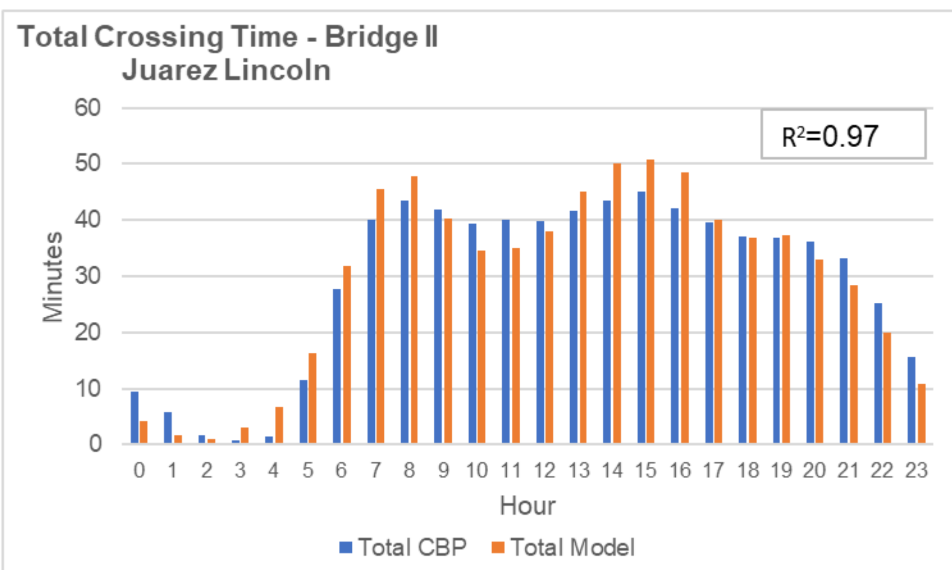
Simulation Program

The simulation model was made in R with the simmer package, which is a process-oriented and trajectory-based DES.[61] This package enables high-level process-oriented modeling, in line with other modern simulators. In addition, it makes use of the novel concept of trajectory: a common path in the simulation model for entities of the same type. In other words, a trajectory consists of a list of standardized actions which defines the life cycle of equivalent processes.

During the simulation script development, the model was checked with the RStudio console to ensure that the computer program of the model and its implementation are correct for the model's verification. This means that all the errors appear before, during, and after running the model along with their corresponding corrections.

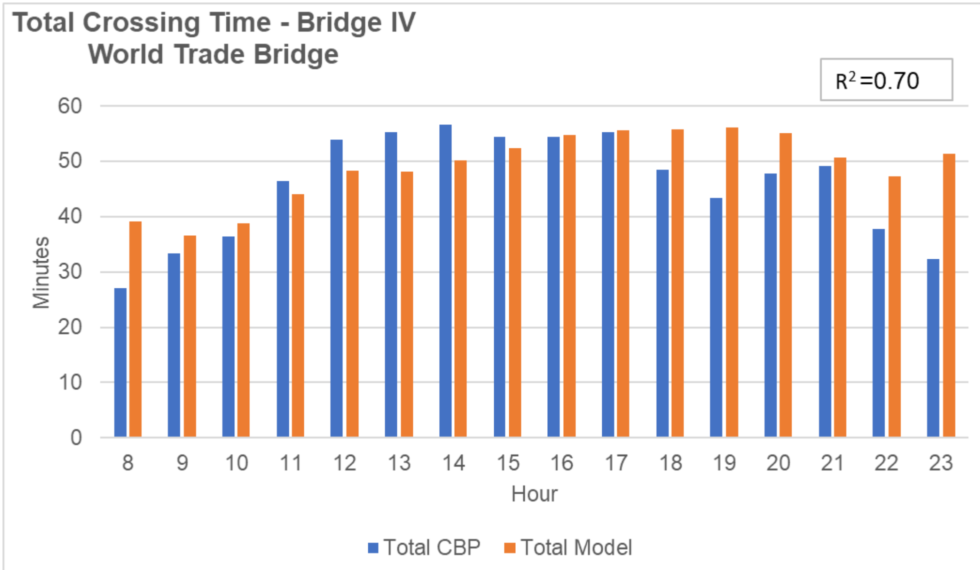
For the model validation, there was a mixture of several techniques implemented, primarily historical data validation, operational graphics, and predictive validation. The first technique consists of a comparison between the model outputs and the available historical data. In this case, the CBP border waiting times and BCIS data were used to validate the waiting times and total crossing times for passenger and commercial vehicles, respectively. Figure 6-22 and Figure 6-23 illustrate the comparison between the most congested bridges for passenger and commercial vehicles: Juarez–Lincoln and World Trade, respectively.

As shown, the model replicates the main peak periods for passenger vehicles in the morning and the afternoon. Furthermore, the model outputs and CBP data are highly correlated, (R^2 = 0.97). For commercial vehicles, there are no relevant peaks, and the crossing time is around 50 minutes after midday. Therefore, the calibration is acceptable when taking into consideration that the daily average total crossing times are 46.55 and 47.85 minutes for the observed and modeled data, respectively.



Note: Average of general lanes and Ready Lanes

Figure 6-22. Passenger Vehicle Model Validation



Note: Average of FAST and non-FAST lanes

Figure 6-23. Commercial Vehicles model validation

The S&B team performed a second validation of the simulation model by considering the total crossing times reported by TxDOT, as shown in Table 6-1.

Table 6-1. Total Crossing Time TxDOT-Simulation comparison

Bridge	Passenger Vehicles		Commercial Vehicles	
	Simulation - Northbound	TxDOT - Northbound	Simulation - Northbound	TxDOT - Northbound
Gateway	41 minutes	43 minutes	-	-
Juarez-Lincoln	29 minutes	24 minutes	-	-
Colombia	8 minutes	10 minutes	21 minutes	16 minutes
World Trade	-	-	46 minutes	30 minutes

As part of the model validation, a predictive validation was made with a sensitivity analysis of the most relevant variables such as the number of booths and the time of each process—i.e., these variables were changed, and the results were checked for consistency. The results of the sensitivity analysis are presented in Section 0.

Number of Runs

According to the universally accepted definition, the simulation model's "goodness of fit" depends not only on its constructor ability (i.e., system analysis, data survey, and logic transcription) but also on correct experimental activity, which should include experimental error measurement among its main targets. In other words, any object system displays its own level of stochasticity, affecting the behaviors of the output variables and entering in the simulation model by producing characteristic "noise" that cannot be set aside.

Analyzing the MSPE trend in the simulated crossing times makes it possible to solve this problem through a graph that demonstrates the total model noise in each moment of simulated time. Therefore, while examining the graph, it is possible, if necessary, to separate real system noise from the total noise.

The MSPE is represented by the following equation:

$$\text{MSPE}_{\text{MED}}(i) = \frac{\sum_{j=1}^{K}\left(\overline{y_{ij}} - \overline{Y_i}\right)^2}{K-1}$$

Equation 1. MSPE of the Replication "j"

Where:

$\overline{y_{ij}}$ = The average of the total crossing time for vehicle type "i"

$\overline{Y_i}$ = The great average of the replication "j"

Figure 6-24 and Figure 6-25 show the MSPEs for passenger and commercial vehicles, respectively. As shown, after the 10th replication, the noise produced by each simulation decreases for both types of vehicles, especially commercial vehicles. Therefore, the simulation can be run with 10 replications to obtain a satisfactory level of accuracy.

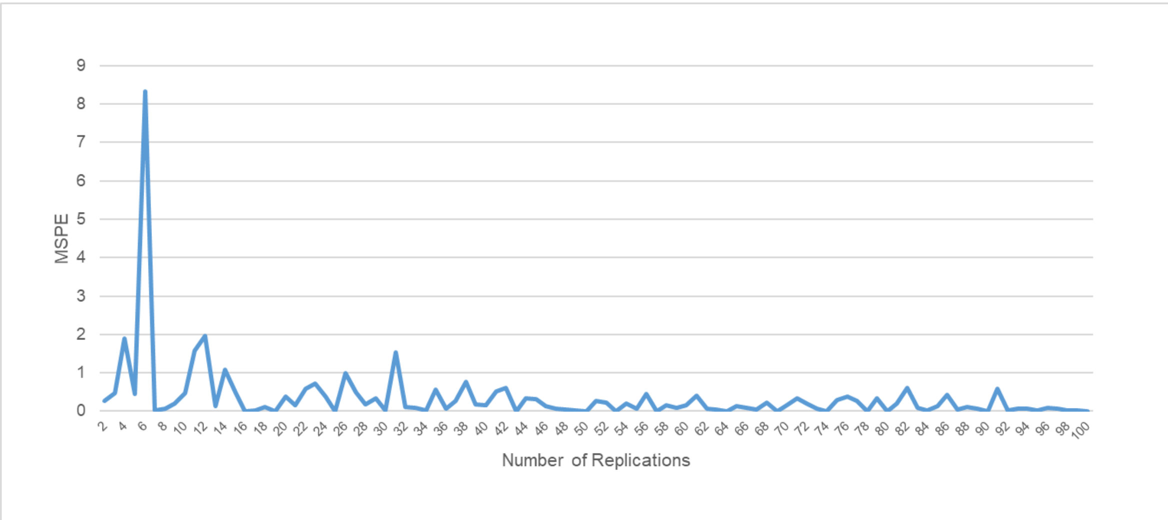


Figure 6-24. Crossing Time MSPE – Passenger Vehicles

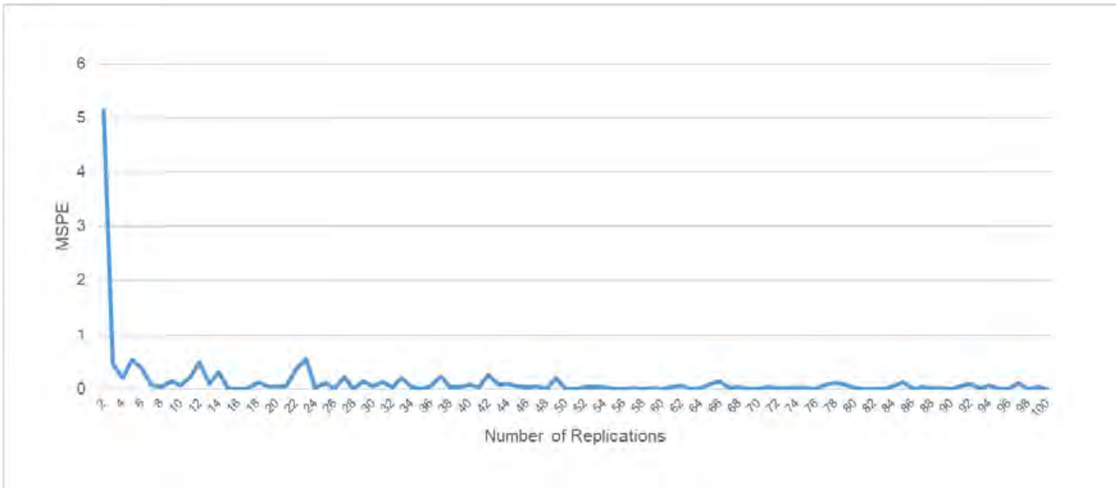


Figure 6-25. Crossing Time MSPE – Commercial Vehicles

Simulation Model Results

This section presents the main model outputs in terms of the waiting time in the queue, the total crossing time, and the queue length on the bridge entrance. The following figures show the waiting time and total crossing time by TOD period on both sides of the border and lane type. All analyses were done with 2019 historical traffic data (times shown in Figure 6-3 and Figure 6-4) and the capacity (number of booths available by hour) reported by CBP.

It is important to mention that southbound crossing times did not have a validation process like northbound crossing times (see previous section). Therefore, the results presented were only validated in congruence of the traffic and the main peaks observed throughout the day.

As shown, the most congested bridge is the Gateway POE, since it has less capacity compared to the Juarez–Lincoln POE. Moreover, on the Gateway POE, the peak demand periods for general lanes and Ready Lanes are in the morning in the northbound direction and in the afternoon in the southbound direction. Furthermore, peak demand for SENTRI lanes is observed between 5:00 p.m. and 7:00 p.m.

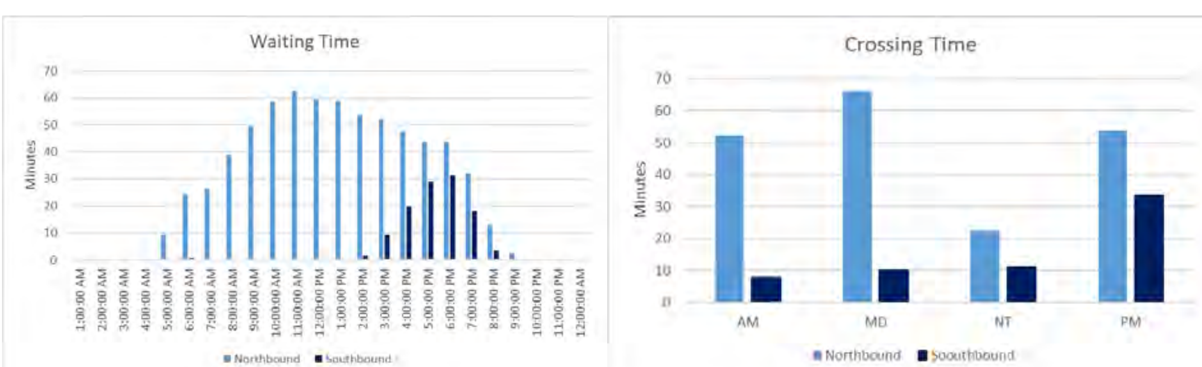


Figure 6-26. Passenger Vehicle Model Results – Gateway POE, General/Ready Lanes

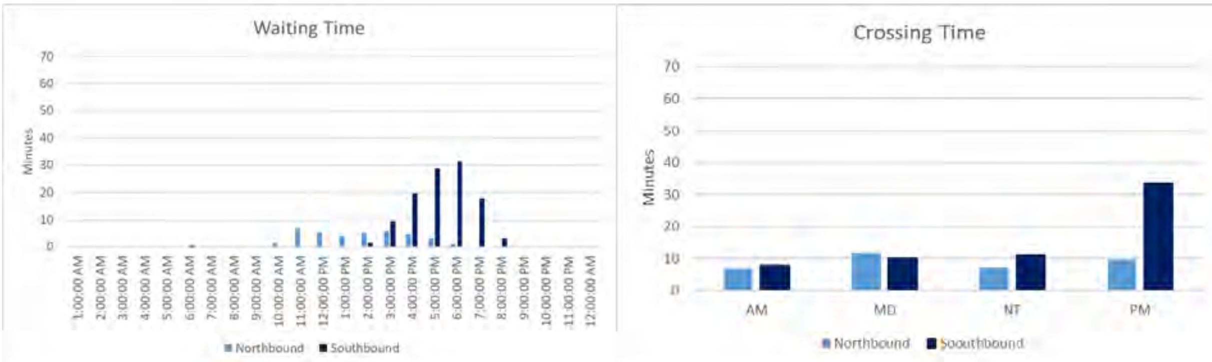


Figure 6-27 Passenger Vehicle Model Results – Gateway POE, SENTRI Lanes

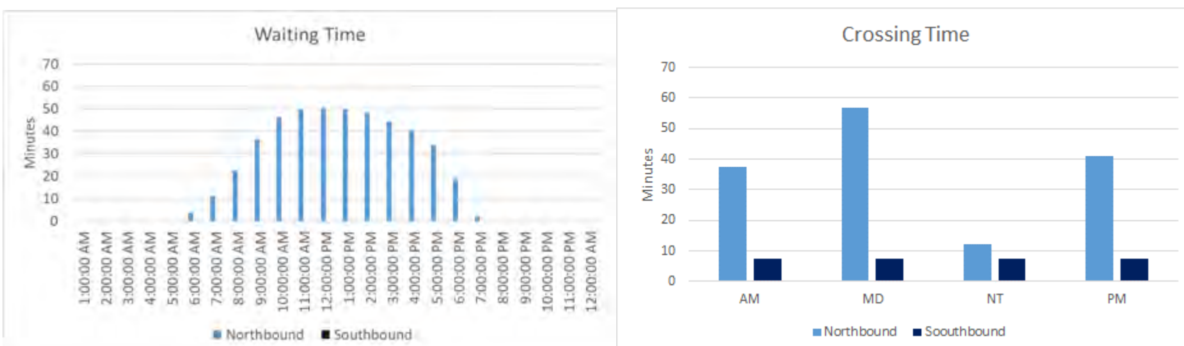


Figure 6-28. Passenger Vehicle Model Results – Juarez-Lincoln POE, General/Ready Lanes

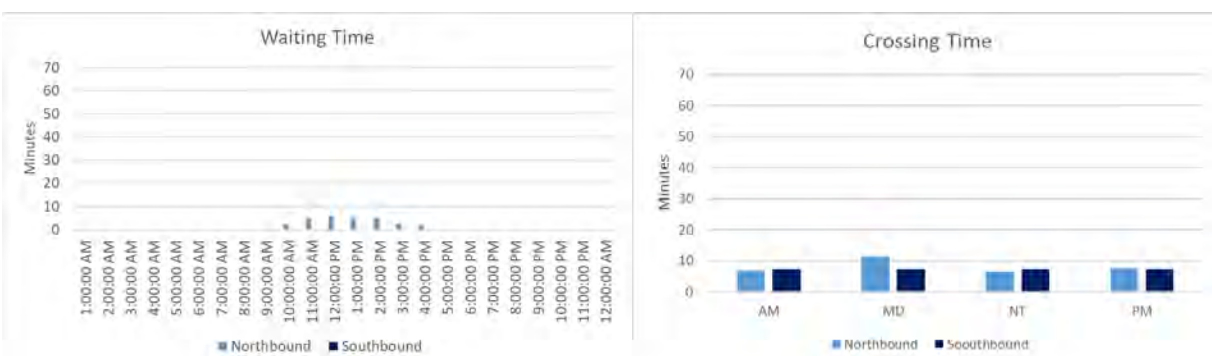


Figure 6-29. Passenger Vehicle Model Results – Juarez-Lincoln POE, SENTRI Lanes

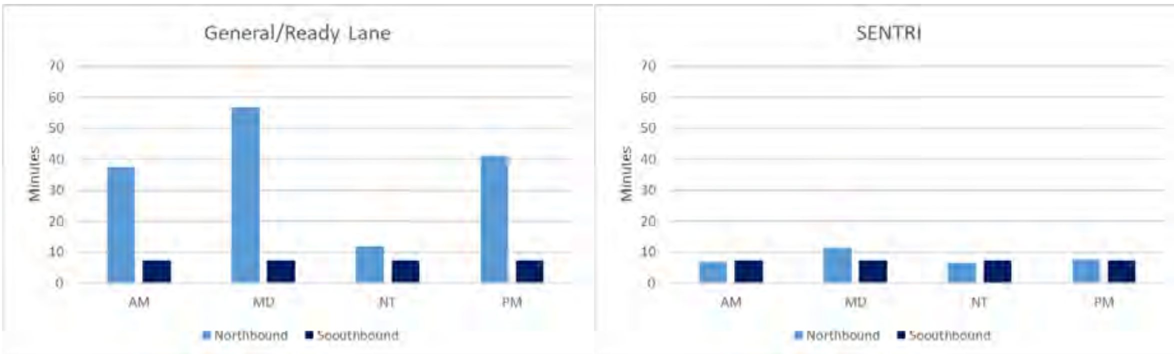


Figure 6-30. Passenger Vehicle Total Crossing Times – Laredo–Colombia POE

Figure 6-31. Passenger Vehicle Waiting Times – Laredo–Colombia POE

As shown in Figure 6-32 and Figure 6-34 , there is a clear difference in congestion between the Laredo–Colombia POE and World Trade POE. On the northbound non-FAST lanes, the peak demand period crossing time on the World Trade POE is almost double the Laredo-Colombia POE's peak period.

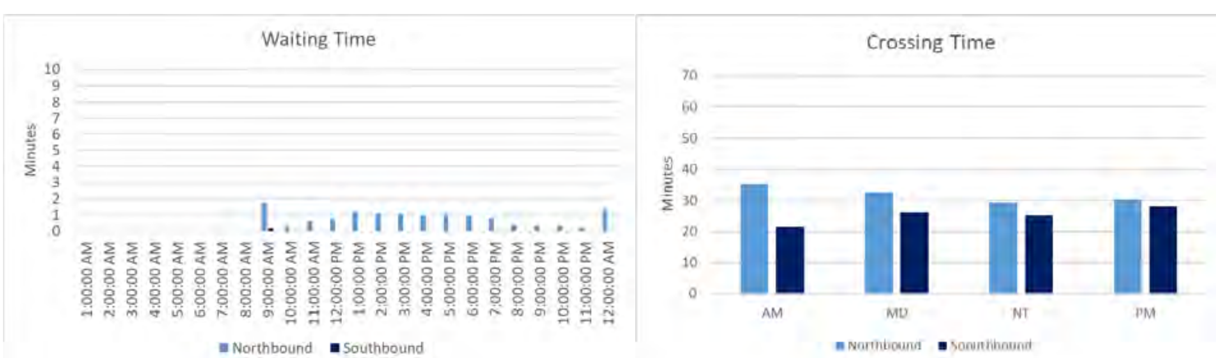


Figure 6-32. Commercial Vehicle Model Results – Laredo–Colombia POE, Non-FAST Lanes

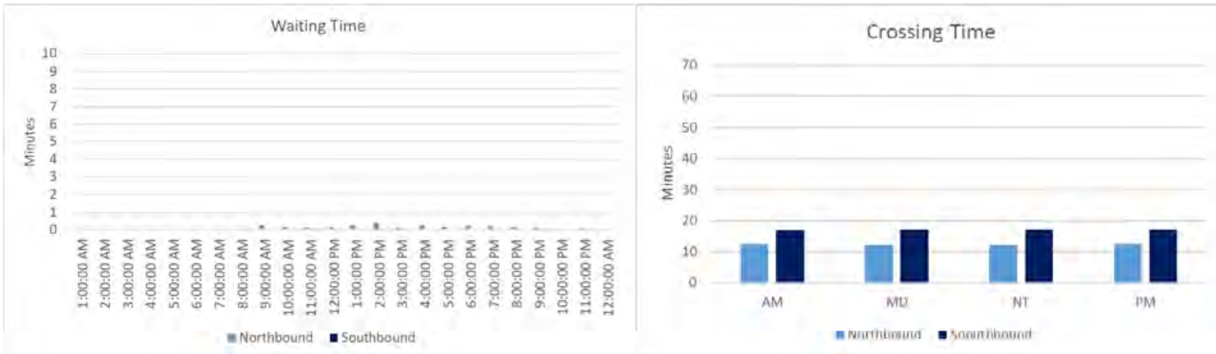


Figure 6-33. Commercial Vehicle Model Results – Laredo–Colombia POE, FAST Lanes

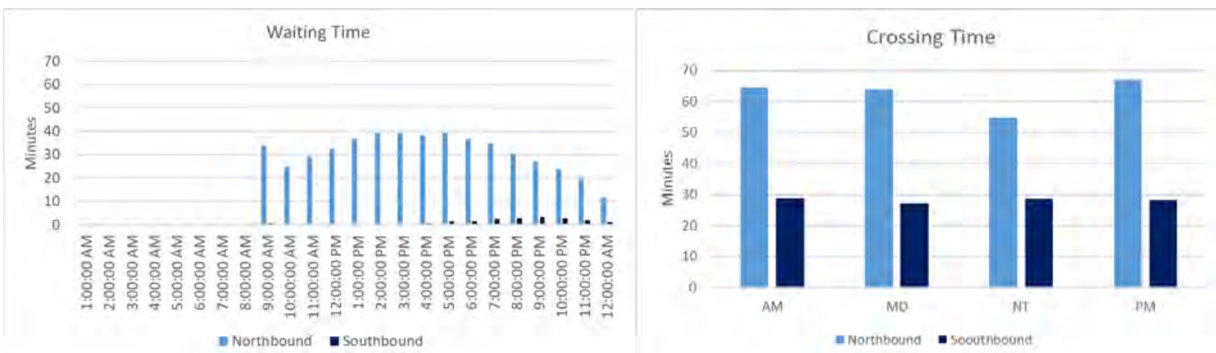


Figure 6-34. Commercial Vehicle Model Results – World Trade POE, Non-FAST Lanes

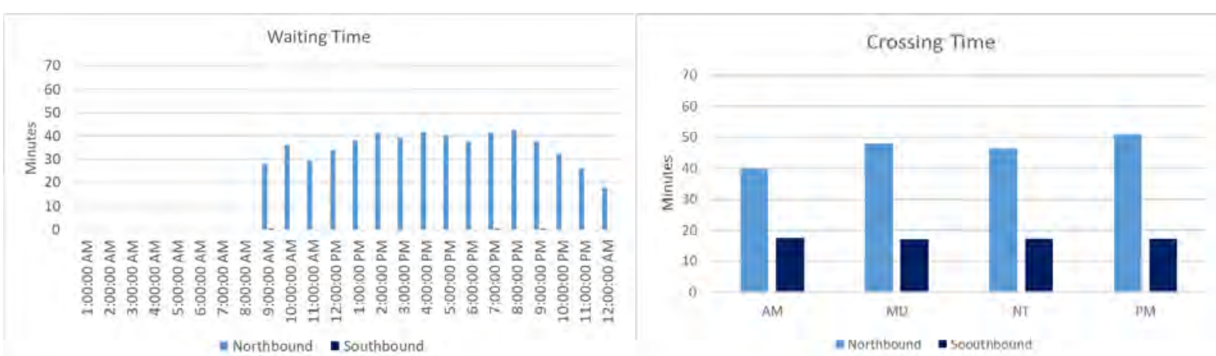


Figure 6-35. Commercial Vehicle Model Results – World Trade POE, FAST Lanes

Whereas the Gateway POE is the most congested, as shown previously in Figure 6-26, the Juarez-Lincoln POE generally outnumbers the Gateway POE in terms of queue length in all categories: northbound and southbound, at the bridge's entrances, and on the bridge itself, as shown in Figure 6-36 and Figure 6-37.

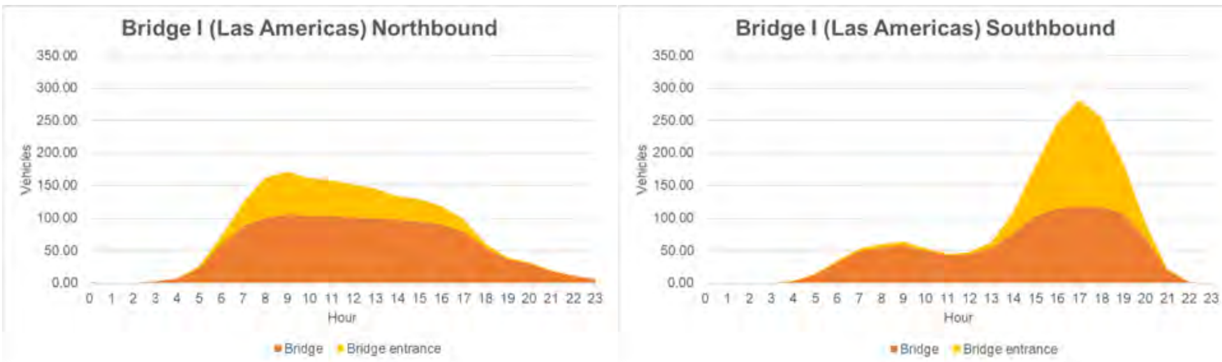


Figure 6-36. Passenger Vehicle Queue Length – Gateway POE

Figure 6-37. Passenger Vehicle Queue Length – Juarez–Lincoln POE

Figure 6-38. Passenger Vehicle Queue Length – Laredo–Colombia POE

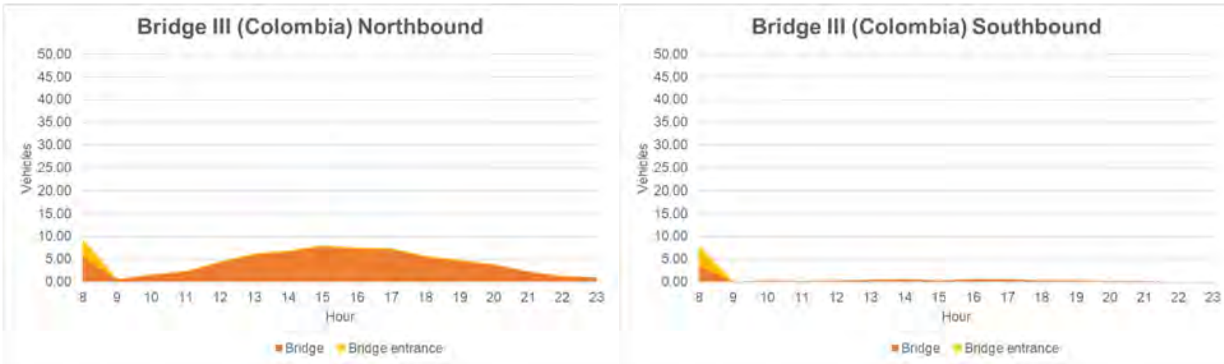


Figure 6-39. Commercial vehicles Queue Length – Bridge III (Colombia)

Following the trend of higher congestion, the World Trade POE has (by far) higher queue lengths than the Laredo–Colombia POE, which is to be expected due to the former being the more popular option for commercial vehicles.

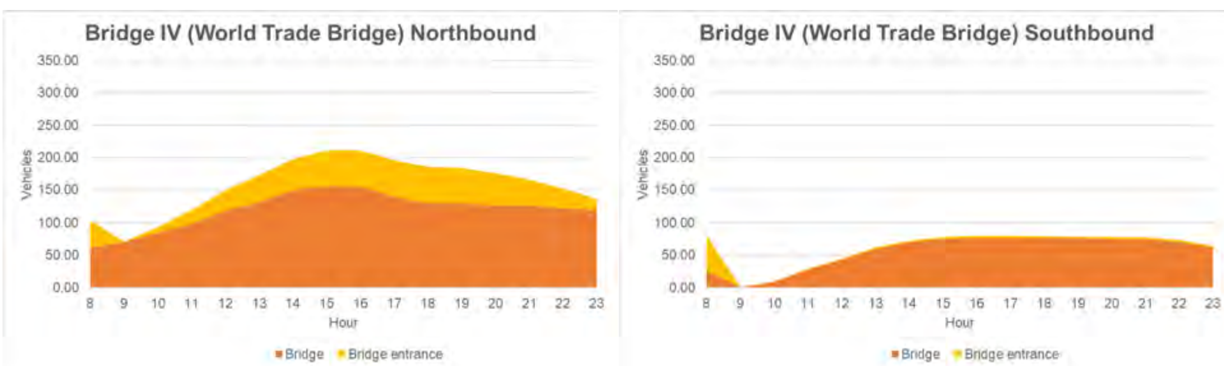


Figure 6-40. Commercial Vehicle Queue Length – World Trade POE

Sensitivity Analysis

Table 6-2 presents the real (actual) current values for demand, number of booths, and the processing time elapsed in the booths for the Laredo POEs. The S&B team compared these real values and added different scenarios to each variable to compare and analyze the resulting outputs. Both southbound and northbound directions were considered for each POE.

It is worth noting that the adjusted scenarios for commercial vehicles in the southbound direction of the Laredo–Colombia POE had very little impact on the output results. While this is expected due to the United States historically making more imports than exports and thus receiving more commercial vehicle traffic, the adjusted scenarios for the World Trade POE in the southbound direction still output similar results to their northbound counterpart.

The most negative impact across the board is the reduction of booth numbers at the POEs, peaking with a 2,100 percent difference at the Gateway POE in the northbound direction. This is attributed to the Gateway POE being the most congested POE for passenger vehicles as well as its current number of booths totaling four. The only exception to the negative impact of reducing available booths is on the Juarez–Lincoln bridge in the southbound direction; however, this is due to the bridge not being nearly as congested as the Gateway POE and having a greater number of current booths (15).

Table 6-2. Sensitivity Analysis Variables by Direction

Northbound

Variable	Scenario	Gateway			Juarez-Lincoln			Laredo-Colombia						World Trade		
		Passenger Vehicles			Passenger Vehicles			Passenger Vehicles			Commercial Vehicles			Commercial Vehicles		
		Value	Time (minutes)	%	Value	Time (minutes)	%	Value	Time (minutes)	%	Value	Time (minutes)	%	Value	Time (minutes)	%
POE Demand	Actual	3,405	41	-	10,535	29	-	282	8	-	910	21	-	7426	43	-
	-20%	2,724	18	-56%	8,428	24	-16%	226	8	0%	728	19	-11%	5,941	35	-18%
	+20%	4,086	120	194%	12,642	48	68%	338	8	0%	1,092	33	59%	8,911	50	16%
	+40%	4,767	290	611%	14,749	78	172%	395	8	6%	1,274	36	70%	10,396	86	99%
Number of Booths	Actual	4	41	-	15	29	-	4	8	-	4	21	-	12	43	-
	-2 booths	2	898	2100%	13	51	79%	2	41	452%	2	49	133%	10	54	25%
	+2 booths	6	12	-71%	17	23	-21%	6	7	-5%	6	18	-14%	14	36	-17%
	+4 booths	8	9	-77%	19	22	-23%	8	7	-5%	8	17	-19%	16	31	-29%
Proccesing Time (Booths)	Actual	2.0 - 3.0 min	41	-	2.0 - 3.0 min	29	-	2.0 - 3.0 min	8	-	3.0 - 4.0 min	21	-	3.0 - 4.0 min	43	-
	+30 seg	2.5 - 3.5 min	87	114%	2.5 - 3.5 min	49	73%	2.5 - 3.5 min	8	10%	3.5 - 4.5 min	28	33%	3.5 - 4.5 min	50	15%
	- 30 seg	1.5 - 2.5 min	21	-48%	1.5 - 2.5 min	22	-22%	1.5 - 2.5 min	7	-6%	2.5 - 3.5 min	18	-12%	2.5 - 3.5 min	38	-12%
	- 60 seg	1.0 - 2.0 min	11	-72%	1.0 - 2.0 min	19	-33%	1.0 - 2.0 min	7	-8%	2.0 - 3.0 min	16	-22%	2.0 - 3.0 min	28	-34%

Southbound

Variable	Scenario	Gateway			Juarez-Lincoln			Laredo-Colombia						World Trade		
		Passenger Vehicles			Passenger Vehicles			Passenger Vehicles			Commercial Vehicles			Commercial Vehicles		
		Value	Time (minutes)	%	Value	Time (minutes)	%	Value	Time (minutes)	%	Value	Time (minutes)	%	Value	Time (minutes)	%
POE Demand	Actual	3,403	37	-	10424	22	-	264	5	-	910	15	-	7426	33	-
	-20%	2,722	19	-48%	8,339	14	-35%	211	5	-9%	728	15	-1%	5,941	30	-8%
	+20%	4,084	85	133%	12,509	30	41%	317	6	3%	1,092	15	0%	8,911	48	45%
	+40%	3,811	199	445%	11,675	47	117%	296	6	14%	1,019	16	4%	8,317	73	121%
Number of Booths	Actual	4	37	-	15	22	-	4	5	-	4	15	-	12	33	-
	-2 booths	2	632	1630%	13	23	7%	2	40	635%	2	18	14%	10	69	111%
	+2 booths	6	13	-64%	17	17	-20%	6	5	-15%	6	15	-5%	14	25	-23%
	+4 booths	8	10	-74%	19	14	-37%	8	5	-13%	8	15	-5%	16	24	-28%
Proccesing Time (Booths)	Actual	2 - 3 min	37	-	2 - 3 min	22	-	2 - 3 min	5	-	3.0 - 4.0 min	15	-	3.0 - 4.0 min	33	-
	+30 seg	2.5 - 3.5 min	98	169%	2.5 - 3.5 min	24	9%	2.5 - 3.5 min	7	23%	3.5 - 4.5 min	16	4%	3.5 - 4.5 min	45	38%
	- 30 seg	1.5 - 2.5 min	18	-51%	1.5 - 2.5 min	13	-38%	1.5 - 2.5 min	5	-18%	2.5 - 3.5 min	15	-4%	2.5 - 3.5 min	28	-15%
	- 60 seg	1 - 2 min	9	-76%	1 - 2 min	5	-76%	1 - 2 min	4	-31%	2.0 - 3.0 min	15	-4%	2.0 - 3.0 min	24	-28%

CHAPTER 7: TRAFFIC & REVENUE FORECAST

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

Chapter 7: TRAFFIC & REVENUE FORECAST

The following chapter presents the traffic and revenue (T&R) estimates for the Laredo International Bridge System over a forecast period of 20 years and presents a summary of the results from the BMP alternatives analysis. C&M employed its network-based Binational Assignment Model to illustrate traffic for a typical working day and to perform future scenario runs to forecast traffic for the years 2025, 2030, and 2040 (see Chapters 5 and 6 for details regarding the modeling effort). To determine the T&R of each POE and for each model year, C&M approximated the crossing time and corresponding traffic for each Laredo POE through its discrete choice model and estimated the southbound transactions that correspond to revenue for the City of Laredo. C&M then incorporated this information into its post-processing model designed to estimate T&R on an annual basis.

The team also incorporated the results of its traffic data analysis and based on experience with existing international bridge facilities, utilized a series of assumptions regarding revenue days and incorporated many details from the current operations such as toll rate, commercial vehicle composition (FAST, Regular, Empty), types of lanes used (SENTRI, Regular), and programs considered in the current operation (C-TPAT). Other assumptions used in the development of the post-processing model are discussed in this chapter.

Additionally, this chapter summarizes the results of the team's alternatives analysis, demonstrating the benefits to the City of Laredo if all alternatives are considered as proposed in the City of Laredo International Bridge System Master Plan.

7.1. Toll Collection System and Schedule

The team's analysis assumes that vehicular toll collection systems for southbound lanes at all Laredo POEs meet industry standards and are properly installed and functional. Tolls are collected by means of electronic toll collection (ETC) and cash. The ETC system electronically debits the account of the registered vehicle owner, relying on overhead gantries that detect transponders mounted inside vehicles, thus registering the appropriate toll without requiring vehicles to stop.

7.2. Toll Rate

Since January 2018, the City of Laredo has maintained toll rates for crossing the U.S./Mexico border in the southbound direction.[62] The current toll rate (in 2019 dollars) is $3.50 for two-axle passenger vehicles, with an increase of $1.75 per axle. For commercial vehicles, the current toll rate is $4.75 per axle.

Based on 2021 prices, Figure 7-1 and Figure 7-2 compare the toll rates of the Laredo POEs to various POEs along the Texas U.S./Mexico border for passenger vehicles and commercial vehicles, respectively. As shown, the Laredo POE toll rates are within the range of other POEs at the Texas/Mexico border.

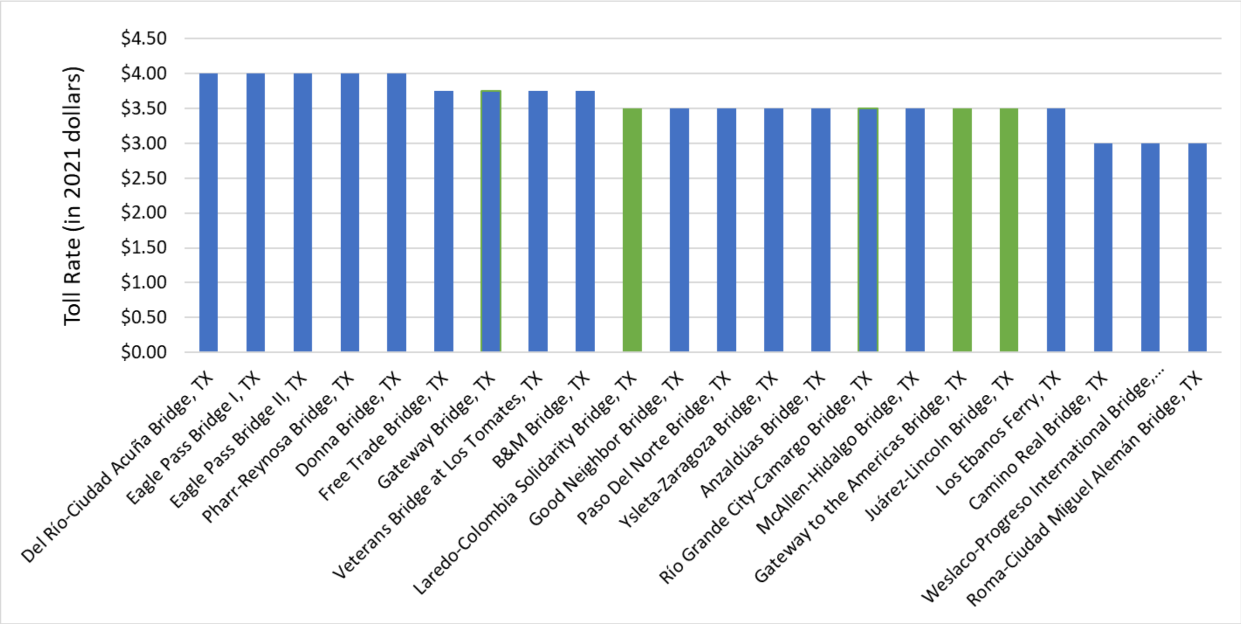


Figure 7-1. 2021 Passenger Vehicle Toll Rates Along the U.S./Mexico Border

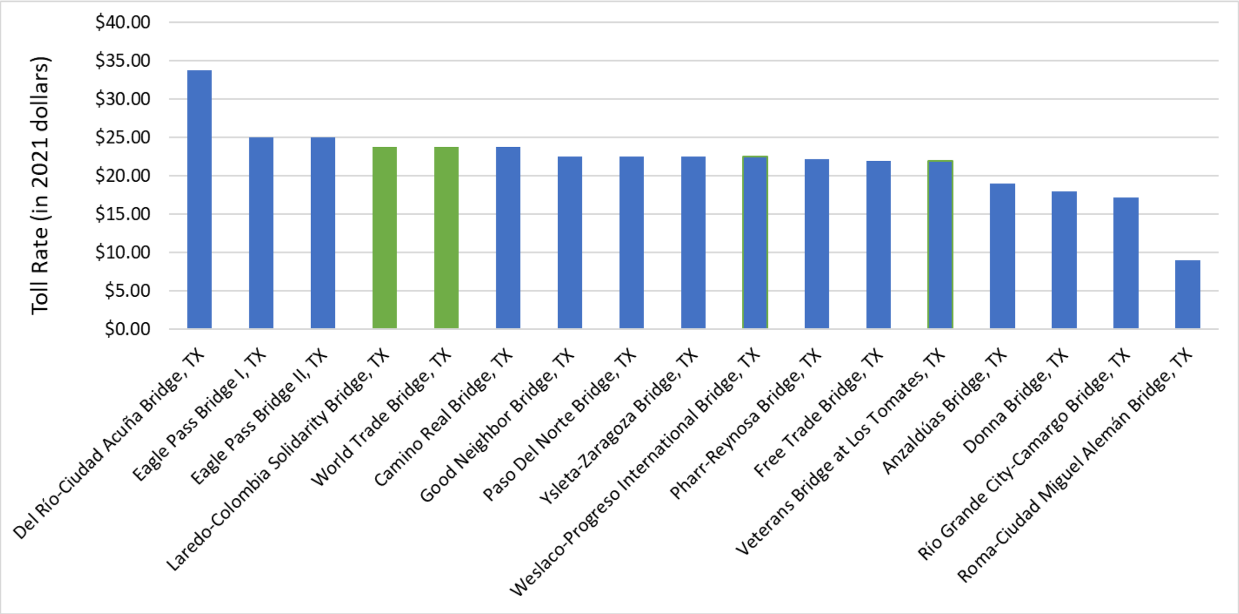


Figure 7-2. 2021 Commercial Vehicle Toll Rates Along the U.S./Mexico Border

7.3. Discrete Choice Model

Discrete choice models are used to estimate traffic demand for alternative facilities, such as the Laredo POEs. The discrete choice model developed by the team for the present analysis is a multinomial logit selection model, which is a probabilistic model that indicates the proportion of users who would choose a particular POE given its comparative advantages in terms of time savings and the user's availability to pay the fee. The final product of the logit model is a probability that reflects the share of trips to each POE between any given OD pair.

The S&B team's discrete choice model uses the following general multinomial logit function equation to split demand between each Laredo POE:

$$P_{ij}^{n} = \frac{\mathrm{e}^{\mathrm{Utility}_{ij}^{n}}}{\mathrm{e}^{\mathrm{Utility}_{ij}^{1}} + \mathrm{e}^{\mathrm{Utility}_{ij}^{2}} + \cdots + \mathrm{e}^{\mathrm{Utility}_{ij}^{n}}}$$

Where:

P_{ij}^{n}= Probability of selecting POE *n* for each origin TAZ *i* to destination TAZ *j*

e = Base of natural logarithm

$\mathrm{Utility}_{ij}^{n}$= The utility for passenger vehicles

$\mathrm{Utility}_{ij}^{n}$= Constant ^{n} + α * Time_{ij}^{n} + β * Toll_{ij}^{n}

α = Coefficient of time savings

Time_{ij}^{n} = Border crossing time using POE *n*, in minutes

β = Coefficient of cost

Toll_{ij}^{n} = Toll of POE *n*, in dollars

$\mathrm{Utility}_{ij}^{n}$= The utility for commercial vehicles

$\mathrm{Utility}_{ij}^{n}$= Constant ^{n} + α * Time_{ij}^{n} + β * Cost_{ij}^{n}

α = Coefficient of time savings

Time_{ij}^{n} = Border crossing time using POE *n*, in minutes

β = Coefficient of cost

$Cost_{ij}^{n}$= Toll_{ij}^{n} + θ * Length_{ij}^{n}

θ = dollars per mile

Toll_{ij}^{n} = Toll of POE *n*, in dollars

Length_{ij}^{n} = Total length from origin and destination using POE *n*, in miles

The passenger vehicle and commercial vehicle discrete choice models discussed above were incorporated into the traffic assignment procedure using the TransCAD macro language (GISDK). This model performs several iterations, distributing the total border-crossing trips among the Laredo POE by optimizing the travel time between the binational OD pairs.

The results from the discrete choice model are presented in Table 7-1 in terms of daily Laredo POE traffic volumes by direction and shares for model years 2025, 2030, and 2040.

Table 7-1. Daily Border Crossing Model Volumes by POE

Year	Category	Gateway	Juarez-Lincoln	Colombia	World Trade	Bridge 4/5
2025	Passenger vehicles	6,187	20,893	885	-	2,205
	Commercial vehicles	-	-	3,654	14,558	2,092
	Total vehicles	6,187	20,893	4,539	14,558	4,297
2030	Passenger vehicles	6,251	21,039	1,873	-	2,260
	Commercial vehicles	-	-	4,483	16,684	2,896
	Total vehicles	6,251	21,039	6,356	16,684	5,156
2040	Passenger vehicles	6,474	22,831	2,071	-	2,744
	Commercial vehicles	-	-	6,464	19,754	5,297
	Total vehicles	6,474	22,831	8,535	19,754	8,040

7.4. Traffic and Revenue Assumptions

The T&R forecast is based on a set of post-processing assumptions. The assumptions used in this study are described in detail below and summarized in Table 7-2

- The toll rates of the existing POEs for passenger vehicles and commercial vehicles are assumed to remain the same as they are today and to grow uniformly with the Consumer Price Index's (CPI) annual growth rate of 2.0 percent.
- Border programs (FAST, SENTRI, and Ready Lanes) are assumed to function as described in Appendix A, with the assumption that the City of Laredo fully implements the BMP.
- The time savings from ETC are not significant compared to cash transaction, since all vehicles must pass the customs inspection on each side of the border; therefore, the team did not apply different time savings to ETC or non-ETC users.
- To develop annual T&R figures, the team estimated 340 revenue days for passenger vehicles in the southbound direction, and 280 for commercial vehicles based on an analysis of weekday and weekend traffic counts.
- The T&R forecast presents southbound traffic only. Northbound revenue is not considered in this T&R analysis because it is collected by the Mexican Concessioner.

- A leakage rate of 0 percent is assumed regarding toll collection, as committing toll violations within POE facilities is virtually impossible given the security measures in place.
- The listed roadway improvements from the Laredo MTP 2020-2045 have been implemented for the U.S. portion of the study.
- It was assumed that there would not be a change in the mode choice. Moreover, the use of modes of transportation within the study area will remain unchanged during the forecast period.
- Trusted trader programs such as C-TPAT and FAST are assumed to be continued for the duration of the forecast period.
- The proposed Laredo Bridge 4/5 POE is assumed to be operated by a private concessioner.

Table 7-2. Traffic and Revenue Assumptions

Item	Assumptions	
Average # of Commercial Vehicle Axles	4.36	
	Commercial Vehicle	Passenger Vehicle
Hours of Operation	World Trade: 7:00 a.m. - midnight	24 hours per day.
	Colombia Solidarity: 8:00 a.m. - midnight	
Toll Rate	CVs $20.70	PVs $3.50
Revenue Days	280	340

7.5. Traffic and Revenue Results

This section presents the results of the team's T&R analysis in terms of annual toll transactions and revenue for southbound crossings using the City of Laredo International Bridge System. All revenues are presented in nominal dollars, while the corresponding tables also presents revenue in 2021 dollars. The model forecast years were interpolated as needed to obtain annual transactions and revenue figures by employing a post-processing model.

The annual T&R forecast for the City of Laredo International Bridge System is presented in Table 7-3 and illustrated in Figure 7-3. Additionally, the T&R forecasts for each POE in the City of Laredo International Bridge System are presented in Table 7-4 through Table 7-7.

In 2021, the team forecasts approximately 4.2 million southbound passenger vehicle transactions for the Laredo International Bridge System, which translates to approximately $14.7 million in revenue. In years 2030 and 2040, 5.0 and 5.4 million passenger vehicle crossings are estimated, respectively. This generates revenue of approximately $21.1 million in 2030 and $27.5 million in 2040. Regarding commercial vehicles, approximately 2.3 million transactions are forecasted in 2021, 3.0 million in 2030, and 3.7 million in 2040. These transactions translate into revenues of approximately $48.2 million in 2021, $73.7 million in 2030, and $111.5 million in 2040.

Table 7-3. Southbound Annual Transactions and Revenue – Laredo International Bridge System

Year	Transactions			Revenue (in 2021 Dollars)			Revenue (in Nominal Dollars)		
	Passenger Vehicles	Commercial Vehicles	Total	Passenger Vehicles	Commercial Vehicles	Total	Passenger Vehicles	Commercial Vehicles	Total
2021	4,190,000	2,315,000	6,505,000	$14,667,000	$47,920,000	$62,617,000	$14,667,000	$47,920,000	$62,587,000
2022	4,932,000	2,462,000	7,394,000	$17,262,000	$50,963,000	$68,240,000	$17,608,000	$51,983,000	$69,591,000
2023	5,031,000	2,594,000	7,625,000	$17,610,000	$53,696,000	$71,340,000	$18,321,000	$55,865,000	$74,186,000
2024	5,089,000	2,712,000	7,801,000	$17,810,000	$56,138,000	$73,965,000	$18,900,000	$59,574,000	$78,474,000
2025	4,822,000	2,559,000	7,381,000	$16,876,000	$52,971,000	$69,876,000	$18,267,000	$57,338,000	$75,605,000
2026	4,864,000	2,643,000	7,507,000	$17,022,000	$54,710,000	$71,756,000	$18,794,000	$60,405,000	$79,199,000
2027	4,906,000	2,726,000	7,632,000	$17,171,000	$56,428,000	$73,635,000	$19,337,000	$63,548,000	$82,885,000
2028	4,948,000	2,810,000	7,758,000	$17,317,000	$58,167,000	$75,514,000	$19,891,000	$66,816,000	$86,707,000
2029	4,990,000	2,894,000	7,884,000	$17,467,000	$59,906,000	$77,393,000	$20,465,000	$70,190,000	$90,655,000
2030	5,032,000	2,977,000	8,009,000	$17,613,000	$61,624,000	$79,272,000	$21,049,000	$73,646,000	$94,695,000
2031	5,067,000	3,049,000	8,116,000	$17,738,000	$63,114,000	$80,884,000	$21,622,000	$76,936,000	$98,558,000
2032	5,103,000	3,121,000	8,224,000	$17,859,000	$64,605,000	$82,496,000	$22,206,000	$80,328,000	$102,534,000
2033	5,138,000	3,193,000	8,331,000	$17,982,000	$66,095,000	$84,108,000	$22,806,000	$83,825,000	$106,631,000
2034	5,173,000	3,265,000	8,438,000	$18,106,000	$67,586,000	$85,720,000	$23,423,000	$87,430,000	$110,853,000
2035	5,208,000	3,337,000	8,545,000	$18,228,000	$69,076,000	$87,332,000	$24,052,000	$91,144,000	$115,196,000
2036	5,243,000	3,409,000	8,652,000	$18,353,000	$70,567,000	$88,944,000	$24,700,000	$94,974,000	$119,674,000
2037	5,278,000	3,481,000	8,759,000	$18,475,000	$72,057,000	$90,558,000	$25,362,000	$98,919,000	$124,281,000
2038	5,314,000	3,552,000	8,866,000	$18,596,000	$73,526,000	$92,170,000	$26,039,000	$102,954,000	$128,993,000
2039	5,349,000	3,624,000	8,973,000	$18,722,000	$75,016,000	$93,782,000	$26,740,000	$107,142,000	$133,882,000
2040	5,384,000	3,696,000	9,080,000	$18,843,000	$76,507,000	$95,394,000	$27,450,000	$111,457,000	$138,907,000

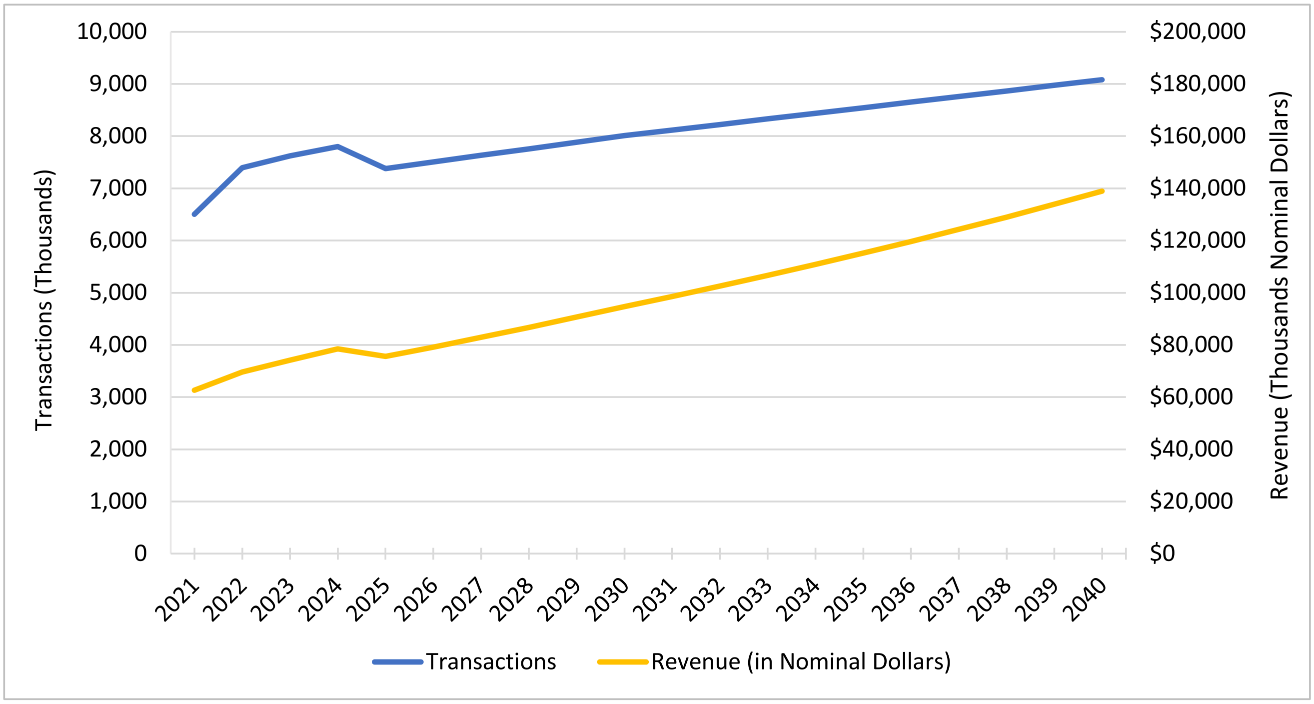


Figure 7-3. Southbound Annual Transactions and Revenue – Laredo International Bridge System

Table 7-4. Southbound Annual Transactions and Revenue – Gateway POE, Passenger Vehicles

Year	Transactions	Revenue (in 2021 Dollars)	Revenue (in Nominal Dollars)
2021	1,004,000	$3,514,000	$3,514,000
2022	1,182,000	$4,136,000	$4,219,000
2023	1,205,000	$4,219,000	$4,389,000
2024	1,219,000	$4,267,000	$4,528,000
2025	1,113,000	$3,896,000	$4,217,000
2026	1,115,000	$3,903,000	$4,309,000
2027	1,117,000	$3,910,000	$4,403,000
2028	1,119,000	$3,917,000	$4,499,000
2029	1,121,000	$3,925,000	$4,599,000
2030	1,123,000	$3,932,000	$4,699,000
2031	1,126,000	$3,941,000	$4,804,000
2032	1,129,000	$3,951,000	$4,913,000
2033	1,132,000	$3,961,000	$5,024,000
2034	1,134,000	$3,970,000	$5,136,000
2035	1,137,000	$3,980,000	$5,252,000
2036	1,140,000	$3,990,000	$5,370,000
2037	1,143,000	$3,999,000	$5,490,000
2038	1,145,000	$4,009,000	$5,614,000
2039	1,148,000	$4,019,000	$5,740,000
2040	1,151,000	$4,028,000	$5,868,000

Table 7-5. Southbound Annual Transactions and Revenue – Juarez-Lincoln POE, Passenger Vehicles

Year	Transactions	Revenue (in 2021 Dollars)	Revenue (in Nominal Dollars)
2021	3,107,000	$10,876,000	$10,876,000
2022	3,657,000	$12,800,000	$13,056,000
2023	3,731,000	$13,058,000	$13,586,000
2024	3,773,000	$13,207,000	$14,015,000
2025	3,610,000	$12,637,000	$13,679,000
2026	3,617,000	$12,660,000	$13,978,000
2027	3,624,000	$12,683,000	$14,283,000
2028	3,630,000	$12,707,000	$14,596,000
2029	3,637,000	$12,730,000	$14,915,000
2030	3,644,000	$12,753,000	$15,241,000
2031	3,673,000	$12,855,000	$15,670,000
2032	3,702,000	$12,956,000	$16,109,000
2033	3,731,000	$13,058,000	$16,561,000
2034	3,760,000	$13,159,000	$17,023,000
2035	3,789,000	$13,261,000	$17,498,000
2036	3,818,000	$13,362,000	$17,983,000
2037	3,847,000	$13,464,000	$18,483,000
2038	3,876,000	$13,565,000	$18,994,000
2039	3,905,000	$13,667,000	$19,520,000
2040	3,934,000	$13,768,000	$20,057,000

Table 7-6. Southbound Annual Transactions and Revenue – Colombia Solidarity POE

Year	Transactions			Revenue (in 2021 Dollars)			Revenue (in Nominal Dollars)		
	Passenger Vehicles	Commercial Vehicles	Total	Passenger Vehicles	Commercial Vehicles	Total	Passenger Vehicles	Commercial Vehicles	Total
2021	79,000	222,000	301,000	$277,000	$4,595,000	$4,872,000	$277,000	$4,595,000	$4,872,000
2022	93,000	236,000	329,000	$326,000	$4,885,000	$5,211,000	$333,000	$4,983,000	$5,316,000
2023	95,000	248,000	343,000	$333,000	$5,134,000	$5,467,000	$346,000	$5,341,000	$5,687,000
2024	96,000	260,000	356,000	$336,000	$5,382,000	$5,718,000	$357,000	$5,711,000	$6,068,000
2025	98,000	372,000	470,000	$343,000	$7,700,000	$8,043,000	$371,000	$8,335,000	$8,706,000
2026	131,000	393,000	524,000	$459,000	$8,135,000	$8,594,000	$507,000	$8,982,000	$9,489,000
2027	165,000	413,000	578,000	$578,000	$8,549,000	$9,127,000	$651,000	$9,628,000	$10,279,000
2028	198,000	433,000	631,000	$693,000	$8,963,000	$9,656,000	$796,000	$10,296,000	$11,092,000
2029	232,000	453,000	685,000	$812,000	$9,377,000	$10,189,000	$951,000	$10,987,000	$11,938,000
2030	265,000	473,000	738,000	$928,000	$9,791,000	$10,719,000	$1,109,000	$11,701,000	$12,810,000
2031	269,000	502,000	771,000	$942,000	$10,391,000	$11,333,000	$1,148,000	$12,667,000	$13,815,000
2032	272,000	531,000	803,000	$952,000	$10,992,000	$11,944,000	$1,184,000	$13,667,000	$14,851,000
2033	275,000	559,000	834,000	$963,000	$11,571,000	$12,534,000	$1,221,000	$14,675,000	$15,896,000
2034	279,000	588,000	867,000	$977,000	$12,172,000	$13,149,000	$1,264,000	$15,746,000	$17,010,000
2035	282,000	617,000	899,000	$987,000	$12,772,000	$13,759,000	$1,302,000	$16,852,000	$18,154,000
2036	286,000	645,000	931,000	$1,001,000	$13,352,000	$14,353,000	$1,347,000	$17,970,000	$19,317,000
2037	289,000	674,000	963,000	$1,012,000	$13,952,000	$14,964,000	$1,389,000	$19,153,000	$20,542,000
2038	292,000	703,000	995,000	$1,022,000	$14,552,000	$15,574,000	$1,431,000	$20,376,000	$21,807,000
2039	296,000	732,000	1,028,000	$1,036,000	$15,152,000	$16,188,000	$1,480,000	$21,641,000	$23,121,000
2040	299,000	760,000	1,059,000	$1,047,000	$15,732,000	$16,779,000	$1,525,000	$22,919,000	$24,444,000

Table 7-7. Southbound Annual Transactions and Revenue – World Trade POE, Commercial Vehicles

Year	Transactions	Revenue (in 2021 Dollars)	Revenue (in Nominal Dollars)
2021	2,093,000	$43,325,000	$43,325,000
2022	2,226,000	$46,078,000	$47,000,000
2023	2,346,000	$48,562,000	$50,524,000
2024	2,452,000	$50,756,000	$53,863,000
2025	2,187,000	$45,271,000	$49,003,000
2026	2,250,000	$46,575,000	$51,423,000
2027	2,313,000	$47,879,000	$53,920,000
2028	2,377,000	$49,204,000	$56,520,000
2029	2,441,000	$50,529,000	$59,203,000
2030	2,504,000	$51,833,000	$61,945,000
2031	2,547,000	$52,723,000	$64,269,000
2032	2,590,000	$53,613,000	$66,661,000
2033	2,634,000	$54,524,000	$69,150,000
2034	2,677,000	$55,414,000	$71,684,000
2035	2,720,000	$56,304,000	$74,292,000
2036	2,764,000	$57,215,000	$77,004,000
2037	2,807,000	$58,105,000	$79,766,000
2038	2,849,000	$58,974,000	$82,578,000
2039	2,892,000	$59,864,000	$85,501,000
2040	2,936,000	$60,775,000	$88,538,000

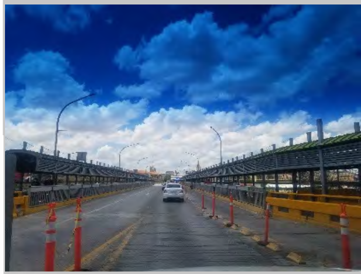
7.6. Laredo International Bridge System Master Plan Results

This section describes the estimated improvements to the Laredo International Bridge System Master Plan based on the full implementation of the BMP. The fully executed BMP will include all alternatives that are proposed in Appendix A. Table 7-8 summarizes the volume throughput, crossing time, waiting time, and queue size and length at each POE by vehicle type.

Table 7-8. Laredo International Bridge System Master Plan Results by POE

Year	Evaluation Criteria	Direction	Gateway (Laredo POE)		Juarez-Lincoln POE		Colombia POE		World Trade POE		Bridge 4/5	
			PV	CV	PV	CV	PV	CV	PV	CV	PV	CV
2025	Volume Throughput	MX-US	2,913	-	10,274	-	597	2,324	-	6,748	1,254	1,180
		US-MX	3,274	-	10,619	-	288	1,330	-	7,810	951	912
	Total Crossing Time (min)	MX-US	6.9	-	9.3	-	8.2	26.5	-	33.4	8.4	24.6
		US-MX	17.4	-	7.3	-	7.3	24.5	-	24.3	7.3	24.3
	Waiting Time (min)	MX-US	0.0	-	1.2	-	0.1	2.1	-	2.9	0.4	0.3
		US-MX	9.6	-	0.0	-	0.0	0.0	-	0.2	0.0	0.0
	Vehicles in the Queue	MX-US	5.9	-	29.4	-	0.3	1.8	-	29.2	1.0	0.6
		US-MX	7.9	-	0.4	-	0.0	1.1	-	6.2	0.1	1.1
	Queue Length (miles)	MX-US	0.0	-	0.0	-	0.0	0.0	-	0.0	0.0	0.0
		US-MX	0.0	-	0.0	-	0.0	0.0	-	0.0	0.0	0.0
2030	Volume Throughput	MX-US	2,947	-	10,322	-	1,093	2,793	-	7,741	1,301	1,617
		US-MX	3,304	-	10,717	-	780	1,690	-	8,943	959	1,279
	Total Crossing Time (min)	MX-US	6.9	-	9.4	-	8.4	24.6	-	38.8	8.5	25.9
		US-MX	17.8	-	7.3	-	7.3	24.8	-	24.8	7.4	24.5
	Waiting Time (min)	MX-US	0.0	-	1.2	-	0.3	3.5	-	7.4	0.5	0.5
		US-MX	9.9	-	0.0	-	0.0	0.0	-	0.5	0.0	0.0
	Vehicles in the Queue	MX-US	6.3	-	31.3	-	0.8	3.6	-	72.3	1.2	1.2
		US-MX	8.3	-	0.5	-	0.0	1.9	-	9.4	0.1	1.2
	Queue Length (miles)	MX-US	0.0	-	0.0	-	0.0	0.0	-	0.0	0.0	0.0
		US-MX	0.0	-	0.0	-	0.0	0.0	-	0.0	0.0	0.0
2040	Volume Throughput	MX-US	3,089	-	11,261	-	1,191	3,749	-	9,268	1,467	2,896
		US-MX	3,385	-	11,570	-	880	2,715	-	10,486	1,277	2,400
	Total Crossing Time (min)	MX-US	6.9	-	10.0	-	8.4	60.5	-	55.6	8.7	26.7
		US-MX	19.2	-	7.4	-	7.3	24.7	-	26.4	7.4	24.4
	Waiting Time (min)	MX-US	0.0	-	1.9	-	0.4	32.3	-	21.9	0.6	4.4
		US-MX	11.2	-	0.0	-	0.0	0.1	-	1.5	0.0	0.0
	Vehicles in the Queue	MX-US	9.6	-	47.9	-	1.0	38.2	-	189.0	1.6	7.6
		US-MX	11.7	-	0.9	-	0.0	2.2	-	15.9	0.1	1.9
	Queue Length (miles)	MX-US	0.0	-	0.0	-	0.0	0.0	-	0.8	0.0	0.0
		US-MX	0.0	-	0.0	-	0.0	0.0	-	0.0	0.0	0.0

Note: PV = Passenger vehicle; CV = Commercial vehicle



SECTION IV: DEVELOPMENT OF OPTIONS

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

SECTION IV: DEVELOPMENT OF OPTIONS

DEVELOPMENT OF ALTERNATIVES

Based on meetings and input from the public and private stakeholders, and the City of Laredo it was decided to evaluate various alternatives that would address the deficiencies at the POEs. These alternatives were evaluated, to streamline and increase the throughput and collectively as a system.

Site Alternative	Brief Description
A	World Trade Bridge: New Bridge Span (south of existing bridge)
B	World Trade Bridge: Two Additional FAST Lanes
C	World Trade Bridge: Entry Primary Inspection Lanes Expansion
D	Mines Rd. Freeway (IH-35 to SH 255)
E	Direct connection from WTB to Killam Industrial Blvd. (IH-69 to IH-35 via DC 1 exit to Tres Equis underpass)
F	Juarez-Lincoln International Bridge: Passenger Vehicle Inspection with Double-Stacked Booths
G	Permanently Moving Empty Commercial vehicles to Colombia POE, 2025-204
H	Colombia Bridge: Proposal of an Overweight/Oversize (OW/OS) Corridor and Implementing a Daily OW/OS Permit Program
I	Safety Improvement (adding inside/outside shoulders) at MEX-2 Hwy between World Trade Bridge and Colombia Bridge
J	La Gloria-Colombia Highway (Super 2 design)
K	Laredo Outer Loop (New Alignment)
L	Expanding Mines Rd. to Eagle Pass (Super 2 design)
M	Vallecillo Extension (IH-35 to US 59 and SH 359)
N	Gateway to the Americas International Bridge: Expansion of the Sidewalk
O	Juarez-Lincoln International Bridge: Intersection Improvements
P	Improving Las Tiendas Road (5-Lane divided section)
Q	New International Bridge 4/5 to SL 20
R	New Bridge 4/5 with Laredo Outer Loop
S	Gateway to the Americas International Bridge: Pedestrian Only Crossing

A. World Trade Bridge: New Bridge Span (south of existing bridge)

Project Description:
Currently, the World Trade Bridge operates at a maximum 15 primary inspection booths including three FAST inspection booths. The number of lanes at the WTB bridge span are four northbound and four southbound lanes, including one separate FAST lane in the northbound direction. This alternative proposes the construction of a new direct bridge structure with eight regular northbound lanes. The proposal includes the conversion of the existing WTB bridge span into six southbound regular lanes and two northbound FAST lanes.

Total Conceptual Cost: $15,927,346.

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 1.):

- This alternative was ranked number 3 out of three "WTB Alternatives" group due to its highest conceptual cost and least operational improvement within the POE.
- This alternative does not provide a solution to reduce congestion at this POE regarding total volume throughput, crossing and waiting times.
- POE operations will be affected on both sides.

B. World Trade Bridge: Two Additional FAST Lanes

Project Description:
Currently, the World Trade Bridge is expanding its current operation of three FAST lanes to a separate FAST lane inspection facility of four primary inspection booths in the center of the WTB. This alternative will expand the four FAST primary inspection booths to a total of six primary inspection booths. The construction will include two additional FAST lanes on the existing WTB span and two additional FAST primary inspection booths.

Total Conceptual Cost: $4,665,646.

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 2.):

- This alternative was ranked number 1 within the three "WTB Alternatives" group due to its lowest conceptual cost and criteria resulting in minimal operational disruption within the POE (per CBP).
- Crossing and waiting times are substantially reduced thus making the alternative a viable solution for relieving congestion at World Trade Bridge POE in 20 years.
- Crossing and waiting times are drastically reduced at Colombia-Solidarity POE, however the total volume throughput are adversely reduced.

C. World Trade Bridge: Entry Primary Inspection Lanes Expansion

Project Description:
The commercial Vehicles at the WTB cross the four lanes of the WTB Bridge span in the northbound direction. At the World Trade Bridge CBP facility, these four lanes convert into only three entry lanes. After about half a mile, these three lanes will open to the 15 lanes connecting to the primary inspection booths. This alternative improves the expansion of the WTB CBP facility entering lanes, including three additional lanes and primary inspection booths to expand existing capacity to five entry lanes at the CBP facility entry and three additional primary inspection booths to a total of 18 primary inspection booths for regular and empty commercial vehicles. The four FAST lanes that are under construction are also considered in this Alternative as part of the base scenario. Additionally, this alternative will add two additional inspections booths for the vehicle inspections after the primary inspection.

Total Conceptual Cost: $5,336,109.

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 3.)**:**
- This alternative was ranked number 2 within the three "WTB Alternatives" group due to its second lowest conceptual cost and operational disruption within the POE (e.g. relocation/elimination of existing POE structures - kennel building, staff parking areas; temporary closure of several primary and secondary inspection lanes, etc.) per discussions with CBP.
- Crossing and waiting times are substantially reduced at World Trade Bridge POE in 20 years.
- Crossing and waiting times are drastically reduced at Colombia-Solidarity POE, however the total volume throughput are adversely reduced.

D. Mines Rd. Freeway (IH-35 to SH 255)

Project Description:

Mines Road is an 18.3-mile one-lane per direction freeway connecting Dolores Boulevard (Colombia POE entry) and IH-35. This alternative includes upgrading Mines Road to a limited-access highway grade facility from the Santa Maria Avenue (IH-35) intersection with FM 1472 to Dolores Boulevard near the Colombia Solidarity Bridge.

Total Conceptual Cost (includes Const., R.O.W., Utilities, & Contingencies): $1,053,118,000.

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 4.)**:**
- Limitation (No-Build): Extraordinarily continues to decrease from an overall average level of service "F" in 2030 to a lower end level of service of "F" in 2040.
- Improvement (with alternative): Extraordinarily operates at an overall level of service of "A" in 2030 and slightly decreases to an overall level of service of "B" in 2040.
- Conceptual Construction Cost = $341M

- 200 feet add'l R.O.W. (partial) required from IH-35 to approx. Sombreretillo Creek = $528M.
- Utilities (partial) required from IH-35 to approx. Sombreretillo Creek = $ 80M.

Total Utilities and ROW Conceptual Cost (57.7%) = **$608M**

- This alternative has several major issues, the highest being the conceptual cost to purchase an additional urban 200 feet wide right-of-way property acquisition to accommodate an urban freeway for approximately $528,000,000 and associated adjustment and/or relocation of all affected existing utilities for approximately $80,000,000; major operational (traffic control) disruption from IH-35 to approximately Pan American Blvd. and other detours.

E. Direct connection from WTB to Killam Industrial Blvd. (IH-69 to IH-35 via DC 1 exit to Tres Equis underpass)

Project Description:

Killam Industrial Boulevard is a road that directly connects El Portal Industrial Park and Killam Industrial Park with IH-35. However, the connection is only in the southbound direction. The alternative evaluates the construction of a two-lane braided ramp access to northbound IH-35 with an underpass and four undivided westbound roadway lanes connecting to Killam Industrial Boulevard. This Alternative will give access from IH-35 to Killam Industrial Blvd. in the northbound and southbound direction, permitting commercial vehicles exiting the WTB to access the industrial parks by using IH-69 and IH-35.

Total Conceptual Cost: $13,636,689.

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 5.)**:**

- Limitation (No-Build): FM 1472 (from Las Cruces Dr. to SH 255) continues to operate at an overall level of service of "E" in 2025 and "E" through 2040; US 59 (from IH-35 to Saunders St.) continues to operate at an overall level of service of "B" in 2025 and "C" through 2040.
- Improvement (with alternative): FM 1472 (from Las Cruces Dr. to SH 255) continues to operate at an overall level of service of "F" in 2025 and "E" through 2040; US 59 (from IH-35 to Saunders St.) continues to operate at an overall level of service of "B" in 2025 and improves to "B" through 2040.
- Reduces route mileage from WTB (IH-69) to Killam Industrial Blvd. along IH-35 ("Tres Equis" bridge) for commercial vehicles, that inadvertently or not, use Direct Connector No. 1 at IH-35 instead of exiting from IH-69 to the IH-35 East Frontage Road and are required to travel to Carrier Dr. instead and return back to "Tres Equis" bridge by approximately 8 miles.
- Direct connection (no traffic signals between WTB and "Tres Equis" bridge) from IH-35/IH-69 Direct Connector (DC) #1 via proposed DC #1 exit ramp to "Tres Equis" bridge.
- Proposed road from IH-35 "Tres Equis" bridge provides access to Union Pacific Blvd. at the existing northeast quadrant of the Milo Distribution Center versus the current and only route to this area through McPherson Road or US 59 WB frontage road.
- Provides direct access from Milo Distribution Center to IH-35 and to El Portal Industrial Park, Killam Industrial Park, Interamerica Distribution Park, and International Trade Center.

- This alternative was ranked number 1 within the five "US Highways Alternatives" group due to several major issues. It has the lowest conceptual cost, there are no POE operation disruptions at WTB, and is very similar to one of TxDOT's alternative in their overall schematic study regarding conversion of IH-35 into a urban/suburban freeway between IH-35 and Carriers Drive. For informational purposes only, TxDOT's alternative limits are also on northbound IH-35 Milo Interchange between Direct Connector No. 1 (DC #1) and the Tres Equis Underpass consisting of a braided ramp configuration which consists of providing a DC #1 dual-purpose overpass bridge entrance ramp to NB IH-35 mainlanes and exit ramp to the east frontage road and unto Tres Equis Underpass. The TxDOT alternative also proposes an at-grade IH-35 northbound mainlane exit ramp to the east frontage road under the overpass bridge.
- The Alternative "E" configuration provides an additional point of ingress and egress from northbound IH-35 to the eastern edge of El Portal Industrial Park and Killam Industrial Park. In addition, the proposed road east of IH-35 from Tres Equis Underpass will provide access to Milo Distribution Center and San Isidro East Point Center thus relieving congestion along McPherson Road north of US 59.
- Alternative "E" provides increased mobility and circulation within the immediate industrial parks and highway network surrounding the World Trade Bridge Port of Entry.

F. Juarez-Lincoln International Bridge: Passenger Vehicle Inspection with Double-Stacked Booths

Project Description:
Implementation of double-stacked booths at the Juarez-Lincoln POE from 14 existing inspection booths to 28 inspection booths, permitting at each double stack/tandem booth the inspection of two passenger vehicles at the same time.

Total Conceptual Cost: <u>$500,000.</u>

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 6.)**:**
- This alternative is feasible since there is enough available space within the POE to implement it.
- Crossing time and waiting time are significantly reduced by the installation of a double-stacked booths at the Juarez-Lincoln POE.

G. Permanently Moving Empty Commercial Vehicles to Colombia Port of Entry (POE)

Project Description:

Effective December 7, 2020, CBP[63] announced that all empty commercial vehicles entering Laredo POEs in the northbound direction will be redirected to the Colombia Solidarity Bridge, with the exception of bona fide participants in trusted trader programs (CBP-Trade Partnership Against Terrorism [C-TPAT], FAST). This redirection of empty tractors and trailers through the Colombia POE will help alleviate wait times at the World Trade POE. The proposal of this pilot program will be up for review in June 2021. The S&B team proposes in this Alternative to permanently implement that empty commercial vehicles entering Laredo

POEs in the northbound direction will be redirected to the Colombia Solidarity Bridge, excluding the empty commercial vehicle that participants in trusted trader programs.

Total Conceptual Cost: Not applicable

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 7.):

- The alternative increases volume throughput significantly (approximately 1,200 commercial vehicles) at Colombia-Solidarity POE thus becoming the second most used bridge in Texas for northbound traffic.
- The utilization of Colombia-Solidarity POE by all empty commercial vehicles is doubled which now substantially affords (provides an opportunity) for more full cargo commercial vehicles (tractor-trailer) to utilize the WTB from MEX to the US.
- Currently there are 19 registered customs brokers at Colombia-Solidarity POE and compared to 223 at World Trade Bridge out of a total of 816 customs brokers in Mexico.

- Permits to cross from MEX to US are only available for four independent aduanas (customs) within Mexico. In the United States, permitted customs brokers are allowed to cross at any customs location. However, a Mexico permit may be registered at any given aduana, thereafter that permit holder will select only three additional aduanas (customs) of his or her choosing. Due to the limited commercial and/or industrial infrastructure available at the Colombia-Solidarity POE, when compared to that of the World Trade Bridge POE, it stands at a disadvantage. Some disadvantages due to its geographical location, as discussed with Mexican customs brokers, of crossing at Colombia-Solidarity POE from MEX into the US instead of at the World Trade Bridge POE are: losing time and money, extra wear and tear on their commercial vehicles, lack of commercial vehicle drivers, longer hours of processing operations at US warehouses.

- The alternative also decreases volume throughput significantly (approximately 1,200 commercial vehicles) at World Trade Bridge POE for northbound traffic, but substantially increases the crossing and waiting times for the next 20 years, thus making the alternative not a viable solution for relieving congestion at World Trade Bridge POE.

H. Colombia Bridge: Proposal of an Overweight/Oversize (OW/OS) Corridor and Implementing a Daily OW/OS Permit Program

Project Description:

Long-haul commercial vehicles movement are especially attractive for the produce industry because commercial vehicles in Mexico are allowed to carry 125,000 pounds, whereas commercial vehicles in the United States are limited to a gross weight 80,000 pounds. When overweight produce commercial vehicles arrive at the border from Mexico, they typically re-distribute their cargo to other commercial vehicles to cross the border. Table 8 presents the current commercial vehicle regulations in the United States and Mexico.

U.S. and Mexican Commercial Vehicle Regulations

Standard	Height	Width	Weight
U.S.	14 ft.	8.5 ft.	80,000 lbs.
Mexico	15.5 ft.	12 ft.	125,000 lbs.

Source: U.S. Department of Transportation

This alternative for Colombia POE proposed a similar OW/OS permit structure that has been established in Hidalgo County. In January 2014, the Hidalgo County Regional Mobility Authority (HCRMA) established an OW/OS permit that covers travel over selected Hidalgo County roads for vehicles weighing no more than the Mexican legal weight limit. This permit is valid for 24 hours upon activation and allows OW/OS commercial vehicles coming from Mexico to travel without having to redistribute their loads.

The proposed Colombia POE permit should be issued through an online-based interface the moment the commercial vehicle arrives at the bridge. The revenue of the permit in Hidalgo County is distributed in shares: 80 percent to TxDOT and 20 percent to the HCRMA to cover additional road maintenance costs.

Total Conceptual Cost: Not applicable

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 9.):

- This alternative will allow all oversize and overweight commercial vehicles entering from Mexico to use the Colombia-Solidarity POE and continue into the US without the need to re-distribute their cargo to other commercial vehicles to cross the border.
- Utilizes Colombia bridge much more and benefits both directions of commercial traffic.
- Produce cargo and heavy MEX commercial vehicles would operate through overweight permits.

I. Safety Improvement (adding inside/outside shoulders) at MEX-2 Hwy between World Trade Bridge and Colombia Bridge

Project Description:
The MEX-2 highway connects the Colombia Solidarity International Bridge and the World Trade Bridge. It is approximately 17 miles from the entrance of the Colombia POE and the entrance of the Word Trade POE. Currently, MEX-2 is made up of two bodies of two lanes in each direction with limited access. The suburban location of the Colombia POE makes it necessary to increase security to build confidence in both passenger and commercial vehicle travelers.

Total Conceptual Cost: $20,978,083*.

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 11.):

- The safety improvements proposed on MEX 2 shows a minimal increase in commercial traffic at the Colombia POE in the next 20 years.
- The total volume at the World Trade Bridge is insignificantly reduced in the next 20 years.
- *Estimate is based on US dollars.

J. La Gloria-Colombia Highway (Super 2 design)

Project Description:
Construction of a highway that would connect the Monterrey-Nuevo Laredo highway (MEX 85) with the Colombia Solidarity International Bridge. The new highway is planned to be a toll road.

Total Conceptual Cost: $220,864,086.

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 13.):

- The new La Gloria-Colombia Highway toll road at the Colombia-Solidarity POE shows a minimal increase in commercial traffic in the next 20 years.
- The total volume at the World Trade Bridge is insignificantly reduced in the next 20 years.

K. Laredo Outer Loop (New Alignment)

Project Description:
Roadway facility that extends east of Laredo from the IH-35/SH 255 interchange in the north to the vicinity of the proposed Fifth Bridge crossing in the south, near the City of Rio Bravo. The loop aims at providing capacity and resiliency to the existing highway network in the county, in addition to planning for Laredo's future growth. Segments 1 and 2 of the Outer Loop are assumed to open to traffic in 2030 while segment is assumed to open in 2035.

Total Conceptual Cost: $418,000,000.

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 14.):

- This alternative performs at an overall Level Of Service of "A" in 2030 and "B" in 2040.
- This alternative does not include a direct connection point with a POE.
- This alternative route provides interchanges at IH-35/SH 255, US 59, SH 359, and US 83.
- TxDOT is planning this project, so construction period may be moved up.

L. Expanding Mines Rd. to Eagle Pass (Super 2 design)

Project Description:
Construction of a limited-access highway that connects the city of Eagle Pass and the Colombia Solidarity International Bridge through the Mines Road/Dolores Boulevard intersection. An approximately 40-mile section of this road is unpaved roadway that needs to be paved and connected between the end of pavement in Webb County and the end of pavement in Maverick County. Mines Road (also known as the "El Indio Road") begins at the terminus of FM 1472 in Webb County, runs roughly parallel to the Rio Grande River, and connects to FM 1021 in Maverick County.

Total Conceptual Cost: $268,434,812.

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 15.):

- On FM 1472 (Mines Road), this alternative (Super 2 design) performs at an overall Level Of Service of "F" in 2030 and 2040, from Las Cruces Dr. to SH 255.
- On IH-35, it performs at an LOS "A" in 2030 and "B" in 2040 from IH-69 to SH 255.
- This alternative will connect with the Ports To Plains Corridor from Texas to Canada, thus providing another alternative route to reduce traffic volumes on IH-35.
- Eliminates the only section of border area in Texas between Brownsville and Eagle Pass that does not have a roadway along the border.

M. Vallecillo Extension (IH-35 to US 59 and SH 359)

Project Description:
Extension of the original Vallecillo project (a four-lane roadway primarily meant to facilitate commercial vehicle movement). This alternative considers the construction of approximately 13.5 miles of a new freeway from the end of the Vallecillo Road project at IH-35 to Highway 359 parallel to Loop 20, including an intersection with US 59.

Total Conceptual Cost: $147,792,857.

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 16.)**:**
- Vallecillo itself is already a future project with the RMA, this will go parallel to Loop 20 from FM 1472 to IH-35.
- This alternative will provide another commercial vehicle route from the WTB industrial parks which are going to Houston or Corpus Christi onto Vallecillo Road thus relieving commercial vehicle traffic from Loop 20 towards US 59 and SH 359. Loop 20 LOS is considerably improved.

N. Gateway to the Americas International Bridge: Expansion of the Sidewalk

Project Description:
The Gateway to the Americas International Bridge pedestrian crossing recently increased the capacity from 5 to 14 inspection booths to speed up crossing and alleviate queues, crossing times, and waiting times.

This alternative focuses on the expansion of the sidewalk leading to the CBP facility. The sidewalk in its existing condition can manage at most two lines for regular and SENTRI crossings. Widening the sidewalk will allow separating and managing the SENTRI and regular pedestrian flows, improving comfort and visibility and, therefore, the security and safety of the bridge.

Total Conceptual Cost: $200,000.

Major Impacts:
- Existing available sidewalk widths are widened 6 feet each (southbound and northbound) to the inside of the existing bridge width.
- Eliminates one complete travel lane.

- Based on the travel demand model for this alternative, the widening of the sidewalks on the Gateway of the Americas Bridge I to accommodate greater pedestrian crossings does not significantly improve the processing of pedestrians at the inspection stations; additionally the bridge's total SENTRI vehicular throughput demand is reduced due to going from four travel lanes to three travel lanes. Thus resulting in a low priority alternative that does not provide a benefit in the crossing and waiting time.

O. Juarez-Lincoln International Bridge: Intersection Improvements

Project Description:
This Alternative aims to improve the conditions for traffic exiting the Juarez-Lincoln International Bridge to alleviate the queues present at the up-stream roads leaving the facility caused by both traffic congestion and traffic signal delays. The proposal includes improving the performance of traffic signals in the surrounding area of the bridge to reduce delays and obtain an acceptable level of service at the up-stream inspections.

The hourly traffic volume of the peak period is 1,195 in the northbound direction between 8:00 and 9:00 a.m. and 1,465 in the southbound direction between 6:00 and 7:00 p.m. These traffic volumes during peak hours are causing traffic back-ups at the exit of the Juarez-Lincoln POE facility. By optimizing the up-stream traffic lights, these back-ups can be avoided.

Total Conceptual Cost: $500,000.

Major Impact:
- Vehicular traffic mobility is improved by avoiding back-ups thus increasing circulation in the downtown IH-35 4-block area and surrounding area.
- A high-level LOS analysis was performed by using common traffic engineering software and travel demand model volumes. However, to evaluate this alternative in more detail, we recommend that a comprehensive traffic analysis of the roadways connecting to the Juarez-Lincoln POE facility be performed, including observed turning movement counts.

P. Improving Las Tiendas Road (5-Lane divided section)

Project Description:
Las Tiendas Road is a 9-mile two-lane (one lane per direction) road that connects SH 255 with Mines Road. Improving the conditions of Las Tiendas Road, this Alternative has the potential to reduce travel times and support future developments in the area. In the analyzed forecast period, no significant impact to the LOS of the Mines Road was observed.

Total Conceptual Cost: $30,725,260

Major Impacts:
- This alternative does not significantly impact the LOS on FM 1472, however it may provide for a high potential for commercial development in this area as well as Colombia Bridge.

Q. New International Bridge 4/5 to SL 20

Project Description:

The proposed Bridge 4/5's purpose is to alleviate traffic congestion along the cities of Nuevo Laredo in Mexico and Laredo in the United States once the World Trade Bridge reaches full capacity. The proposed bridge location is in southern Webb County and will connect MEX 85 with US 83 and the extension of Loop 20 (Quatro Vientos). In the future, the proposed bridge is planned to have direct access to the Laredo Outer Loop.

Total Conceptual Cost: $360,869,211

- Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tbls. 17 and 18., and Figure 32.):
- This is the best alternative, based on evaluation criteria ranking results, thus improving the overall volume throughput capacity of the entire City of Laredo Bridge System and will help the industrial/commercial trade traffic circulation throughout the City of Laredo, Texas and City of Nuevo Laredo, Tamaulipas.
- With respect to "Passenger Vehicles", this alternative substantially reduces Juarez-Lincoln MEX to US waiting time substantially, and US to MEX waiting time extraordinarily.
- With respect to "Commercial Vehicles", crossing and waiting times are drastically reduced at World Trade Bridge POE and Colombia-Solidarity POE, however the total volume throughputs are adversely reduced in the next 20 years.
- Texas-Mexico border master plan concurs with building of an additional international bridge, specifically BRG 4/5.
- CBP has a low preference for this alternative, while the Mexico customs brokers have a high preference for it.

R. New International Bridge 4/5 with Laredo Outer Loop

Project Description:
The proposed Bridge 4/5 with an additional loop connecting to Laredo. Segments 1 and 2 of the Outer Loop are assumed to open to traffic in 2030, while Segment 3 is assumed to open in 2035.

Total Conceptual Cost: $726,869,211

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 20.):
- This is the second best alternative, based on evaluation criteria results, thus improving the capacity of the whole bridge system and will help the total volume throughput of the whole area.
- Crossing and waiting times are substantially reduced at World Trade Bridge POE in 20 years.
- Crossing and waiting times are drastically reduced at Colombia-Solidarity POE, however the total volume throughput are adversely reduced.
- Texas-Mexico border master plan concurs with building of an additional international bridge, specifically BRG 4/5.

- CBP has a low preference for this alternative, while the Mexico customs brokers have a high preference for it.

S. Gateway to the Americas International Bridge: Pedestrian Only Crossing

Opening Year Scenario: 2025
Limits: Gateway POE

Description: The Gateway POE currently allows passenger vehicle and pedestrian border crossings. This alternative proposes that the Gateway POE would be exclusively for pedestrian crossings. The alternative aims to improve the Laredo downtown area to a more pedestrian friendly environment.

Total Conceptual Cost: Not available

Major Impacts (Refer to Traffic Analysis Report, Appendix A, Tb. 21.)**:**
- Based on the travel demand model for this alternative the conversion of the Gateway of the Americas Bridge I to a pedestrian crossing only will have a significant negative effect on the Juarez-Lincoln Bridge II since it cannot handle all of the additional vehicular volume coming from the Gateway of Americas Bridge I.

INFRASTRUCTURE

SECTION V: EVALUATION OF ALTERNATIVES

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

DECISION MATRIX OF ALTERNATIVES

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

SECTION V: EVALUATION OF ALTERNATIVES

1. DECISION MATRIX OF ALTERNATIVES

SUMMARY OF EVALUATION TABLE

Score Summary / **Score by Element**

				Benefits		Costs	Support		Technical Process	
Group	Alternative Code	Alternative Name	Overall Score	NB	SB		Stakeholder	Agencies	Right of Way	Studies
POE	B	World Trade Bridge - Fast Lane Expansion	75.7	21.1	5.3	40.0	2.0	3.0	4.0	0.3
POE	C	World Trade Bridge - Entry Lanes Expansion	72.7	21.1	5.3	40.0	1.3	0.9	4.0	0.1
US Corridor	E	Direct Connection From World Trade Bridge to Killam Industrial Blvd	62.7	16.3	16.3	26.0	0.6	0.9	2.6	0.1
POE	F	Juarez-Lincoln Bridge - Passenger Vehicle Inspection with Double-Stacked Booths	59.6	9.8	5.3	40.0	0.2	0.3	4.0	0.1
US Corridor	O	Juarez Lincoln Bridge - Intersection Improvements	59.6	7.5	7.5	40.0	0.2	0.3	4.0	0.1
POE	Q	New International Bridge 4/5	58.2	32.5	11.4	12.0	0.2	0.3	1.2	0.7
MX Corridor	J	Construction of La Gloria-Colombia Highway	52.8	16.3	7.5	26.0	0.6	0.9	1.2	0.3
POE	N	Gateway to the Americas Bridge - Sidewalk Expansion	52.4	3.3	1.8	40.0	1.3	2.0	4.0	0.1
POE	S	Gateway POE : Pedestrian-Only Crossing	50.6	3.3	1.8	40.0	0.6	0.9	4.0	0.1
POE	G	Permanently Moving Empty Trucks to Colombia POE	49.8	3.3	1.8	40.0	0.2	0.3	4.0	0.3
POE	H	Colombia Bridge - Proposed OW/OS Corridor and Daily Program	49.6	3.3	1.8	40.0	0.2	0.3	4.0	0.1
POE	R	New International Bridge 4/5 with Laredo Outer Loop	49.4	32.5	11.4	4.0	0.2	0.3	0.4	0.7
MX Corridor	I	Safety Improvement at MEX 2 between WTB and Colombia Bridge	45.6	7.5	7.5	26.0	0.2	0.3	4.0	0.1
POE	A	World Trade Bridge - New Span	45.2	9.8	5.3	26.0	0.6	0.9	2.6	0.1
US Corridor	M	Vallecillo Extension to US 59 and SH 359	38.4	2.5	2.5	26.0	1.3	2.0	4.0	0.1
US Corridor	D	Mines Road Freeway	38.3	16.3	16.3	4.0	0.2	0.3	1.2	0.1
US Corridor	P	Improving Las Tiendas Road	36.6	2.5	2.5	26.0	0.6	0.9	4.0	0.1
US Corridor	L	Expanding Mines Road to Eagle Pass	24.4	2.5	2.5	12.0	1.3	2.0	4.0	0.1
US Corridor	K	Laredo Outer Loop	22.5	2.5	2.5	12.0	2.0	3.0	0.4	0.1
		Top Score	100.0	100.0						

SUMMARY OF RANKING BY GROUP

POE Alternatives	
Alternative	Overall Score
B	75.675
C	72.675
F	59.6
Q	58.225
N	52.35
S	50.6
G	49.8
H	49.6
R	49.425
A	45.2
Top Score	100

US Corridor Alternatives	
Alternative	Overall Score
E	62.7
O	59.6
M	38.35
D	38.3
P	36.6
L	24.35
K	22.5
Top Score	100

MX Corridor Alternatives	
Alternative	Overall Score
J	52.75
I	45.6
Top Score	100

PORT OF ENTRY EVALUATION TABLE

Major Criteria	Major Criteria Weight	Criteria	Criteria Weight	Overall Weight	Criteria Description	Very High	High	Medium	Low
Benefits	50%	System-Wide Time Crossing Savings Value ($US) NB	65%	33%	Time savings value of border crossings in the Laredo International Bridge System in the MX-US direction	Greater than $300 mil	$101 to $300 mil	$0.1 to $100 mil	None
		System-Wide Time Crossing Savings Value ($US) SB	35%	18%	Time savings value of border crossings in the Laredo International Bridge System in the US-MX direction	Greater than $300 mil	$101 to $300 mil	$0.1 to $100 mil	None
Costs	40%	Investment Costs	100%	40%	Construction costs related to the project	$0 to $10 mil	$11 to $250 mil	$251 to $500 mil	Greater than $501 mil
Support	5%	Local Stakeholder Support	40%	2%	Level of support of local stakeholders	High	Medium	Low	None/Unknown
		Agency Support	60%	3%	Level of support of agencies	High	Medium	Low	None/Unknown
Technical Process	5%	Right of Way	80%	4%	Acres of Right of Way required	0 Acres	1 to 100 Acres	101 to 1000 Acres	Greater than 1000 Acres
		Feasibility Studies	20%	1%	Existence of feasibility, pre-feasibility, or sketch-level studies of the alternative	Final Studies	Preliminary Studies	Sketch Level	No Studies/ Unknown
					Overall Weight	100%	65%	30%	10%

Alternative Variables

A	B	C	F	G	H	N	Q	R	S
$17.1	$206.7	$255.2	$7.5	$0.0	$0.0	$0.0	$329.3	$354.7	$0.0
$6.6	$0.6	$2.9	$0.3	$0.0	$0.0	$0.0	$214.2	$226.7	$0.0
$15.9	$4.7	$5.3	$0.5	$0.0	$0.0	$0.2	$360.9	$726.9	$0.0
Low	High	Medium	Unknown	Unknown	Unknown	Medium	Unknown	Unknown	Low
Low	High	Low	Unknown	Unknown	Unknown	Medium	Unknown	Unknown	Low
10.0	0.0	0.0	0.0	0.0	0.0	0.0	310.0	2,150.0	0.0
No Studies	Sketch Level	No Studies	No Studies	Sketch Level	No Studies	No Studies	Preliminary Studies	Preliminary Studies	No Studies

Alternative Variables Qualifications

A	B	C	F	G	H	N	Q	R	S
Medium	High	High	Medium	Low	Low	Low	Very High	Very High	Low
Medium	Medium	Medium	Medium	Low	Low	Low	High	High	Low
High	Very High	Very High	Very High	Very High	Very High	Very High	Medium	Low	Very High
Medium	Very High	High	Low	Low	Low	High	Low	Low	Medium
Medium	Very High	Medium	Low	Low	Low	High	Low	Low	Medium
High	Very High	Very High	Very High	Very High	Very High	Very High	Medium	Low	Very High
Low	Medium	Low	Low	Medium	Low	Low	High	High	Low

Evaluation

A	B	C	F	G	H	N	Q	R	S
9.8	21.1	21.1	9.8	3.3	3.3	3.3	32.5	32.5	3.3
5.3	5.3	5.3	5.3	1.8	1.8	1.8	11.4	11.4	1.8
26.0	40.0	40.0	40.0	40.0	40.0	40.0	12.0	4.0	40.0
0.6	2.0	1.3	0.2	0.2	0.2	1.3	0.2	0.2	0.6
0.9	3.0	0.9	0.3	0.3	0.3	2.0	0.3	0.3	0.9
2.6	4.0	4.0	4.0	4.0	4.0	4.0	1.2	0.4	4.0
0.1	0.3	0.1	0.1	0.3	0.1	0.1	0.7	0.7	0.1

Overall Score

A	B	C	F	G	H	N	Q	R	S
45.2	75.7	72.7	59.6	49.8	49.6	52.4	58.2	49.4	50.6

US CORRIDORS EVALUATION TABLE

Major Criteria	Major Criteria Weight	Criteria	Criteria Weight	Overall Weight	Criteria Description	Feasibility Qualification Range: Very High	High	Medium	Low
Benefits	50%	Level of Service Shift NB	50%	25%	Shift in Level of Service in the northbound alternative	4 to 5	2.1 to 3.9	1 to 2	0.00
		Level of Service Shift SB	50%	25%	Shift in Level of Service in the southbound alternative	4 to 5	2.1 to 3.9	1 to 2	0.00
Costs	40%	Investment Costs	100%	40%	Construction costs related to the project	$0 to $10 mil	$11 to $250 mil	$251 to $500 mil	Greater than $501 mil
Support	5%	Local Stakeholder Support	40%	2%	Level of support of local stakeholders	High	Medium	Low	None/Unknown
		Agency Support	60%	3%	Level of support of agencies	High	Medium	Low	None/Unknown
Technical Process	5%	Right Of Way	80%	4%	Acres of Right of Way required	0 Acres	1 to 100 Acres	101 to 1000 Acres	Greater than 1000 Acres
		Feasibility Studies	20%	1%	Existence of feasibility, pre-feasibility, or sketch-level studies of the alternative	Investment Grade	Preliminary Studies	Sketch Level	No Studies/Unknown
					Overall Weight	100%	65%	30%	10%

Alternative Features

D	E	K	L	M	O	P
3.31	3.31	0.62	0.61	0.58	1.2	0.0
3.85	3.85	0.68	0.14	0.29	1.2	0.0
$1,053.1	$13.6	$418.0	$268.4	$45.9	$0.5	$30.7
Unknown	Low	High	Medium	Medium	Unknown	Low
Unknown	Low	High	Medium	Medium	Unknown	Low
170.0	20.0	2,040.0	0.0	0.0	0.0	0.0
No studies	No studies	No studies	No studies	No studies	No studies	No studies

Alternative Features Qualifications

D	E	K	L	M	O	P
High	High	Low	Low	Low	Medium	Low
High	High	Low	Low	Low	Medium	Low
Low	High	Medium	Medium	High	Very High	High
Low	Medium	Very High	High	High	Low	Medium
Low	Medium	Very High	High	High	Low	Medium
Medium	High	Low	Very High	Very High	Very High	Very High
Low	Low	Low	Low	Low	Low	Low

Evaluation

D	E	K	L	M	O	P
16.3	16.3	2.5	2.5	2.5	7.5	2.5
16.3	16.3	2.5	2.5	2.5	7.5	2.5
4.0	26.0	12.0	12.0	26.0	40.0	26.0
0.2	0.6	2.0	1.3	1.3	0.2	0.6
0.3	0.9	3.0	2.0	2.0	0.3	0.9
1.2	2.6	0.4	4.0	4.0	4.0	4.0
0.1	0.1	0.1	0.1	0.1	0.1	0.1

Overall Score

D	E	K	L	M	O	P
38.3	62.7	22.5	24.4	38.4	59.6	36.6

MX CORRIDORS EVALUATION TABLE

Major Criteria	Major Criteria Weight	Criteria	Criteria Weight	Overall Weight	Criteria Description	Feasibility Qualification Range: Very High	High	Medium	Low
Benefits	50%	System-wide Crossing Time Saving Value ($US) NB	50%	25%	Time savings value of border crossings in the Laredo International Bridge System in the MX-US direction	Greater than $300 mil	$101 to $300 mil	$0.1 to $100 mil	None
		System-wide Crossing Time Saving Value ($US) SB	50%	25%	Time savings value of border crossings in the Laredo International Bridge System in the US-MX direction	Greater than $300 mil	$101 to $300 mil	$0.1 to $100 mil	None
Costs	40%	Investment Costs	100%	40%	Construction costs related to the project	$0 to $10 mil	$11 to $250 mil	$251 to $500 mil	Greater than $501 mil
Support	5%	Local Stakeholder Support	40%	2%	Level of support of local stakeholders	High	Medium	Low	None/Unknown
		Agency Support	60%	3%	Level of support of agencies	High	Medium	Low	None/Unknown
Technical Process	5%	Right Of Way	80%	4%	Acres of Right of Way required	0 Acres	1 to 100 Acres	101 to 1000 Acres	Greater than 1000 Acres
		Feasibility Studies	20%	1%	Existence of feasibility, pre-feasibility, or sketch-level studies	Investment Grade	Preliminary Studies	Sketch Level	No studies/Unknown
					Overall Weight	100%	65%	30%	10%

Alternative Features		Alternative Features		Evaluation	
I	J	I	J	I	J
$17.1	$206.7	Medium	High	7.5	16.3
$7	$1	Medium	Medium	7.5	7.5
$33.6	$179.3	High	High	26.0	26.0
Unknown	Low	Low	Medium	0.2	0.6
Unknown	Low	Low	Medium	0.3	0.9
0.0	950.0	Very High	Medium	4.0	1.2
No Studies	Sketch Level	Low	Medium	0.1	0.3

Overall Score	
I	J
45.6	52.8

SCHEDULE OF PROJECTS (PRIORITY)

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

2. SCHEDULE OF PROJECTS BASED ON PRIORITY (SHORT, MID & LONG RANGE)

The S&B TEAM submitted a list of the short-range (2025-2030), mid-range (2030-2040) and long-range (2040+) POE and transportation facility projects planned to optimize the City of Laredo Bridge System

TIME LINE PRIORITY LIST				
Alt.	**Facility Description**	**Conceptual Cost (FY 21)**	**Projected Construction Time Line**	
Short Term				
B	World Trade Bridge: Two Additional FAST Lanes	$4,665,646	Short	2025-2030
C	World Trade Bridge: Entry Primary Inspection Lanes Expansion	$5,336,109	Short	2025-2030
E	Direct connection from WTB to Killam Industrial Blvd. (IH-69 to IH-35 via DC 1 exit to Tres Equis underpass)	$13,636,689	Short	2025-2030
F	Juarez-Lincoln International Bridge: Passenger Vehicle Inspection with Double-Stacked Booths	$500,000	Short	2025-2030
O	Juarez-Lincoln International Bridge: Intersection Improvements	$500,000	Short	2025-2030
Q	New International Bridge 4/5 to SL 20	$360,869,211	Short	2025-2030
N	Gateway to the Americas International Bridge: Expansion of the Sidewalk	$200,000	Short	2025-2030
S	Gateway to the Americas International Bridge: Pedestrian Only Crossing	N/A	Short	2025-2030
G	Permanently Moving Empty Trucks to Colombia Port of Entry (POE)	N/A	Short	2025-2030
H	Colombia Bridge: Proposal of an Overweight/Oversize (OW/OS) Corridor and Implementing a Daily OW/OS Permit Program	N/A	Short	2025-2030
I	Safety Improvement (adding inside/outside shoulders) at MEX-2 Hwy between World Trade Bridge and Colombia Bridge	$20,978,083	Short	2025-2030
Mid Range				
A	World Trade Bridge: New Bridge Span (south of existing bridge)	$15,927,346	Mid	2030-2040
M	Vallecillo Extension (IH-35 to US 59 and SH 359)	$147,792,857	Mid	2030-2040
P	Improving Las Tiendas Road (5-Lane divided section)	$30,725,260	Mid	2030-2040
Long Range				
J	La Gloria-Colombia Highway (Super 2 design)	$220,864,086	Long	2040+
R	New International Bridge 4/5 with Laredo Outer Loop	$726,869,211	Long	2040+
D	Mines Rd. Freeway (IH-35 to SH 255)	$1,053,118,000	Long	2040+
L	Expanding Mines Rd. to Eagle Pass (Super 2 design)	$268,434,812	Long	2040+
K	Laredo Outer Loop (New Alignment)	$418,000,000	Long	2040+

INFRASTRUCTURE

SECTION VI: FINAL MODEL RESULTS

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

SECTION VI: FINAL MODEL RESULTS

Final Results

- Border crossing traffic annual growth rate by crossing type:
    - Commercial Vehicles: 3.3 % from 2019 to 2030, 3.0 % from 2019 to 2040
    - Passenger Vehicles : 0.7 % from 2019 to 2030, 0.7 % from 2019 to 2040
    - Pedestrian : 0.6 % from 2019 to 2030, 0.7 % from 2019 to 2040
- Pedestrian crossing volume increases as passenger vehicle waiting time increases
- Approximately 8% of commercial vehicles crossing the U.S.-Mexico border in Laredo originate in Monterrey.
- World Trade Bridge crossing time increases by year without any improvements to the actual situation:
    - 2030 – approximately 130 %
    - 2040– approximately 300 %
- The Colombia International Bridge is underutilized for several reasons:
    - Mexican customs broker “licensing,” transfer costs (per-mile cost), etc.

FINDINGS

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

Findings

- The COVID-19 pandemic has impacted passenger vehicle crossings more than commercial vehicle crossings. COVID-19 also impacted the sources of imports and personal consumption expenditure.
    - In 2020, passenger vehicle crossings decreased 37.9 % and pedestrians decreased 54.9 %.
    - Commercial vehicle crossings decreased 1.9 %.
- Historical socioeconomic analysis indicates that over 30 % of northbound U.S. imports by volume are destined for Texas.
- Southbound commercial vehicle crossings have followed a trend nearly identical to northbound crossings.
- 83 % of total southbound commercial vehicles cross via the World Trade Bridge; likewise, 89 % of total southbound passenger vehicles cross via the Juarez-Lincoln POE.
- Roughly 16 % of total commercial vehicles are FAST lane users.
- Approximately 5 % of total passenger vehicle trips and 9 % of total commercial vehicle trips originate in the area of influence of Eagle Pass.
- The FAST lane waiting time at the Colombia-Solidarity POE is roughly 50 % less than regular lane waiting times.
- The peak daily crossing times at the Gateway to the Americas POE are between 8:00 – 9:00 a.m. in the morning and 3:00 – 5:00 p.m. in the afternoon. The World Trade Bridge's peak crossing time is from 12:00 p.m. to 9:00 pm.
- The Juarez-Lincoln POE is not nearly as congested as the Gateway POE because it has a greater number of booths (15).
- For passenger vehicles, the peak demand periods for general lanes and Ready Lanes are in the morning in the northbound direction and in the afternoon in the southbound direction.

ALTERNATIVES EVALUATION

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

Alternatives Evaluation

- The analysis considered the benefits, the cost, and the support of each alternative.
- Three groups of alternatives: POE, US Corridor, and MX Corridor
- Best-scoring alternatives:
    - FAST Lane expansion on the WTB (considering 2 additional FAST lanes to the 4 FAST lanes that are under construction) with Score: 75.7
    - Entry Lanes improvement and expanding existing capacity at the World Trade Bridge (improves the expansion of the CBP facility entering lanes and includes primary inspection booths) Score: 72.7

Group	Alternative Code	Alternative Name	Overall Score
POE	B	World Trade Bridge - Fast Lane Expansion	75.7
POE	C	World Trade Bridge - Entry Lanes Expansion	72.7
US Corridor	E	Direct Connection From World Trade Bridge to Killam Industrial Blvd	62.7
POE	F	Juarez-Lincoln Bridge - Passenger Vehicle Inspection with Double-Stacked Booths	59.6
US Corridor	O	Juarez Lincoln Bridge - Intersection Improvements	59.6
POE	Q	New International Bridge 4/5	58.2
MX Corridor	J	Construction of La Gloria-Colombia Highway	52.8
POE	N	Gateway to the Americas Bridge - Sidewalk Expansion	52.4
POE	S	Gateway POE : Pedestrian-Only Crossing	50.6
POE	G	Permanently Moving Empty Trucks to Colombia POE	49.8
POE	H	Colombia Bridge - Proposed OW/OS Corridor and Daily Program	49.6
POE	R	New International Bridge 4/5 with Laredo Outer Loop	49.4
MX Corridor	I	Safety Improvement at MEX 2 between WTB and Colombia Bridge	45.6
POE	A	World Trade Bridge - New Span	45.2
US Corridor	M	Vallecillo Extension to US 59 and SH 359	38.4
US Corridor	D	Mines Road Freeway	38.3
US Corridor	P	Improving Las Tiendas Road	36.6
US Corridor	L	Expanding Mines Road to Eagle Pass	24.4
US Corridor	K	Laredo Outer Loop	22.5

Group 1: POE | Group 2: US Corridor | Group 3: MX Corridor

TRAFFIC AND REVENUE

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

Traffic and Revenue

- The fully-executed Border Master Plan (considering all proposed alternatives) results in the following forecasts for the Laredo International Bridge System:
    - 5.0 million southbound PV transactions (2030)
    - 5.4 million southbound PV transactions (2040)
    - 3.0 million CV transactions (2030)
    - 3.7 million CV transactions (2040)

S&B INFRASTRUCTURE

SECTION VII: EXECUTIVE ANALYSIS

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

SECTION VII: EXECUTIVE ANALYSIS

INTRODUCTION

Cross-border travel at the 4 land ports of entry (POEs) in the Laredo – Nuevo Laredo / Colombia region has grown significantly over the years. Laredo is the No. 1 inland port in the U.S. as proof of the important role the City of Laredo plays in the State and National economy. Travel demand is expected to increase at all POEs in the region based on the S&BI Laredo Bridge Master Plan Traffic Analysis report.

Growth in population and economic projections show that cross border travel demand will increase substantially at all POE facilities and connecting roads. Overall, the growth rate for commercial vehicle crossings between 2009 and 2019 is 5.5 percent.

Given the current and projected travel demand at the existing POEs, improving the capacity and operations of the current infrastructure is critical to decrease traffic congestion and delays, facilitate international trade, and improve the quality of life for residents in the border region.

The City of Laredo, Federal, State, regional, and local agencies responsible for planning and implementation of POEs and related transportation facilities in the Laredo/Nuevo Laredo region agree that a master planning process is needed to evaluate and integrate POE and transportation infrastructure development on a coordinated basis.

PROJECT OVERVIEW

The S&B team has developed a project approach for the International Bridge Master Plan that addresses the City of Laredo's (Client) needs. The Masterplan consists of finding existing deficiencies with respect to traffic throughput at the below POE's: Laredo- Columbia Solidarity Bridge, World Trade Bridge, Gateway to the Americas Bridge and the Juarez-Lincoln Bridge. These throughput deficiencies have been evaluated, and the S&B team presents viable options to streamline and increase the throughput individually and collectively as a system. The primary objectives of the City of Laredo Border Master Plan are as follows:

DEVELOPMENT OF EVALUATION OF OPTIONS

- Layout existing conditions with possible build scenarios for each bridge while the traffic model is being developed.
- Use different scenarios to look at using shared used lanes, technology upgrades, expansion of facilities, lane reconfiguration, additional way fare signage and/or lighting, booth upgrades, feasibility to restrict International Bridge I to process 100% of pedestrian only traffic.
- Also, the impact to passenger vehicle traffic and the assessment to accommodate the increased commercial traffic demand have been evaluated.
- Identify any provisions that need to be made for future development. Options are developed to the point that their broad physical, staging, service delivery, operational and capital implications are identified and can be evaluated against one another. No more than 4 options per POE will be moved forward to Task 5.

- POE and Transportation Facilities Projects – Evaluation Criteria and Rankings (POE alternatives and Ranking): Develop criteria for prioritizing projects related to existing and new POEs, as well as transportation facilities leading to the City of Laredo POEs; rank short-, mid-, and long-term projects and services. (e.g., roads, POE improvements, etc.)

EVALUATION OF ALTERNATIVES

- Develop Matrix that details evaluation criteria agreed by the Project Control Group (PCG).
- Provide a performance of each of the options against the criteria and rank the POE options.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

The following section describes the four main findings and recommendations for each of the primary objectives of the study and are listed from north to south within the City of Laredo International Bridge Border Master Plan jurisdiction limits:

WORLD TRADE BRIDGE (BRIDGE #4):
WTB: Additional Fast Lane Expansion 2030 – 2040

POE GROUP

Project Description:

Currently, the World Trade Bridge is expanding its current operation of three FAST lanes to a separate FAST lane inspection facility of four primary inspection booths in the center of the WTB. This alternative will expand the four FAST primary inspection booths to a total of six primary inspection booths. The construction will include two additional FAST lanes on the existing WTB span and two additional FAST primary inspection booths.

Total Conceptual Cost: $4,665,646.

MAJOR IMPACTS (Refer to Traffic Analysis Report, Appendix A, Tb. 2.):

- This alternative was ranked number 1 within the three "WTB Alternatives" group due to its lowest conceptual cost and criteria resulting in minimal operational disruption within the POE (per CBP).
- Crossing and waiting times are substantially reduced thus making the alternative a viable solution for relieving congestion at World Trade Bridge POE in 20 years.
- Crossing and waiting times are drastically reduced at Colombia-Solidarity POE, however the total volume throughput is adversely reduced.

UNITED STATES HIGHWAYS (IH-35 TRES EQUIS UNDERPASS):

Direct Connection from WTB to Killam Industrial Blvd.

UNITED STATES HIGHWAYS GROUP

Project Description:

Killam Industrial Boulevard is a road that directly connects El Portal Industrial Park and Killam Industrial Park with IH-35. However, the connection is only in the southbound direction. The alternative evaluates the construction of a two-lane braided ramp access to northbound IH-35 with an underpass and four undivided westbound roadway lanes connecting to Killam Industrial Boulevard. This Alternative will give access from IH-35 to Killam Industrial Blvd. in the northbound and southbound direction, permitting commercial vehicles exiting the WTB to access the industrial parks by using IH-69 and IH-35.

Total Conceptual Cost: $13,636,689.

MAJOR IMPACTS (Refer to Traffic Analysis Report, Appendix A, Tb. 5.):

- Limitation (No-Build): FM 1472 (from Las Cruces Dr. to SH 255) continues to operate at an overall level of service of “E” in 2025 and “E” through 2040; US 59 (from IH-35 to Saunders St.) continues to operate at an overall level of service of “B” in 2025 and “C” through 2040.
- Improvement (with alternative): FM 1472 (from Las Cruces Dr. to SH 255) continues to operate at an overall level of service of “F” in 2025 and “E” through 2040; US 59 (from IH-35 to Saunders St.) continues to operate at an overall level of service of “B” in 2025 and improves to “B” through 2040.
- Reduces route mileage from WTB (IH-69) to Killam Industrial Blvd. along IH-35 (“Tres Equis” bridge) for commercial vehicles, that inadvertently or not, use Direct Connector No. 1 at IH-35 instead of exiting from IH-69 to the IH-35 East Frontage Road and are required to travel to Carrier Dr. instead and return back to “Tres Equis” bridge by approximately 8 miles.
- Direct connection (no traffic signals between WTB and “Tres Equis” bridge) from IH-35/IH-69 Direct Connector (DC) #1 via proposed DC #1 exit ramp to “Tres Equis” bridge.
- Proposed road from IH-35 “Tres Equis” bridge provides access to Union Pacific Blvd. at the existing northeast quadrant of the Milo Distribution Center versus the current and only route to this area through McPherson Road or US 59 WB frontage road.
- Provides direct access from Milo Distribution Center to IH-35 and to El Portal Industrial Park, Killam Industrial Park, Interamerica Distribution Park, and International Trade Center.
- This alternative was ranked number 1 within the five “US Highways Alternatives” group due to several major issues. It has the lowest conceptual cost, there are no POE operation disruptions at WTB, and is very similar to one of TxDOT’s alternative in their overall schematic study regarding conversion of IH-35 into an urban/suburban freeway between IH-35 and Carriers Drive. For informational purposes only, TxDOT’s alternative limits are also on northbound IH-35 Milo Interchange between Direct Connector No. 1 (DC #1) and the Tres Equis Underpass consisting of a braided ramp configuration which consists of providing a DC #1 dual-purpose overpass bridge entrance ramp to NB IH-35 mainlanes and exit ramp to the east frontage road and unto Tres Equis Underpass. The TxDOT alternative also proposes an at-grade IH-35 northbound mainlane exit ramp to the east frontage road under the overpass bridge.

- This alternative provides an additional point of ingress and egress from northbound IH-35 to the eastern edge of El Portal Industrial Park and Killam Industrial Park. In addition, the proposed road east of IH-35 from Tres Equis Underpass will provide access to Milo Distribution Center and San Isidro East Point Center thus relieving congestion along McPherson Road north of US 59.
- Also provides increased mobility and circulation within the immediate industrial parks and highway network surrounding the World Trade Bridge Port of Entry.

PORT OF ENTRY BRIDGE 4/5:

New Bridge 4/5 2025-2040

POE GROUP

Project Description:

The proposed Bridge 4/5's purpose is to alleviate traffic congestion along the cities of Nuevo Laredo in Mexico and Laredo in the United States once the World Trade Bridge reaches full capacity. The proposed bridge location is in southern Webb County and will connect MEX 85 with US 83 and the extension of Loop 20 (Quatro Vientos). In the future, the proposed bridge is planned to have direct access to the Laredo Outer Loop.

Total Conceptual Cost: $360,869,211

MAJOR IMPACTS (Refer to Traffic Analysis Report, Appendix A, Tbls. 17 and 18., and Figure 32.):

- This is the best alternative, based on evaluation criteria ranking results, thus improving the overall volume throughput capacity of the entire City of Laredo Bridge System and will help the industrial/commercial trade traffic circulation throughout the City of Laredo, Texas and City of Nuevo Laredo, Tamaulipas.
- With respect to "Passenger Vehicles", this alternative substantially reduces Juarez-Lincoln MEX to US waiting time substantially, and US to MEX waiting time extraordinarily.
- With respect to "Commercial Vehicles", crossing and waiting times are drastically reduced at World Trade Bridge POE and Colombia-Solidarity POE, however the total volume throughputs are adversely reduced in the next 20 years.
- Texas-Mexico border master plan concurs with building of an additional international bridge, specifically BRG 4/5.
- CBP has a low preference for this alternative, while the Mexico customs brokers have a high preference for it.

COLOMBIA-SOLIDARITY (BRIDGE #3):

Permanently Moving Empty Commercial vehicles to Colombia POE, 2025 – 2040

POE GROUP

Project Description:

Effective December 7, 2020, CBP announced that all empty commercial vehicles entering Laredo POEs in the northbound direction will be redirected to the Colombia Solidarity Bridge, with the exception of bona fide participants in trusted trader programs (CBP-Trade Partnership Against Terrorism [C-TPAT], FAST). This redirection of empty tractors and trailers through the Colombia POE will help alleviate wait times at the World Trade POE. The proposal of this pilot program will be up for review in June 2021. The S&B team proposes in this Alternative to permanently implement that empty commercial vehicles entering Laredo POEs in the northbound direction will be redirected to the Colombia Solidarity Bridge, excluding the empty commercial vehicle that participants in trusted trader programs.

Total Conceptual Cost: Not applicable

MAJOR IMPACTS (REFER TO TRAFFIC ANALYSIS REPORT, APPENDIX A, TB. 7.):

- The alternative increases volume throughput significantly (approximately 1,200 commercial vehicles) at Colombia-Solidarity POE thus becoming the second most used bridge in Texas for northbound traffic.
- The utilization of Colombia-Solidarity POE by all empty commercial vehicles is doubled which now substantially affords (provides an opportunity) for more full cargo commercial vehicles (tractor-trailer) to utilize the WTB from MEX to the US.
- Currently there are 19 registered customs brokers at Colombia-Solidarity POE and compared to 223 at World Trade Bridge out of a total of 816 customs brokers in Mexico.
- The alternative also decreases crossing volumes significantly (approx. 1,200 trucks in 2021) at WTB POE for northbound traffic and, as a result, substantially decreases crossing and waiting times for the short term. However, at the end of the 20-year forecast period, due to a higher number of loaded trucks crossing at the WTB, this alternative does not significantly improve congestion at the WTB.
- Permits to cross from MEX to US are only available for 4 independent aduanas (customs) within Mexico.
- Due to the limited commercial and/or industrial infrastructure available at the Colombia-Solidarity POE, it stands at a disadvantage.
- Some disadvantages due to its geographical location include higher costs regarding time and cost, extra wear and tear on trucks, lack of truck drivers, and longer hours of processing operations.

Table 9. Alternatives Assessment – Overall Scores

Score Summary				Score by Element						
				Benefits		Costs	Support		Technical Process	
Group	Alternative Code	Alternative Name	Overall Score	NB	SB		Stakeholder	Agencies	Right of Way	Studies
POE	B	World Trade Bridge - Fast Lane Expansion	75.7	21.1	5.3	40.0	2.0	3.0	4.0	0.3
POE	C	World Trade Bridge - Entry Lanes Expansion	72.7	21.1	5.3	40.0	1.3	0.9	4.0	0.1
US Corridor	E	Direct Connection From World Trade Bridge to Killam Industrial Blvd	62.7	16.3	16.3	26.0	0.6	0.9	2.6	0.1
POE	F	Juarez-Lincoln Bridge - Passenger Vehicle Inspection with Double-Stacked Booths	59.6	9.8	5.3	40.0	0.2	0.3	4.0	0.1
US Corridor	O	Juarez Lincoln Bridge - Intersection Improvements	59.6	7.5	7.5	40.0	0.2	0.3	4.0	0.1
POE	Q	New International Bridge 4/5	58.2	32.5	11.4	12.0	0.2	0.3	1.2	0.7
MX Corridor	J	Construction of La Gloria-Colombia Highway	52.8	16.3	7.5	26.0	0.6	0.9	1.2	0.3
POE	N	Gateway to the Americas Bridge - Sidewalk Expansion	52.4	3.3	1.8	40.0	1.3	2.0	4.0	0.1
POE	S	Gateway POE : Pedestrian-Only Crossing	50.6	3.3	1.8	40.0	0.6	0.9	4.0	0.1
POE	G	Permanently Moving Empty Trucks to Colombia POE	49.8	3.3	1.8	40.0	0.2	0.3	4.0	0.3
POE	H	Colombia Bridge - Proposed OW/OS Corridor and Daily Program	49.6	3.3	1.8	40.0	0.2	0.3	4.0	0.1
POE	R	New International Bridge 4/5 with Laredo Outer Loop	49.4	32.5	11.4	4.0	0.2	0.3	0.4	0.7
MX Corridor	I	Safety Improvement at MEX 2 between WTB and Colombia Bridge	45.6	7.5	7.5	26.0	0.2	0.3	4.0	0.1
POE	A	World Trade Bridge - New Span	45.2	9.8	5.3	26.0	0.6	0.9	2.6	0.1
US Corridor	M	Vallecillo Extension to US 59 and SH 359	38.4	2.5	2.5	26.0	1.3	2.0	4.0	0.1
US Corridor	D	Mines Road Freeway	38.3	16.3	16.3	4.0	0.2	0.3	1.2	0.1
US Corridor	P	Improving Las Tiendas Road	36.6	2.5	2.5	26.0	0.6	0.9	4.0	0.1
US Corridor	L	Expanding Mines Road to Eagle Pass	24.4	2.5	2.5	12.0	1.3	2.0	4.0	0.1
US Corridor	K	Laredo Outer Loop	22.5	2.5	2.5	12.0	2.0	3.0	0.4	0.1
		Top Score	100.0	100.0						

Table 9. (Cont'd) Alternatives Assessment – Overall Scores

POE Alternatives	
Alternative	Overall Score
B	75.675
C	72.675
F	59.6
Q	58.225
N	52.35
S	50.6
G	49.8
H	49.6
R	49.425
A	45.2
Top Score	100

US Corridor Alternatives	
Alternative	Overall Score
E	62.7
O	59.6
M	38.35
D	38.3
P	36.6
L	24.35
K	22.5
Top Score	100

MX Corridor Alternatives	
Alternative	Overall Score
J	52.75
I	45.6
Top Score	100

The development of criteria for ranking POE and transportation projects has allowed the City of Laredo to create a bridge master plan to prioritize projects within a binational study area.

Future projects included in the TIP and the TPM were inventoried and included in the model for this study. The alternatives are not included in these reports.

The ranked list serves as a guideline to identify projects of importance within the Laredo from Colombia-Solidarity POE to the POE 4/5 (south Laredo).

A total of 19 POE projects submitted by the S&B Team were ranked individually and then grouped by POE and highways.

The individual project rankings were then used to establish the following priority order for the POEs.

TIME LINE PRIORITY LIST				
Alt.	**Facility Description**	**Conceptual Cost (FY 21)**	**Projected Construction Time Line**	
Short Term				
B	World Trade Bridge: Two Additional FAST Lanes	$4,665,646	Short	2025-2030
C	World Trade Bridge: Entry Primary Inspection Lanes Expansion	$5,336,109	Short	2025-2030
E	Direct connection from WTB to Killam Industrial Blvd. (IH-69 to IH-35 via DC 1 exit to Tres Equis underpass)	$13,636,689	Short	2025-2030
F	Juarez-Lincoln International Bridge: Passenger Vehicle Inspection with Double-Stacked Booths	$500,000	Short	2025-2030
O	Juarez-Lincoln International Bridge: Intersection Improvements	$500,000	Short	2025-2030
Q	New International Bridge 4/5 to SL 20	$360,869,211	Short	2025-2030
N	Gateway to the Americas International Bridge: Expansion of the Sidewalk	$200,000	Short	2025-2030
S	Gateway to the Americas International Bridge: Pedestrian Only Crossing	N/A	Short	2025-2030
G	Permanently Moving Empty Trucks to Colombia Port of Entry (POE)	N/A	Short	2025-2030
H	Colombia Bridge: Proposal of an Overweight/Oversize (OW/OS) Corridor and Implementing a Daily OW/OS Permit Program	N/A	Short	2025-2030
I	Safety Improvement (adding inside/outside shoulders) at MEX-2 Hwy between World Trade Bridge and Colombia Bridge	$20,978,083	Short	2025-2030
Mid Range				
A	World Trade Bridge: New Bridge Span (south of existing bridge)	$15,927,346	Mid	2030-2040
M	Vallecillo Extension (IH-35 to US 59 and SH 359)	$147,792,857	Mid	2030-2040
P	Improving Las Tiendas Road (5-Lane divided section)	$30,725,260	Mid	2030-2040
Long Range				
J	La Gloria-Colombia Highway (Super 2 design)	$220,864,086	Long	2040+
R	New International Bridge 4/5 with Laredo Outer Loop	$726,869,211	Long	2040+
D	Mines Rd. Freeway (IH-35 to SH 255)	$1,053,118,000	Long	2040+
L	Expanding Mines Rd. to Eagle Pass (Super 2 design)	$268,434,812	Long	2040+
K	Laredo Outer Loop (New Alignment)	$418,000,000	Long	2040+

CONCLUSION

Development of a new POE or improvement to an existing POE and related transportation facilities is a complex and lengthy undertaking that requires close coordination and collaboration with governmental agencies on both sides of the border. The City of Laredo Bridge Master Plan process is a new tool that can be used to help prioritize infrastructure projects and enhance coordination of planning and implementation of POE and transportation projects in both the United States and Mexico. A comprehensive approach helps agencies in both U.S. and Mexico complete needed projects to efficiently facilitate international trade and improve the quality of life for residents in the border region.

INFRASTRUCTURE

APPENDIX A: FUTURE PROJECTS

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

APPENDIX A

FUTURE PROJECTS

The S&B project team considered a series of future projects as part of the future binational network. These projects are included in several short- and long-range development plans for the City of Laredo and Webb County, as discussed in Chapter 6. All projects listed here already have a completion date or at least an assigned project budget. For the Laredo International Bridge System Master Plan, the team assumes that all these projects will be built based on their presented schedules.

P01. World Trade Bridge Alternative Upgrade: FAST Lane Bypass Alternative I

CSJ: N/A

Listed: N/A

Sponsor: City of Laredo

Opening Year: 2022

Model Year: 2025

Limits: From World Trade Bridge to World Trade Bridge

Description: The first improvement scenario is the FAST lane bypass. The current FAST lanes on the World Trade Bridge (WTB) intermix with the general lanes. Moving them to the north of the plaza can provide a dedicated area for shippers certified under the FAST program. This would allow the existing FAST booths to be used by other commercial vehicles not registered under the FAST program if CBP staffs these booths. This potential improvement scenario includes building four new FAST lanes to the north of the plaza, which will maintain access to the enhanced inspection building and tie into IH-69 at the exit. Two exit booths will be constructed after the split to the enhanced inspection building to maintain the same number of inspections that CBP currently conducts. This scenario will make use of the second lane that is currently blocked on IH-69 just after the exit from the WTB plaza.

P02. World Trade Bridge Alternative Upgrade: Empty Trailer Bypass Alternative II

CSJ: N/A

Listed: N/A

Sponsor: City of Laredo

Opening Year: 2023

Model Year: 2025

Limits: From World Trade Bridge to World Trade Bridge

Description: The empty trailer bypass is similar to the FAST lane bypass in that the bypass is located to the north of the inspection plaza. However, only two lanes and inspection booths are proposed to handle empty commercial vehicle traffic. The empty commercial vehicles would be required to travel through one of two primary inspection booths, have access to the enhanced inspection plaza, use one of the two exit booths, and then merge to one lane on IH-69 after exiting the plaza. The empty trailer bypass lanes would make use of the second lane that is currently blocked on IH-69, just after the WTB plaza's exit. In this scenario, the remaining lanes on the plaza would remain in their current configuration. Because the bypass can be accessed from the FAST lanes on the WTB, only commercial vehicles participating in the FAST program with empty trailers would be able to access the empty trailer bypass.

P03. World Trade Bridge Alternative Upgrade: Fast Bypass Alternative III

CSJ: N/A

Listed: N/A

Sponsor: City of Laredo

Opening Year: 2023

Model Year: 2025

Limits: From World Trade Bridge to World Trade Bridge

Description: All FAST traffic is relocated to a new bypass on the north side of the CBP inspection facility in the center of the WTB. This bypass has four primary inspection booths, a roadway to access the enhanced inspection plaza, and two exit booths. Bypass traffic enters the left lane of IH-69. The existing FAST primary inspection booths and queueing area could be repurposed for general traffic if CBP decides to staff these booths.

P04. IH-69W Loop Upgrade

CSJ: N/A

Listed: TX-MX BTMP,[64] MTP[65]

Sponsor: TxDOT

Opening Year: 2021

Model Year: 2025

Limits: Multiple locations

Description: Additional IH-69W Loop mainlanes.

P05. Hachar-Reuthinger Road Project

CSJ: 92233166

Listed: MTP, TX-MX BTMP

Sponsor: Webb County

Opening Year: 2024

Model Year: 2025

Limits: From 0.1 miles east of Beltway Parkway to IH-35

Description: The project extends approximately 8.4 miles from the FM 1472 (Mines Road) to the southbound (western) frontage road of IH-35 approximately 2 miles north of the Beltway Parkway/Uniroyal Drive overpass. The initial phase of the project from FM 1472 to Beltway Parkway (Phase 1) will consist of a frontage road with two 12-foot lanes with a 4-foot inside shoulder and 10-foot outside shoulder in each direction, typically separated by an approximately 180-foot grassy median. Phase 2 will continue the same configuration from Beltway Parkway to the IH-35 frontage road.

An ultimate future phase will be developed as a full controlled-access freeway and will consist of three 12-foot main lanes with 10-foot inside and outside shoulders in each direction separated by a concrete barrier, three proposed overpasses, and the original at-grade frontage roads.

The project will require between 400 to 500 feet of new right-of-way along its entire length consisting of approximately 480 acres to be donated. The proposed facility will cross the 100-year floodplains of Cuervo Creek and Sombreretillo Creek.

P06. IH-35 I

CSJ: 1806183

Listed: TX-MX BTMP, MTP,

Sponsor: City of Laredo

Opening Year: 2022, 2020

Model Year: 2025

Limits: From 0.5 miles south of US 59 to 0.5 miles east of IH-35

Description: New direct connector (#8) for eastbound 1-69W to southbound IH-35.

P07. IH-35 II

CSJ: 1806484

Listed: MTP, TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2024

Model Year: 2025

Limits: From 0.207 miles west of US 59-SL20/IH-35 to 0.197 miles south of IH-35/US 59-SL20

Description: New direct connector (#5) for westbound 1-69W to southbound IH-35.

P08. IH-35 III

CSJ: 1806186

Listed: MTP, TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2024 – 2035

Model Year: 2025

Limits: From 0.5 miles east of IH-35 to 0.5 miles north of US-59

Description: Construct Direct Connector (#4)

P09. City Street New Interchange at Calton Road

CSJ: 92233093

Listed: MTP, TX-MX BTMP

Sponsor: City of Laredo

Opening Year: 2021 – 2024

Model Year: 2025

Limits: From 0.25 miles east of Calton/San Maria to 0.25 miles west of Calton/San Maria

Description: Construction of a new two-lane grade separated interchange over the Union Pacific Railroad (UPRR) tracks.

P10. IH-69W

CSJ: 8614084

Listed: TX-MX BTMP, MTP

Sponsor: TxDOT

Opening Year: 2022

Model Year: 2025

Limits: From World Trade Bridge GSA facility to IH-35

Description: Widening of main lane (four to six lanes) from World Trade Bridge to IH-35.

P11. IH-35 Railroad Overpass North of Shiloh Avenue

CSJ: 1806136

Listed: TX-MX BTMP, MTP

Sponsor: TxDOT

Opening Year: 2022-2024

Model Year: 2025

Limits: From Shiloh Dr. 0.25 miles north of US 59 to 0.38 miles south of the US 59/IH-35 interchange

Description: The project includes the replacement of the existing IH-35 underpass of the UPRR with an overpass, an addition of northbound and southbound frontage roads with at-grade railroad crossings, provision of turnarounds, a bridge replacement, and new bridges at Shiloh Road.

P12. IH-35 Up Railroad Grade Separation Mile Marker 18

CSJ: 1805904

Listed: TX-MX BTMP, MTP

Sponsor: TxDOT

Opening Year: 2024

Model Year: 2025

Limits: From 2.68 miles north of Uniroyal interchange to 1.2 miles north of US 83 interchange

Description: Widening from four to six lanes and construction of a railroad separation from Uniroyal Dr. to Pacific Missouri Railyards.

P13. US 59 Interchanges I

CSJ: 8614075

Listed: MTP, TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2023-2024

Model Year: 2025

Limits: From 0.5 miles south of Del Mar Blvd. to 0.5 miles north of Del Mar Blvd.

Description: Construction of interchange with new six-lane grade separation.

P14. US 59 Interchanges II

CSJ: 8614076

Listed: MTP, TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2023-2024

Model Year: 2025

Limits: From 0.5 miles south of Shiloh Dr. to 0.5 miles north of Shiloh Dr.

Description: Construction of interchange with new six-lane grade separation.

P15. US 59 Interchanges III

CSJ: 8614078

Listed: MTP, TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2023-2024

Model Year: 2025

Limits: From 0.50 miles south of Jacaman Rd. to 0.50 miles north of Jacaman Rd.

Description: Construction of interchange with new six-lane grade separation.

P16. US-59 Interchanges IV

CSJ: 8614079

Listed: MTP, TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2023-2024

Model Year: 2025

Limits: From 0.5 miles south of University Blvd. to 0.5 miles north of University Blvd.

Description: Construction of interchange with new six lane grade separation.

P17. IH-35 United Avenue Overpass

CSJ: 1806196

Listed: MTP, TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2024

Model Year: 2025

Limits: From 0.25 miles north of the US 59 interchange to 1.353 miles south of Carriers Dr.

Description: Widen United Ave. overpass and add one additional lane with turnarounds.

P18. SH 359

CSJ: 8601073

Listed: MTP, TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2023, 2028

Model Year: 2025

Limits: From 4.06 miles east of SL 20 to 8.935 miles east of SL 20.

Description: The project consists of two sections. The first section extends from 4 miles east of SL 20 to 2.7 miles east of SL 20 and would involve widening the existing SH 359 roadway from two 12-foot-wide travel lanes with a 14-foot-wide center turn lane and 4-foot-wide shoulders to four 12-foot-wide travel lanes with a 16-foot center turn lane and 10-foot-wide shoulders. The second section extends from 6.7 miles east of

SL 20 to 3.1 miles east of SL 20. In this section, SH 359 would be widened to a four-lane divided facility consisting of two 12-foot-wide travel lanes with 10-foot-wide outside shoulders and 4-foot-wide inside shoulders in each direction divided by a grassy median.

In the location of the proposed four-lane divided facility, the existing Right-of-Way (ROW) would be widened from its existing 135-foot ROW width to approximately 225 feet. This would require the acquisition of approximately 36 acres. Although additional ROW is required, no residential or non-residential structures would be displaced.

P19. WTB Port Modifications Alternative I

CSJ: N/A

Listed: N/A

Sponsor: City of Laredo

Opening Year: 2024

Model Year: 2025

Limits: From World Trade Bridge to World Trade Bridge

Description: Bridge expansion in the northbound direction: Construction of a new direct bridge facility and a new FAST program facility.

P20. WTB Port Modifications Alternative II

CSJ: N/A

Listed: N/A

Sponsor: City of Laredo

Opening Year: 2024

Model Year: 2025

Limits: From World Trade Bridge to World Trade Bridge

Description: Bridge expansion in the northbound direction: Construction of a new bridge facility adjacent to the existing bridge and a new FAST program facility.

P21. WTB Revise Commercial Route

CSJ: N/A

Listed: N/A

Sponsor: City of Laredo

Opening Year: 2021 – 2023

Model Year: 2025

Limits: From Mines Road to IH-35

Description: Revise commercial route from the POE to Mines Road northbound to eliminate left turns.

P22. Single Point Urban Interchange

CSJ: 215004080

Listed: N/A

Sponsor: TxDOT

Opening Year: 2023

Model Year: 2025

Limits: From FM 1472 to FM 1472

Description: Four-Phase Single Point Urban Interchange to be constructed at the interchange of FM 1472 and IH-69W. Phase 1 would allow for northbound and southbound left turn movements. Phase 2 would allow northbound and southbound through traffic and right turn movements. Phase 3 would allow eastbound and westbound left turn movements. Phase 4 would allow for eastbound and westbound through traffic and right turn movements.

P23. Median U-Turn Intersection at Killam Industrial Boulevard/ Riverbank Drive and FM 1472

CSJ: 215004080

Listed: N/A

Sponsor: TxDOT

Opening Year: 2023

Model Year: 2025

Limits: From Killam Industrial Boulevard/Riverbank Drive to FM 1472

Description: Construction of a median U-turn intersection. The proposed design consists of one main signalized intersection at Killam Industrial Boulevard and two median crossovers to the north and south. Traffic continuing straight or turning right would be able to proceed as usual. All left turns would be completed by making U-turns at one of the median crossovers.

Drivers on FM 1472 northbound wanting to turn left onto Riverbank Drive would continue straight through the intersection, then make a U-turn at the northern median crossover to turn right onto Riverbank Drive. Drivers on FM 1472 southbound wanting to turn left onto Killam Industrial Boulevard would continue straight through the intersection, then make a U-turn at the southern median crossover to turn right onto Killam Industrial Boulevard.

P24. Restricted Crossing U-Turn Intersection at Interamerica Boulevard and FM 1472

CSJ: 215004080

Listed: N/A

Sponsor: TxDOT

Opening Year: 2023

Model Year: 2025

Limits: From Interamerica Boulevard to FM 1472

Description: Construction of a restricted crossing U-turn intersection. The proposed intersection design restricts through traffic and left-turn traffic movements from Interamerica Boulevard onto FM 1472 at the main intersection but provides for these movements through a median crossing to the south of the proposed intersection. The northbound traffic can either turn left or continue straight at the main intersection. FM 1472 southbound traffic would operate as it does currently.

Restricted Crossing U-Turn Intersection at AF Muller Boulevard and FM 1472

CSJ: 215004080

Listed: N/A

Sponsor: TxDOT

Opening Year: 2023

Model Year: 2025

Limits: From AF Muller Boulevard to FM 1472

Description: Construction of a restricted crossing U-turn intersection. The proposed intersection design restricts through and left turn movements from the cross streets. Traffic would turn right from the cross streets and use the median crossovers to the north. Through traffic on FM 1472 would operate as it does currently.

P25. Restricted Crossing U-Turn Intersection at Trade Center Boulevard and FM 1472

CSJ: 215004080

Listed: N/A

Sponsor: TxDOT

Opening Year: 2023

Model Year: 2025

Limits: From Trade Center Boulevard to FM 1472

Description: Construction of a restricted crossing U-turn intersection. All traffic on Trade Center Boulevard would turn right at the FM 1472 intersection. Traffic wanting to travel northbound on FM 1472 would use the southern median crossing.

Traffic on FM 1472 northbound wanting to turn left would be controlled by a traffic signal but the northbound through traffic would not. Southbound traffic on FM 1472 would operate as it currently does.

P26. Restricted Crossing U-Turn Intersection at Pan American Boulevard and FM 1472

CSJ: 215004080

Listed: N/A

Sponsor: TxDOT

Opening Year: 2023

Model Year: 2025

Limits: From Pan American Boulevard to FM 1472

Description: Construction of a restricted crossing U-turn intersection. Traffic on Pan American Boulevard would be restricted to a right turn only onto FM 1472 southbound and then users would be required to travel southbound to Trade Center Boulevard to utilize the restricted U-turn.

All traffic on Pan American Boulevard would turn right at the FM 1472 intersection. Traffic wanting to travel northbound on FM 1472 would then use the median crossover to the south of Trade Center Boulevard. Southbound traffic on FM 1472 would operate in the same manner as it currently does.

P27. Green "T" Intersection at Milo Road and FM 1472

CSJ: 215004080

Listed: N/A

Sponsor: TxDOT

Opening Year: 2023

Model Year: 2025

Limits: From Milo Road to FM 1472

Description: The conflict points for the proposed intersection would remain the same, but the new intersection design is anticipated to reduce overall intersection delays by approximately 45 percent during peak traffic periods.

P28. US 59 Upgrade

CSJ: N/A

Listed: N/A

Sponsor: TxDOT

Opening Year: 2035

Model Year: 2030

Limits: From International Blvd. to Saunders St.

Description: The US 59 Loop corridor between International Boulevard and the US 59/Loop 20 intersection is proposed to be upgraded to an urban expressway. This expressway is proposed to include the following:

- Three main lanes in each direction.
- Construction of three-lane frontage roads on each side of the main lanes.
- Elevating the main lanes over the major street crossings including Airport Drive, Jacaman Road, University Boulevard, Del Mar Boulevard, and Shiloh Road.
- Constructing sidewalks on each side and a bicycle path adjacent to the east-side frontage road.

This project will integrate with the International Boulevard project that is under construction and the near future construction project of installing the Loop main lanes over IH-35 and the UPRR line. The main lanes over McPherson Road would also be completed.

P29. Southern Loop 20 Extension

CSJ: N/A

Listed: TX-MX BTMP

Sponsor: TxDOT

Opening Year: 2025

Model Year: 2030

Limits: From Proposed Bridge V to Proposed Bridge V

Description: Construct six main lanes and six frontage roads to connect Cuatro Vientos Blvd. with the proposed International Bridge V.

P30. Laredo Outer Loop

CSJ: 92233151

Listed: TX-MX BTMP

Sponsor: TxDOT

Opening Year: 2050

Model Year: 2030, 2035, 2040

Limits: From IH-35 at SH 255 to US 83 South

Description: New road approximately 42 miles long with frontage road and main lanes (six main lanes, and six frontage roads). Extends east of Laredo from the IH-35/SH 255 interchange in the north to the vicinity of the proposed Fifth Bridge crossing in the south, near the city of Rio Bravo. The loop aims to provide capacity and resiliency to the existing highway network in the county in addition to planning for Laredo's future growth.

P31. IH-35 IV

CSJ: 1806185

Listed: MTP, TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2024

Model Year: 2030

Limits: From 0.5 miles east of IH-35 to 0.5 miles north of US-59

Description: Construct Direct Connector #3

P32. IH-35 V

CSJ: 1806187

Listed: MTP, TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2024

Model Year: 2030

Limits: From 0.5 miles south of IH-35 to 0.5 miles east of US-59

Description: Construct Direct Connector #6

P33. IH-35 VI

CSJ: 1806198

Listed: TX-MX BTMP, MTP

Sponsor: TxDOT

Opening Year: 2024

Model Year: 2030

Limits: From 0.38 miles south of US 59/I-59 Interchange to 0.8 miles north of US 59/IH-69W interchange

Description: Widen the number of lanes (from four to six lanes) and cover the intersection with IH-69.

P34. SL20 I

CSJ: 8616009

Listed: MTP, TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2026-2029

Model Year: 2030

Limits: From 0.1 miles south of Cielito Lindo Rd. to 0.1 miles north of Cielito Lindo Rd.

Description: New interchange in Cielito Lindo with a six-lane grade separation interchange.

P35. SL20 II

CSJ: 8616010

Listed: MTP, TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2026-2030

Model Year: 2030

Limits: From 0.1 miles south of Sierra Vista Rd. to 0.1 miles north of Sierra Vista Rd.

Description: New interchange in Sierra Vista with a six-lane grade separation interchange.

P36. SL20 III

CSJ: 8616008

Listed: MTP, TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2026-2027

Model Year: 2030

Limits: From 2.77 miles south of SH 359 to 2.39 miles south of SH 359.

Description: New interchange in Lomas del Sur with a six-lane grade separation interchange.

P37. Vallecillo Road

CSJ: N/A

Listed: TX-MX BTMP

Sponsor: WC-CL RMA

Opening Year: 2024

Model Year: 2035

Limits: From FM 1472 to IH-35

Description: Approximately 3.2 miles of new roadway that includes a continuous 150-foot-wide ROW for future expansion. Initially this will be a five-lane roadway that will link key north–south roadways (FM 1472 and IH-35) where continued industrial growth can be expected to occur in the region south of the road. The project ties into A.F. Muller Boulevard and will have sidewalks on both sides, including a 10-foot shared-use path on one side.

P38. Gloria - Colombia Highway

CSJ: N/A

Listed: TX-MX BTMP

Sponsor: SCT / Corporation for the Development of the Nuevo León Border Zone Design

Opening Year: 2023 – 2024

Model Year: 2045

Limits: N/A

Description: 102-kilometer stretch from La Gloria to Colombia with a vehicular capacity of 5,000 cargo and light vehicles. This project would strengthen the operations of Puente Colombia, Anahuac, and Nuevo León.

P39. Airport Modernization

CSJ: N/A

Listed: N/A

Sponsor: Laredo International Airport.

Opening Year: 2021-2025

Model Year: Not included

Limits: From Laredo International Airport to Laredo International Airport.

Description: Extend the runway approximately 1,500 feet to the north. Includes instrument landing system, approach lighting, runway edge lighting, and extending Taxiway J to full length of extended runway. Reconstruct approximately 19,000 square yards of apron along the east edge of the west apron because of poor pavement condition. Expand east cargo apron by approximately 26,500 square yards to the north to accommodate additional cargo operations. Construct approximately 124,000 square feet of building for expanded cargo area. Reconstruct approximately 23,000 square yards of apron in the southwest corner of the west apron because of poor pavement condition. Expand the terminal by approximately 32,000 square feet. Allows for addition of one gate. Construct approximately 27,000 square yards of pavement in the southwest corner of the airport to accommodate expansion of the general aviation area. New Near Term Flex Facility (General Aviation/Cargo with approximately 160,000 square yards of pavement to accommodate additional cargo/general aviation operations. Can be phased as needed to meet demand at the Airport. Construct approximately 75,000 square feet of building/hangar space for expanded cargo/general aviation operations.

P40. Expand Border Capacity of World Trade Bridge

CSJ: N/A

Listed: N/A

Sponsor: SCT & Nuevo Laredo Government

Opening Year: 2025

Model Year: 2025

Limits: From World Trade Bridge Mexican side to World Trade Bridge Mexican side

Description: Expand port capacity from 8 to 16 lanes on the Mexican side of the World Trade Bridge.

P41. Multimodal Industrial Park

CSJ: N/A

Listed: TX-MX BTMP

Sponsor: Mexico Railroads.

Opening Year: 2025

Model Year: Not included

Limits: N/A

Description: Connect to the World Trade Bridge with a new main access road for commercial vehicles. Includes construction of infrastructure to connect with railroad. Expansion of the Sanchez Yard located 16 kilometers (9.94 mi) from Nuevo Laredo.

P42. KCS Rail Bridge

CSJ: N/A

Listed: TX-MX BTMP

Sponsor: KSC

Opening Year: Unknown

Model Year: Not included

Limits: From Texas Mexican Railway International Bridge to Texas Mexican Railway International Bridge

Description: Construction of a second body in the current rail bridge of 327 m (203.18 miles) parallel to the current rail pass.

P43. WTB Term Port Improvements

CSJ: N/A

Listed: N/A

Sponsor: City of Laredo

Opening Year: 2024

Model Year: 2025

Limits: From World Trade Bridge to World Trade Bridge

Description: Cargo traffic control tower, unification of cargo processing, and portal scanner with x-ray imaging analysis station.

P44. WTB Term Port Improvements

CSJ: N/A

Listed: N/A

Sponsor: City of Laredo

Opening Year: 2025

Model Year: 2025

Limits: From World Trade Bridge to World Trade Bridge

Description: Reconfiguring existing non-FAST egress onto IH-69W with new exit control booths.

P45. Springfield Road Extension Project

CSJ: N/A

Listed: N/A

Sponsor: City of Laredo

Opening Year: 2022 or beyond

Model Year: Included but not active project.

Limits: From Del Mar to US 59

Description: Development and implementation of extending and inter-connecting Springfield Road in north Laredo from Del Mar to US 59.

P46. Los Presidentes Phase 1 and Phase 2A from Loop 20 South (Cuatro Vientos) to Brownwood St

CSJ: N/A

Listed: N/A

Sponsor: City of Laredo

Opening Year: 2022 or beyond

Model Year: 2030

Limits: From Loop 20 South to Brownwood Street

Description: RMA developed plans, specifications, and an estimate for the implementation of a new location Modified Major Arterial that will extend east from the intersection of Los Presidentes and Loop 20 South (Cuatro Vientos) to the intersection of Los Presidentes and Brownwood Street, for a length of 0.85 miles. Construction of the project let in November 2020 and the project will be constructed in 2021, as overseen by the City of Laredo. The project will also include an acceleration and deceleration lane on Loop 20 South (Cuatro Vientos). This portion of the project will be let for construction by the TxDOT Laredo District in October 2021. Construction of the TxDOT portion of the project will be constructed in 2022. Construction of the City of Laredo portion of Los Presidentes will be completed in 2022. Originally, the project only consisted of the portion from Cuatro Vientos to Concord Hills, known as Phase 1. The RMA implemented additional project development efforts to extend the limits of the project from Concord Hills to Brownwood Street as part of the overall construction advertisement (Resolution 20-13, Resolution 20-20, Resolution 20-21, and Resolution 20-22). The extension is known as Phase 2A.

P47. River Bend Road

CSJ: N/A

Listed: N/A

Sponsor: City of Laredo

Opening Year: 2022 or beyond

Model Year: Included but not active project.

Limits: From Aquero Rd to FM 1472

Description: New road from Aquero Road to FM 1472.

P48. FM 3338 Expansion

CSJ: N/A

Listed: TX-MX BTMP, MTP

Sponsor: TxDOT

Opening Year: 2030

Model Year: Not included

Limits: From FM 1472 to SH 255

Description: Upgrade to an urban five-lane roadway: Widens the road and adds two additional turn lanes with one continuous left turn lane.

P49. IH-35 VII

CSJ: 1805102

Listed: TX-MX BTMP

Sponsor: N/A

Opening Year: 2040-2050

Model Year: Included but not active project.

Limits: From 0.50 miles south of Hachar-Reuthinger Rd. to 0.50 miles north of Hachar-Reuthinger Rd.

Description: Interchange improvement with the future Hachar Road.

P50. US 59 Interchanges IV

CSJ: 8614077

Listed: MTP, TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2040-2050

Model Year: Not included

Limits: From 0.5 miles south of E Corridor Rd. (Airport) to 0.5 miles north of E Corridor Rd. (Airport)

Description: Construction of interchange with a new six-lane grade separation.

P51. Construct New Road Mangana Hein Road – IH-35

CSJ: 92233066

Listed: TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2050

Model Year: Not included

Limits: From Mangana-Hein Rd. to US 83 At Rio Bravo

Description: Construct new road from Mangana Hein Road to US 83 at Rio Bravo.

P52. Hachar-Reuthinger Extension East of IH-35

CSJ: N/A

Listed: TX-MX BTMP

Sponsor: Webb County

Opening Year: 2050

Model Year: Not included

Limits: From Hachar Rd to east of IH-35 at the Outer Loop

Description: Extension of the Hachar Project east to the proposed Laredo Outer Loop.

P53. US 59

CSJ: 54202043

Listed: TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2050+

Model Year: Not included

Limits: From Duval County Line to Miles West of FM 2895

Description: Widen road by adding lanes and shoulders.

P54. Construct New Road US 59 to IH-35

CSJ: 92233182

Listed: TX-MX BTMP

Sponsor: TxDOT Design

Opening Year: 2050+

Model Year: Not included

Limits: From US 59 to SH 255

Description: Construction of a new location non-freeway from US 59 to SH 255.

P55. WTB Technology Integration: Multi-Energy Portal (MEP)

CSJ: N/A

Listed: N/A

Sponsor: N/A

Opening Year: 2021-2023

Model Year: 2025

Limits: From World Trade Bridge to World Trade Bridge

Description: Integration and deployment of the Multi-Energy Portal (MEP) systems for non-intrusive inspection of commercial vehicles.

P56. WTB Technology Integration: Radio Frequency Identification (RFID)

CSJ: N/A

Listed: N/A

Sponsor: N/A

Opening Year: 2021-2023

Model Year: 2025

Limits: From World Trade Bridge to World Trade Bridge

Description: Integration and deployment of Radio Frequency Identification (RFID) systems for border crossing users' identification (commercial and pedestrians).

P57. WTB Technology Integration: Optical Recognition

CSJ: N/A

Listed: N/A

Sponsor: N/A

Opening Year: 2021-2023

Model Year: 2025

Limits: From World Trade Bridge to World Trade Bridge

Description: Integration and deployment of optical character recognition on box trailers to increase security and reduce processing time.

P58. WTB Technology Integration: Biometric Recognition

CSJ: N/A

Listed: N/A

Sponsor: N/A

Opening Year: 2021-2023

Model Year: 2025

Limits: From World Trade Bridge to World Trade Bridge

Description: Integration and deployment of Biometric Facial Comparison to secure and streamline border crossings.

P59. WTB Technology Integration: Automated Commercial Environment (ACE)

CSJ: N/A

Listed: N/A

Sponsor: N/A

Opening Year: 2021-2023

Model Year: 2025

Limits: From World Trade Bridge to World Trade Bridge

Description: The Automated Commercial Environment (ACE) is the system through which the trade community reports imports and exports; the government determines admissibility.

P60. WTB Technology Integration: Weigh in-Motion Scale

CSJ: N/A

Listed: N/A

Sponsor: N/A

Opening Year: 2021-2023

Model Year: 2025

Limits: From World Trade Bridge to World Trade Bridge

Description: Integration and deployment of weigh-in-motion scale: process of measuring the dynamic tire forces of commercial vehicles and estimating the gross vehicle weight (GVW) as well as the portion of that weight carried by each wheel, axle, and axle group of a corresponding static vehicle (static wheel and axle loads).

P61. WTB Technology Integration: Z-Portal Scanner

CSJ: N/A

Listed: N/A

Sponsor: N/A

Opening Year: 2021-2023

Model Year: 2025

Limits: From World Trade Bridge to World Trade Bridge

Description: Integration and deployment of a Z-Portal scanner as part of the inventory of inspection tools—including gamma ray and X-ray non-intrusive inspection technologies—that are presently being used at the nation's POEs. In comparison to the technology currently used by the CBP, the Z-Portal provides a much clearer image of low-density objects that may be hidden in car fenders, tires, trunks, gas tanks, or under the hood.

On January 5, 2021, the U.S. Congress published the H.R. 5273 act, which requires to the Secretary of Homeland Security to develop a plan to increase to 100 percent the scanning rates of commercial and passenger vehicles and freight rail entering the United States at land POEs along the border using large-scale, non-intrusive inspection systems to enhance border security, and for other purposes.

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[1]Texas Department of Transportation (2020, November 11). *Texas-Mexico Border Transportation Master Plan.* Retrieved from https://www.txdot.gov/inside-txdot/projects/studies/statewide/040219.html

[2] Laredo Area Metropolitan Planning Organization (2020). *Laredo Metropolitan Transportation Plan 2020-2045*. Retrieved from http://www.laredompo.org/mtp/.

INFRASTRUCTURE

APPENDIX B: ALTERNATIVES CONSIDRED

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

APPENDIX B

ALTERNATIVES CONSIDERED

The alternatives development process typically involves developing conceptual alternatives that address the Purpose and Need of the project. Public and agency coordination is then conducted to receive input on

Site Alternative	Brief Description
A	World Trade Bridge: New Bridge Span (south of existing bridge)
B	World Trade Bridge: Two Additional FAST Lanes
C	World Trade Bridge: Entry Primary Inspection Lanes Expansion
D	Mines Rd. Freeway (IH-35 to SH 255)
E	Direct connection from WTB to Killam Industrial Blvd. (IH-69 to IH-35 via DC 1 exit to Tres Equis underpass)
F	Juarez-Lincoln International Bridge: Passenger Vehicle Inspection with Double-Stacked Booths
G	Permanently Moving Empty Commercial vehicles to Colombia POE, 2025-204
H	Colombia Bridge: Proposal of an Overweight/Oversize (OW/OS) Corridor and Implementing a Daily OW/OS Permit Program
I	Safety Improvement (adding inside/outside shoulders) at MEX-2 Hwy between World Trade Bridge and Colombia Bridge
J	La Gloria-Colombia Highway (Super 2 design)
K	Laredo Outer Loop (New Alignment)
L	Expanding Mines Rd. to Eagle Pass (Super 2 design)
M	Vallecillo Extension (IH-35 to US 59 and SH 359)
N	Gateway to the Americas International Bridge: Expansion of the Sidewalk
O	Juarez-Lincoln International Bridge: Intersection Improvements
P	Improving Las Tiendas Road (5-Lane divided section)
Q	New International Bridge 4/5 to SL 20
R	New Bridge 4/5 with Laredo Outer Loop
S	Gateway to the Americas International Bridge: Pedestrian Only Crossing

The S&B Team carried out an assessment of alternatives for the City of Laredo Border Master Plan to determine the impact of each improvement to the region's Ports of Entry and the border corridors in Laredo and Webb County. The alternatives considered include the new construction or the expansion of existing POE infrastructure or binational corridors. The alternatives evaluated by the S&B team are described below along with the corresponding model demand results and level of service (LOS) analysis results.

A. WTB: New Bridge Span (South of Existing Bridge)

Opening Year Scenario: 2030-2040

Limits: From World Trade Bridge to World Trade Bridge

Description: Currently, the World Trade Bridge operates at a maximum 15 primary inspection booths including three FAST inspection booths. The number of lanes at the WTB bridge span are four northbound and four southbound lanes, including one sperate FAST lane in the northbound direction. This alternative proposes a bridge expansion in the northbound direction and the construction of a new direct bridge facility and a new FAST program facility. The proposal includes the conversion of the existing WTB Bridge span into six southbound lanes and two northbound FAST lanes. This alternative also includes construction of a second bridge span with eight regular northbound lanes.

Location:

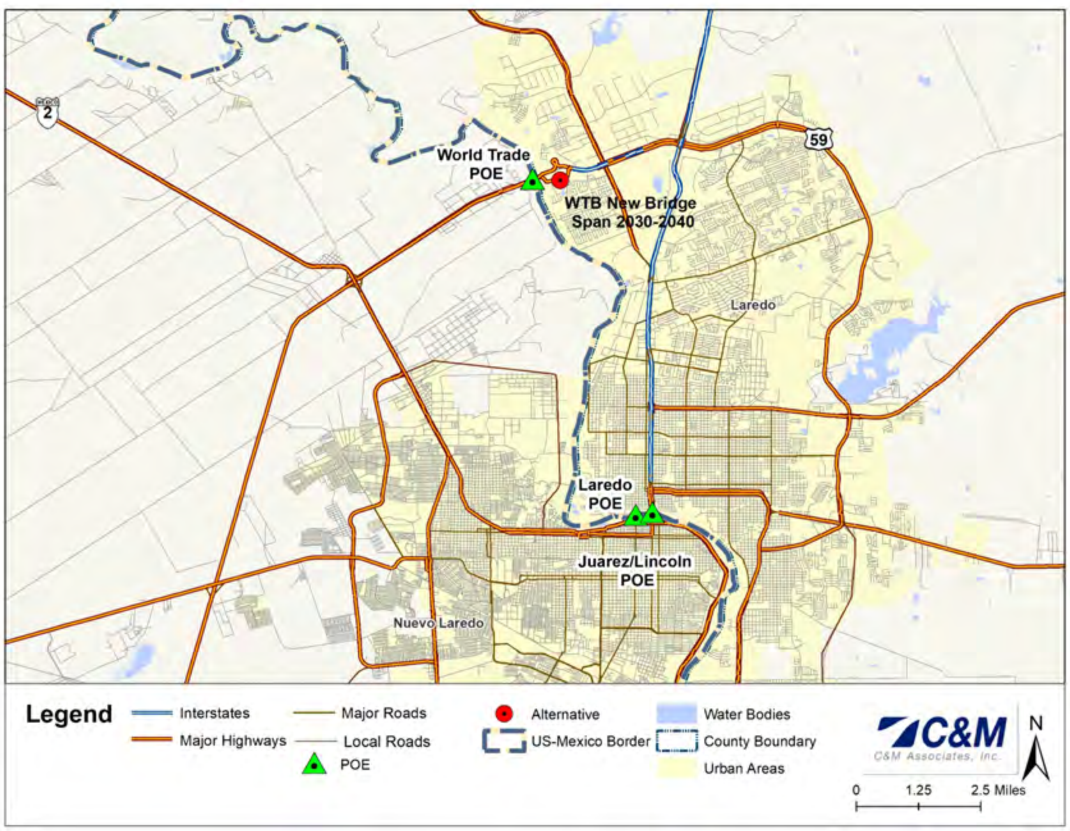

Figure 4. Alternative A Location

Travel Demand Model Results:

Table 10. Alternative A Model Demand Results

Evaluation Criteria	Direction	Year	Colombia POE			World Trade POE		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2030	2,116	2,085	**-1.5%**	10,035	10,066	**0.3%**
	US-MX	2030	1,779	1,636	**-8.0%**	10,133	10,276	**1.4%**
Total Crossing Time (min)	MX-US	2030	50.2	48.3	**-3.8%**	69.0	71.0	**2.8%**
	US-MX	2030	25.8	23.0	**-10.6%**	50.3	52.5	**4.4%**
Waiting Time (min)	MX-US	2030	18.4	11.7	**-36.7%**	37.1	38.9	**4.6%**
	US-MX	2030	0.3	0.1	**-60.5%**	16.1	17.2	**7.2%**
Vehicles in the queue	MX-US	2030	43.1	26.0	**-39.8%**	253.5	248.7	**-1.9%**
	US-MX	2030	4.7	2.41	**-49.1%**	128.0	125.8	**-1.7%**
Queue Length (miles)	MX-US	2030	0.00	0.00	**0.0%**	2.1	1.0	**-51.9%**
	US-MX	2030	0.00	0.00	**0.0%**	1.4	1.1	**-23.0%**
Volume Throughput	MX-US	2040	4,486	4,074	**-9.2%**	11,427	11,839	**3.6%**
	US-MX	2040	3,771	3,612	**-4.2%**	11,830	11,989	**1.3%**
Total Crossing Time (min)	MX-US	2040	134.5	114.1	**-15.2%**	249.9	258.72	**3.5%**
	US-MX	2040	100.1	93.0	**-7.1%**	149.7	152.2	**1.7%**
Waiting Time (min)	MX-US	2040	84.4	65.3	**-22.6%**	160.5	165.5	**3.1%**
	US-MX	2040	53.5	48.1	**-10.1%**	85.4	87.1	**2.0%**
Vehicles in the queue	MX-US	2040	276.4	235.3	**-14.8%**	461.8	503.6	**9.1%**
	US-MX	2040	126.9	116.7	**-8.0%**	714.4	705.5	**-1.2%**
Queue Length (miles)	MX-US	2040	3.9	3.5	**-11.0%**	4.9	5.6	**14.2%**
	US-MX	2040	2.8	2.7	**-5.7%**	10.3	9.8	**-4.4%**

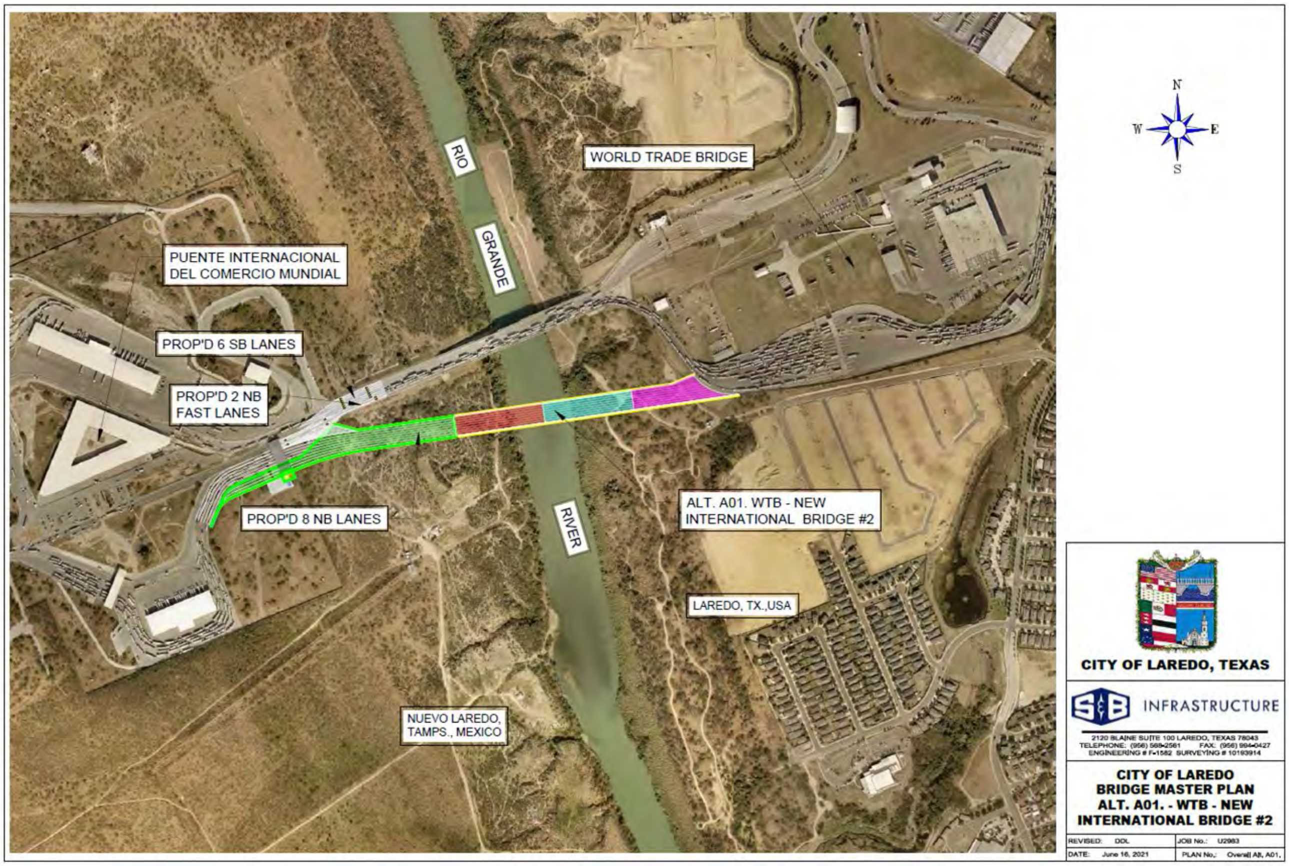

Figure 5. Alternative A Description

B. WTB: FAST Lane Expansion 2030-2040 (Future Construction)

Opening Year Scenario: 2030-2040

Limits: From World Trade Bridge to World Trade Bridge

Description: Currently, the World Trade Bridge is expanding its current operation of three FAST lanes to a separate FAST lane inspection facility of four primary inspection booths in the center of the WTB. This alternative will expand the four FAST primary inspection booths to a total of six primary inspection booths. The construction will include two additional FAST lanes on the existing WTB span and two additional FAST primary inspection booths.

Location:

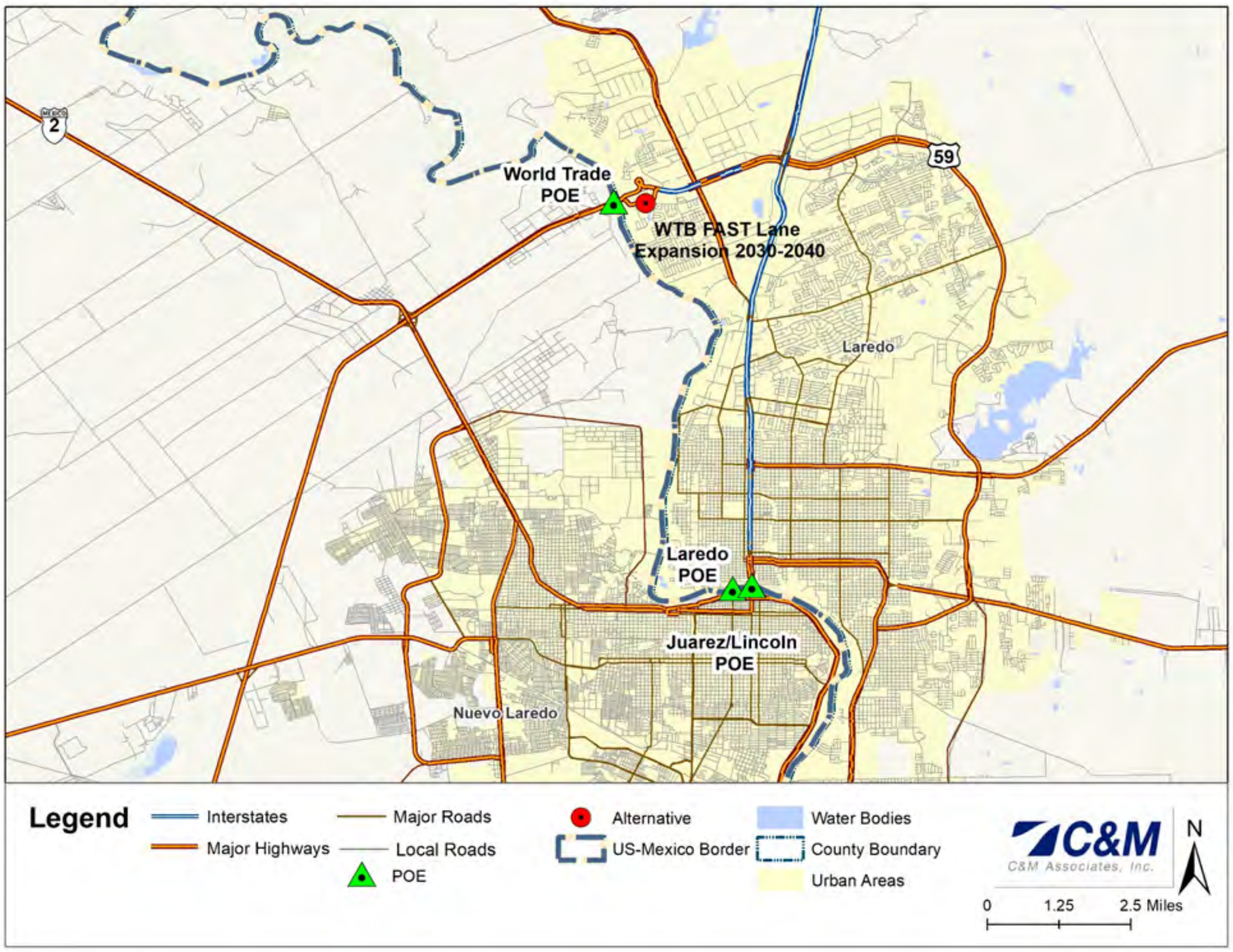

Figure 6. Alternative B Location

Figure 7. Alternative B Description

Travel Demand Model Results:

Table 11. Alternative B Model Demand Results

Evaluation Criteria	Direction	Year	Colombia POE			World Trade POE		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2030	2,116	1,854	**-12.4%**	10,035	10,297	**2.6%**
	US-MX	2030	1,779	1,770	**-0.5%**	10,133	10,142	**0.1%**
Total Crossing Time (min)	MX-US	2030	50.2	33.3	**-33.5%**	69.0	50.0	**-27.6%**
	US-MX	2030	25.8	25.3	**-1.9%**	50.3	50.6	**0.6%**
Waiting Time (min)	MX-US	2030	18.4	5.2	**-71.6%**	37.1	24.3	**-34.6%**
	US-MX	2030	0.3	0.3	**-7.1%**	16.1	16.2	**0.5%**
Vehicles in the queue	MX-US	2030	43.1	14.0	**-67.5%**	253.5	266.4	**5.1%**
	US-MX	2030	4.7	4.61	**-2.4%**	128.0	128.3	**0.3%**
Queue Length (miles)	MX-US	2030	0.00	0.00	**0.0%**	2.1	1.5	**-25.2%**
	US-MX	2030	0.00	0.00	**0.0%**	1.4	1.4	**0.2%**
Volume Throughput	MX-US	2040	4,486	3,509	**-21.8%**	11,427	12,404	**8.5%**
	US-MX	2040	3,771	3,737	**-0.9%**	11,830	11,864	**0.3%**
Total Crossing Time (min)	MX-US	2040	134.5	102.0	**-24.1%**	249.9	142.5	**-43.0%**
	US-MX	2040	100.1	99.5	**-0.6%**	149.7	149.9	**0.2%**
Waiting Time (min)	MX-US	2040	84.4	57.7	**-31.7%**	160.5	80.5	**-49.9%**
	US-MX	2040	53.5	52.8	**-1.4%**	85.4	85.6	**0.2%**
Vehicles in the queue	MX-US	2040	276.4	152.5	**-44.8%**	461.8	549.3	**18.9%**
	US-MX	2040	126.9	126.5	**-0.4%**	714.4	715.5	**0.2%**
Queue Length (miles)	MX-US	2040	3.9	1.9	**-51.2%**	4.9	6.3	**28.5%**
	US-MX	2040	2.8	2.8	**-2.4%**	10.3	10.3	**0.5%**

C. WTB: Entry Lanes Expansion 2030-2040

Opening Year Scenario: 2030-2040

Limits: From World Trade Bridge to World Trade Bridge

Description: The commercial Vehicles at the WTB cross the four lanes of the WTB Bridge span in the northbound direction. At the World Trade Bridge CBP facility, these four lanes convert into only three entry lanes. After about half a mile, these three lanes will open to the 15 lanes connecting to the primary inspection booths. This alternative improves the expansion of the WTB CBP facility entering lanes, including three additional lanes and primary inspection booths to expand existing capacity to five entry lanes at the CBP facility entry and three additional primary inspection booths to a total of 18 primary inspection booths for regular and empty commercial vehicles. The four FAST lanes that are under construction are also considered in this Alternative as part of the base scenario. Additionally, this alternative will add two additional inspections booths for the vehicle inspections after the primary inspection.

Location:

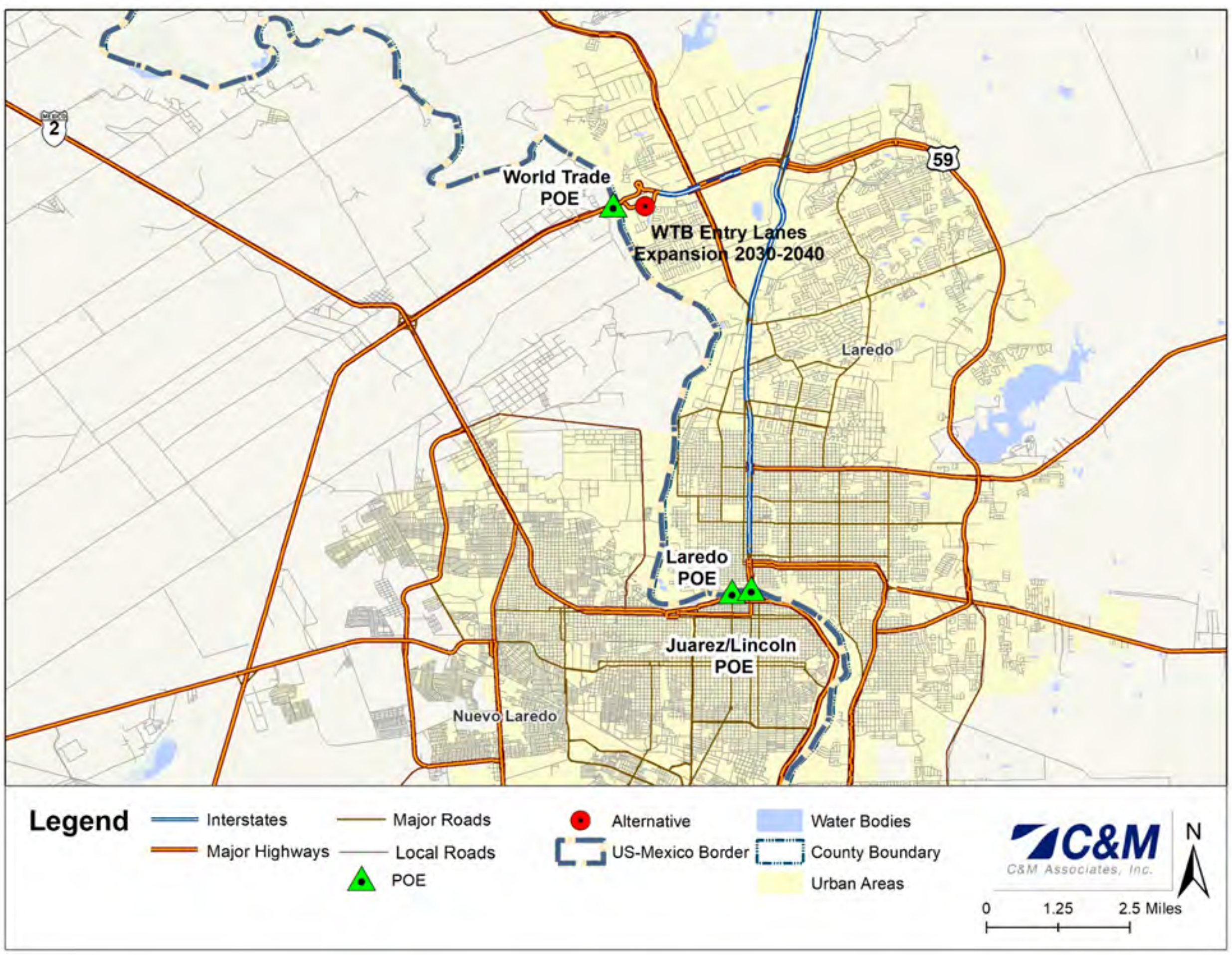

Figure 8. Alternative C Location

Travel Demand Model Results:

Table 12. Alternative C Model Demand Results

Evaluation Criteria	Direction	Year	Colombia POE			World Trade POE		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2030	2,116	1,654	**-21.8%**	10,035	10,497	**4.6%**
	US-MX	2030	1,779	1,755	**-1.3%**	10,133	10,157	**0.2%**
Total Crossing Time (min)	MX-US	2030	50.2	28.7	**-42.8%**	69.0	47.4	**-31.4%**
	US-MX	2030	25.8	24.3	**-5.8%**	50.3	50.7	**0.7%**
Waiting Time (min)	MX-US	2030	18.4	4.9	**-73.6%**	37.1	22.7	**-39.0%**
	US-MX	2030	0.3	0.3	**-12.8%**	16.1	16.2	**0.7%**
Vehicles in the queue	MX-US	2030	43.1	12.0	**-72.3%**	253.5	212.8	**-16.1%**
	US-MX	2030	4.7	4.6	**-3.3%**	128.0	128.5	**0.4%**
Queue Length (miles)	MX-US	2030	0.00	0.00	**0.0%**	2.1	1.2	**-42.6%**
	US-MX	2030	0.00	0.00	**0.0%**	1.4	1.4	**0.9%**
Volume Throughput	MX-US	2040	4,486	3,056	**-31.9%**	11,427	12,857	**12.5%**
	US-MX	2040	3,771	3,729	**-1.1%**	11,830	11,872	**0.4%**
Total Crossing Time (min)	MX-US	2040	134.5	92.3	**-31.4%**	249.9	119.4	**-52.2%**
	US-MX	2040	100.1	97.5	**-2.6%**	149.7	150.3	**0.4%**
Waiting Time (min)	MX-US	2040	84.4	48.7	**-42.3%**	160.5	58.4	**-63.6%**
	US-MX	2040	53.5	52.3	**-2.3%**	85.4	85.9	**0.6%**
Vehicles in the queue	MX-US	2040	276.4	113.0	**-59.1%**	461.8	543.2	**17.6%**
	US-MX	2040	126.9	125.8	**-0.9%**	714.4	718.5	**0.6%**
Queue Length (miles)	MX-US	2040	3.9	1.0	**-73.7%**	4.9	5.9	**20.7%**
	US-MX	2040	2.8	2.8	**-2.7%**	10.3	10.4	**0.8%**

Figure 9. Alternative C Description

D. Mines Rd. Freeway 2030-2040

Opening Year Scenario: 2030-2040

Limits: From IH-35 to Dolores Blvd.

Description: Mines Road is an 18.3-mile one-lane per direction freeway connecting Dolores Boulevard (Colombia POE entry) and IH-35. This alternative includes upgrading Mines Road to a limited-access highway grade facility from the Santa Maria Avenue (IH-35) intersection with FM 1472 to Dolores Boulevard near the Colombia Solidarity Bridge.

Location:

Figure 10. Alternative D Location

Level of Service (LOS) Results:

Table 13. Alternative D Level of Service Results

Road	Segment #	From	To	Year	Length (miles)	Northbound		Southbound	
						Base Case	Alternative	Base Case	Alternative
Mines Road FM 1472	1	Las Cruces Dr	I-69 Bob Bullock Loop	2030	1.30	D	A	D	A
				2040	1.30	E	A	D	A
	2	I-69 Bob Bullock Loop	Riverbank Dr	2030	0.88	E	B	E	A
				2040	0.88	E	B	E	B
	3	Riverbank Dr	F. Muller Blvd	2030	0.76	F	B	F	B
				2040	0.76	F	C	F	C
	4	F. Muller Blvd	Pan American Blvd	2030	0.77	F	C	F	C
				2040	0.77	F	C	F	C
	5	Pan American Blvd	FM 3338	2030	3.59	F	A	F	A
				2040	3.59	F	B	F	B
	6	FM 3338	FM 255	2030	11.35	A	A	B	A
				2040	11.35	D	A	E	A

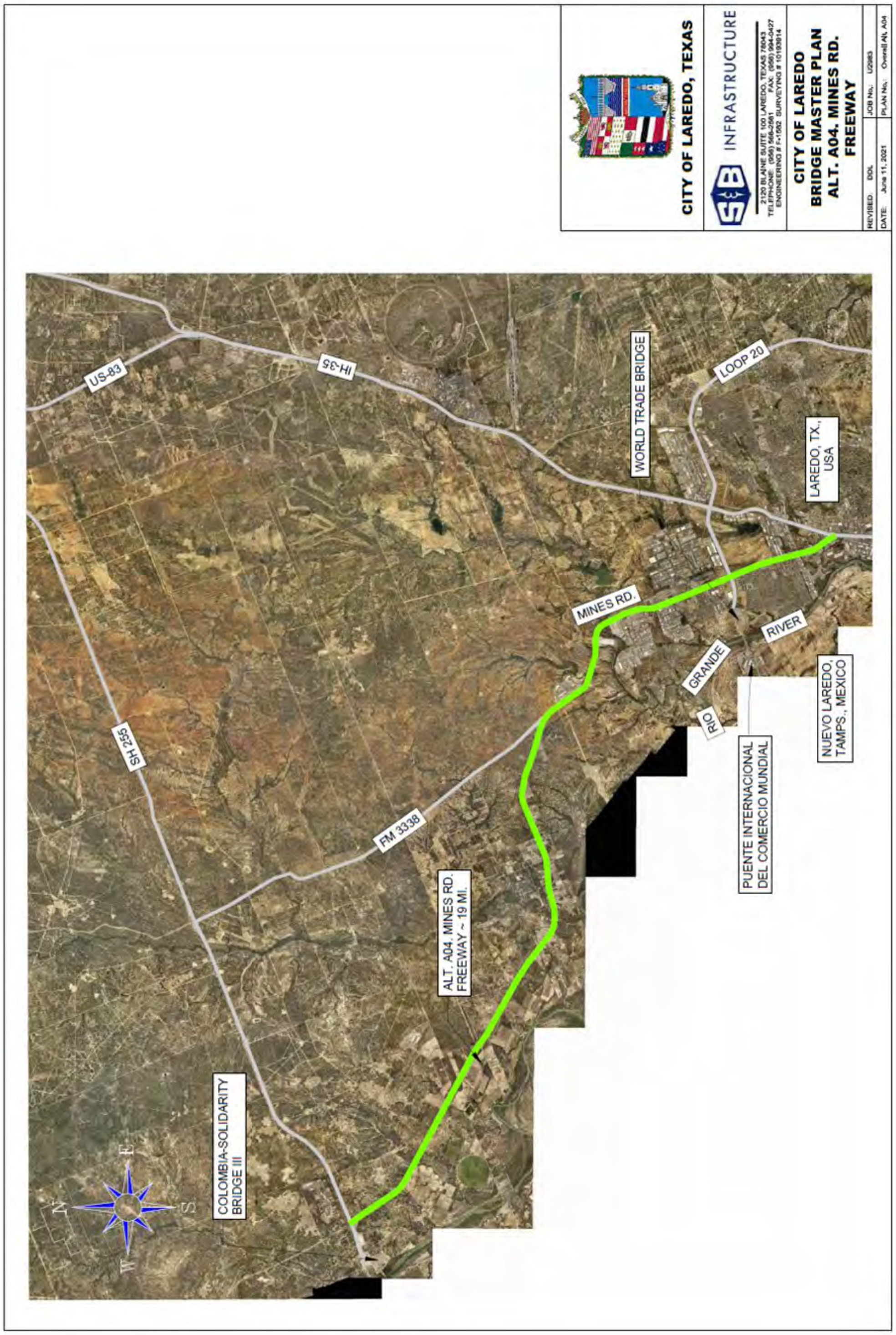

Figure 11. Alternative D Description

E. Direct connection from WTB to Killam Industrial Blvd. 2025-2040

Opening Year Scenario: 2025-2040

Limits: From IH-35 0.45 north of IH-69W to Killam Industrial Blvd.

Description: Killam Industrial Boulevard is a road that directly connects El Portal Industrial Park and Killam Industrial Park with IH-35. However, the connection is only in the southbound direction. The alternative evaluates the construction of a two-lane braided ramp access to northbound IH-35 with an underpass and four undivided westbound roadway lanes connecting to Killam Industrial Boulevard. This Alternative will give access from IH-35 to Killam Industrial Blvd. in the northbound and southbound direction, permitting commercial vehicles exiting the WTB to access the industrial parks by using IH-69 and IH-35.

Location:

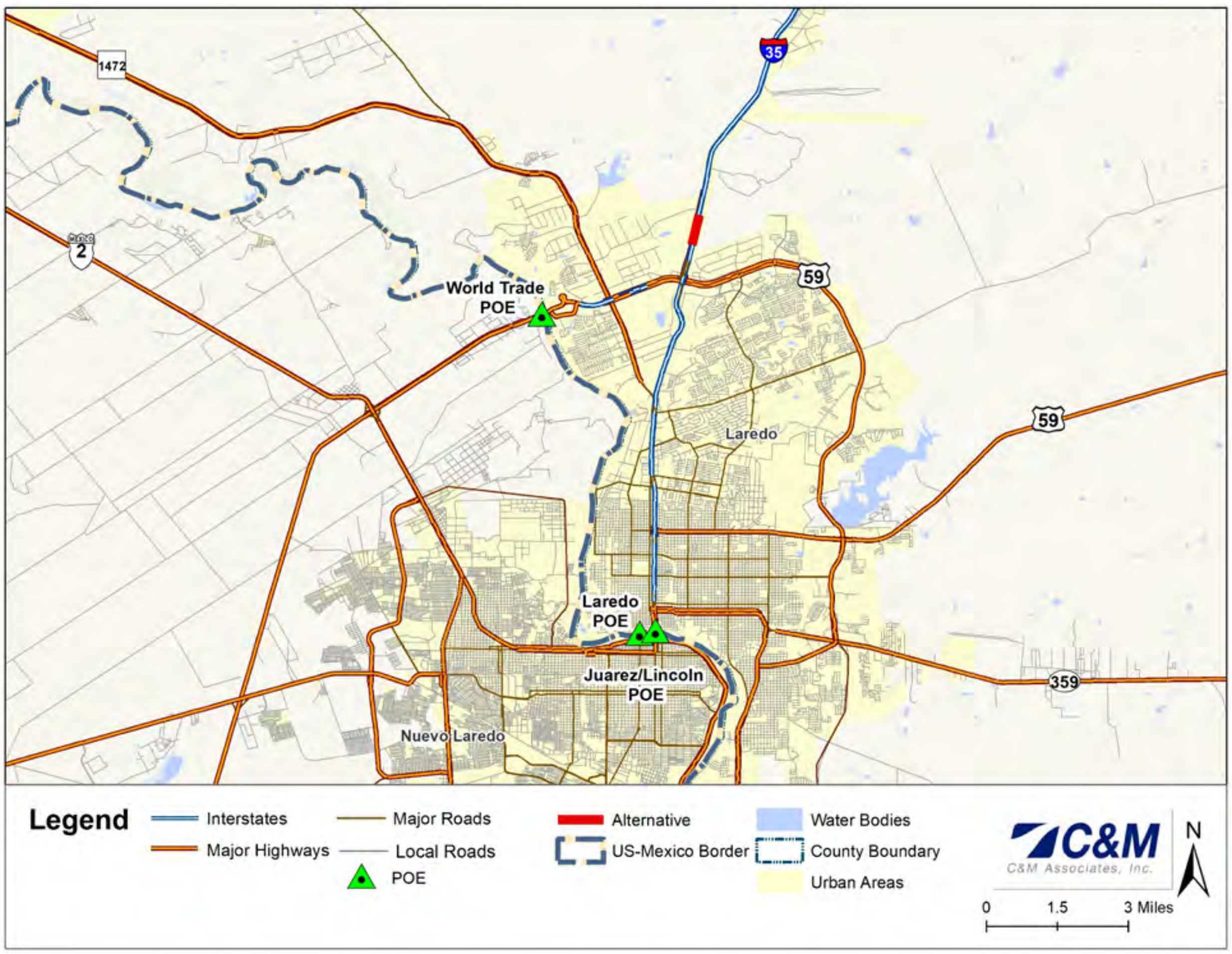

Figure 12. Alternative E Location

Level of Service (LOS) Results:

Table 14. Alternative E Level of Service Results

Road	Segment #	From	To	Year	Length (miles)	Northbound		Southbound	
						Base Case	Alternative	Base Case	Alternative
Mines Road FM 1472	1	Las Cruces Dr	I-69 Bob Bullock Loop	2030	1.30	D	C	D	B
				2040	1.30	E	D	D	C
	2	I-69 Bob Bullock Loop	Riverbank Dr	2030	0.88	E	E	E	E
				2040	0.88	E	E	E	E
	3	Riverbank Dr	F. Muller Blvd	2030	0.76	F	F	F	F
				2040	0.76	F	F	F	F
	4	F. Muller Blvd	Pan American Blvd	2030	0.77	F	F	F	F
				2040	0.77	F	F	F	F
	5	Pan American Blvd	FM3338	2030	3.59	F	F	F	F
				2040	3.59	F	F	F	F
	6	FM3338	FM255	2030	11.35	A	A	B	B
				2040	11.35	D	C	E	E
US 59 - Bob Bullock Loop/ Loop 20	1	Riverbank Dr	Mines Road FM1472	2030	0.55	B	B	A	B
				2040	0.55	C	C	B	D
	2	Mines Road FM1472	I-35	2030	1.44	B	A	B	A
				2040	1.44	B	B	B	B
	3	I-35	International Blvd	2030	2.34	B	A	B	A
				2040	2.34	B	B	B	A
	4	International Blvd	Shiloh Dr	2030	0.83	D	A	D	A
				2040	0.83	D	A	D	A
	5	Shiloh Dr	E Del Mar	2030	1.20	D	A	B	A
				2040	1.20	D	A	C	A
	6	E Del Mar	University	2030	0.79	C	D	B	D
				2040	0.79	C	D	B	D
	7	University	Jacaman	2030	1.20	C	D	B	B
				2040	1.20	D	D	C	C
	8	Jacaman	Saunders St.	2030	2.35	C	C	B	B
				2040	2.35	D	C	C	B

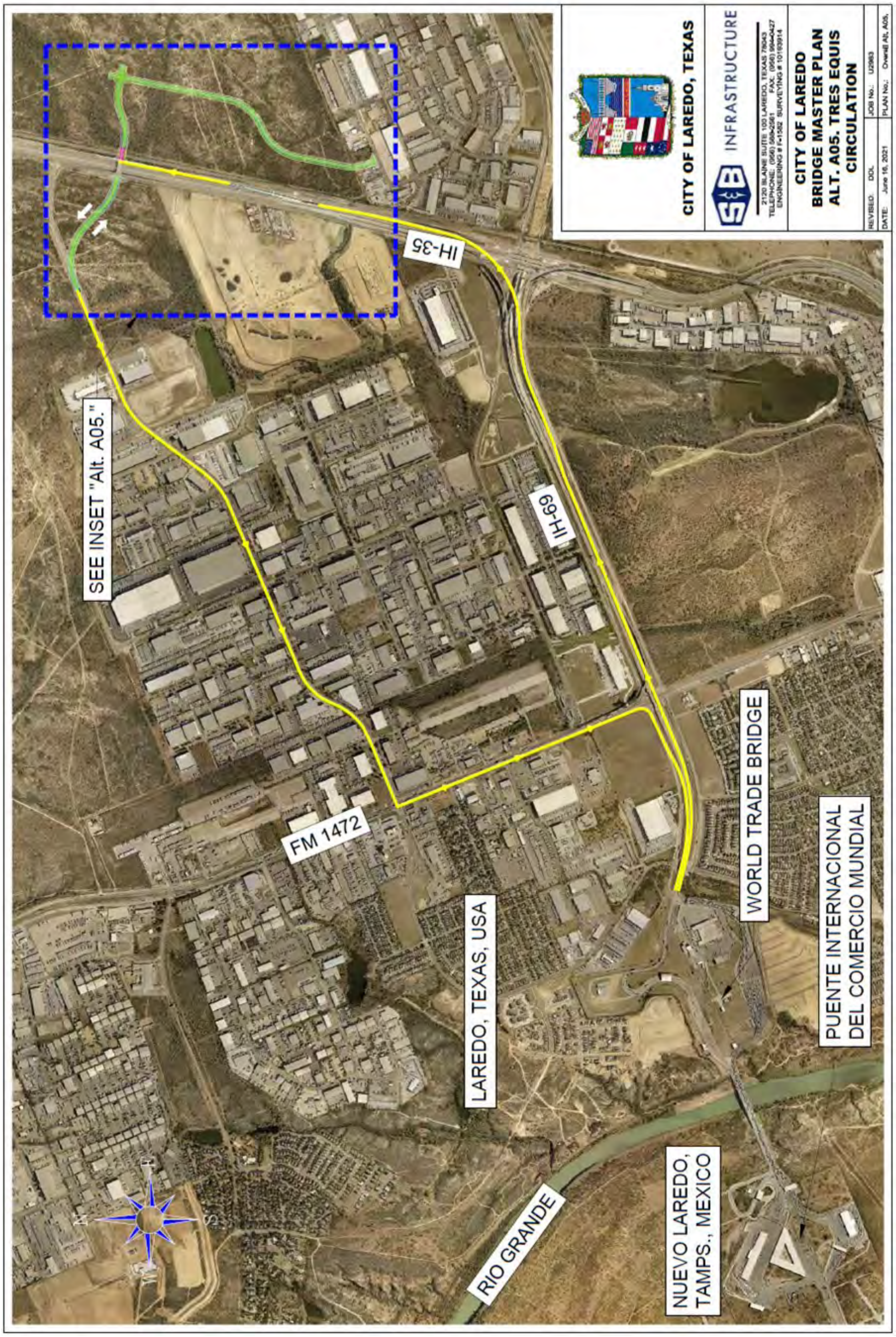

Figure 13. Alternative E Description

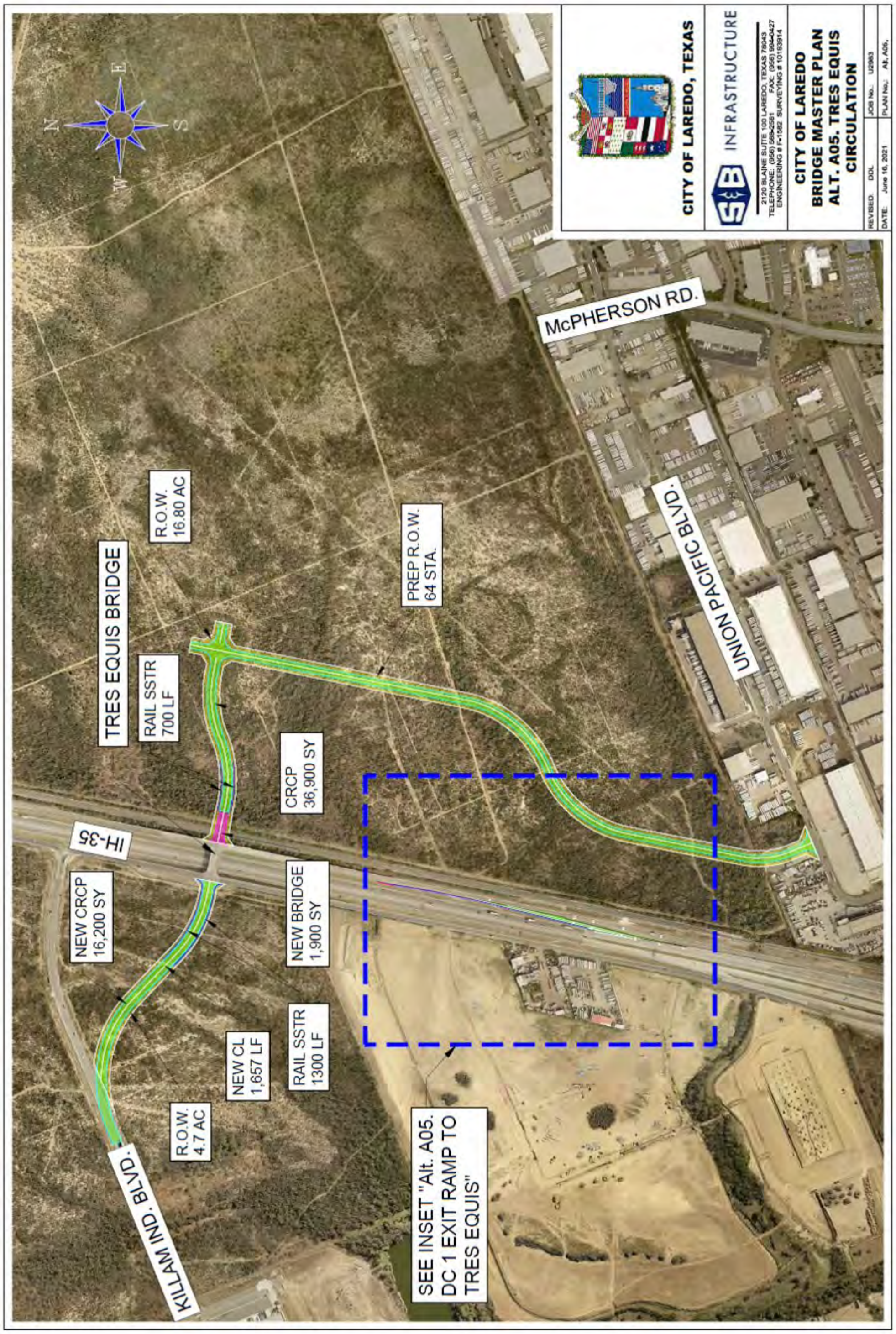

Figure 14. Alternative E Description

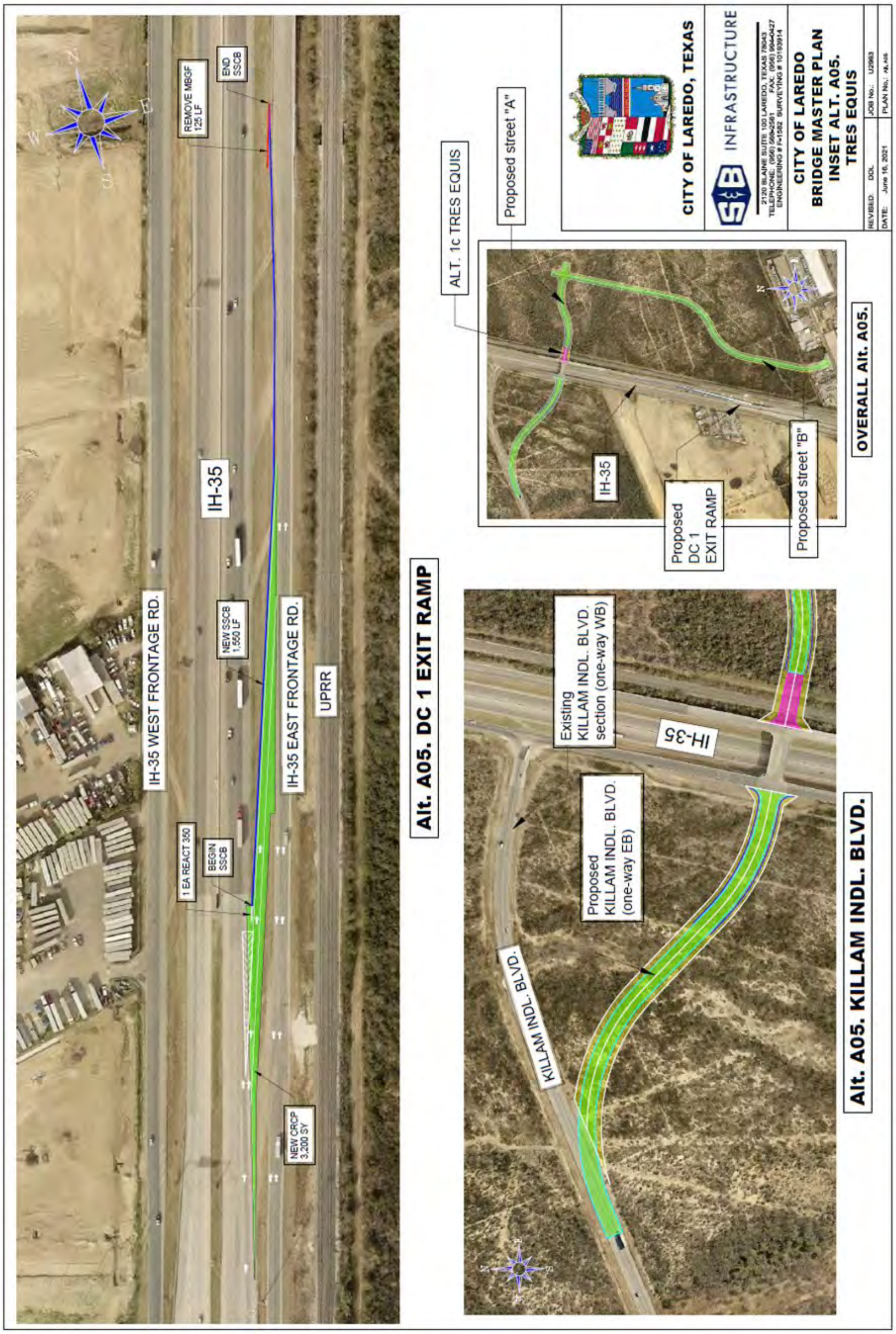

Figure 15 Alternative E Description

F. Juarez-Lincoln International Bridge: Passenger Vehicle Inspection with Double-Stacked Booths 2030-2040

Opening Year Scenario: 2025-2040

Limits: Juarez-Lincoln International Bridge

Description Implementation of double-stacked booths at the Juarez-Lincoln POE from 14 existing inspection booths to 28 inspection booths, permitting at each double stack/tandem booth the inspection of two passenger vehicles at the same time.

Location:

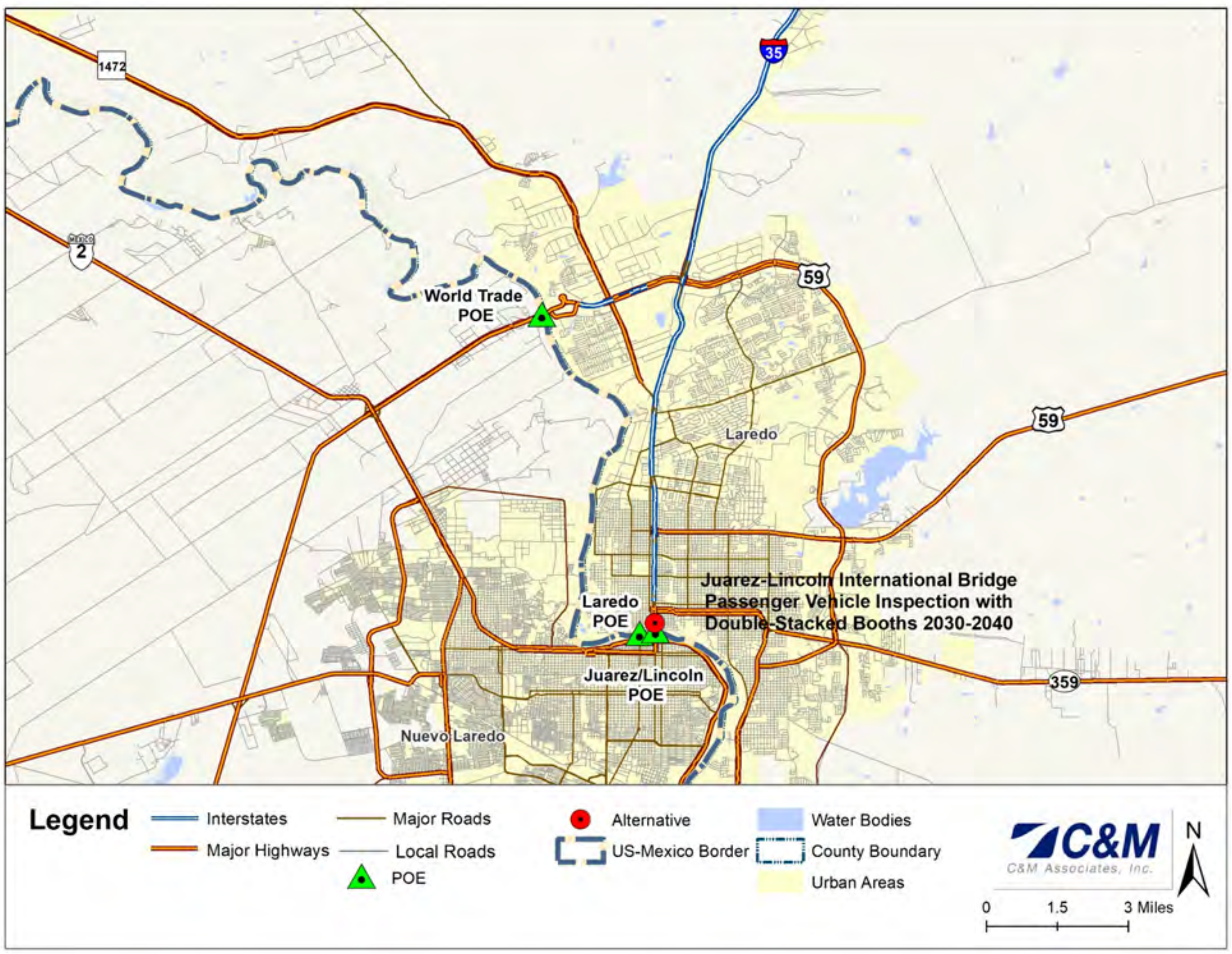

Figure 16. Alternative F Location

The model demand results show a significant reduction in waiting time in 2030 and 2040 (15% and 20%, respectively). It is important to mention that although capacity was doubled, the waiting time is not reduced proportionally because the second booth cannot be fully served until the first booth's inspection ends. However, the project will provide greater flexibility, especially in handling larger volumes during annual peak periods.

Travel Demand Model Results:

Table 15. Alternative F Model Demand Results

Evaluation Criteria	Direction	Year	Gateway (Laredo POE)			Juarez-Lincoln POE			Colombia POE		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2030	3,206	3,207	**0.0%**	11,425	11,533	**0.9%**	1,032	923	**-10.6%**
	US-MX	2030	3,486	3,436	**-1.4%**	11,985	12,037	**0.4%**	289	287	**-0.7%**
Total Crossing Time (min)	MX-US	2030	6.9	6.9	**0.3%**	24.0	19.9	**-16.8%**	7.5	7.3	**-2.3%**
	US-MX	2030	17.7	17.7	**0.0%**	7.4	7.4	**0.1%**	7.3	7.3	**-0.7%**
Waiting Time (min)	MX-US	2030	0.0	0.0	**0.0%**	19.8	16.8	**-15.2%**	0.0	0.0	**0.0%**
	US-MX	2030	11.4	11.4	**0.0%**	0.1	0.1	**2.0%**	0.0	0.0	**0.0%**
Vehicles in the queue	MX-US	2030	24.9	24.9	**0.0%**	124.1	88.0	**-29.1%**	0.2	0.2	**-1.7%**
	US-MX	2030	14.5	14.4	**-0.9%**	1.3	1.3	**4.3%**	0.0	0.0	**0.0%**
Queue Length (miles)	MX-US	2030	0.0	0.0	**0.0%**	0.0	0.0	**0.0%**	0.0	0.0	**0.0%**
	US-MX	2030	0.0	0.0	**0.0%**	0.0	0.0	**0.0%**	0.0	0.0	**0.0%**
Volume Throughput	MX-US	2040	3,485	3,452	**-0.9%**	12,249	12,537	**2.4%**	1,273	1,018	**-20.0%**
	US-MX	2040	3,704	3,645	**-1.6%**	13,088	13,148	**0.5%**	320	319	**-0.3%**
Total Crossing Time (min)	MX-US	2040	6.9	6.9	**0.2%**	38.8	26.2	**-32.4%**	7.7	7.3	**-5.1%**
	US-MX	2040	18.8	18.4	**-2.4%**	7.5	7.5	**0.1%**	7.4	7.4	**0.1%**
Waiting Time (min)	MX-US	2040	0.0	0.0	**0.0%**	29.1	23.1	**-20.8%**	0.1	0.1	**-4.9%**
	US-MX	2040	12.4	12.1	**-2.0%**	0.2	0.2	**2.5%**	0.0	0.0	**0.0%**
Vehicles in the queue	MX-US	2040	62.9	62.9	**0.0%**	313.3	155.8	**-50.3%**	0.5	0.4	**-17.5%**
	US-MX	2040	17.3	16.6	**-3.6%**	3.5	3.7	**3.9%**	0.0	0.0	**0.0%**
Queue Length (miles)	MX-US	2040	0.0	0.0	**0.0%**	0.3	0.2	**-43.7%**	0.0	0.0	**0.0%**
	US-MX	2040	0.0	0.0	**0.0%**	0.0	0.0	**0.0%**	0.0	0.0	**0.0%**

G. Permanently Moving Empty Commercial vehicles to Colombia POE, 2025–2040

Opening Year Scenario: 2025-2040

Limits: Colombia-Solidarity International Bridge

Description: Effective December 7, 2020, CBP[66] announced that all empty commercial vehicles entering Laredo POEs in the northbound direction will be redirected to the Colombia Solidarity Bridge, with the exception of bona fide participants in trusted trader programs (CBP-Trade Partnership Against Terrorism [C-TPAT], FAST). This redirection of empty tractors and trailers through the Colombia POE will help alleviate wait times at the World Trade POE. The proposal of this pilot program will be up for review in June 2021. C&M proposes in this Alternative to permanently implement that empty commercial vehicles entering Laredo POEs in the northbound direction will be redirected to the Colombia Solidarity Bridge, excluding the empty commercial vehicle that participants in trusted trader programs.

Location:

Figure 17. Alternative G Location

Travel Demand Model Results:

Table 16. Alternative G Model Demand Results

Evaluation Criteria	Direction	Year	Colombia			World Trade Bridge		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2025	1,597	3,074	**92.5%**	8,655	7,180	**-17.0%**
	US-MX	2025	1,267	1,154	**-8.9%**	8,785	8,898	**1.3%**
Total Crossing Time (min)	MX-US	2025	29.6	34.3	**15.9%**	39.8	70.3	**76.6%**
	US-MX	2025	24.6	24.7	**0.4%**	34.6	30.7	**-11.3%**
Waiting Time (min)	MX-US	2025	1.4	10.3	**635.7%**	13.6	33.9	**149.5%**
	US-MX	2025	0.3	0.0	**-100.0%**	5.8	3.5	**-39.3%**
Vehicles in the queue	MX-US	2025	3.7	31.3	**743.7%**	82.7	81.8	**-1.0%**
	US-MX	2025	2.0	1.9	**-6.9%**	59.6	42.8	**-28.2%**
Queue Length (miles)	MX-US	2025	0.0	0.0	**0.0%**	0.0	0.0	**0.0%**
	US-MX	2025	0.0	0.0	**0.0%**	0.4	0.0	**-100.0%**
Volume Throughput	MX-US	2040	4,486	5,733	**27.8%**	11,427	10,213	**-10.6%**
	US-MX	2040	3,771	3,688	**-2.2%**	11,830	11,913	**0.7%**
Total Crossing Time (min)	MX-US	2040	134.5	182.3	**35.6%**	249.9	375.0	**50.0%**
	US-MX	2040	100.1	154.1	**53.9%**	149.7	144.0	**-3.8%**
Waiting Time (min)	MX-US	2040	84.4	110.7	**31.2%**	160.5	292.0	**81.9%**
	US-MX	2040	53.5	49.2	**-8.0%**	85.4	83.9	**-1.7%**
Vehicles in the queue	MX-US	2040	276.4	131.1	**-52.6%**	461.8	879.0	**90.4%**
	US-MX	2040	126.9	101.9	**-19.7%**	714.4	745.2	**4.3%**
Queue Length (miles)	MX-US	2040	3.9	1.7	**-56.9%**	4.9	17.2	**251.3%**
	US-MX	2040	2.8	0.6	**-80.6%**	10.3	10.7	**4.2%**

H. Colombia Bridge: Proposal of an Overweight/Oversize (OW/OS) Corridor and Implementing a Daily OW/OS Permit Program

Opening Year Scenario: 2025-2040

Limits: Various locations

Description: Long-haul commercial vehicle movements are especially attractive for the produce industry because commercial vehicles in Mexico are allowed to carry 125,000 pounds, whereas commercial vehicles in the United States are limited to a gross weight of 80,000 pounds. When overweight produce commercial vehicles arrive at the border from Mexico, they typically re-distribute their cargo to other commercial vehicles to cross the border. **Table 17** presents the current commercial vehicle regulations in the United States and Mexico.

Table 17. U.S. and Mexican Commercial Vehicle Regulations

Standard	Height	Width	Weight
U.S.	14 ft.	8.5 ft.	80,000 lbs.
Mexico	15.5 ft.	12 ft.	125,000 lbs.

Source: U.S. Department of Transportation

This alternative for the Colombia POE proposes a similar OW/OS permit structure that has been established in Hidalgo County. In January 2014, the Hidalgo County Regional Mobility Authority (HCRMA) established an OW/OS permit that covers travel over selected Hidalgo County roads for vehicles weighing no more than the Mexican legal weight limit. This permit is valid for 24 hours upon activation and allows OW/OS commercial vehicles coming from Mexico to travel without having to redistribute their loads.

The proposed Colombia POE permit should be issued through an online-based interface the moment the commercial vehicle arrives at the bridge. The revenue of the permit in Hidalgo County is distributed in shares: 80 percent to TxDOT and 20 percent to the HCRMA to cover additional road maintenance costs.

Location:

Figure 18. Alternative H Location

Travel Demand Model Results:

Table 18. Alternative H Model Demand Results

Evaluation Criteria	Direction	Year	Colombia			World Trade Bridge		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2025	1,597	1,690	**5.8%**	8,655	8,562	**-1.1%**
	US-MX	2025	1,267	1,361	**7.4%**	8,785	8,691	**-1.1%**
Total Crossing Time (min)	MX-US	2025	29.6	32.3	**9.2%**	39.8	39.0	**-2.0%**
	US-MX	2025	24.6	26.2	**6.2%**	34.6	32.8	**-5.2%**
Waiting Time (min)	MX-US	2025	1.4	1.4	**3.7%**	13.6	12.7	**-6.1%**
	US-MX	2025	0.0	0.0	**0.0%**	5.8	4.5	**-22.8%**
Vehicles in the queue	MX-US	2025	3.7	4.0	**8.1%**	82.7	78.7	**-4.8%**
	US-MX	2025	2.0	2.1	**4.9%**	59.6	52.6	**-11.7%**
Queue Length (miles)	MX-US	2025	0.0	0.0	**0.0%**	0.0	0.0	**0.0%**
	US-MX	2025	0.0	0.0	**0.0%**	0.4	0.3	**-22.7%**
Volume Throughput	MX-US	2040	4,486	4,782	**6.6%**	11,427	11,131	**-2.6%**
	US-MX	2040	3,771	4,065	**7.8%**	11,830	11,536	**-2.5%**
Total Crossing Time (min)	MX-US	2040	134.5	240.5	**78.9%**	249.9	187.8	**-24.9%**
	US-MX	2040	100.1	125.8	**25.7%**	149.7	127.6	**-14.8%**
Waiting Time (min)	MX-US	2040	84.4	138.7	**64.4%**	160.5	87.5	**-45.5%**
	US-MX	2040	53.5	67.0	**25.1%**	85.4	66.8	**-21.8%**
Vehicles in the queue	MX-US	2040	276.4	376.4	**36.2%**	461.8	92.0	**-80.1%**
	US-MX	2040	126.9	156.9	**23.6%**	714.4	2.0	**-99.7%**
Queue Length (miles)	MX-US	2040	3.9	4.4	**12.8%**	4.9	0.0	**-100.7%**
	US-MX	2040	2.8	3.6	**28.1%**	10.3	0.0	**-100.0%**

I. Safety Improvement at MEX 2 Between the WTB and Colombia Bridge 2025–2040

Opening Year Scenario: 2025–2040

Limits: From World Trade International Bridge to Colombia-Solidarity International Bridge

Description: The MEX 2 highway connects the Colombia Solidarity International Bridge and the World Trade Bridge. It is approximately 17 miles from the entrance of the Colombia POE and the entrance of the Word Trade POE. Currently, MEX 2 is made up of two bodies of two lanes in each direction with limited access. The suburban location of the Colombia POE makes it necessary to increase security to build confidence in both passenger and commercial vehicle travelers.

Location:

Figure 19. Alternative I Location

Travel Demand Model Results:

Table 18. Alternative I Model Demand Results – Passenger Vehicles

Evaluation Criteria	Direction	Year	Gateway (Laredo POE)			Juarez-Lincoln			Colombia POE		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2025	3078	3075	**-0.1%**	10,997	10,971	**-0.2%**	**962**	**991**	**3.0%**
	US-MX	2025	3,391	3,385	**-0.2%**	11,469	11,468	**0.0%**	**272**	**279**	**2.6%**
Total Crossing Time (min)	MX-US	2025	6.9	6.9	**0.0%**	19.0	16.1	**-15.3%**	**7.5**	**7.4**	**-1.3%**
	US-MX	2025	16.8	17.1	**2.3%**	7.4	7.4	**0.0%**	**7.3**	**7.3**	**0.0%**
Waiting Time (min)	MX-US	2025	0.0	0.0	**-31.4%**	6.2	5.9	**-4.6%**	**0.0**	**0.1**	**163.2%**
	US-MX	2025	11.4	12.8	**12.2%**	0.1	0.0	**-29.4%**	**0.0**	**0.0**	**66.1%**
Vehicles in the queue	MX-US	2025	16	15	**-4.6%**	78	74	**-5.0%**	**0**	**0**	**119.1%**
	US-MX	2025	12	16	**33.4%**	1	1	**-26.6%**	**0**	**0**	**41.9%**
Queue Length (miles)	MX-US	2025	0.0	0.0	**0.0%**	0.0	0.0	**0.0%**	**0.0**	**0.0**	**0.0%**
	US-MX	2025	0.0	0.0	**0.0%**	0.0	0.0	**0.0%**	**0.0**	**0.0**	**0.0%**
Volume Throughput	MX-US	2040	3,485	3,468	**-0.5%**	12,249	12,229	**-0.2%**	**1,273**	**1,310**	**2.9%**
	US-MX	2040	3,704	3,691	**-0.4%**	13,088	13,092	**0.0%**	**320**	**329**	**2.8%**
Total Crossing Time (min)	MX-US	2040	6.9	6.8	**-1.4%**	38.8	8.6	**-74.6%**	**7.7**	**7.7**	**0.0%**
	US-MX	2040	18.8	20.9	**11.2%**	7.5	7.5	**0.0%**	**7.4**	**7.4**	**0.0%**
Waiting Time (min)	MX-US	2040	0.0	0.0	**-7.4%**	29.1	7.1	**-70.4%**	**0.1**	**0.1**	**4.3%**
	US-MX	2040	12.4	12.8	**-1.7%**	0.2	0.2	**-6.0%**	**0.0**	**0.0**	**-19.5%**
Vehicles in the queue	MX-US	2040	63	38	**-40.2%**	313	90	**-71.1%**	**1**	**0**	**1.6%**
	US-MX	2040	17	17	**-0.3%**	4	3	**-7.5%**	**0**	**0**	**4.6%**
Queue Length (miles)	MX-US	2040	0.0	0.0	**-100.0%**	0.3	0.0	**-100.0%**	**0.0**	**0.0**	**0.0%**
	US-MX	2040	0.0	0.1	**0.0%**	0.0	0.0	**0.0%**	**0.0**	**0.0**	**0.0%**

Table 19. Alternative I Model Demand Results – Commercial Vehicles

Evaluation Criteria	Direction	Year	Colombia POE			World Trade POE		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2025	1,597	1,639	**2.6%**	8,655	8,613	**-0.5%**
	US-MX	2025	1,267	1,304	**2.9%**	8,785	8,748	**-0.4%**
Total Crossing Time (min)	MX-US	2025	30	30	**2.0%**	40	37	**-8.0%**
	US-MX	2025	25	25	**0.0%**	35	35	**0.0%**
Waiting Time (min)	MX-US	2025	1	0	**-67.3%**	14	27	**98.6%**
	US-MX	2025	0	0	**114.5%**	6	2	**-60.2%**
Vehicles in the queue	MX-US	2025	4	2	**-43.3%**	83	152	**83.5%**
	US-MX	2025	2	2	**-14.5%**	60	27	**-54.3%**
Queue Length (ft)	MX-US	2025	0	0	**0.0%**	0	0	**0.0%**
	US-MX	2025	0	0	**0.0%**	0	0	**-100.0%**
Volume Throughput	MX-US	2040	4,486	4,639	**3.4%**	11,427	11,274	**-1.3%**
	US-MX	2040	3,771	3,895	**3.3%**	11,830	11,706	**-1.0%**
Total Crossing Time (min)	MX-US	2040	134	203	**51.3%**	250	188	**-24.9%**
	US-MX	2040	100	104	**3.9%**	150	139	**-6.9%**
Waiting Time (min)	MX-US	2040	84	126	**48.7%**	161	120	**-25.2%**
	US-MX	2040	54	60	**11.3%**	85	78	**-8.1%**
Vehicles in the queue	MX-US	2040	276	388	**40.5%**	462	382	**-17.2%**
	US-MX	2040	127	151	**18.7%**	714	642	**-10.2%**
Queue Length (ft)	MX-US	2040	4	6	**49.2%**	5	4	**-25.5%**
	US-MX	2040	3	3	**15.4%**	10	9	**-8.8%**

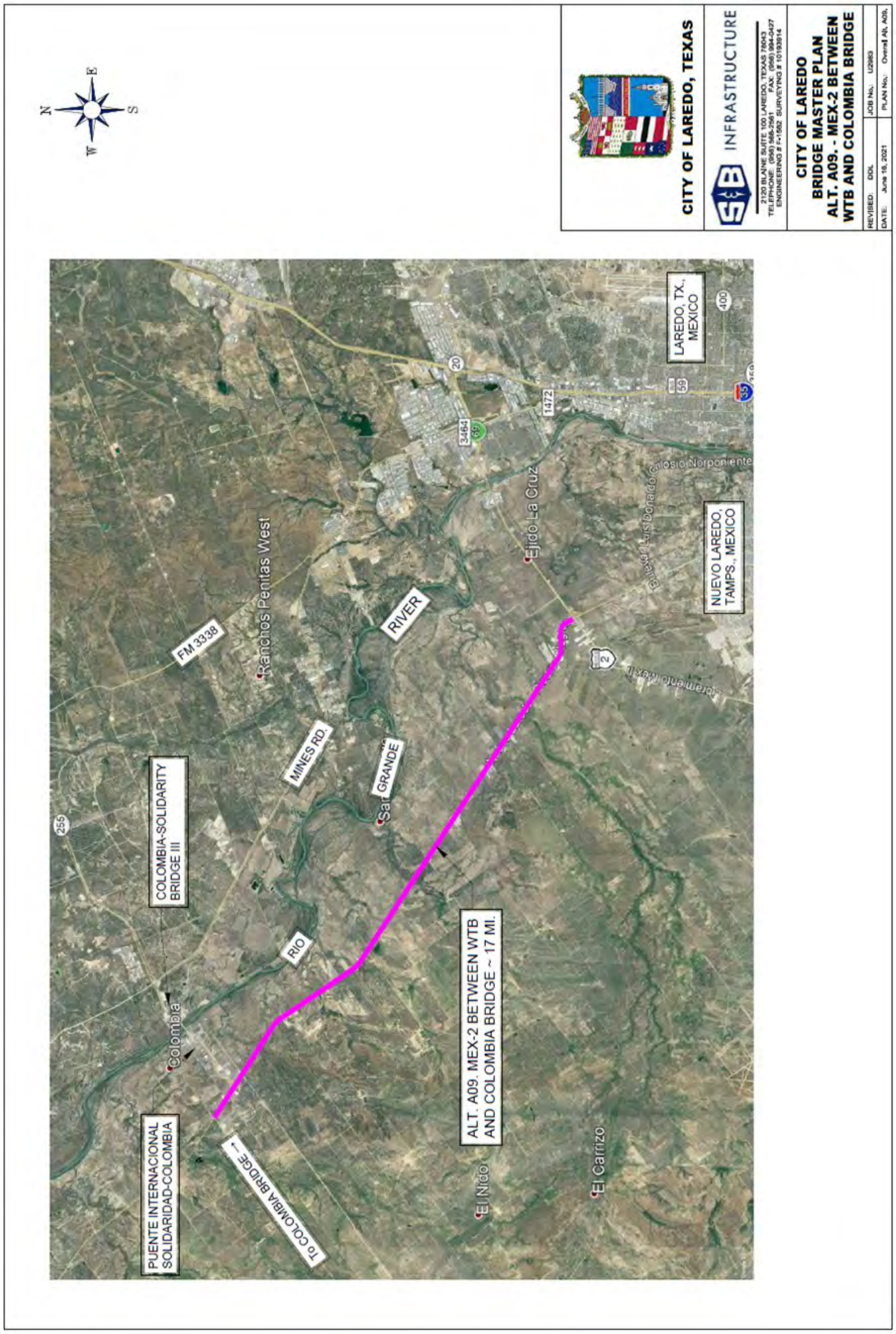

Figure 20. Alternative I Description

J. La Gloria-Colombia Highway 2030-2040

Opening Year Scenario: 2030-2040

Limits: From MEX 85 at La Gloria to the Colombia Solidarity International Bridge

Description: Construction of a highway that would connect the Monterrey-Nuevo Laredo highway (MEX 85) with the Colombia Solidarity International Bridge. The new highway is planned to be a toll road.

Location:

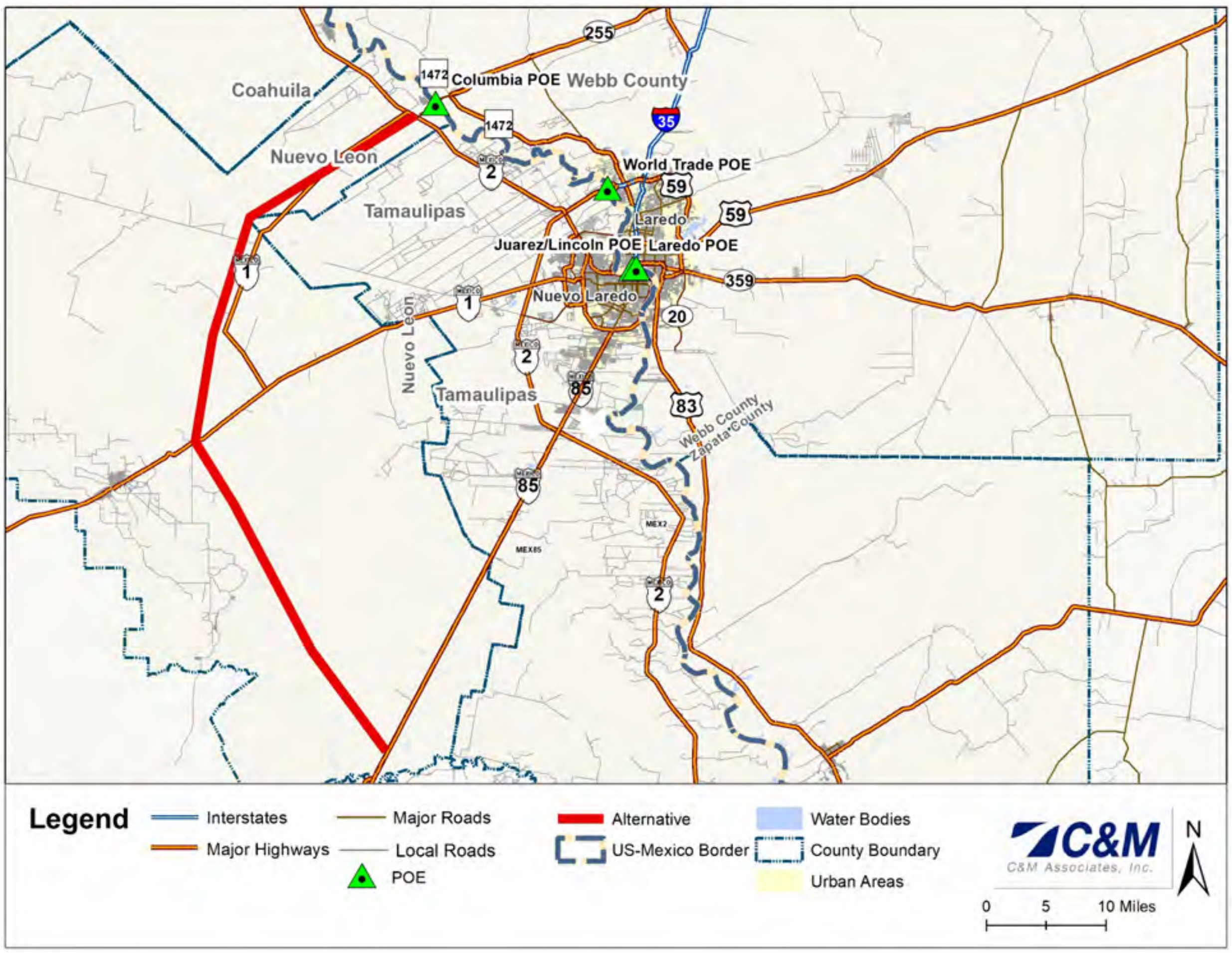

Figure 21. Alternative J Location

Travel Demand Model Results:

Table 19. Alternative J Model Demand Results – Passenger Vehicles

Evaluation Criteria	Direction	Year	Gateway (Laredo POE)			Juarez-Lincoln POE			Colombia POE		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2030	3,206	3,110	**-3.0%**	11,425	11,293	**-1.2%**	1,032	1,260	**22.1%**
	US-MX	2030	3,486	3,301	**-2.7%**	11,985	11,675	**-2.6%**	289	689	**138.4%**
Total Crossing Time (min)	MX-US	2030	7	7	**0.0%**	24	16	**-16.8%**	8	7	**-4.0%**
	US-MX	2030	18	7	**-58.8%**	7	9	**16.2%**	7	7	**1.4%**
Waiting Time (min)	MX-US	2030	0	0	**-11.0%**	20	8	**-17.1%**	0	0	**170.3%**
	US-MX	2030	11	12	**-3.7%**	0	0	**-9.3%**	0	0	**1071.0%**
Vehicles in the queue	MX-US	2030	25	21	**-17.6%**	124	102	**-17.8%**	0	0	**141.0%**
	US-MX	2030	15	12	**-16.1%**	1	1	**-14.2%**	0	0	**1201.6%**
Queue Length (ft)	MX-US	2030	0	0	**0.0%**	0	0	**0.0%**	0	0	**0.0%**
	US-MX	2030	0	0	**0.0%**	0	0	**0.0%**	0	0	**0.0%**
Volume Throughput	MX-US	2040	3,485	3,400	**-2.4%**	12,249	12,017	**-1.9%**	1,273	1,590	**24.9%**
	US-MX	2040	3,704	3,690	**-0.4%**	13,088	12,467	**-4.7%**	320	955	**198.4%**
Total Crossing Time (min)	MX-US	2040	7	7	**-1.4%**	39	33	**-2.4%**	8	18	**135.1%**
	US-MX	2040	19	7	**-63.3%**	8	8	**0.0%**	7	7	**0.0%**
Waiting Time (min)	MX-US	2040	0	0	**-12.5%**	29	15	**-39.5%**	0	0	**44.7%**
	US-MX	2040	12	19	**48.5%**	0	0	**-40.5%**	0	0	**1185.4%**
Vehicles in the queue	MX-US	2040	63	37	**-40.8%**	313	185	**-40.9%**	1	1	**34.7%**
	US-MX	2040	17	38	**117.9%**	4	2	**-42.2%**	0	0	**1321.0%**
Queue Length (ft)	MX-US	2040	0	0	**-80.2%**	0	0	**-80.1%**	0	0	**0.0%**
	US-MX	2040	0	0	**0.0%**	0	0	**0.0%**	0	0	**0.0%**

Table 20. Alternative J Model Demand Results – Commercial Vehicles

Evaluation Criteria	Direction	Year	Colombia POE			World Trade POE		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2030	2,116	2,177	**2.9%**	10,035	9,974	**-0.6%**
	US-MX	2030	1,779	1,828	**2.8%**	10,133	10,080	**-0.5%**
Total Crossing Time (min)	MX-US	2030	50	52.6	**4.9%**	69	65	**-5.4%**
	US-MX	2030	26	26	**0.0%**	50	48	**-5.3%**
Waiting Time (min)	MX-US	2030	18	18.5	**0.5%**	37	35	**-5.8%**
	US-MX	2030	0	0.3	**0.0%**	16	14	**-15.1%**
Vehicles in the queue	MX-US	2030	43	44	**2.0%**	253	244	**-3.7%**
	US-MX	2030	5	5	**0.0%**	128	115	**-10.1%**
Queue Length (ft)	MX-US	2030	0	0	**0.0%**	2	2	**0.0%**
	US-MX	2030	0	0	**0.0%**	1	1	**-32.7%**
Volume Throughput	MX-US	2040	4,486	4,646	**3.6%**	11,427	11,267	**-1.4%**
	US-MX	2040	3,771	3,902	**3.5%**	11,830	11,699	**-1.1%**
Total Crossing Time (min)	MX-US	2040	134	173	**28.6%**	250	183	**-26.8%**
	US-MX	2040	100	106	**5.5%**	150	137	**-8.5%**
Waiting Time (min)	MX-US	2040	84	123	**45.8%**	161	116	**-27.9%**
	US-MX	2040	54	58	**7.7%**	85	76	**-10.5%**
Vehicles in the queue	MX-US	2040	276	388	**40.4%**	462	451	**-2.3%**
	US-MX	2040	127	147	**15.5%**	714	621	**-13.1%**
Queue Length (ft)	MX-US	2040	4	6	**50.2%**	5	5	**-4.9%**
	US-MX	2040	3	3	**13.4%**	10	9	**-11.9%**

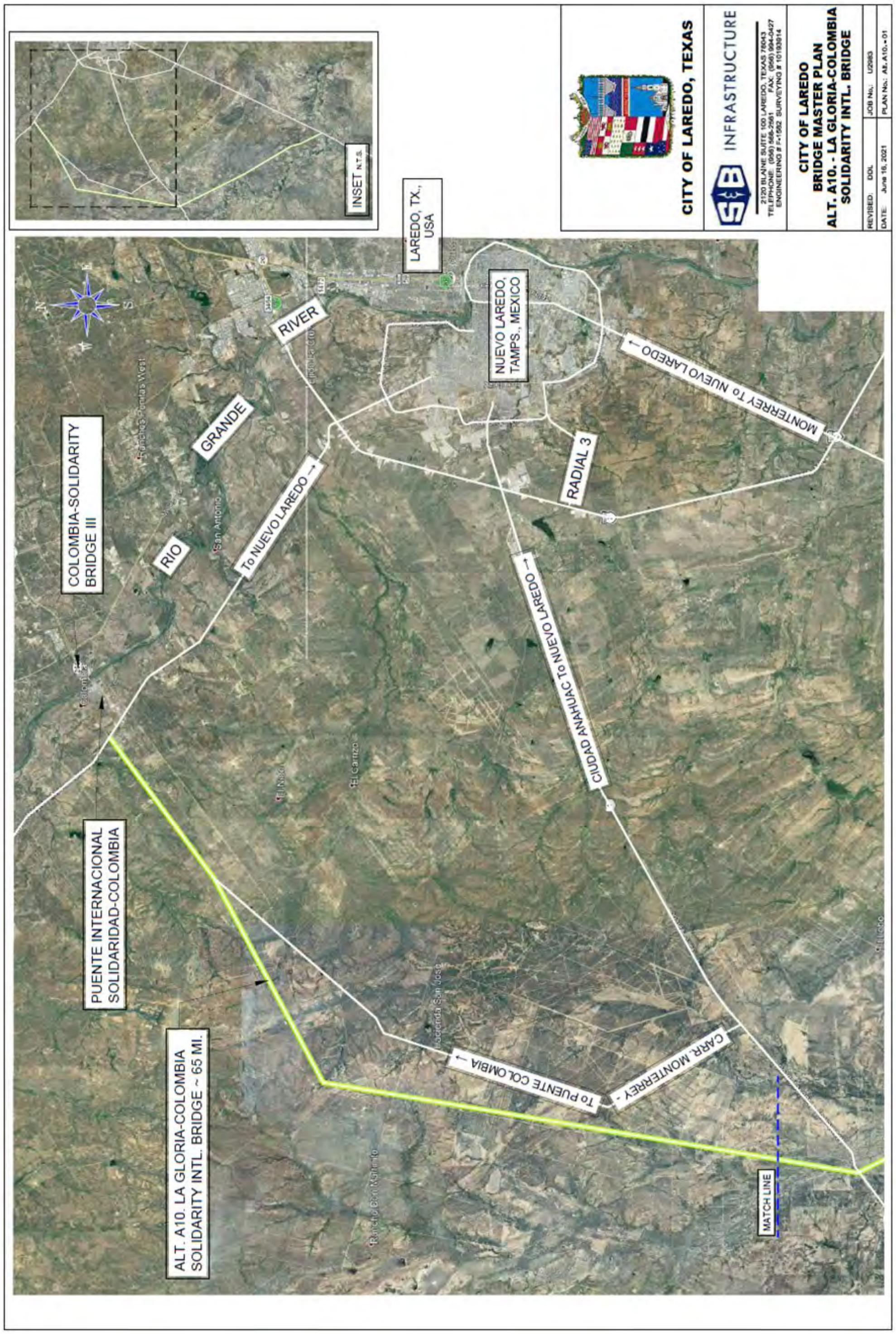

Figure 22. Alternative J Description

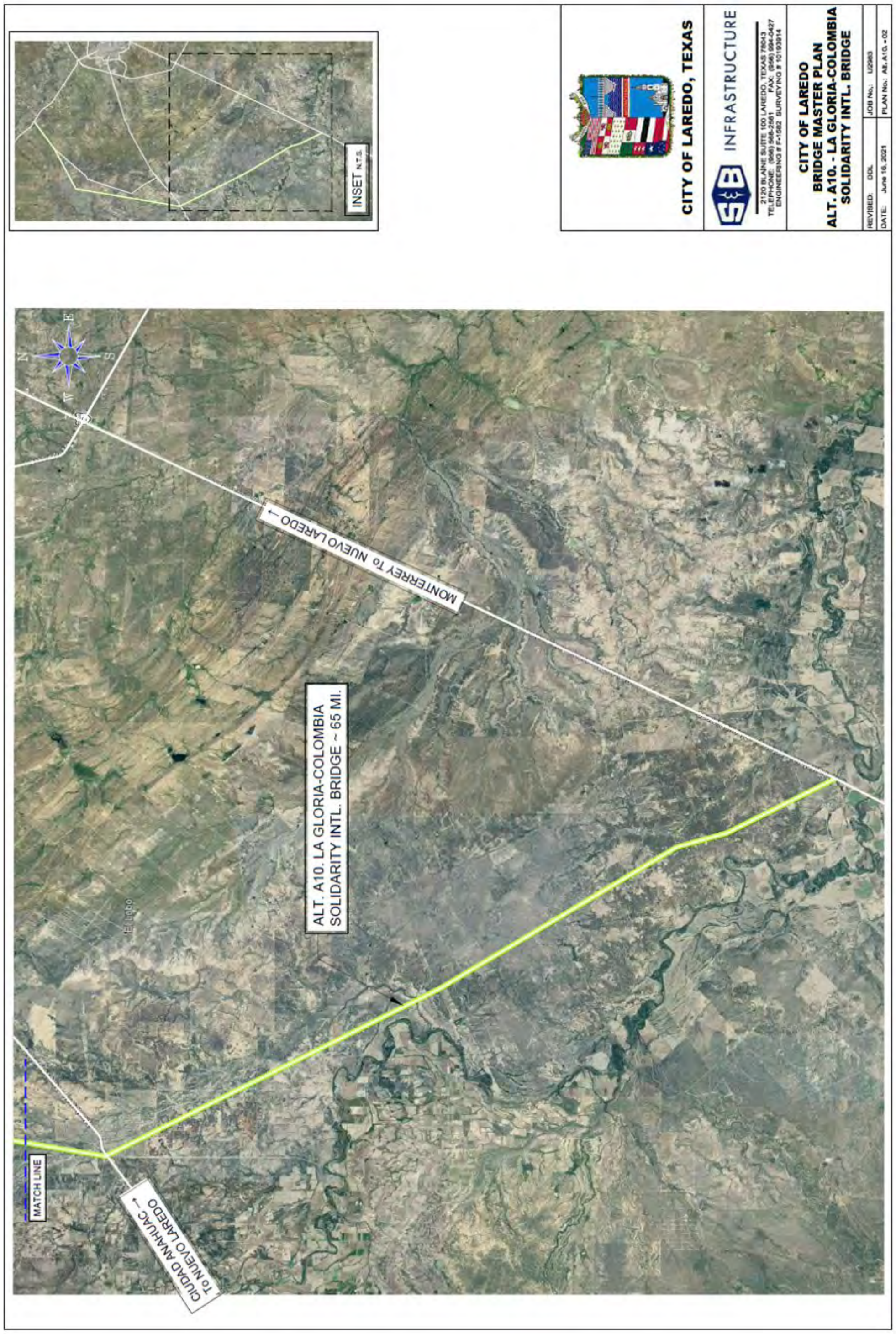

Figure 23. Alternative J Description

K. Laredo Outer Loop 2030-2035

Opening Year Scenario: 2050

Limits: From IH-35 at SH 255 to US 83 South

Description: Roadway facility that extends east of Laredo from the IH-35/SH 255 interchange in the north to the vicinity of the proposed Fifth Bridge crossing in the south, near the city of Rio Bravo. The loop aims at providing capacity and resiliency to the existing highway network in the county, in addition to planning for Laredo's future growth. Segments 1 and 2 of the Outer Loop are assumed to open to traffic in 2030 while Segment 3 is assumed to open in 2035.

Location:

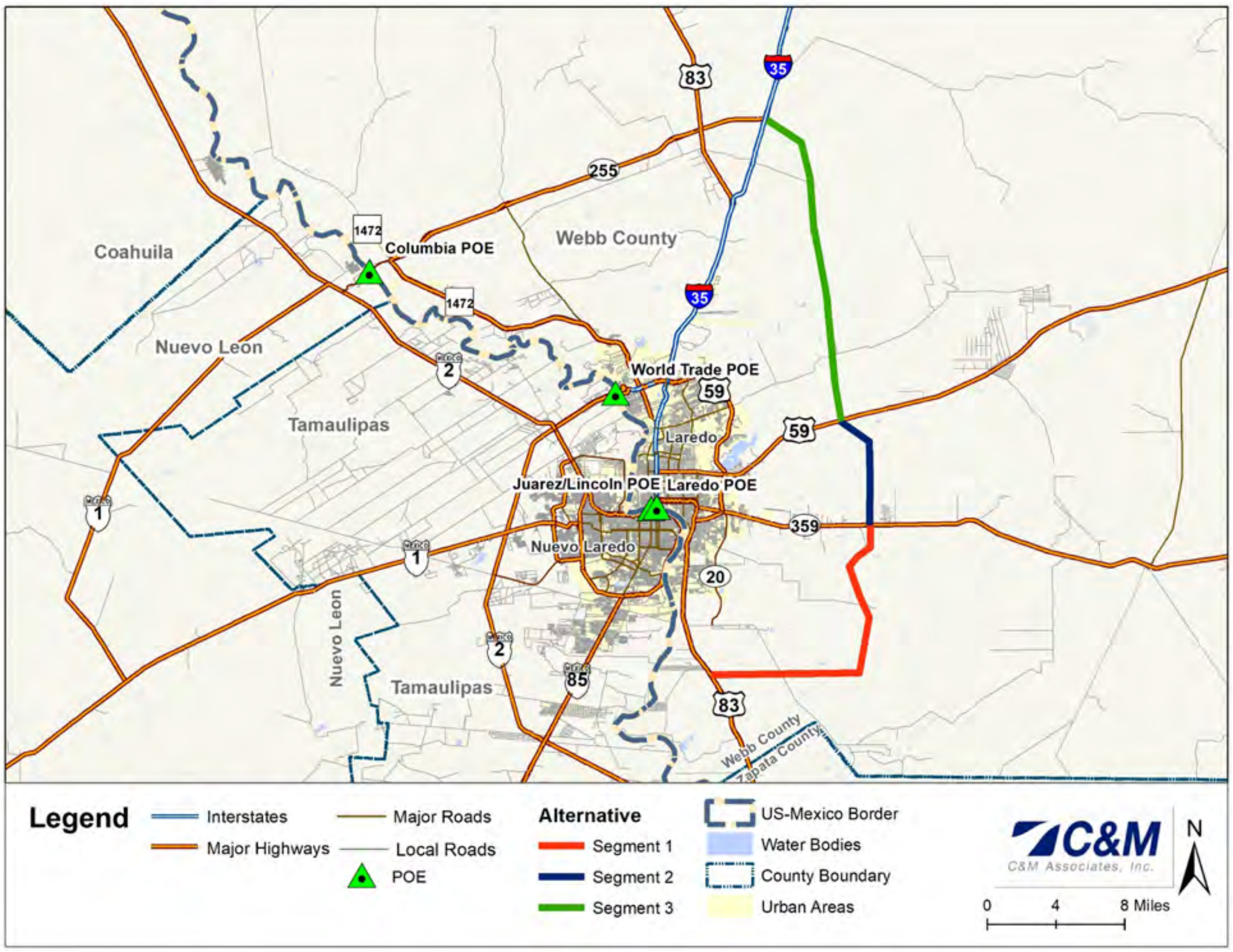

Figure 24. Alternative K Location

Level of service (LOS) Results:

Table 21. Alternative K Level of Service Results

Road	Segment #	From	To	Year	Length (miles)	Northbound		Southbound	
						Base Case	Alternative	Base Case	Alternative
US 59 - Bob Bullock Loop/ Loop 20	1	I-35	International Blvd	2030	2.34	B	B	A	A
				2040	2.34	C	B	B	A
	2	International Blvd	Shiloh Dr	2030	0.83	B	A	B	A
				2040	0.83	B	A	B	A
	3	Shiloh Dr	E Del Mar	2030	1.20	B	A	B	A
				2040	1.20	B	A	B	A
	4	E Del Mar	University	2030	0.79	D	D	D	D
				2040	0.79	D	C	D	D
	5	University	Jacaman	2030	1.20	D	C	B	B
				2040	1.20	D	C	C	B
	6	Jacaman	SH 59 Saunders	2030	2.35	C	B	B	A
				2040	2.35	C	C	B	A
	7	US 59 Saunders	SH 359	2030	1.20	C	C	B	B
				2040	1.20	D	C	C	B
	8	SH 359	US 83	2030	2.35	C	C	B	B
				2040	2.35	D	C	C	B
I-35	1	I-69	Killam Industrial Blvd	2030	1.45	B	A	B	A
				2040	1.45	B	A	B	A
	2	Killam Industrial Blvd	Uniroyal Drive	2030	5.19	B	B	B	B
				2040	5.19	C	B	C	B
	3	Uniroyal Drive	US 83	2030	5.25	A	A	B	B
				2040	5.25	C	B	C	C
	4	US 83	SH 255	2030	5.26	A	A	A	A
				2040	5.26	A	A	B	A

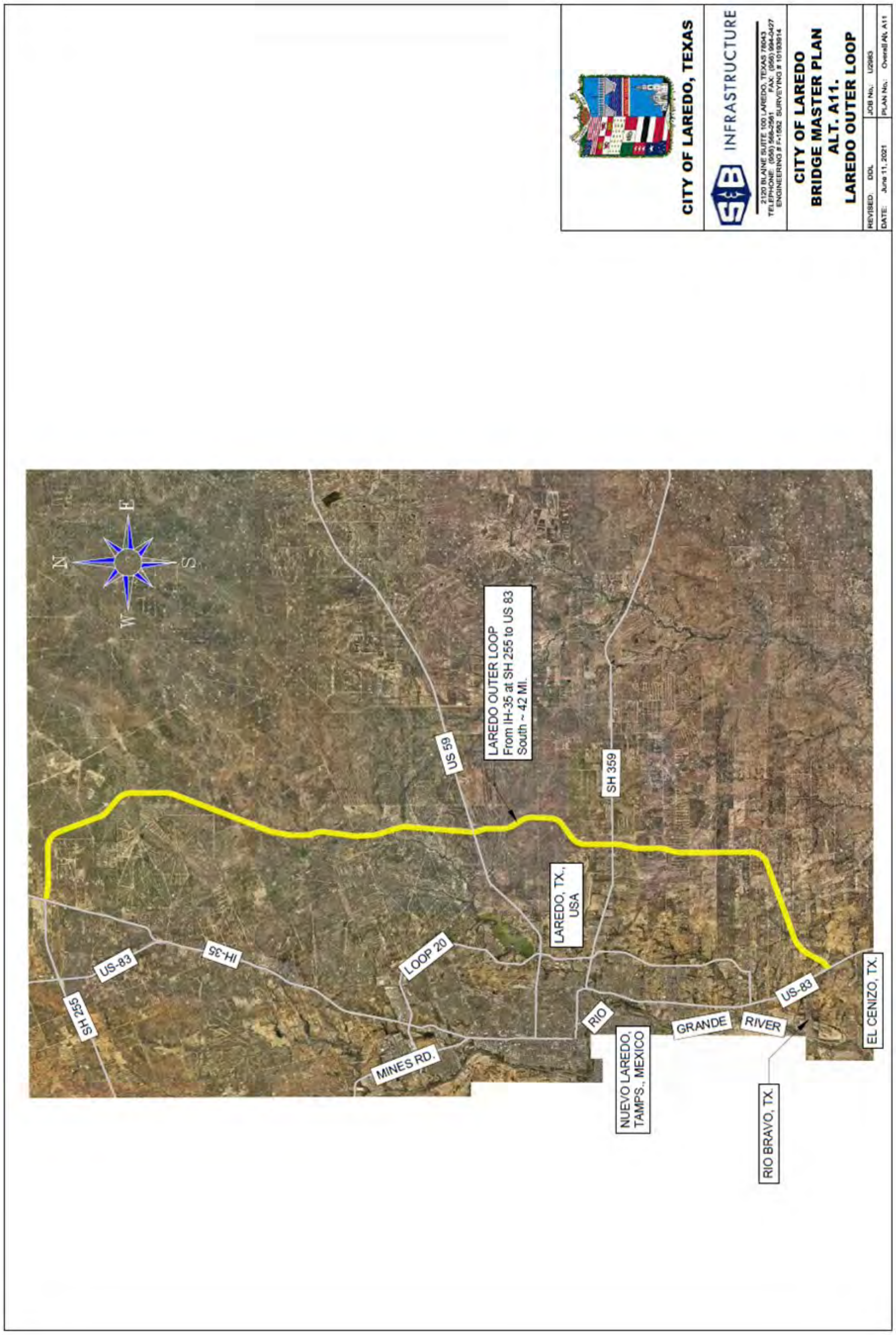

Figure 25. Alternative K Description

L. Expanding Mines Rd. to Eagle Pass 2030-2040

Opening Year Scenario: 2030-2040

Limits: From Eagle Pass to Mines Rd. and Dolores Blvd.

Description: Construction of a limited-access highway that connects the city of Eagle Pass and the Colombia Solidarity International Bridge through the Mines Road/Dolores Boulevard intersection. An approximately 40-mile section of this road is unpaved roadway that needs to be paved and connected between the end of pavement in Webb County and the end of pavement in Maverick County. Mines Road (also known as the "El Indio Road") begins at the terminus of FM 1472 in Webb County, runs roughly parallel to the Rio Grande River, and connects to FM 1021 in Maverick County.

Location:

Figure 26. Alternative L Location

Level of Service Results:

Table 22. Alternative L Level of Service Results

	Segment #	From	To	Year	Length (miles)	Northbound		Southbound	
						Base Case	Alternative	Base Case	Alternative
Mines Road FM 1472	1	Las Cruces Dr	I-69 Bob Bullock Loop	2030	1.30	D	E	D	E
				2040	1.30	E	E	D	E
	2	I-69 Bob Bullock Loop	Riverbank Dr	2030	0.88	E	E	E	E
				2040	0.88	E	E	E	E
	3	Riverbank Dr	F. Muller Blvd	2030	0.76	F	F	F	F
				2040	0.76	F	F	F	F
	4	F. Muller Blvd	Pan American Blvd	2030	0.77	F	F	F	F
				2040	0.77	F	F	F	F
	5	Pan American Blvd	FM 3338	2030	3.59	F	F	F	F
				2040	3.59	F	F	F	F
	6	FM 3338	FM 255	2030	11.35	A	B	B	B
				2040	11.35	D	C	E	E
I-35	1	I-69	Killam Industrial Blvd	2030	1.45	A	A	A	A
				2040	1.45	A	A	A	A
	2	Killam Industrial Blvd	Uniroyal Drive	2030	5.19	B	A	B	A
				2040	5.19	C	B	C	B
	3	Uniroyal Drive	US 83	2030	5.25	A	A	B	A
				2040	5.25	C	B	C	C
	4	US 83	SH 255	2030	5.26	A	A	A	A
				2040	5.26	A	A	B	B

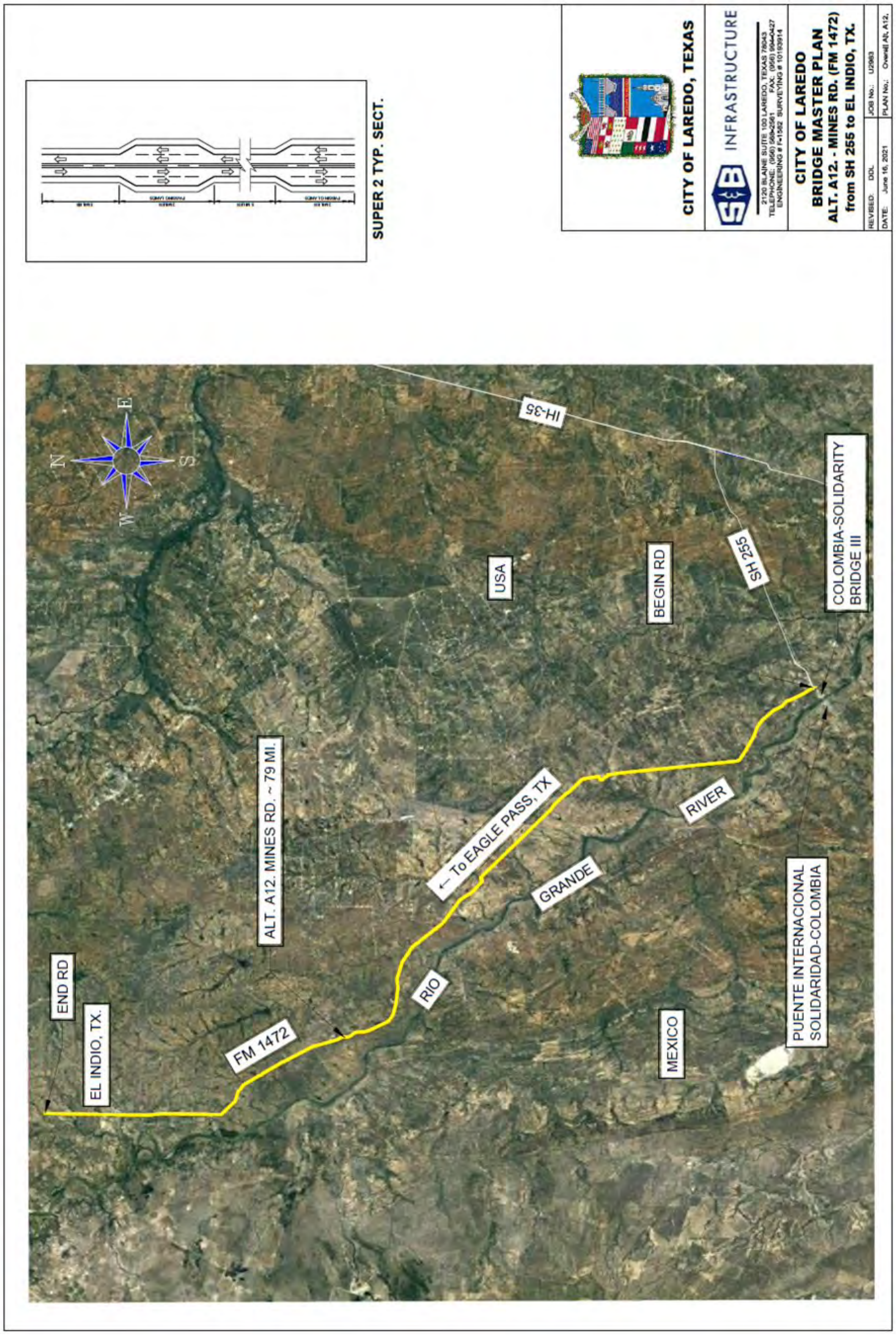

Figure 27. Alternative L Description

M. Vallecillo Extension to US 59 and SH 359 – 2030 – 2040

Opening Year Scenario: 2030-2040

Limits: From IH-35 to SH 359

Description: Extension of the original Vallecillo project (a four-lane roadway primarily meant to facilitate commercial vehicle movement). This alternative considers the construction of approximately 13.5 miles of a new freeway from the end of the Vallecillo Road project at IH-35 to Highway 359 parallel to Loop 20, including an intersection with US 59.

Location:

Figure 28. Alternative M Location

Level of service (LOS) Results:

Table 23. Alternative M Level of Service Results

Road	Segment #	From	To	Year	Length (miles)	Northbound		Southbound	
						Base Case	Alternative	Base Case	Alternative
US 59 - Bob Bullock Loop / Loop 20	1	I-35	International Blvd	2030	2.34	B	B	A	A
				2040	2.34	C	B	B	A
	2	International Blvd	Shiloh Dr	2030	0.83	A	A	A	A
				2040	0.83	A	A	A	A
	3	Shiloh Dr	E Del Mar	2030	1.20	A	A	A	A
				2040	1.20	A	A	A	A
	4	E Del Mar	University	2030	0.79	D	C	D	D
				2040	0.79	D	D	D	D
	5	University	Jacaman	2030	1.20	D	B	B	A
				2040	1.20	D	C	C	B
	6	Jacaman	US 59 Saunders	2030	2.35	C	B	B	A
				2040	2.35	C	C	B	B
	7	US 59 Saunders	SH 359	2030	1.20	C	C	B	B
				2040	1.20	D	C	C	C
	8	SH 359	US 83	2030	2.35	C	C	B	B
				2040	2.35	D	C	C	C

N. Expansion of the Sidewalk of the Gateway to the Americas International Bridge

Opening Year Scenario: 2030-2040

Limits: From the Gateway to the Americas International Bridge to the Gateway to the Americas International Bridge.

Description: The Gateway to the Americas International Bridge pedestrian crossing recently increased the capacity from 5 to 14 inspection booths to speed up crossing and alleviate queues, crossing times, and waiting times.

This alternative focuses on the expansion of the sidewalk leading to the CBP facility. The sidewalk in its existing condition can manage at most two lines for regular and SENTRI crossings. Widening the sidewalk will allow separating and managing the SENTRI and regular pedestrian flows, improving comfort and visibility and, therefore, the security and safety of the bridge.

Location:

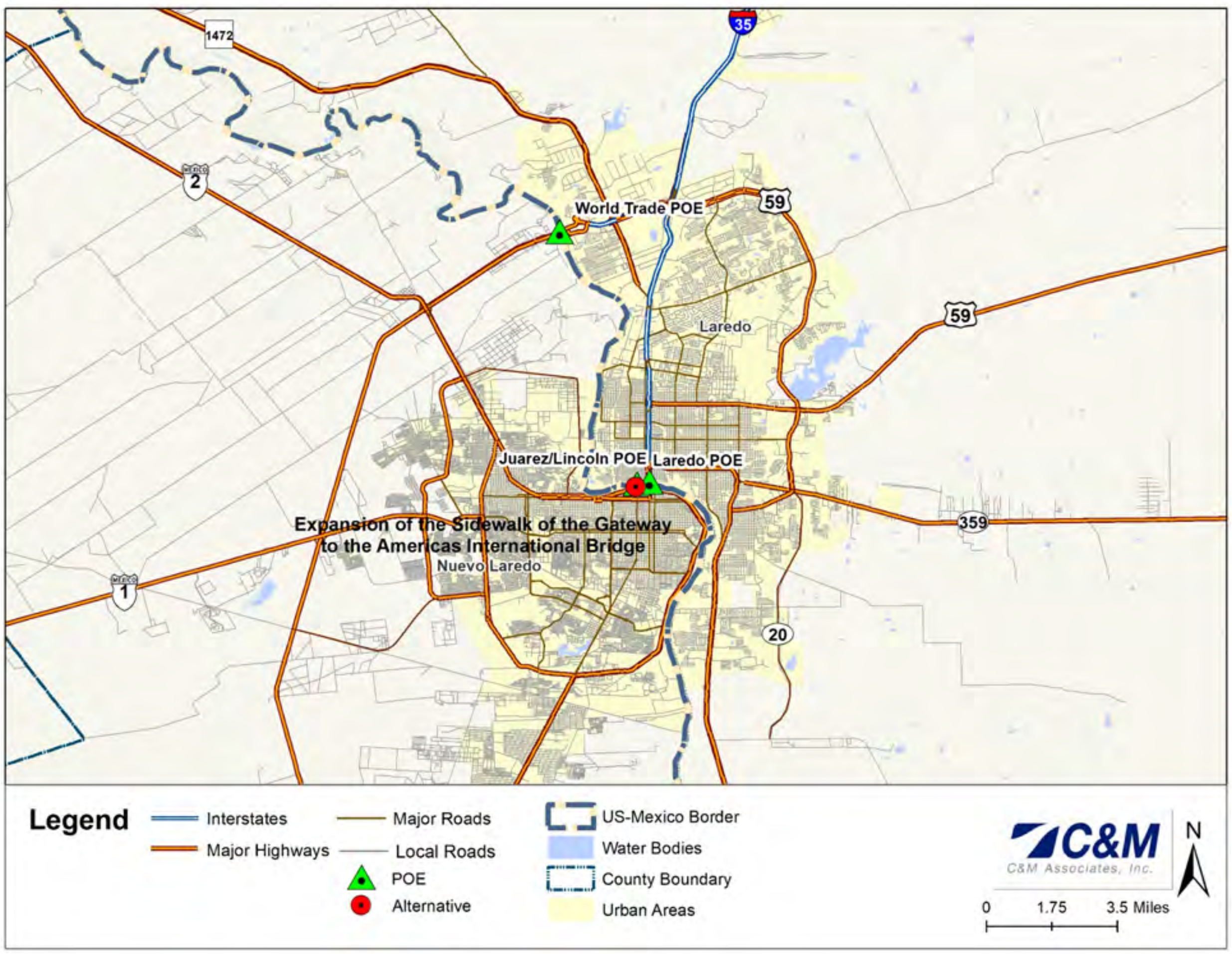

Figure 29. Alternative N Location

Figure 30. Pedestrian crossings at the Gateway to the Americas International Bridge

O. Intersection improvements at Juarez-Lincoln International Bridge

Opening Year Scenario: 2030-2040

Limits: From the Juarez-Lincoln International Bridge to the Juarez-Lincoln International Bridge

Description: This Alternative aim to improve the conditions for traffic exiting the Juarez-Lincoln International Bridge to alleviate the queues present at the up-stream roads leaving the facility caused by both traffic congestion and traffic signal delays. The proposal includes improving the performance of traffic signals in the surrounding area of the bridge to reduce delays and obtain an acceptable level of service at the up-stream inspections.

The hourly traffic volume of the peak period is 1,195 in the northbound direction between 8:00 and 9:00 a.m. and 1,465 in the southbound direction between 6:00 and 7:00 p.m. These traffic volumes during peak hours are causing traffic back-ups at the exit of the Juarez-Lincoln POE facility. By optimizing the up-stream traffic lights, these back-ups can be avoided.

Location:

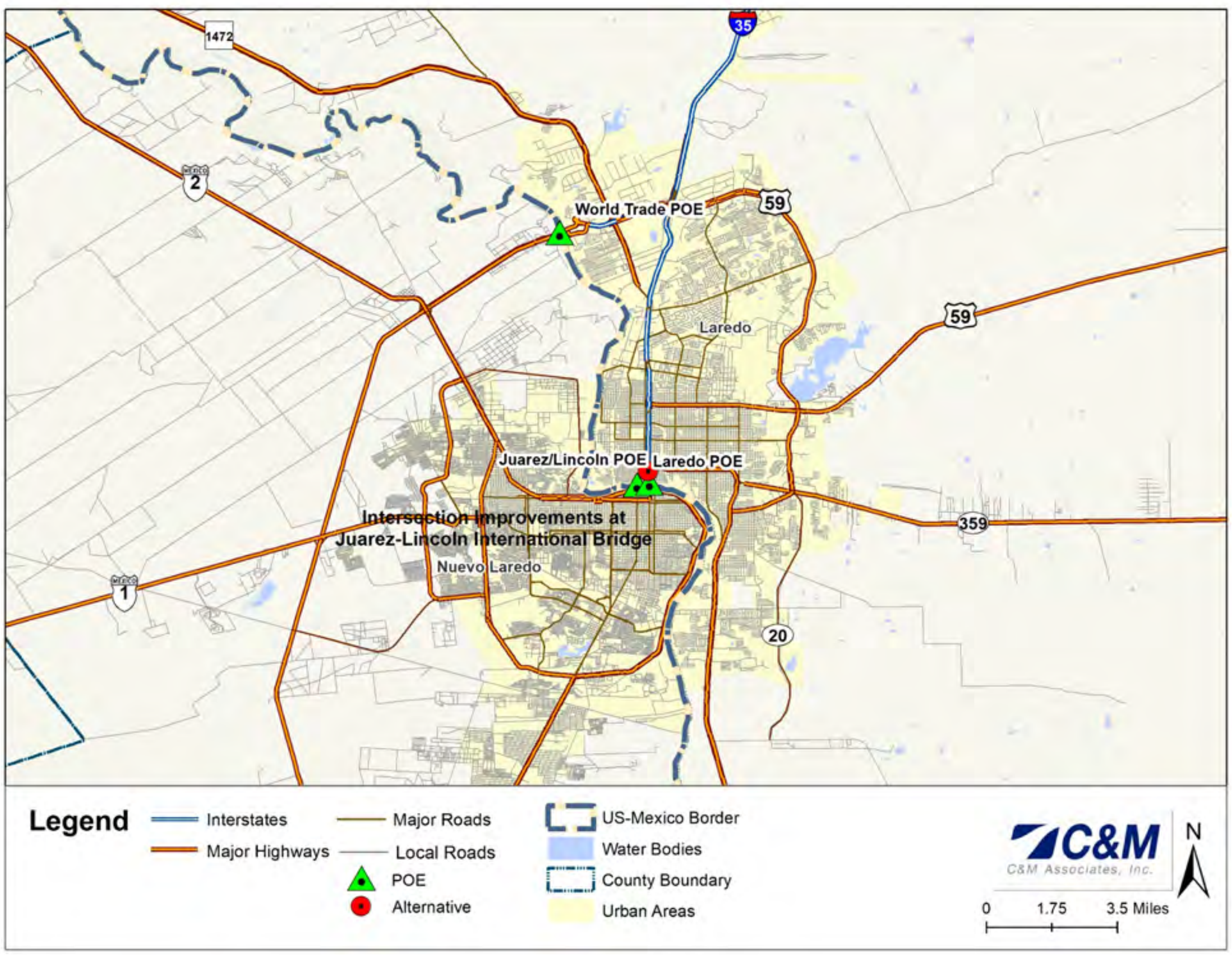

Figure 31. Alternative O Location

C&M performed a high-level LOS analysis by using common traffic engineering software and travel demand model volumes. However, to evaluate this alternative in more detail, C&M recommends a comprehensive traffic analysis of the roadways connecting to the Juarez-Lincoln POE facility, including observed turning movement counts.

Model Results:

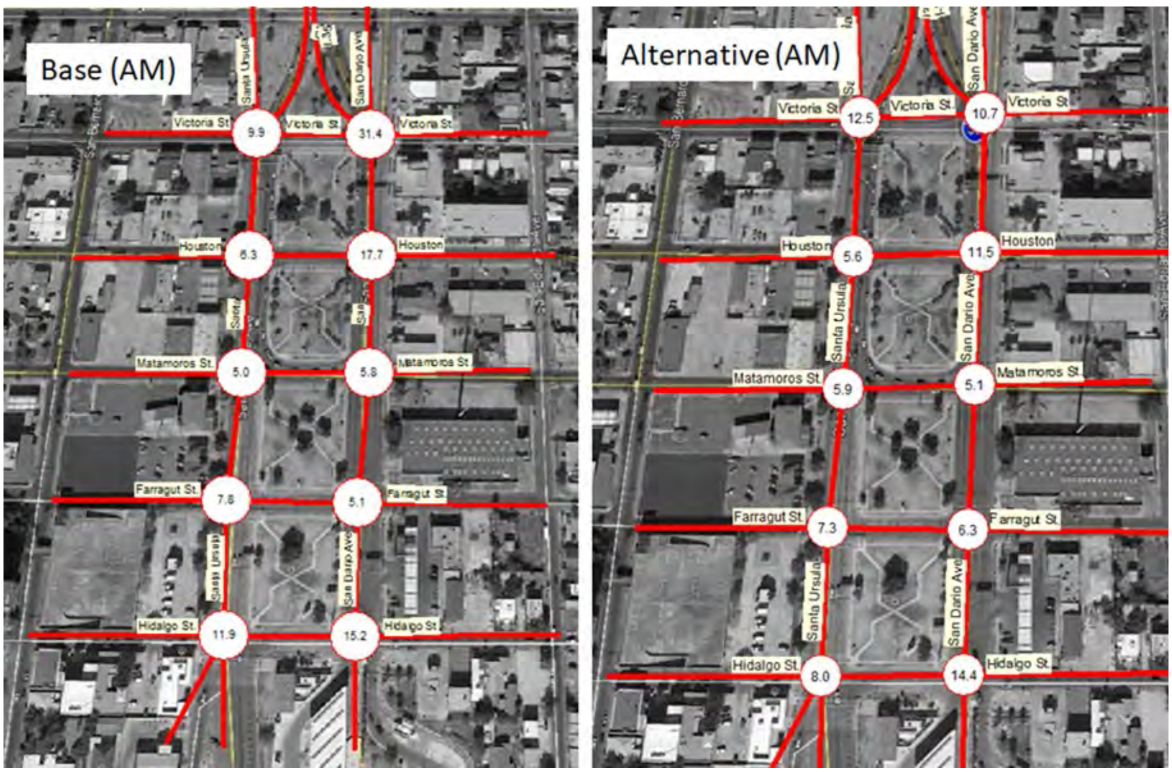

Figure 32. Alternative O Intersection Delay Comparison

P. Improving Las Tiendas Road – 2030 – 2040

Opening Year Scenario: 2030-2040

Limits: From Dolores Blvd. to Mines Road Access

Description: Las Tiendas Road is a 9-mile two-lane (one lane per direction) road that connects SH 255 with Mines Road. Improving the conditions of Las Tiendas Road, this Alternative has the potential to reduce travel times and support future developments in the area. In the analyzed forecast period, no significant impact to the LOS of the Mines Road was observed.

Location:

Figure 33. Alternative P Location

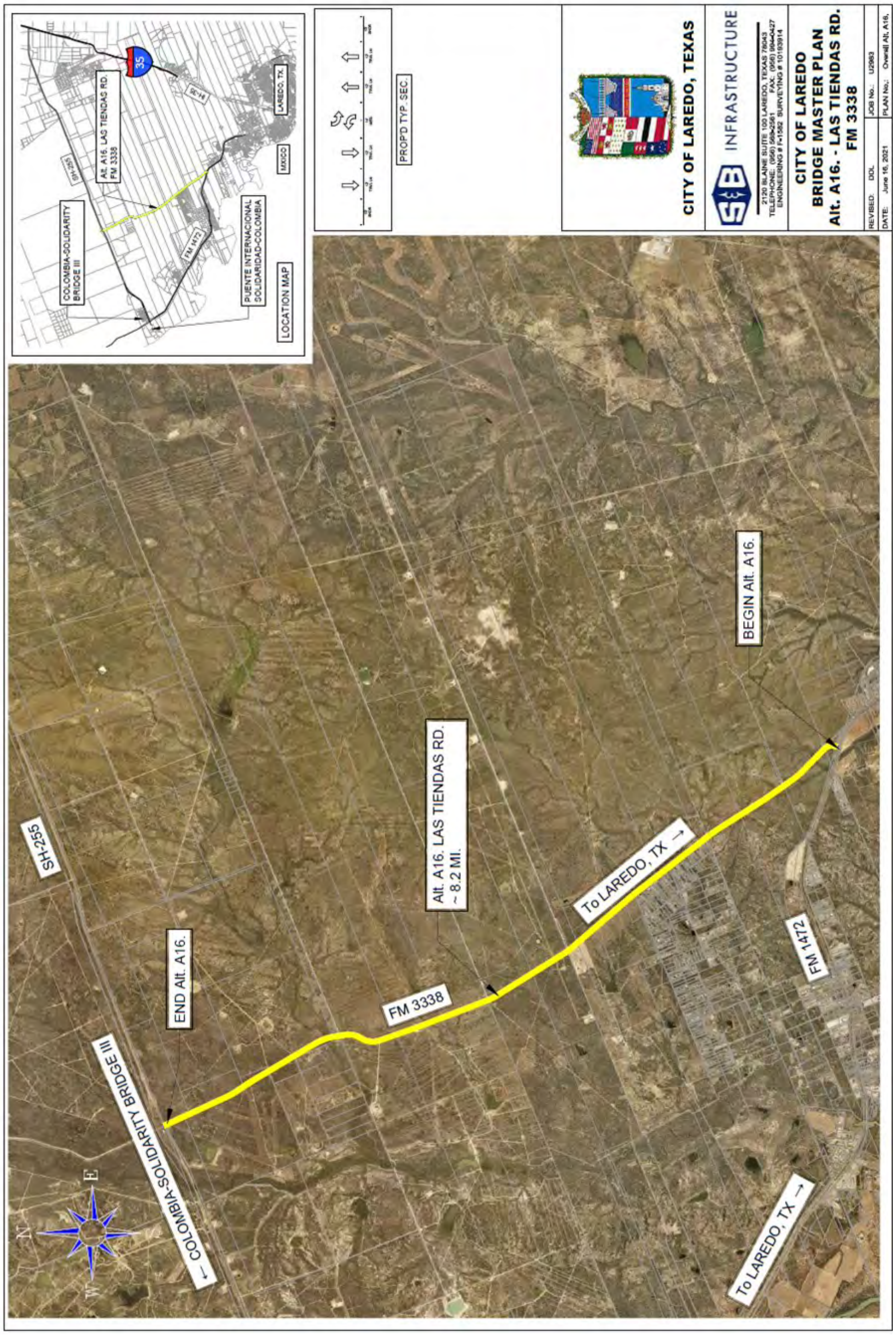

Figure 34. Alternative P Description

Q. New International Bridge 4/5 2025-2040

Opening Year Scenario: 2025

Limits: From Bridge 4/5 to SL 20

Description: The proposed Bridge 4/5's purpose is to alleviate traffic congestion along the cities of Nuevo Laredo in Mexico and Laredo in the United States once the World Trade Bridge reaches full capacity. The proposed bridge location is in southern Webb County and will connect MEX 85 with US 83 and the extension of Loop 20 (Quatro Vientos). In the future, the proposed bridge is planned to have direct access to the Laredo Outer Loop.

Location:

Figure 35. Alternative Q Location

Travel Demand Model Results:

Table 24. Alternative Q Model Demand Results – Passenger Vehicles

Evaluation Criteria	Direction	Year	Gateway (Laredo POE)			Juarez-Lincoln POE			Colombia POE			Bridge 4/5		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference	Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2025	3,078	2,921	-5.1%	10,997	10,201	-7.2%	962	861	-10.5%	0	1,054	NA
	US-MX	2025	3,391	3,265	-3.7%	11,469	10,812	-5.7%	272	241	-11.4%	0	814	NA
Total Crossing Time (min)	MX-US	2025	7	7	-2.0%	20	16	-22.9%	7	7	-2.7%	0	13	NA
	US-MX	2025	17	16	-7.4%	7	7	-0.4%	7	7	-4.0%	0	7	NA
Waiting Time (min)	MX-US	2025	0	0	0.0%	16	12	-27.1%	0	0	0.0%	0	0	NA
	US-MX	2025	11	10	-9.4%	0	0	-54.2%	0	0	0.0%	0	0	NA
Vehicles in the queue	MX-US	2025	16	14	-8.4%	78	23	-70.8%	0	0	-100.0%	0	1	NA
	US-MX	2025	12	11	-9.0%	1	1	-52.8%	0	0	0.0%	0	0	NA
Queue Length (miles)	MX-US	2025	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	NA
	US-MX	2025	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	NA
Volume Throughput	MX-US	2040	3,485	3,176	-8.9%	12,249	11,439	-6.6%	1,273	1,150	-9.7%	0	1,242	NA
	US-MX	2040	3,704	3,454	-6.7%	13,088	12,334	-5.8%	320	287	-10.3%	0	1,037	NA
Total Crossing Time (min)	MX-US	2040	7	7	-0.4%	39	23	-40.9%	8	7	-2.8%	0	13	NA
	US-MX	2040	19	18	-6.0%	7	7	-1.4%	7	7	-0.2%	0	7	NA
Waiting Time (min)	MX-US	2040	0	0	0.0%	29	19	-35.5%	0	0	-61.7%	0	0	NA
	US-MX	2040	12	11	-7.8%	0	0	-64.9%	0	0	0.0%	0	0	NA
Vehicles in the queue	MX-US	2040	63	25	-60.4%	313	117	-62.6%	0	0	-58.4%	0	1	NA
	US-MX	2040	17	15	-15.7%	4	2	-33.1%	0	0	0.0%	0	0	NA
Queue Length (miles)	MX-US	2040	0	0	0.0%	0	0	-100.0%	0	0	0.0%	0	0	NA
	US-MX	2040	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	NA

Table 25. Alternative Q Model Demand Results – Commercial Vehicles

Evaluation Criteria	Direction	Year	Colombia POE			World Trade POE			Bridge 4/5		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2025	1,597	1,271	-20.4%	8,655	7,184	-17.0%	0	1,797	NA
	US-MX	2025	1,267	977	-22.9%	8,785	7,700	-12.4%	0	1,375	NA
Total Crossing Time (min)	MX-US	2025	30	25	-14.1%	40	30	-23.6%	0	26	NA
	US-MX	2025	25	22	-12.0%	35	27	-22.6%	0	24	NA
Waiting Time (min)	MX-US	2025	1	0	-100.0%	14	4	-67.6%	0	1	NA
	US-MX	2025	0	0	-100.0%	6	1	-74.8%	0	0	NA
Vehicles in the queue	MX-US	2025	4	2	-50.4%	83	18	-78.8%	0	2	NA
	US-MX	2025	2	1	-35.6%	60	19	-67.9%	0	2	NA
Queue Length (miles)	MX-US	2025	0	0	0.0%	0	0	0.0%	0	0	NA
	US-MX	2025	0	0	0.0%	0	0	0.0%	0	0	NA
Volume Throughput	MX-US	2040	4,486	3,207	-28.5%	11,427	9,840	-13.9%	0	2,866	NA
	US-MX	2040	3,771	2,614	-30.7%	11,830	10,488	-11.3%	0	2,499	NA
Total Crossing Time (min)	MX-US	2040	134	74	-44.8%	250	94	-62.3%	0	40	NA
	US-MX	2040	100	26	-74.1%	150	77	-48.7%	0	26	NA
Waiting Time (min)	MX-US	2040	84	26	-68.9%	161	23	-85.9%	0	12	NA
	US-MX	2040	54	0	-100.0%	85	14	-83.4%	0	1	NA
Vehicles in the queue	MX-US	2040	276	84	-69.5%	462	390	-15.5%	0	31	NA
	US-MX	2040	127	6	-95.0%	714	233	-67.3%	0	8	NA
Queue Length (miles)	MX-US	2040	4	1	-86.5%	5	4	-17.2%	0	0	NA
	US-MX	2040	3	0	-100.0%	10	3	-67.4%	0	0	NA

R. New Bridge 4/5 2025–2040 with Laredo Outer Loop

Opening Year Scenario: 2025

Limits: From Bridge 4/5 POE to IH-35 (at SH 255)

Description: The proposed Bridge 4/5 with an additional loop connecting to Laredo. Segments 1 and 2 of the Outer Loop are assumed to open to traffic in 2030, while Segment 3 is assumed to open in 2035.

Location:

Figure 36. Alternative R Location

Travel Demand Model Results:

Table 26. Alternative R Model Demand Results – Passenger Vehicles

Evaluation Criteria	Direction	Year	Gateway (Laredo POE)			Juarez-Lincoln POE			Colombia POE			Bridge 4/5		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference	Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2025	3,078	2,914	**-5.3%**	10,997	10,102	**-8.1%**	962	817	**-15.1%**	0	1,255	**0.0%**
	US-MX	2025	3,391	3,277	**-3.4%**	11,469	10,675	**-6.9%**	272	226	**-16.9%**	0	954	**0.0%**
Total Crossing Time (min)	MX-US	2025	7	7	**-2.1%**	20	15	**-25.5%**	7	7	**-4.0%**	0	14	**0.0%**
	US-MX	2025	17	16	**-6.6%**	7	7	**-0.5%**	7	7	**-6.4%**	0	8	**0.0%**
Waiting Time (min)	MX-US	2025	0	0	**0.0%**	16	11	**-30.2%**	0	0	**0.0%**	0	0	**0.0%**
	US-MX	2025	11	10	**-8.4%**	0	0	**-56.9%**	0	0	**0.0%**	0	0	**0.0%**
Vehicles in the queue	MX-US	2025	16	14	**-8.8%**	78	17	**-78.9%**	0	0	**-100.0%**	0	0	**0.0%**
	US-MX	2025	12	11	**-8.1%**	1	0	**-55.4%**	0	0	**0.0%**	0	0	**0.0%**
Queue Length (miles)	MX-US	2025	0	0	**0.0%**	0	0	**0.0%**	0	0	**0.0%**	0	0	**0.0%**
	US-MX	2025	0	0	**0.0%**	0	0	**0.0%**	0	0	**0.0%**	0	0	**0.0%**
Volume Throughput	MX-US	2040	3,485	3,156	**-9.4%**	12,249	11,225	**-8.4%**	1,273	1,092	**-14.2%**	0	1,534	**0.0%**
	US-MX	2040	3,704	3,428	**-7.5%**	13,088	12,112	**-7.5%**	320	252	**-21.3%**	0	1,320	**0.0%**
Total Crossing Time (min)	MX-US	2040	7	7	**-0.4%**	39	21	**-46.2%**	8	7	**-4.2%**	0	15	**0.0%**
	US-MX	2040	19	18	**-6.6%**	7	7	**-1.8%**	7	7	**-0.5%**	0	9	**0.0%**
Waiting Time (min)	MX-US	2040	0	0	**0.0%**	29	17	**-40.1%**	0	0	**-92.5%**	0	1	**0.0%**
	US-MX	2040	12	11	**-8.6%**	0	0	**-87.3%**	0	0	**0.0%**	0	0	**0.0%**
Vehicles in the queue	MX-US	2040	63	22	**-64.7%**	313	92	**-70.6%**	0	0	**-87.6%**	0	0	**0.0%**
	US-MX	2040	17	14	**-17.5%**	4	2	**-44.5%**	0	0	**0.0%**	0	0	**0.0%**
Queue Length (miles)	MX-US	2040	0	0	**0.0%**	0	0	**-112.9%**	0	0	**0.0%**	0	0	**0.0%**
	US-MX	2040	0	0	**0.0%**	0	0	**0.0%**	0	0	**0.0%**	0	0	**0.0%**

Table 27. Alternative R Model Demand Results – Commercial Vehicles

Evaluation Criteria	Direction	Year	Colombia POE			World Trade POE			Bridge 4/5		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2025	1,597	1,249	**-21.8%**	8,655	7,182	**-17.0%**	0	1,821	**0.0%**
	US-MX	2025	1,267	962	**-24.1%**	8,785	7,700	**-12.4%**	0	1,390	**0.0%**
Total Crossing Time (min)	MX-US	2025	30	25	**-15.1%**	40	30	**-23.6%**	0	28	**0.0%**
	US-MX	2025	25	22	**-12.6%**	35	27	**-22.6%**	0	25	**0.0%**
Waiting Time (min)	MX-US	2025	1	0	**-100.0%**	14	4	**-67.7%**	0	1	**0.0%**
	US-MX	2025	0	0	**-105.4%**	6	1	**-74.8%**	0	0	**0.0%**
Vehicles in the queue	MX-US	2025	4	2	**-54.0%**	83	17	**-78.9%**	0	2	**0.0%**
	US-MX	2025	2	1	**-37.5%**	60	19	**-67.9%**	0	2	**0.0%**
Queue Length (miles)	MX-US	2025	0	0	**0.0%**	0	0	**0.0%**	0	0	**0.0%**
	US-MX	2025	0	0	**0.0%**	0	0	**-100.0%**	0	0	**0.0%**
Volume Throughput	MX-US	2040	4,486	3,026	**-32.5%**	11,427	9,716	**-15.0%**	0	3,171	**0.0%**
	US-MX	2040	3,771	2,513	**-33.4%**	11,830	10,433	**-11.8%**	0	2,655	**0.0%**
Total Crossing Time (min)	MX-US	2040	134	70	**-47.6%**	250	82	**-67.1%**	0	44	**0.0%**
	US-MX	2040	100	20	**-79.6%**	150	74	**-50.7%**	0	29	**0.0%**
Waiting Time (min)	MX-US	2040	84	0	**-100.0%**	161	12	**-92.6%**	0	12	**0.0%**
	US-MX	2040	54	0	**-100.0%**	85	11	**-86.8%**	0	2	**0.0%**
Vehicles in the queue	MX-US	2040	276	72	**-73.9%**	462	385	**-16.7%**	0	34	**0.0%**
	US-MX	2040	127	0	**-100.0%**	714	214	**-70.1%**	0	10	**0.0%**
Queue Length (miles)	MX-US	2040	4	0	**-92.1%**	5	4	**-18.6%**	0	0	**0.0%**
	US-MX	2040	3	0	**-100.0%**	10	3	**-70.2%**	0	0	**0.0%**

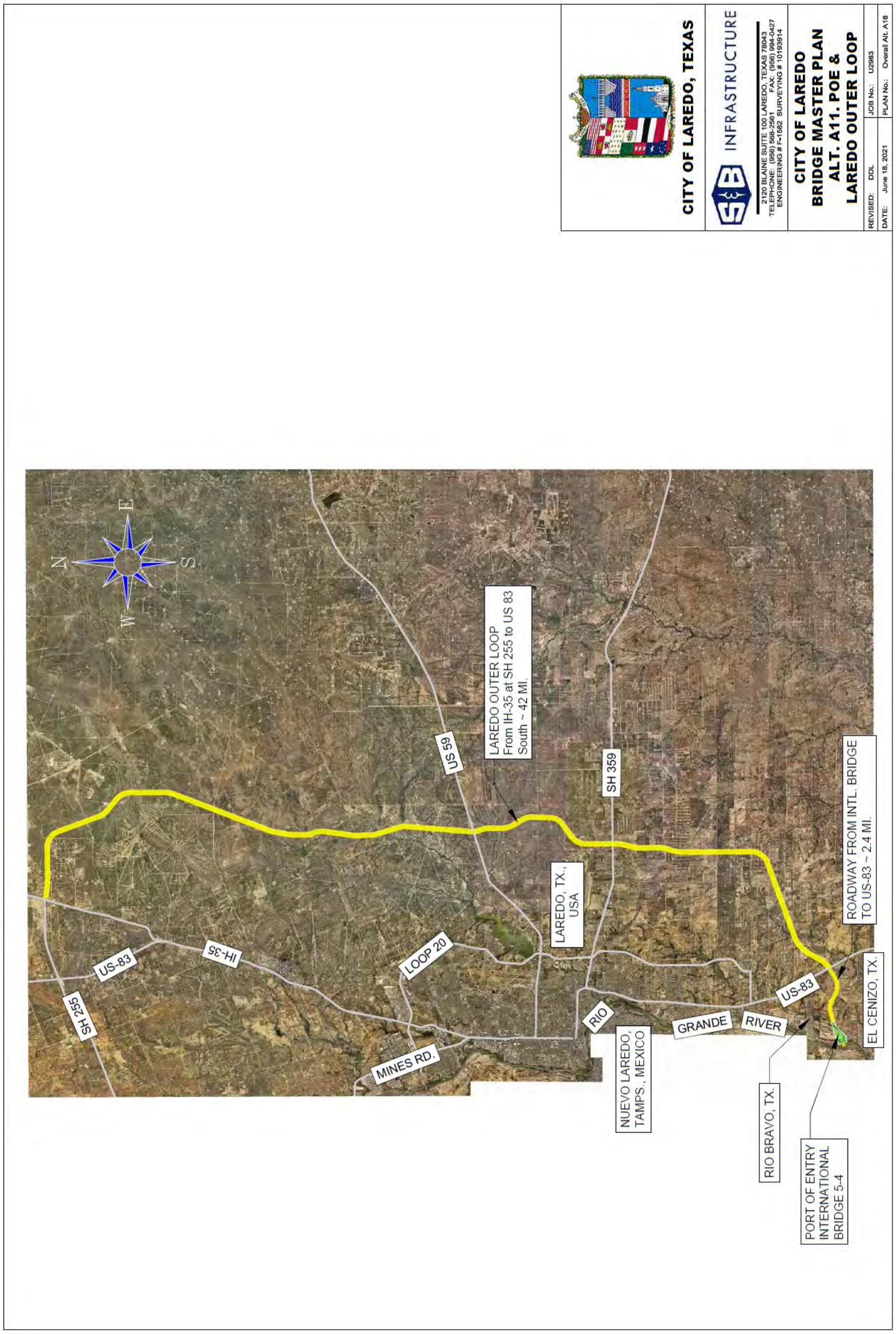

Figure 37. Alternative R Description

S. Gateway POE: Only Pedestrian Crossing

Opening Year Scenario: 2025

Limits: Gateway POE

Description: The Gateway POE currently allows passenger vehicle and pedestrian border crossings. This alternative proposes that the Gateway POE would be exclusively for pedestrian crossings. The alternative aims to improve the Laredo downtown area to a more pedestrian friendly environment.

Location:

Figure 38. Alternative S Location

Travel Demand Model Results:

Table 28. Alternative S Model Demand Results – Passenger Vehicles

Evaluation Criteria	Direction	Year	Gateway (Laredo POE)			Juarez Lincoln POE			Colombia POE		
			Base Case	Alternative	Difference	Base Case	Alternative	Difference	Base Case	Alternative	Difference
Volume Throughput	MX-US	2025	3,078	0	**-100.0%**	10,997	13,409	**21.9%**	962	1,629	**69.3%**
	US-MX	2025	3,391	0	**-100.0%**	11,469	14,795	**29.0%**	272	337	**23.9%**
Total Crossing Time (min)	MX-US	2025	7	0	**-100.0%**	15	63	**312.4%**	7	15	**106.8%**
	US-MX	2025	17	0	**-100.0%**	7	8	**5.4%**	7	7	**0.0%**
Waiting Time (min)	MX-US	2025	0	0	**-100.0%**	6	52	**746.8%**	0	9	**23172.4%**
	US-MX	2025	11	0	**-100.0%**	0	1	**1031.8%**	0	0	**127.9%**
Vehicles in the queue	MX-US	2025	16	0	**-100.0%**	78	337	**330.3%**	0	15	**9733.8%**
	US-MX	2025	12	0	**-100.0%**	1	13	**1153.5%**	0	0	**0.0%**
Queue Length (ft)	MX-US	2025	0	0	**0.0%**	0	2	**0.0%**	0	0	**0.0%**
	US-MX	2025	0	0	**0.0%**	0	0	**0.0%**	0	0	**0.0%**
Volume Throughput	MX-US	2040	3,485	0	**-100.0%**	12,249	15,330	**25.2%**	1,273	1,677	**31.8%**
	US-MX	2040	3,704	0	**-100.0%**	13,088	16,636	**27.1%**	320	476	**48.8%**
Total Crossing Time (min)	MX-US	2040	7	0	**-100.0%**	34	77	**129.0%**	8	21	**167.5%**
	US-MX	2040	19	0	**-100.0%**	8	11	**45.3%**	7	7	**0.0%**
Waiting Time (min)	MX-US	2040	0	0	**-100.0%**	24	66	**172.1%**	0	17	**12559.7%**
	US-MX	2040	13	0	**-100.0%**	0	5	**2676.8%**	0	0	**0.0%**
Vehicles in the queue	MX-US	2040	63	0	**-100.0%**	313	642	**104.9%**	0	30	**5930.0%**
	US-MX	2040	17	0	**-100.0%**	4	107	**2931.2%**	0	0	**0.0%**
Queue Length (ft)	MX-US	2040	0	0	**-100.0%**	0	2	**824.8%**	0	0.0	**0.0%**
	US-MX	2040	0	0	**0.0%**	0	0	**0.0%**	0	0.0	**0.0%**

APPENDIX C: ALTERNATIVES SUMMARY

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

APPENDIX C

ALTERNATIVES SUMMARY

Error! Not a valid bookmark self-reference. and Table 30 summarize the travel demand results by alternative for commercial vehicles and passenger vehicles, respectively. These tables highlight each alternative's impact on demand at each Laredo POE.

Table 29. Alternatives Summary – Commercial Vehicles

POE	Evaluation Criteria	Direction	Year	Base Case	Alternative A		Alternative B		Alternative C		Alternative G		Alternative H		Alternative I		Alternative J		Alternative Q		Alternative R	
					Alternative	Difference	Alternative	Difference	Alternative	Difference	Alternative	Difference	Alternative	Difference	Alternative	Difference	Alternative	Difference	Alternative	Difference	Alternative	Difference
Colombia	Volume	MX-US	2040	4,486	4,074	**-9.2%**	3,509	**-21.8%**	3,056	**-31.9%**	5,733	**27.8%**	4,782	**6.6%**	4,639	**3.4%**	4,646	**3.6%**	3,207	**-28.5%**	3,026	**-32.5%**
	Throughput	US-MX	2040	3,771	3,612	**-4.2%**	3,737	**-0.9%**	3,729	**-1.1%**	3,688	**-2.2%**	4,065	**7.8%**	3,895	**3.3%**	3,902	**3.5%**	2,614	**-30.7%**	2,513	**-33.4%**
	Total Crossing	MX-US	2040	135	114	**-15.2%**	102	**-24.1%**	92	**-31.4%**	182	**35.6%**	241	**78.9%**	203	**51.3%**	173	**28.6%**	74	**-44.8%**	70	**-47.6%**
	Time (min)	US-MX	2040	100	93	**-7.1%**	100	**-0.6%**	98	**-2.6%**	154	**53.9%**	126	**25.7%**	104	**3.9%**	106	**5.5%**	26	**-74.1%**	20	**-79.6%**
World Trade	Volume	MX-US	2040	11,427	11,839	**3.6%**	12,404	**8.5%**	12,857	**12.5%**	10,213	**-10.6%**	11,131	**-2.6%**	11,274	**-1.3%**	11,267	**-1.4%**	9,840	**-13.9%**	9,716	**-15.0%**
	Throughput	US-MX	2040	11,830	11,989	**1.3%**	11,864	**0.3%**	11,872	**0.4%**	11,913	**0.7%**	11,536	**-2.5%**	11,706	**-1.0%**	11,699	**-1.1%**	10,488	**-11.3%**	10,433	**-11.8%**
	Total Crossing	MX-US	2040	250	259	**3.5%**	143	**-43.0%**	119	**-52.2%**	375	**50.0%**	188	**-24.9%**	188	**-24.9%**	183	**-26.8%**	94	**-62.3%**	82	**-67.1%**
	Time (min)	US-MX	2040	150	152	**1.7%**	150	**0.2%**	150	**0.4%**	144	**-3.8%**	128	**-14.8%**	139	**-6.9%**	137	**-8.5%**	77	**-48.7%**	74	**-50.7%**
Bridge 4/5	Volume	MX-US	2040	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,866	**0.0%**	3,171	**10.6%**
	Throughput	US-MX	2040	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,499	**0.0%**	2,655	**6.2%**
	Total Crossing	MX-US	2040	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	**0.0%**	44	**10.1%**
	Time (min)	US-MX	2040	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26	**0.0%**	29	**11.5%**

Table 30. Alternatives Summary – Passenger Vehicles

POE	Evaluation Criteria	Direction	Year	Base Case	Alternative F		Alternative I		Alternative J		Alternative Q		Alternative R		Alternative S	
					Alternative	Difference	Alternative	Difference	Alternative	Difference	Alternative	Difference	Alternative	Difference	Alt	Diff
Gateway (Laredo	Volume	MX-US	2040	3,485	3,452	**-0.9%**	3,468	**-0.5%**	3,400	**-2.4%**	3,176	**-8.9%**	3,156	**-9.4%**	0	**-100.0%**
	Throughput	US-MX	2040	3,704	3,645	**-1.6%**	3,691	**-0.4%**	3,690	**-0.4%**	3,454	**-6.7%**	3,428	**-7.5%**	0	**-100.0%**
	Total Crossing	MX-US	2040	7	7	**0.2%**	7	**-1.4%**	7	**-1.4%**	7	**-0.4%**	10,102	**-8.1%**	0	**-100.0%**
	Time (min)	US-MX	2040	19	18	**-2.4%**	21	**11.2%**	7	**-63.3%**	18	**-6.0%**	10,675	**-6.9%**	0	**-100.0%**
Juarez-Lincoln	Volume	MX-US	2040	12,249	12,537	**2.4%**	12,229	**-0.2%**	12,017	**-1.9%**	11,439	**-6.6%**	11,225	**-8.4%**	15,330	**27.4%**
	Throughput	US-MX	2040	13,088	13,148	**0.5%**	13,092	**0.0%**	12,467	**-4.7%**	12,334	**-5.8%**	12,112	**-7.5%**	16,636	**27.1%**
	Total Crossing	MX-US	2040	39	26	**-32.4%**	9	**-74.6%**	33	**-2.4%**	23	**-40.9%**	817	**-15.1%**	77	**129.0%**
	Time (min)	US-MX	2040	8	8	**0.1%**	8	**0.0%**	8	**0.0%**	7	**-1.4%**	226	**-16.9%**	11	**45.3%**
Colombia	Volume	MX-US	2040	1,273	1,018	**-20.0%**	1,310	**2.9%**	1,590	**24.9%**	1,150	**-9.7%**	1,092	**-14.2%**	1,677	**31.8%**
	Throughput	US-MX	2040	320	319	**-0.3%**	329	**2.8%**	955	**198.4%**	287	**-10.3%**	252	**-21.3%**	476	**48.8%**
	Total Crossing	MX-US	2040	8	7	**-5.1%**	8	**0.0%**	18	**135.1%**	7	**-2.8%**	1,255	**19.1%**	21	**167.5%**
	Time (min)	US-MX	2040	7	7	**0.1%**	7	**0.0%**	7	**0.0%**	7	**-0.2%**	954	**17.2%**	7	**0.0%**
Bridge 4/5	Volume	MX-US	2040	-	-	-	-	-	-	-	1,242	**0.0%**	1,534	**23.5%**		
	Throughput	US-MX	2040	-	-	-	-	-	-	-	1,037	**0.0%**	1,320	**27.3%**		
	Total Crossing	MX-US	2040	-	-	-	-	-	-	-	13	**0.0%**	15	**12.2%**		
	Time (min)	US-MX	2040	-	-	-	-	-	-	-	7	**0.0%**	9	**22.3%**		

INFRASTRUCTURE

APPENDIX D: ALTERNATIVES EVALUATION

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

APPENDIX D

ALTERNATIVES EVALUATION

The multiple-criteria matrix is an evaluation tool that allows for the inclusion of a wide variety of quantitative and qualitative criteria, which makes it particularly useful for evaluating the previously presented alternatives. Decision making via the multiple-criteria method entails measuring the relevant impacts of each of the alternatives (e.g., benefits, costs, agency support, etc.) based on individual weightings to generate a global score comparable across alternatives.

The criteria used in the present evaluation are distributed across two levels: major criteria and minor criteria. The major criteria include the benefits associated with the alternative, investment costs, support from interested agents, and the progress made to date on relevant technical processes. The major criteria are then sub-divided into minor criteria such as benefits in northbound and southbound directions. Table 33 presents the evaluated criteria and their associated weights.

Table 33. Major and Minor Criteria

Major Criteria	Major Criteria Weight	Criteria	Criteria Weight	Overall Weight	Criteria Description
Benefits	60%	System-Wide Time Crossing Savings Value ($US) NB	65%	39%	Time savings value of border crossings in the Laredo International Bridge System in the MX-US direction
		System-Wide Time Crossing Savings Value ($US) SB	35%	21%	Time savings value of border crossings in the Laredo International Bridge System in the US-MX direction
Costs	30%	Investment Costs	100%	30%	Construction costs related to the project
Support	5%	Local Stakeholder Support	40%	2%	Level of support from local stakeholders
		Agency Support	60%	3%	Level of support from agencies
Technical Process	5%	Right of Way	80%	4%	Acres of Right of Way required
		Feasibility Studies	20%	1%	Existence of feasibility, pre-feasibility, or sketch-level studies for the alternative

The attributes of each alternative imply different types of benefits. In order to measure, compare, and ultimately rank these benefits, the alternatives were divided into three groups based on their location. Thefirst group includes projects related to POEs and their impact on border crossing time. The second group includes alternatives that provide LOS improvements to corridors in the United States. Finally, the third group includes alternatives for corridors in Mexico. These groupings are presented in Table 34.

Table 34. Alternative Grouping

Alternative Name	Alternative Code	Group
World Trade Bridge - New Span	A	POE
World Trade Bridge - Fast Lane Expansion	B	POE
World Trade Bridge - Entry Lanes Expansion	C	POE
Juarez-Lincoln Bridge - Passenger Vehicle Inspection with Double-Stacked Booths	F	POE
Permanently Moving Empty Commercial vehicles to Colombia POE	G	POE
Colombia Bridge - Proposed OW/OS Corridor and Daily Program	H	POE
Gateway to the Americas Bridge - Sidewalk Expansion	N	POE
New International Bridge 4/5	Q	POE
New International Bridge 4/5 with Laredo Outer Loop	R	POE
Gateway POE: Pedestrian-Only Crossing	S	POE
Mines Road Freeway	D	US Corridor
Direct Connection from World Trade Bridge to Killam Industrial Blvd	E	US Corridor
Laredo Outer Loop	K	US Corridor
Expanding Mines Road to Eagle Pass	L	US Corridor
Vallecillo Extension to US 59 and SH 359	M	US Corridor
Juarez Lincoln Bridge - Intersection Improvements	O	US Corridor
Improving Las Tiendas Road	P	US Corridor
Safety Improvement at MEX 2 between WTB and Colombia Bridge	I	MX Corridor
Construction of La Gloria-Colombia Highway	J	MX Corridor

To calculate the benefits of group 1 (POE) and group 3 (MX Corridor), C&M analyzed the results of system- wide time crossing savings for both passenger and commercial vehicles. It should be noted that the time saving benefits for each type of vehicle differ due to their different annual volumes. To equivalently compare the benefits between alternatives, C&M calculated the monetary value of the time savings (in U.S. Dollars) by multiplying the value of time (VOT) of each vehicle type by the system-level time savings, by the daily volume, and by the annualization factor for both northbound and southbound directions.

Similarly, the benefits of the U.S. Corridor alternatives were calculated based on the degree of LOS improvement. A matrix of LOS scores was prepared by scoring the alternatives based on their LOS benefits.

Table 35 presents the overall scores of the evaluated alternatives. The three best-scored alternatives are Alternative B with a score of 75.7, Alternative C with 72.7, and Alternative E with 62.7.

Table 35. Alternatives Assessment – Overall Scores

Group	Alternative Code	Alternative Name	Overall Score
POE	B	World Trade Bridge - Fast Lane Expansion	75.7
POE	C	World Trade Bridge - Entry Lanes Expansion	72.7
US Corridor	E	Direct Connection From World Trade Bridge to Killam Industrial Blvd	62.7
POE	F	Juarez-Lincoln Bridge - Passenger Vehicle Inspection with Double-Stacked Booths	59.6
US Corridor	O	Juarez Lincoln Bridge - Intersection Improvements	59.6
POE	Q	New International Bridge 4/5	58.2
MX Corridor	J	Construction of La Gloria-Colombia Highway	52.8
POE	N	Gateway to the Americas Bridge - Sidewalk Expansion	52.4
POE	S	Gateway POE : Pedestrian-Only Crossing	50.6
POE	G	Permanently Moving Empty Trucks to Colombia POE	49.8
POE	H	Colombia Bridge - Proposed OW/OS Corridor and Daily Program	49.6
POE	R	New International Bridge 4/5 with Laredo Outer Loop	49.4
MX Corridor	I	Safety Improvement at MEX 2 between WTB and Colombia Bridge	45.6
POE	A	World Trade Bridge - New Span	45.2
US Corridor	M	Vallecillo Extension to US 59 and SH 359	38.4
US Corridor	D	Mines Road Freeway	38.3
US Corridor	P	Improving Las Tiendas Road	36.6
US Corridor	L	Expanding Mines Road to Eagle Pass	24.4
US Corridor	K	Laredo Outer Loop	22.5

Group 1: POE   Group 2: US Corridor   Group 3: MX Corridor

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INFRASTRUCTURE

APPENDIX E: AGEB-LEVEL PROJECTIONS NUEVO LAREDO TAMAULIPAS

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

AGEB-Level Projections for Nuevo Laredo, Tamaulipas

SIREM

September 2020

SiREM
Consultoría Económica

Proyecciones a escala AGEB para Nuevo Laredo, Tamaulipas

Resumen ejecutivo preparado por

Sistema de Información Regional de México, S.A. de C.V (SIREM)

Para

C&M Associates, Inc.

Septiembre de 2020

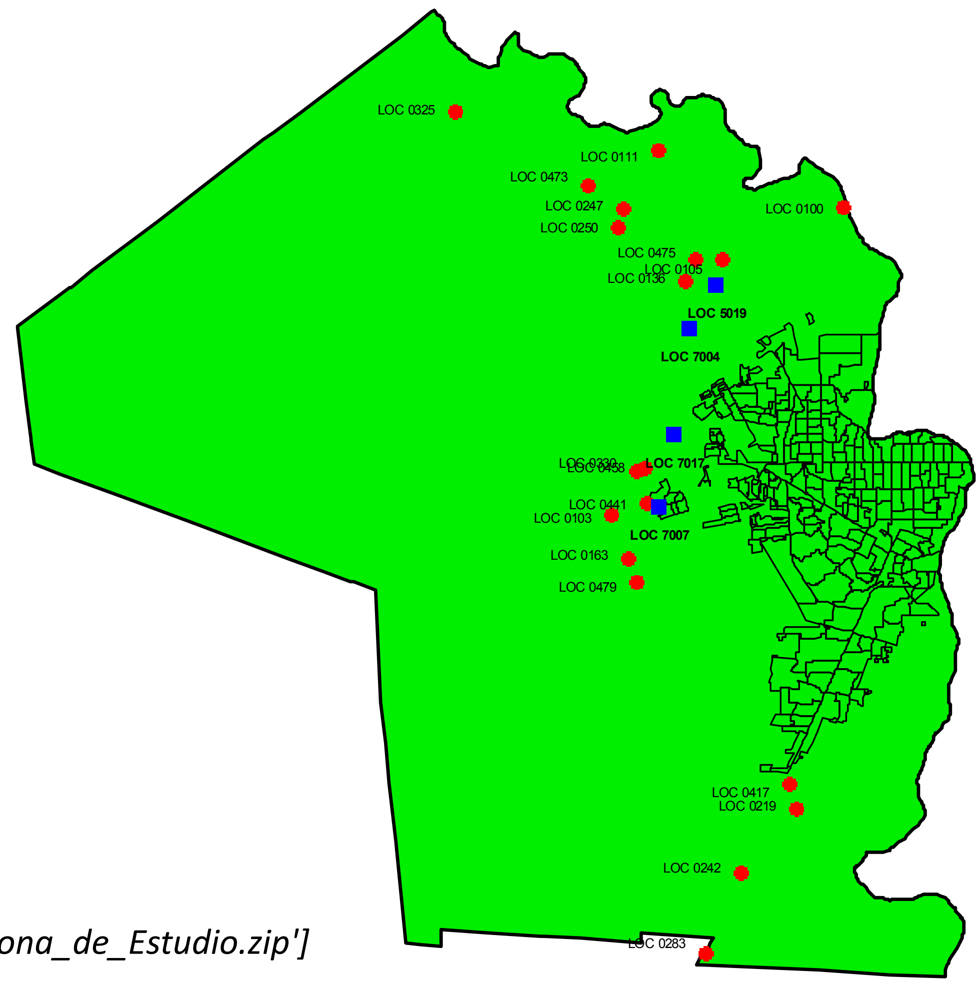
La zona del estudio se ubica en el estado mexicano de Tamaulipas, en el municipio de Nuevo Laredo (28027)

		CVEGEO	LOC
1		28027010000278	1000
2		28027010317548	1031
3		28027010500278	1050
4		28027011100278	1110
5		28027013600278	1360
6		28027016317548	1631
7		28027021901018	2190
8		28027024200998	2420
9		28027024700278	2470
10		28027025000278	2500
11		28027028301018	2830
12		28027032516998	3251
13		28027033024858	3302
14		28027041701018	4170
15		28027044117548	4411
16		28027045824858	4582
17		28027047316998	4731
18		28027047500278	4750
19		28027047917548	4791
20		2802750190027	5019
21		2802770040027	7004
22		2802770072485	7007
23		2802770172485	7017

[los detalles se encuentran en el archivo 'Zona_de_Estudio.zip']

Municipio de Nuevo Laredo (28027)

(con AGEB urbanas y otras localidades con actividad económica)



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SIREM preparó proyecciones anuales de 2018 a 2060 de población total, personal ocupado total y Valor Agregado Bruto total para cada AGEB

- *Población total (personas)*
  - Fuentes de información
    - Censo de Población y Vivienda 2010, información por AGEB; Proyecciones de población a escala municipal de CONAPO, extendidas por SIREM.
  - Metodología
    - SIREM proyectó la población con base en información demográfica, respetando los totales de control municipales proyectados por CONAPO y extendidos por SIREM; para incluir las AGEB creadas despúes de 2010, las proyecciones fueron ajustadas con base en conteos de casas visibles en imágenes satelitales del año 2018.

- *Valor Agregado Bruto (VAB) total (millones de pesos de 2013)*
  - Fuentes de información
    - Censo Económico 2014 (datos de 2013); DENUE (2018); Modelo Municipal de SIREM (junio de 2020).
  - Metodología
    - Construcción de coeficientes de VAB por persona ocupado detallados por sector y estrato de empleo;
    - Cálculo del VAB por sector y estrato a escala AGEB para el año 2018; y
    - Proyección mediante la técnica RAS en el contexto del Modelo Municipal de SIREM, con desglose en 4 meta-sectores de actividad económica disponibles a escala de AGEB (industria básica; manufacturas, comercio y transporte, y servicios).
- *Personal ocupado total*
  - Fuentes de información
    - Censo Económico 2014 (datos de 2013); DENUE (2018); Cuenta de Bienes y Servicios del Sistema de Cuentas Nacionales de México.
  - Metodología
    - Aplicación de coeficientes de VAB por persona ocupado a las proyecciones del VAB a escala AGEB, con desglose en 4 meta-sectores; y
    - Corrección por las tendencia s en productividad en los 4 meta-sectores.

[los detalles se encuentran en el archivo 'SIREM_Nota_Técnica_NvoLaredo_24viii2020.pdf']

Resumen de las proyecciones de población para Nuevo Laredo (muestra)

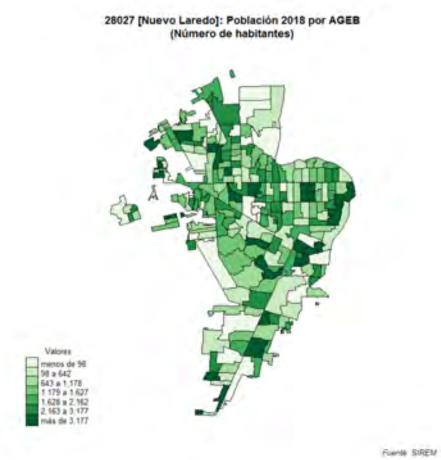
28027: Resumen POBLACIÓN

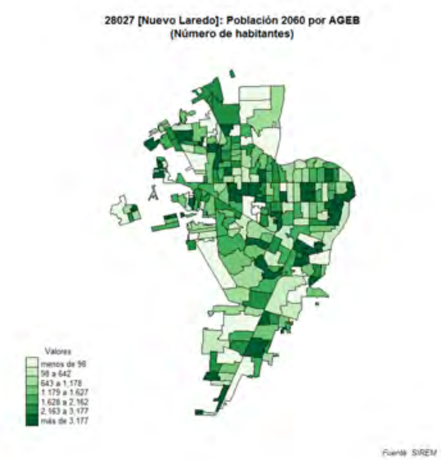
AGEB **CVE_AGEB**	**EST** **POB2018** *(Personas)*	**PROY** **POB2060** *(Personas)*	**CRECIMIENTO** **2019 a 2060** *Tasa media (%)*
2802700010120	1684	1914	0.306%
280270001014A	2249	2555	0.305%
2802700010192	2897	3292	0.305%
2802700010239	2617	2971	0.302%
2802700010243	1742	1977	0.301%
2802700010258	1641	1862	0.302%
2802700010281	956	1084	0.301%
2802700010296	622	705	0.297%
2802700010309	1430	1621	0.299%
2802700010313	2685	3046	0.301%
2802700010328	2947	3346	0.303%
[…]	**[…]**	**[…]**	**[…]**
Total	***407269***	***462958***	***0.31%***

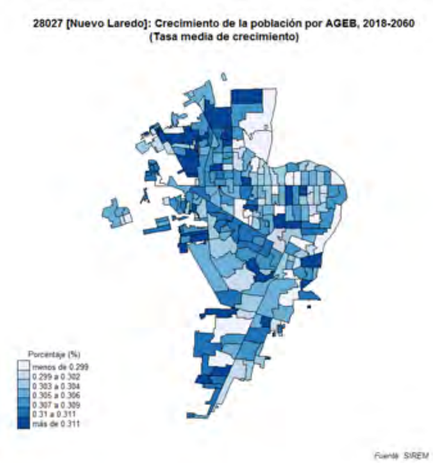
[los detalles se encuentran en el archivo 'Resumen_POB_28027_final.xls']

[las proyecciones anuales se encuentran en el archivo 'Final_Proy_POB_AGEB_28027.xls']

Resumen de las proyecciones de población para Nuevo Laredo (muestra)







[los detalles se encuentran en el archivo 'Mapas_POB_28027.zip']

Resumen de las proyecciones de personal ocupado para Nuevo Laredo (muestra)

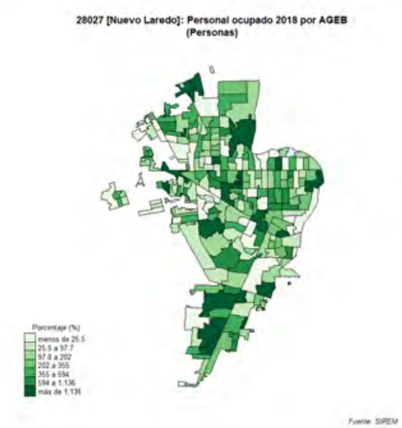
28027: Resumen de resultados sobre PO (Personal Ocupado)

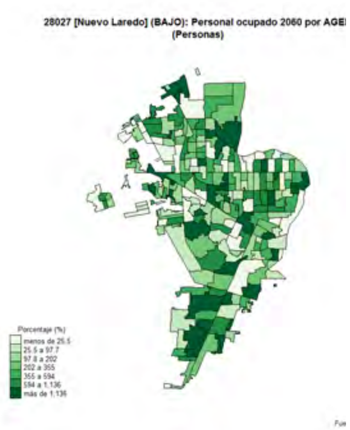
AGEB CVE_AGEB	EST PO2018 (Personas)	PES PO2060 (Personas)	BASE PO2060 (Personas)	OPT PO2060 (Personas)	EST 2003-2018 Tasa media (%)	PES 2019-2060 Tasa media (%)	BASE 2019-2060 Tasa media (%)	OPT 2019-2060 Tasa media (%)
2802700010120	523	762	883	1021	1.80	0.92	1.27	1.62
280270001014A	352	502	578	667	2.30	0.86	1.20	1.55
2802700010192	754	1144	1396	1701	2.18	1.05	1.53	2.01
2802700010239	405	576	681	806	2.19	0.86	1.27	1.68
2802700010243	213	266	323	391	2.14	0.56	1.03	1.49
2802700010258	620	487	612	766	1.26	-0.51	0.03	0.57
2802700010281	2418	3473	4057	4731	2.36	0.89	1.26	1.63
2802700010296	1996	3013	3624	4350	2.21	1.03	1.47	1.92
2802700010309	3061	4436	5239	6157	2.12	0.92	1.32	1.71
2802700010313	1251	1824	2148	2526	2.25	0.93	1.32	1.71
2802700010328	512	809	998	1236	2.00	1.15	1.66	2.18
2802700010366	422	643	778	942	2.14	1.05	1.51	1.97
2802700010385	1297	1916	2218	2581	2.19	0.94	1.30	1.66
280270001039A	1341	1937	2259	2631	2.31	0.90	1.27	1.64
2802700010402	1668	2595	3129	3771	2.13	1.10	1.55	2.01
2802700010436	819	1235	1493	1804	2.12	1.03	1.48	1.94
[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]
	102459	**150524**	**179281**	**213551**	***2.09***	***0.96***	***1.38***	***1.81***

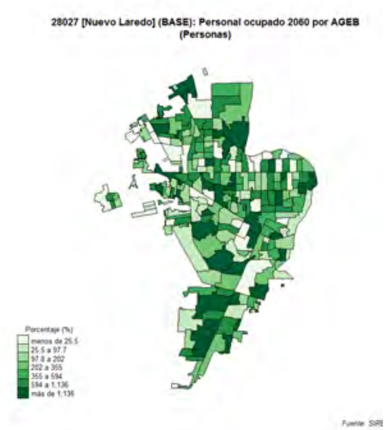
[los detalles se encuentran en el archivo 'Resumen_PO_28027_final.xls']

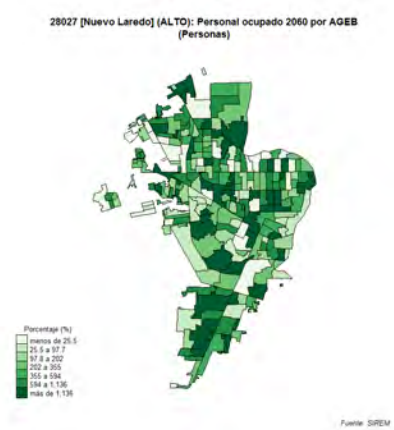
[las proyecciones anuales se encuentran en el archivo 'Final_Proy_PO_AGEB_3Escenarios_28027.xls']

Resumen de las proyecciones de personal ocupado para Nuevo Laredo (muestra)



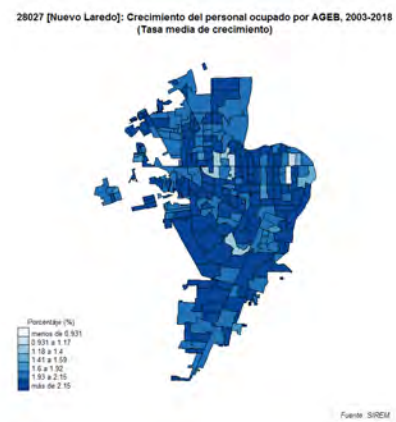


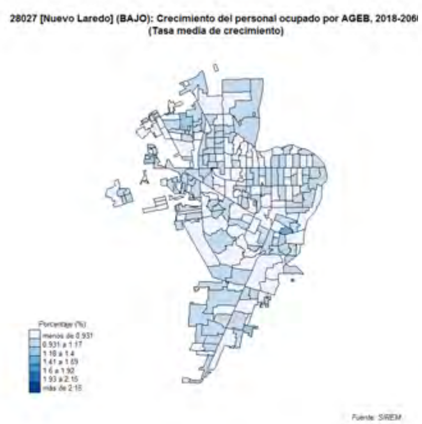


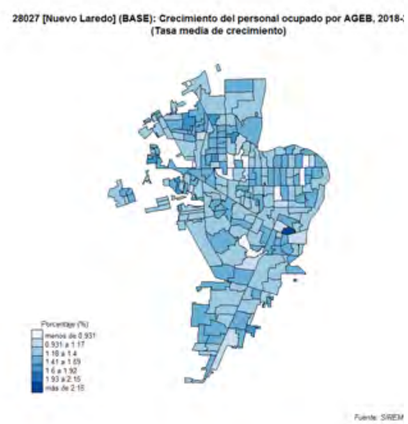


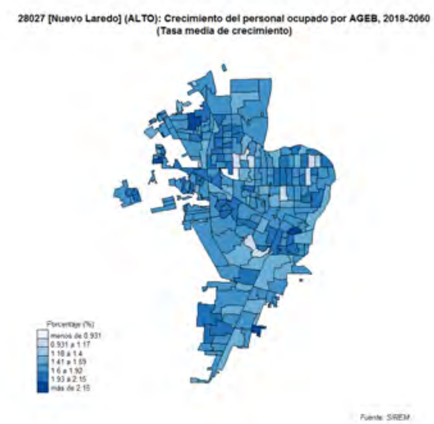
[los detalles se encuentran en el archivo 'Mapas_PO_28027.zip']

Resumen de las proyecciones de personal ocupado para Nuevo Laredo (muestra)









[los detalles se encuentran en el archivo 'Mapas_PO_28027.zip']

Resumen de las proyecciones de VAB para Nuevo Laredo (muestra)

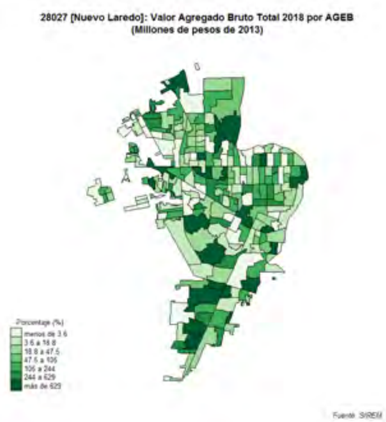
28027: Resumen de resultados sobre VAB

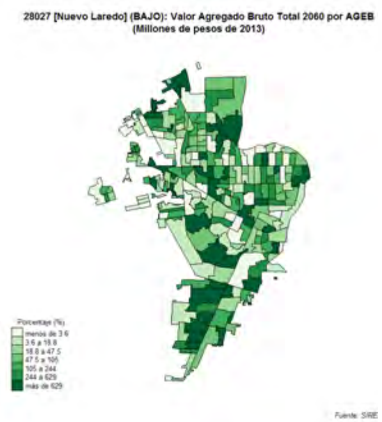
AGEB CVE_AGEB	EST VAB2018	BAJO VAB2060	BASE VAB2060	ALTO VAB2060	EST 2003-2018	BAJO 2019-2060	BASE 2019-2060	ALTO 2019-2060
	(Millones de pesos de 2013)	*(Millones de pesos de 2013)*	*(Millones de pesos de 2013)*	*(Millones de pesos de 2013)*	*Tasa media (%)*	*Tasa media (%)*	*Tasa media (%)*	*Tasa media (%)*
280270001012	258.6	353.5	403.8	458.2	2.04	0.76	1.08	1.39
280270001014	187.6	269.6	312.0	360.5	2.42	0.88	1.23	1.58
280270001019	278.0	406.6	481.4	568.1	2.15	0.94	1.35	1.75
280270001023	119.4	169.1	199.3	234.0	2.22	0.86	1.25	1.64
280270001024	39.9	53.9	64.2	76.2	2.06	0.75	1.17	1.58
280270001025	1413.0	1493.0	1835.9	2245.7	0.83	0.17	0.66	1.15
280270001028	1133.5	1645.6	1918.7	2233.2	2.35	0.91	1.28	1.65
280270001029	830.7	1212.2	1433.5	1690.3	2.18	0.93	1.34	1.73
280270001030	1811.5	2602.1	3040.7	3534.1	2.12	0.89	1.27	1.63
280270001031	528.3	772.3	906.0	1060.5	2.28	0.93	1.32	1.70
280270001032	139.6	206.1	244.8	289.8	2.08	0.97	1.38	1.79
280270001036	102.8	151.3	178.8	210.6	2.17	0.95	1.36	1.75
280270001038	1029.5	1472.0	1701.1	1962.6	2.39	0.87	1.22	1.56
280270001039	537.5	779.7	909.6	1059.2	2.34	0.91	1.28	1.65
280270001040	926.1	1359.8	1613.2	1908.3	2.14	0.95	1.36	1.77
[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]	[…]
	53961	**76490**	**89567**	**104549**	***2.14***	***0.86***	***1.24***	***1.62***

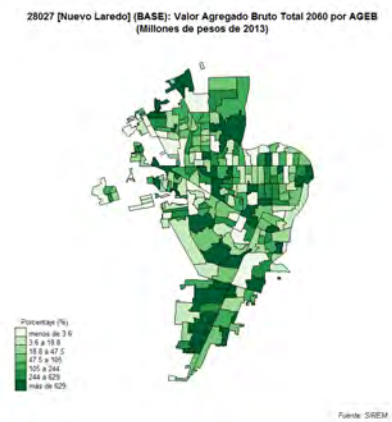
[los detalles se encuentran en el archivo 'Resumen_VAB_28027_final.xls']

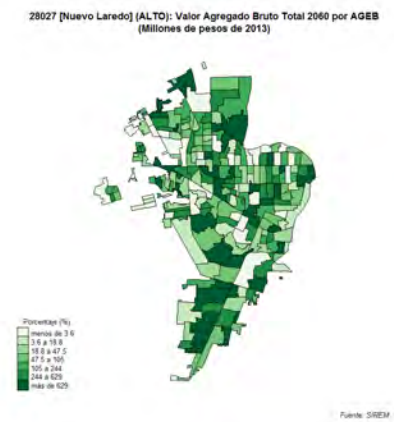
[las proyecciones anuales se encuentran en el archivo 'Final_Proy_VAB_AGEB_3Escenarios_28027.xls']

Resumen de las proyecciones de VAB para Nuevo Laredo (muestra)



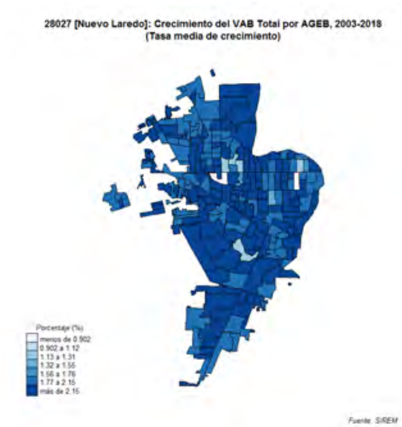


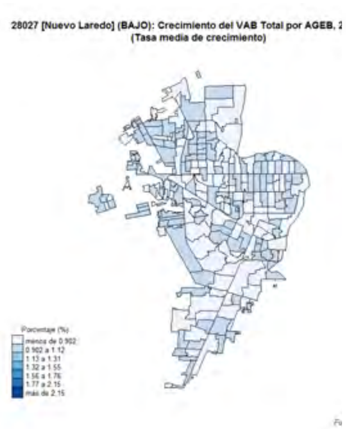


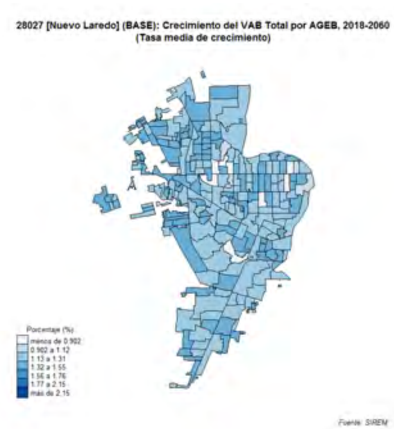


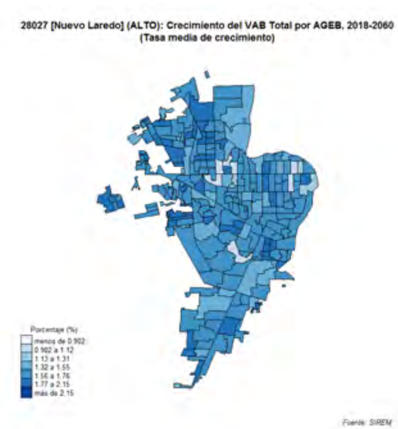
[los detalles se encuentran en el archivo 'Mapas_VAB_28027.zip']

Resumen de las proyecciones de VAB para Nuevo Laredo (muestra)









[los detalles se encuentran en el archivo 'Mapas_VAB_28027.zip']

SiREM
Consultoría Económica

Nota Técnica

Proyecciones a escala de AGEB para Nuevo Laredo, Tamaulipas[1]

Preparada por
Sistema de Información Regional de México, S.A. de C.V.
(SIREM)

para
C&M Associates, Inc.

en apoyo al proyecto
"Donna Bridge Investment Grade Traffic and Revenue Study"

23 de agosto de 2020

Antecedentes

C&M Associates, Inc. (C&M) solicitó la preparación de proyecciones anuales hasta el año 2060, con escenarios base, optimista y pesimista del Valor Agregado Bruto (VAB) total y el personal ocupado (PO) total; y también de proyecciones de población (POB) total con escenario único para las AGEB del municipio de Nuevo Laredo (28027), Tamaulipas.

Fuentes de información y metodología

El Sistema de Información Regional, S.A de C.V. (SIREM) tiene más de 35 años de experiencia en la preparación de análisis económicos y proyecciones de variables económicas y socio-demográficas en México, para un amplio rango de clientes de los sectores público y privado en México e internacionalmente.

Las proyecciones anuales a escala de AGEB fueron elaboradas por SIREM con base en su Sistema Integrado de Modelos para la economía mexicana a escala nacional, sectorial, regional (estatal) y municipal.

1 NOTA: SIREM elabora estas estimaciones y proyecciones con base en la información disponible a la fecha del informe. Cualquier estimación o proyección está sujeta a una series de supuestos, cifras estadísticas preliminares y actores condicionantes que pueden producer cambios según el desarrollo de los eventos y la publicación de nuevas estadísticas e información oficial. SIREM proporciona sus estimaciones y proyecciones sobre estas bases, esperando que puedan servir como punto de referencia general sobre el desempeño posible de aspectos de la economía nacional en los próximos años. Estas estimaciones y proyecciones no son predicciones exactas de la evolución futura de la economía mexicana ni de las variables aquí reportadas. SIREM no será responsable por los usos que sus clientes o terceras partes den a estas estimaciones y proyecciones, o de las decisiones que tomen a partir de ellas.

Cada trimestre, SIREM actualiza su familia de modelos anuales, tomando en cuenta la más reciente información disponible tanto para México como para Estados Unidos, compilada de fuentes oficiales de México[2] y agencias estadísticas estadounidenses e internacionales.[3] En particular, SIREM hace referencia a las proyecciones de corto, mediano y largo plazos para la economía estadounidense preparadas por la Oficina del Presupuesto del Congreso (Congressional Budget Office, CBO), como insumo en la elaboración de proyecciones futuras de la economía mexicana. Las proyecciones más recientes de CBO para la actividad económica en Estados Unidos reflejan un deterioro en la prospectiva a largo plazo. Esta nueva tendencia tiene un efecto moderador sobre el crecimiento futuro de la economía mexicana.

SIREM resuelve su familia de modelos "de arriba hacia abajo", empezando con proyecciones macroeconómicas y sectoriales a escala nacional, mismas que sirven como marco de referencia para la solución de nuestro Modelo Regional (32 estados), cuyos resultados son congruentes con los totales respectivos de carácter nacional.

El Modelo Regional de SIREM tiene un desglose de 19 sectores de actividad económica y 21 subsectores de manufacturas para cada estado, y sus resultados son consistentes con el Sistema de Cuentas Nacionales de México Base 2013 y el Sistema de Clasificación Industrial de América del Norte (SCIAN).

El Modelo Municipal de SIREM cubre todos los municipios del país, y se estima con base a los resultados del Modelo Regional. A escala municipal SIREM proyecta la actividad económica con un desglose en 5 meta-sectores: el sector agropecuario; las industrias básicas (minería, construcción y electricidad y agua), el sector manufacturero; las actividades de comercio y transporte; y servicios. Las estimaciones y proyecciones municipales son completamente consistentes con los resultados del Modelo Regional para el estado correspondiente.

1. SIREM preparó las proyecciones con base en información estadística disponible durante el mes de julio de 2020. Las proyecciones de población fueron revisadas durante el mes de agosto de 2020.

- *Proyecciones de Valor Agregado Bruto (VAB) total*

SIREM estima el VAB a escala de AGEB con base en múltiples fuentes de información, incluyendo (a) estadísticas sectoriales para 2013 del Censo Económico 2014 (CE2014) publicado por INEGI, (b) registros administrativos (DENUE[4]) publicados por INEGI a escala de AGEB y (c) los resultados del Modelo Municipal de SIREM. Cabe señalar que las fuentes de CE2014 y DENUE son deficientes en la captación de la actividad agropecuaria, y por ende este sector se excluye de los análisis y proyecciones a escala AGEB.

<u>Censo Económico 2014</u>. SIREM utiliza cifras estadísticas del CE2014 para el estado de Tamaulipas

2 Entre las fuentes oficiales resaltan el Instituto Nacional de Geografía y Estadística (INEGI), el Banco de México (Banxico) y el Consejo Nacional de Población (CONAPO).

3 El Buró de Análisis Económico (Bureau of Economic Analysis, BEA), la Reserva Federal (Federal Reserve Board, FRB), la Oficina del Presupuesto del Congreso (Congressional Budget Office, CBO), el Fondo Monetario Internacional (FMI), el Banco Mundial (BM) y la Organización de Cooperación y Desarrollo Económico (OCDE), entre otros.

4 Directorio Estadístico Nacional de Unidades Económicas.

para estimar coeficientes de VAB por persona ocupada en el año 2013 por sector de actividad y subsector de manufacturas, con desglose por estrato de empleo.[5] De esta forma se toman en consideración las diferencias en el VAB por persona en los distintos sectores y estratos de tamaño de empresa.

DENUE. Tomando en cuenta el estrato de empleo de las empresas y establecimientos individuales incluidos en el DENUE para 2018[6] a escala AGEB del municipio bajo análisis, SIREM estima el empleo total por sector y estrato y luego aplica los coeficientes derivados del CE2014 para estimar el VAB correspondiente. Este procedimiento permite la consideración de la distribución de la actividad por tamaño de empresa, para tener estimaciones del VAB en pesos de 2013 que son representativas a escala AGEB. Finalmente SIREM agrega el VAB resultante por AGEB con desglose en 4 de los 5 meta-sectores que utiliza el Modelo Municipal de SIREM.

Modelo Municipal de SIREM. SIREM utiliza el método RAS[7] para "cuadrar" los resultados del análisis de DENUE a escala de AGEB a los resultados del Modelo Municipal para 2018, y también emplea la misma técnica para extender la matriz de valores para 2018 a años sucesivos durante el horizonte de proyección, dentro del marco de consistencia de las proyecciones municipales de SIREM.[8]

Es pertinente observar que se excluye al sector agropecuario tanto de las proyecciones como de las retropolaciones a escala de AGEB. Por lo tanto, el VAB total a escala de AGEB equivale al subtotal del VAB de los siguientes meta-sectores a escala municipal: industria básica; sector manufacturero; actividades de comercio y transporte; y servicios.

Finalmente, se extraen las estimaciones y proyecciones de las AGEB de la zona del estudio del conjunto total de las AGEB estimadas y proyectadas para cada municipio.

Proyecciones de personal ocupado total

Los mismos coeficientes detallados de VAB por persona ocupado por sector y estrato que fueron calculados del CE2014 permiten la derivación de estimaciones de coeficientes totales de VAB por persona ocupada para los 4 meta-sectores en cada AGEB para el año 2018. SIREM aplica estos coeficientes totales por meta-sector en cada AGEB al VAB por meta-sector correspondiente de 2018 y años anteriores. Las proyecciones del personal ocupado a partir de 2019 se calculan de forma semejante, pero incorporan una corrección por la tendencia en la productividad laboral derivada de las estadísticas de la Cuenta de Bienes y Servicios del Sistema de Cuentas Nacionales de México Base 2013.[9]

Finalmente se extraen los resultados de personal ocupado para las AGEB de la zona del estudio del

5 En ciertos casos, cuando las estadísticas estatales muestren deficiencias, se sustituyen coeficientes derivados de los resultados del CE2014 a escala nacional.

6 Las estadísticas de DENUE anteriores a 2018 son de menor confiabilidad, según la experiencia de SIREM.Este año también servirá como el nuevo año base para el Sistema de Cuentas Nacionales de México Base 2018

7 Esta técnica, también conocida como "ajuste proporcional iterativo" (*Iterative Proporcional Fitting*), se emplea con frecuencia en la construcción de matrices de insumo-producto y en el ajuste final de los sistemas de cuentas nacionales.

8 Vale la pena mencionar que la técnica RAS se aplica a la matriz formada por el VAB desglosado por meta-sector en el conjunto de AGEB de cada municipio. Se aplica la misma técnica para retropolar los resultados de 2018 al año 2003.

9 Estas tendencias se estimaron de las cifras nacionales sectoriales del periodo 2003 a 2018, agregadas a los 4 meta-sectores pertinentes.

conjunto total de las AGEB estimadas y proyectadas para cada municipio.

Proyecciones de población total urbana a escala de AGEB

SIREM utiliza estimaciones y proyecciones de la población total estatal y municipal a mitad del año producidas por CONAPO para el periodo 2005 a 2030.[10] A partir de 2031 SIREM elabora sus propias proyecciones estatales y municipales, dentro del marco de proyecciones a escala nacional que publica CONAPO. Estas estimaciones y proyecciones a escala municipal sirven como marco de referencia para las estimaciones y proyecciones de SIREM a escala de AGEB en cada año.

El Censo de Población y Vivienda 2010 del INEGI es la única fuente existente de estadísticas de población total y otras variables socio-demográficos a escala de AGEB. Como no existen series de tiempo, SIREM tuvo que recurrir a otras formas de estimar el crecimiento de la población de las AGEB, tomando en cuenta características demográficas disponibles para el año 2010.

A tal propósito, para el conjunto de AGEB de cada municipio, SIREM calcula un factor de dispersión por cada AGEB, derivado de la proporción de la población de 0 a 14 años de edad en la población total. Bajo el supuesto de un vínculo entre esta proporción y la tasa de crecimiento de la población total, SIREM calibró el factor de dispersión para variar entre 1.05 y 0.95.

SIREM aplicó posteriormente este factor de dispersión a la tasa de crecimiento de la población total municipal en cada año, calculada con base en las proyecciones correspondientes de CONAPO, consiguiendo así tasas diferenciales de crecimiento para la población total de cada AGEB del municipio en cada año.

No obstante, la mancha urbana de Nuevo Laredo ha crecido notablemente en los años posteriores a 2010, como se puede percibir en las imágenes satelitales históricas sucesivas.[11] A petición de CyM, SIREM examinó las imágenes satelitales más recientes para nuevas AGEB formadas después de 2010 (y algunos existentes que mostraron cambios importantes desde 2010. SIREM estimó las población total en estas nuevas zonas urbanas mediante la enumeración de casas visibles en imágenes satelitales recientes y la aplicación de estimaciones del número de habitantes por casa derivadas de la Encuesta Intercensal 2015.

SIREM luego ajustó sus proyecciones preliminares para la población en cada AGEB del municipio para los años 2018 a 2060 con base en estas nuevas estimaciones.[12] Es conveniente reiterar que SIREM ajusta sus estimaciones y proyecciones de la población urbana a escala de AGEB a las proyecciones de población total a escala municipal convalidadas por CONAPO. Los resultados presentados incluyen solamente las AGEB urbanas de la zona del estudio que contiene asentimientos humanos.

10 SIREM emplea las nuevas estimaciones y proyecciones publicadas por CONAPO a escala estatal y municipal con base en la Encuesta Intercensal 2015.

11 Estas imágenes pueden consultarse en plataformas de visualización terrestre tales como *Google Earth Pro*.

12 En el caso de proyectar la población total de las nuevas AGEB definidas después de 2010, se aplicó la tasa interanual de crecimiento del municipio de Nuevo Laredo, por falta de información demográfica adecuada.

INFRASTRUCTURE

APPENDIX F: COMMERCIAL VEHICLE BORDER CROSSING FORECAST

CITY OF LAREDO

LAREDO INTERNATIONAL BRIDGE SYSTEM MASTER PLAN

Commercial Vehicle Border Crossings Forecast

Mercator International, LLC

September 21, 2020

Laredo Border Master Plan:
forecast of trucks border crossings

C&M Associates Inc.
City of Laredo

Sep 21, 2020

Draft report

Contents

Figures

Tables

1. Project background

C&M Associates Inc engaged Mercator International LLC (Mercator) to provide technical support in the development of econometric forecast of truck crossings over the US-Mexico border in the Laredo–Nuevo Laredo region that could potentially compete with a planned commercial border crossing in the City of Laredo. This report presents the outputs of this engagement.

The US is the top-ranked destination for Mexican exports, while Mexico is the second-ranked destination for US exports. Truck crossing volumes through Texas land ports of entry (LPOE) are a function of the US-Mexico and Texas-Mexico bilateral trade and the underlying economic activity on both sides of the Rio Grande River.

Between 1994 to 2019, the amount of trade between the US and Mexico more than tripled. In 2019, the US and Mexico traded approximately $615 billion dollars bilaterally. From this trade, 68% passes through the Texas-Mexico border. In the same year, Texas LPOEs processed $452 billion of US-Mexico trade—a 5.4% compounded annual growth rate (CAGR) from the $281 billion processed in 2010[1]. Approximately 75% of the value processed by Texas POEs entered the Texas-Mexico border by truck, while 18% entered by rail. (The remaining balance is split between pipelines, ships, and air.)

The Laredo Customs District is by far the most active along the overall US-Mexico border for truck traffic, and it handles 70% of the total Texas-Mexico bilateral trade. This Customs District is comprised by the following eight LPOEs (in order of relevance): 1. Laredo (port), 2. Hidalgo, 3. Eagle Pass, 4. Brownsville, 5. Del Rio, 6. Progreso, 7. Roma, and 8. Rio Grande City. In terms of the bilateral trade with Mexico, the Laredo LPOE has shown a sustained positive trend over the last decade. At present, there are two commercial vehicle border crossings for trucks: (i) Laredo-Colombia Solidarity Bridge and (ii) World Trade Bridge.[2] In 2019, the Laredo LPOE handled 5,355,958 trucks, a 4.7% CAGR from the 3,557,753 trucks handled in 2010.

The passing of the North American Free Trade Agreement (NAFTA) resulted in a proliferation of cross-border supply chains. NAFTA was replaced by the United States-Mexico-Canada Agreement (USMCA) in 2020, and additional protections under the USMCA are expected to result in further growth in cross-border supply chains, and in the industries in the growing logistics clusters that have emerged with hubs in Monterrey, San Luis Potosi, Mexico City, and Torreon. As demonstrated in this report, the cross-border metropolitan area of Laredo-Nuevo Laredo is the node through which these cross-border supply chains will route commercial vehicles. Therefore, demand for commercial border crossings in the Laredo Customs District and, more specifically, the truck traffic via both the Laredo-Colombia Solidarity Bridge and the World Trade Bridge is expected to continue to rise at relatively strong rates.

1.1 Objective

The objective of Mercator's analysis is to provide scenario-based forecasts of commercial truck crossings over the Laredo port district.

[1] Texas is composed of five Customs Districts: 1. Dallas-Fort Worth, 2. El Paso, 3. Houston-Galveston, 4. Laredo, and 5. Port Arthur.

[2] The Laredo region also has a commercial LPOE for rail, the Texas Mexican Railway International Bridge, which is owned and operated by the Texas Mexican Railway (KCS) and Kansas City Southern de México (KCSM).

1.2 Structure of the report

The balance of this report is comprised of three main sections. The next section provides an overview of major US-Mexico transportation corridors relative to industrial manufacturing and logistics clusters in Mexico and manufacturing centers and major population centers in the US. In this section, each of the main commercial ports of entry are reviewed.

In the following section, historical volumes by major commodity are reviewed by major commercial port of entry. The final section provides an overview of US-Mexico trade in the context of major trade deals and other disruptions.

Through an analysis of historical data, we were able to show that all the major variables that influence US-Mexico trade and the commercial Laredo LPOEs progressed through three major stages – each associated with major trade deals – but all have settled into stable trends as the US recovered from the 2008-2009 recession.

After discussion of modeling techniques and describing three scenarios, this final section wraps up with a presentation of commercial truck crossings for each scenario.

2. Laredo–Nuevo Laredo commercial land ports of entry (LPOE)

In this section, the study area is defined, and historical traffic volumes for each commercial LPOE are reviewed.

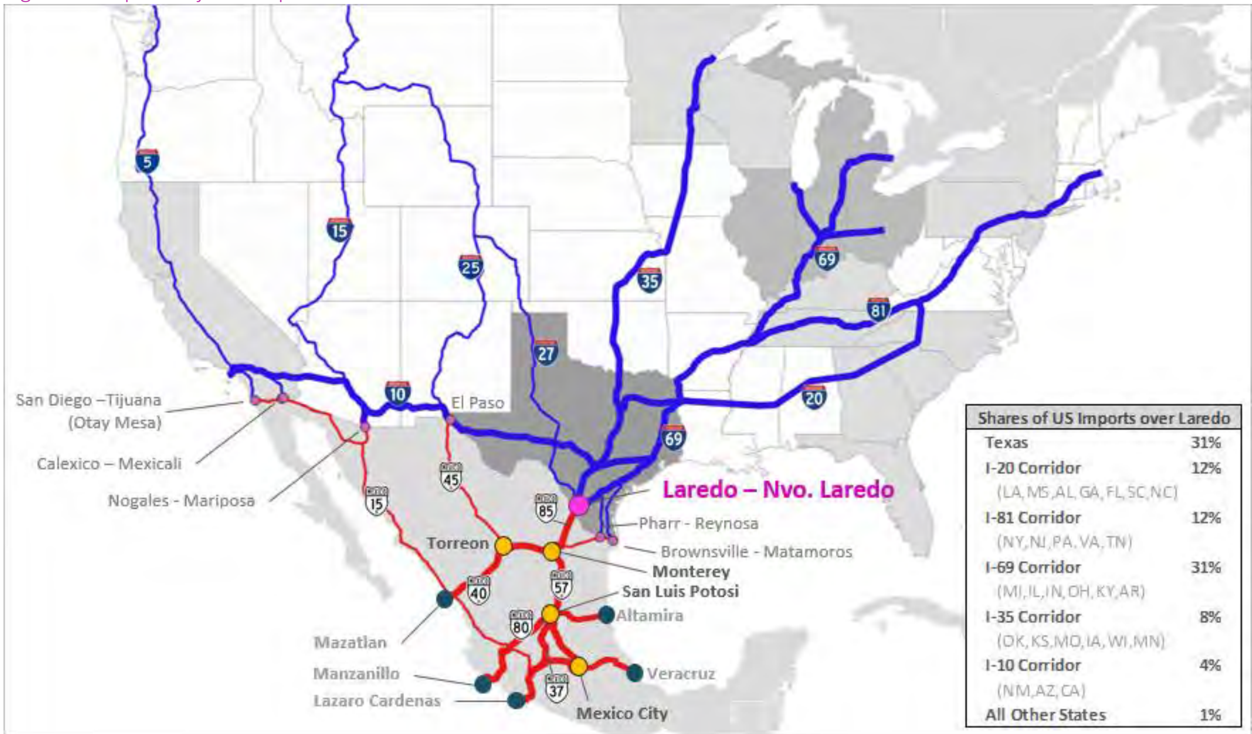
2.1 Overview of major transportation corridors and flows

The map below provides a visual summary of the major highway transportation corridors and LPOEs. The highways that are depicted by the heavier lines are the main corridors that serve bi-lateral trade between the US and Mexico through the Laredo LPOE. The shading of the US states reflects each state's share of US imports from Mexico that are funneled through the Laredo-Nuevo Laredo region and over the Laredo Colombia Solidarity Bridge and the World Trade International Bridge. Just over 30% of the northbound volumes are destined for Texas, and a similar volume is destined for states along the I-69 corridor, with significant volumes destined for Illinois, Michigan, and Ohio. Another 12% is destined for states along the I-81 corridor serving the Northeast states, and an equal share is destined for the Southeastern states along the I-20 corridor. Around 8% is destined for states along the I-35 corridor, and only 4% is destined for states along the I-10 corridor, with almost all of this volume being destined for California. Very little (around 1%) of the volume is destined for other states west of the Mississippi, but the I-27 corridor carries volumes destined for Western Canada, and to a much lesser degree, this is true for the other three north-south corridors.

Similar distribution data is not available for Mexico by state, but four major industrial manufacturing clusters that account for the great majority of Laredo LPOE commercial truck crossings are represented by the orange dots in the map below. From north to south on the Mexico 85/57 corridor the industrial clusters are centered around: Monterrey (which is a cluster that also includes Nuevo Laredo), San Luis Potosi, and Mexico City. There is another, smaller industrial manufacturing cluster centered around Torreon on the Mexico 40 corridor. The other three cities represented with navy blue dots and labeled on the map below are all major container ports, and as can be seen in the map, each of these major industrial manufacturing clusters lies between the Laredo LPOE and a major container seaport. Thus, manufacturing facilities in these clusters can efficiently source inputs from the US (with an emphasis on the manufacturing areas of the US that are located in the Midwest and Southeast states) as well as from Asia (through the Pacific Coast ports of Manzanillo, Lazaro Cardenas, and to a lesser extent, Mazatlán, which handles some automotive trade).

The map in Figure 1 clearly demonstrates that the Laredo-Nuevo Laredo region is the central node in the cross-border highway network, as all but a few of the main corridors converge on this region.

Figure 1. Map of major transportation corridors



In the map below, the cartographer used population by census tract to reimagine the US as having only four states of equal population. Hence, each of the contiguous areas below account for 25% of the total population, or approximately 83 million people. Comparing the map below to the map above, we see that Laredo is the most efficient port of entry for the four main corridors that serve approximately 75% of the US population. This interesting reimagining of the US as four states of equal size further emphasizes the central role that the Laredo-Nuevo Laredo region plays as the chief node in cross-border trade. A more detailed description of each of the major corridors is included in Appendix A.

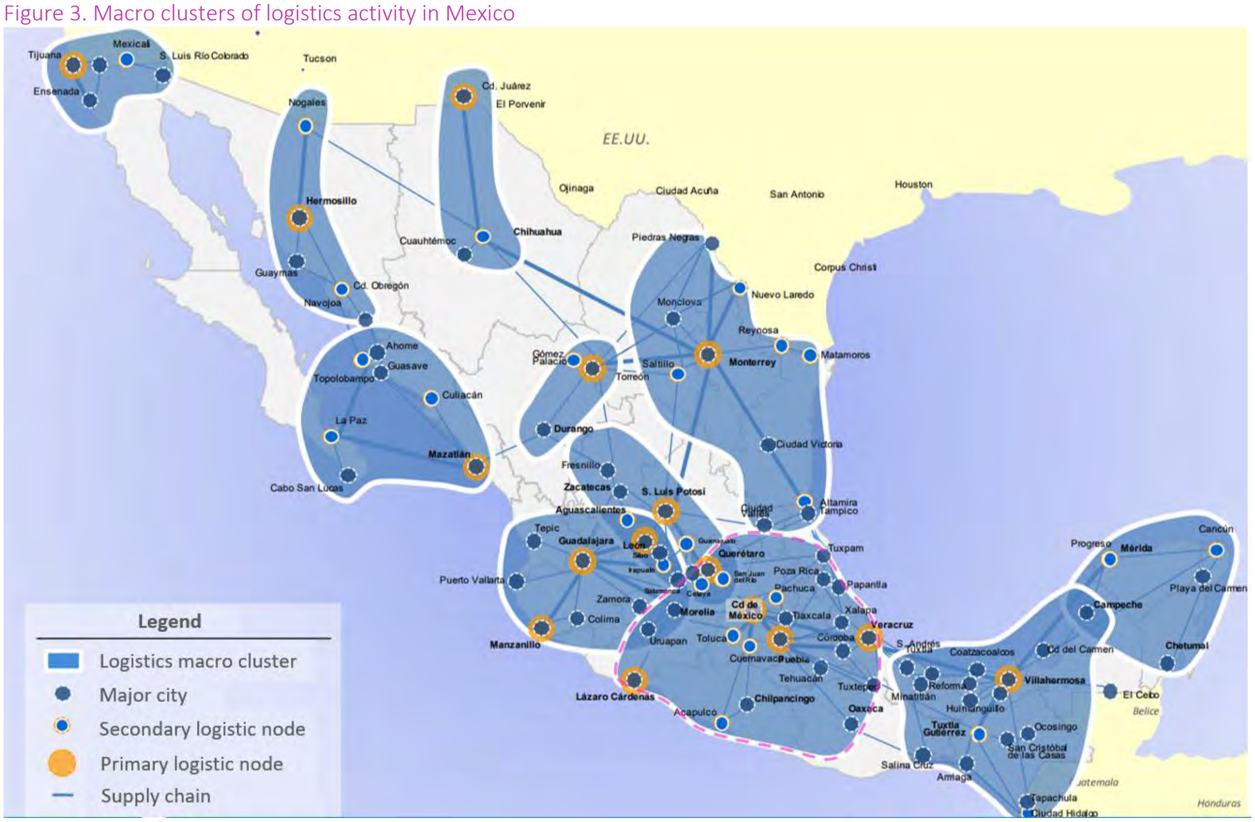
Figure 2. Map of US population

Created by Ben Blatt. Data Source: 2010 US Census

Location of industrial parks in Mexico

Mexico's logistics sector is one of the most modern among Latin American countries. The maquiladora and automotive industries were among the first to establish just-in-time supply chains, as a platform to launch different products to the US and the rest of the world, and later to satisfy domestic distribution needs. In Mexico, trucking is the most widely used mode of distribution, given the flexibility it gives to shippers in terms of delivery speed and enabling door-to-door delivery. The 370,000 km of Mexican toll-roads allow connectivity between almost all locations in the country, taking advantage of intermodal logistics channels, which have been a priority for Mexico over the last 20 years. The Mexican national logistics system can be organized in 11 macro clusters of activity, as illustrated in Figure 3. These clusters are defined based on the range and degree of connectivity of their respective logistic activities.

Figure 3. Macro clusters of logistics activity in Mexico

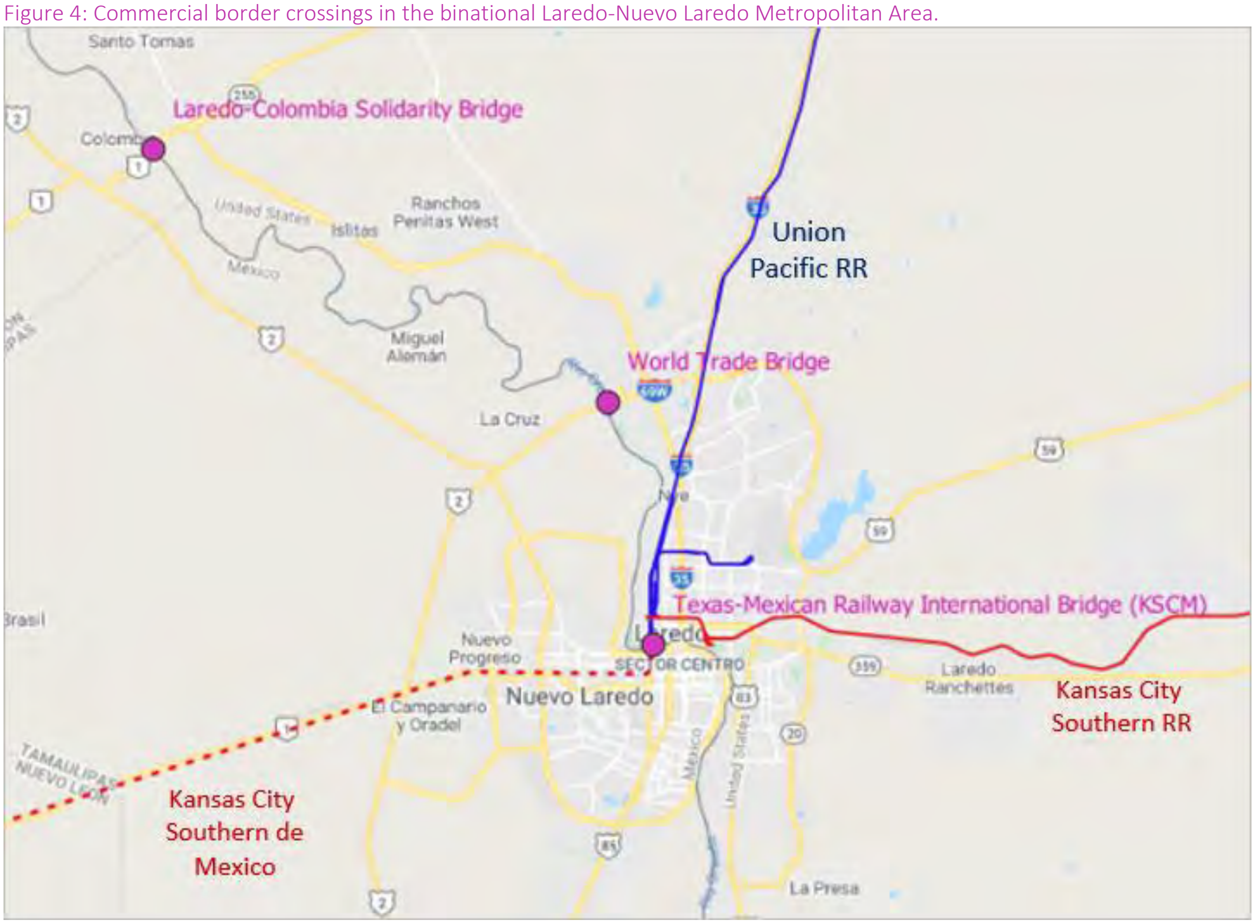


Source: Sistema Nacional de Plataformas Logísticas de México. Inter-American Development Bank.

2.2 Commercial LPOEs in the Laredo-Nuevo Laredo region

There are two fully operational *commercial truck LPOEs* in the Laredo-Nuevo Laredo region: (i) the Laredo-Colombia Solidarity Bridge and (ii) the World Trade Bridge. Additionally, two other LPOEs currently serve primarily passenger vehicles and one more is rail-served. These crossings are shown in the map below.

Figure 4: Commercial border crossings in the binational Laredo-Nuevo Laredo Metropolitan Area.



Source: City of Laredo, International Bridge System.

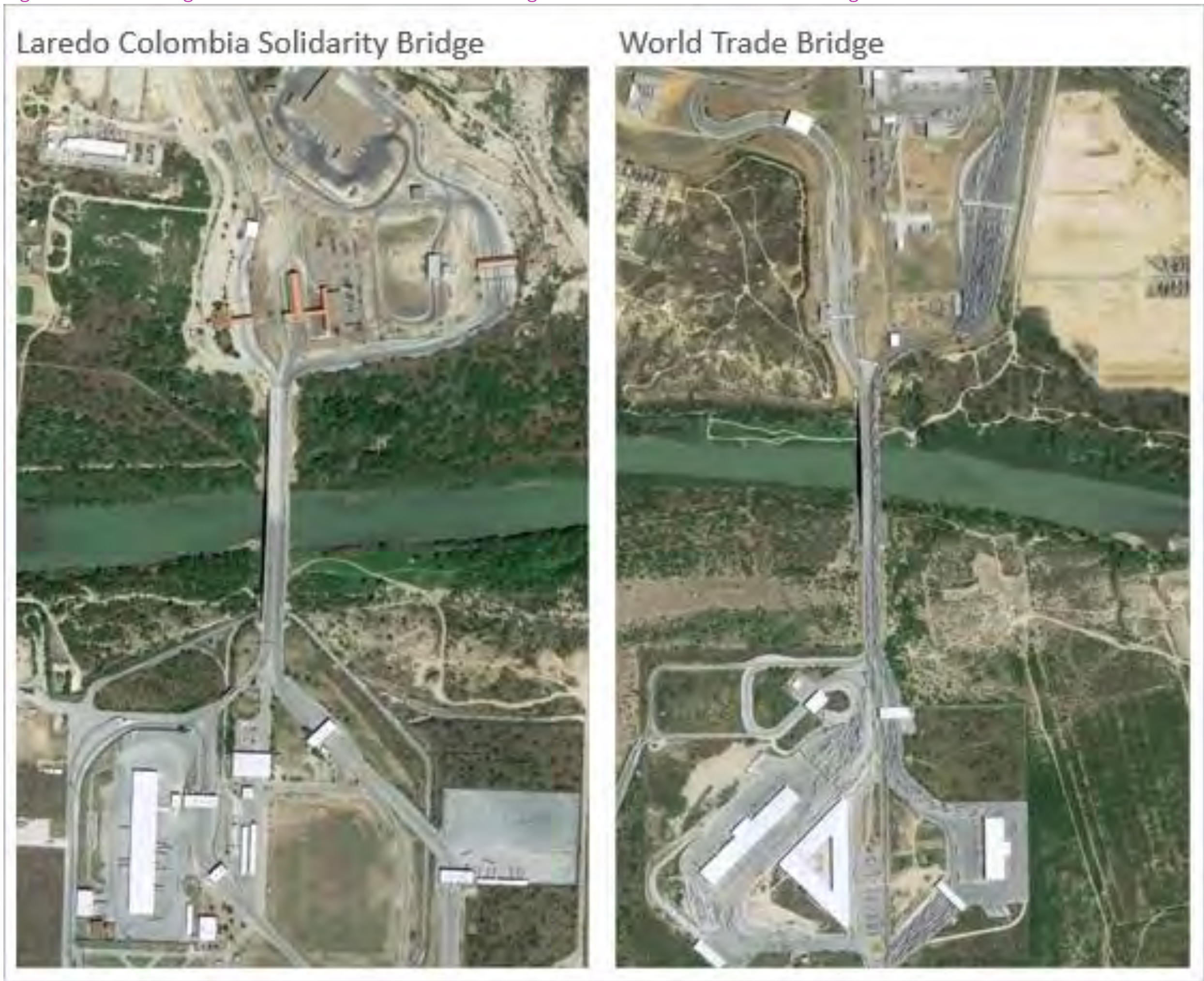
From North to South, the Laredo Colombia Solidarity Bridge (Bridge 3) consists of eight commercial lanes and is open to all traffic (commercial and non-commercial).[3] The World Trade International Bridge (Bridge 4) consists of eight commercial lanes reserved solely for commercial truck traffic. The Texas-Mexican Railway International Bridge (KCS Rail) is a railroad bridge connecting the Kansas City Southern de Mexico Railway to the western termini of the Texas-Mexican Railway (a subsidiary of the Kansas City Southern Railway). Additional infrastructure characteristics for these LPOEs are described in Table 1, and aerial images of these two bridges are provided in Figure 5.

[3] The City of Laredo utilizes a bridge numbering system assigning a Bridge No. ID to the bridge name.

Table 1. Commercial border crossings in the binational Laredo-Nuevo Laredo Metropolitan Area—physical characteristics.

Commercial LPOE	Bridge No. ID	Truck traffic	No of commercial bridge lanes		No of commercial processing booths		No of FAST lanes
			NB	SB	NB	SB	
Laredo Colombia Solidarity Bridge	3	Yes	4	4	8	6	2
World Trade International Bridge	4	Yes	4	4	15	14	4
Texas-Mexican Railway International Bridge	KCS	No	N/A	N/A	N/A	N/A	N/A

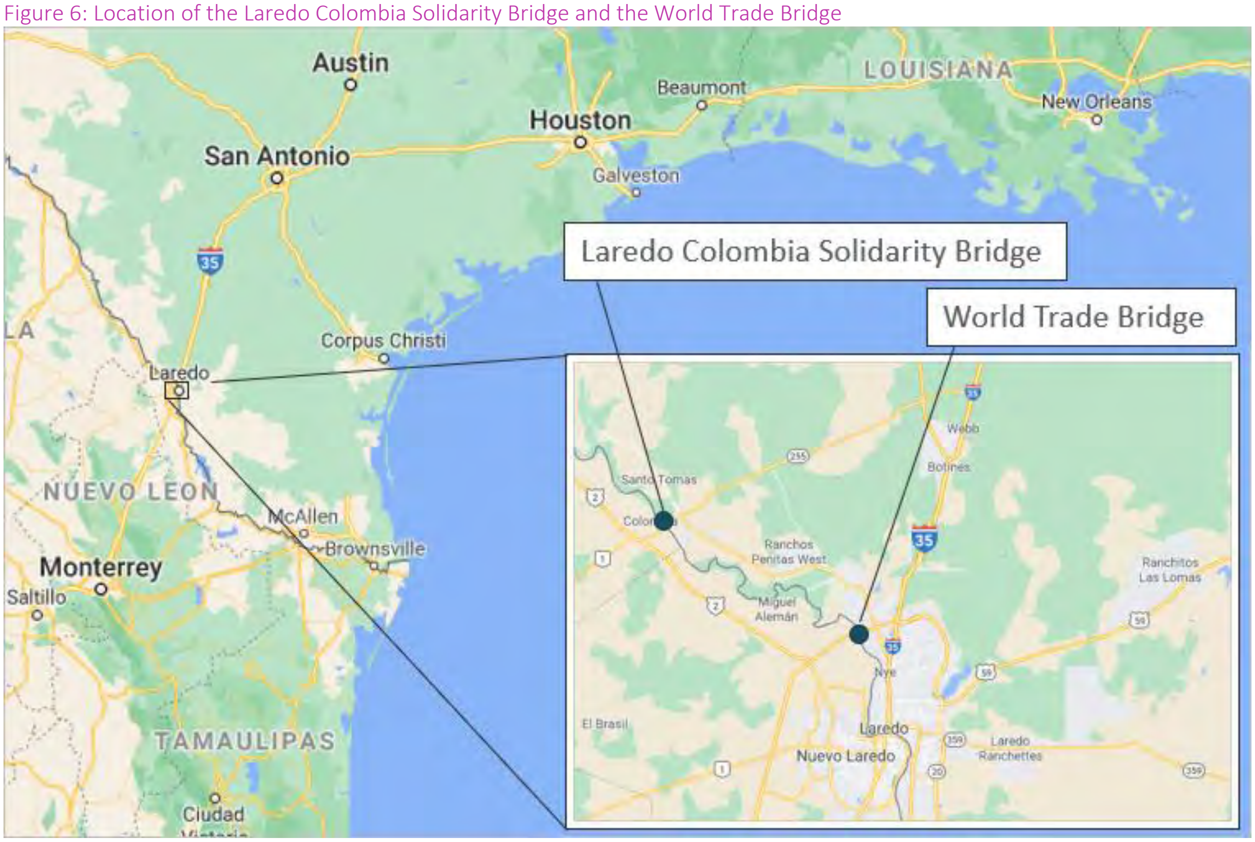
Figure 5. Aerial images of the two commercial truck bridges in the Laredo-Nuevo Laredo region



2.2.1 Laredo Colombia Solidarity Bridge

Opened in July 1991, the Laredo Colombia LPOE is operated by the City of Laredo on the US side and by Corporación para el Desarrollo de la Zona Fronteriza de Nuevo León (CODEFRONT) on the Mexican side. It is located 20 miles northwest from downtown Laredo on FM 255 near its intersection with FM 1472. This LPOE connects Laredo over the Rio Grande (Rio Bravo) with Colombia in Anáhuac, Nuevo León. On the US side, FM 255T connects to the Camino Colombia toll road and Mines Road. On the Mexican side, Highway 2 connects to Highway 85D at Nuevo Laredo, Tamaulipas which is the main corridor connecting with industry clusters in Nuevo León and the rest of the country. This is the only border crossing between Texas and the Mexican state of Nuevo León.

Figure 6: Location of the Laredo Colombia Solidarity Bridge and the World Trade Bridge



This facility is composed of an eight-lane undivided bridge (four southbound and four northbound) that spans 1,216 ft (0.23 miles) on elevated lanes. Southbound, the four lanes feed into six processing booths for commercial traffic on the Mexican side of the border. Northbound, the four lanes feed into eight processing booths for commercial traffic on the US side. The Free and Secure Trade (FAST) lane program began operating in December 2007, providing two lanes for this service to expedite trade. Along US 83, between toll road FM 255T and Carrizo Springs, intermittent passing lanes have been added every five to eight miles to alleviate congestion from trucks leaving the facilities and entering into the US. Operation hours for commercial traffic are Monday to Friday 8:00am - 10:30pm and Saturday 9:00am - 4:00pm (no commercial traffic on Sundays). This LPOE also provides a commercial parking lot operating seven days a week.

2.2.2 World Trade International Bridge

Opened on April 2000, the World Trade International Bridge relieved congestion on the downtown Laredo bridges and I-35. This LPOE is operated by the City of Laredo on the US side and by Caminos y Puentes

Federales de Ingresos y Servicios Conexos (CAPUFE) on the Mexican side. This LPOE is one of the major trade gateways and one of the busiest LPOEs for commercial traffic serving the movement of international trade between Mexico and the US

On the Mexican side, Highway 2 connects to Highway 85D at Nuevo Laredo, Tamaulipas which is the main corridor connecting with industry clusters such as Monterrey (Nuevo Leon and Saltillo), Sal Luis Potosi, and Mexico City (CDMX). On the US side, Loop 20, near FM 1472 and I-35, connects to the World Trade International Bridge.

The Free and Secure Trade (FAST) lane program began operating in April 2004, providing four lanes for this service to expedite trade. The bridge design incorporates Automated Vehicle Identification (AVI) and Weigh in Motion technology, which allows trucks to pass without stopping.

In terms of its infrastructure, the World Trade International Bridge is 1,800 feet long composed of an eight-lane undivided bridge (four southbound and four northbound) on elevated lanes corresponding to the bridge section. Southbound, the four lanes feed into 19 processing booths for loaded commercial traffic and six for empties, on the Mexican side of the border. Northbound, the four lanes feed into 11 processing booths for commercial traffic and four additional FAST lanes also for commercial traffic (for a total of 15 processing booths) on the US side. Operation hours for commercial traffic are Monday to Friday 8:00am - 12:00am, Saturdays 8:00am - 4:00pm, and Sundays 10:00am – 2:00pm. This LPOE is not intended for pedestrian traffic. “Pedestrians” crossing northbound from Mexico to the US are actually the accompanying passengers other than the driver from freight trucks.

In 2019, the Texas Department of Transportation (TxDOT) authorized the execution of a funding agreement for the relocation and construction of four additional inspection booths and other new facilities at the World Trade International Bridge. The project included construction of a non-intrusive inspection area, two exit control booths and access to the current secondary inspection facilities and hazardous material offsite containment facility.[4]

2.2.3 Proposed Laredo International Bridge 5

During the last decades, several plans have existed in the binational Laredo-Nuevo Laredo Metropolitan Area to augment their LPOE infrastructure. There are three new LPOEs in the pipeline: (i) Laredo International Bridge 5 (South Laredo International Bridge project), (ii) Union Pacific International Railway Bridge project, and (iii) Laredo-Colombia International Railway project.[5] From these, only the South Laredo International Bridge project will accommodate commercial truck traffic – the other two are exclusively for railroad traffic, and are needed for railroads to meet organic growth.

Laredo International Bridge 5, also known as the South Laredo International Bridge, is a proposed bridge to be built on the US-Mexico border between the southern portion of Webb County, Texas, and Nuevo Laredo, Tamaulipas. Although the location of the bridge is unknown as of today, three potential locations being considered for the bridge, all several miles south of the existing bridges in Laredo, are: (i) Mangana-Hein Road in southern Laredo, (ii) one mile south of Mangana-Hein Road in southern Laredo, and (iii) a site between Rio Bravo and El Cenizo, south of the Laredo city limits. In preparation for the bridge and to accommodate urban growth in south Laredo, extensive construction has been undertaken on

[4]https://www.virtualbx.com/construction-preview/laredo-and-txdot-enter-agreement-for-11-7m-addition-to-world-trade-international-bridge/

[5] City of Laredo. August 12, 2001. https://en.wikipedia.org/wiki/International_bridges_in_Laredo,_Texas [access Aug 12, 2020).

US Highway 83, including a creation of a median, widening, and an interchange with flyovers with State Highway 359 on US-83.[6]

2.2.4 Binational Rail System at Laredo

Three US Class I freight rail operators interchange with Mexico at the border. These include UP, KCS, and BNSF. Two Mexican Class I freight rail operators interchange with US freight operators. These include Ferrocarril Mexicano (Ferromex) and KCS de México (KCSM), a subsidiary of KCS. UP is a shareholder of Ferromex.

At Laredo, KCSM interchanges with BNSF and UP. The Texas Mexican Railway (Tex-Mex) was sold to the KCS in 2005. Kansas Southern de Mexico (KCSM) has interchange service at Laredo and Brownsville, Texas, and it serves the Ports of Veracruz, Tampico, Lazaro Cardenas, Bulkmatic Transload Service at Monterrey, Mexico and will service a Plastic, Steel, and Industrial product tansloading center in Toluca.

The Texas Mexican Railway International Bridge is the only rail bridge in the Laredo–Nuevo Laredo region connecting the two cities across the Rio Grande River, and it is one of five rail-only bridges on the Texas-Mexico border. The Texas-Mexican Railway International Bridge operates 24 hours each day. For purposes of operational efficiency, trains are typically run in one direction for six-hour shifts (i.e. six hours for strictly northbound trains and then six hours for southbound). Prior to arrival at the border, the train operator provides information electronically to the railroad counterpart receiving it across the border. Aduanas Mexico scans trains traveling both north and south on each side of the border and processes fines for incorrect documentation, which lead to delays. CBP only scans, via R-VACIS, northbound trains traveling at a speed of 5 mph. After crossing the Rio Grande, the Tex-Mex line connects with Corpus Christi.

There are three major rail yards in Laredo and Nuevo Laredo:

- KCS's Laredo Yard—has a 750-car capacity yard and is located approximately 7.5 miles east of the Texas Mexican Railway International Bridge.
- UP's Port Laredo Yard—has a capacity of 750 cars and is located approximately 8.2 miles north of the bridge.
- The Sanchez Yard—is located 11 miles south of the bridge and to the west of Nuevo Laredo. The Sanchez Yard is a 1,500-acre facility that mirrors the functions at the Port Laredo and Laredo Yards. The yard has 22 tracks, including two for car repairs and an intermodal terminal capable of handling 1,500 trucks per day.

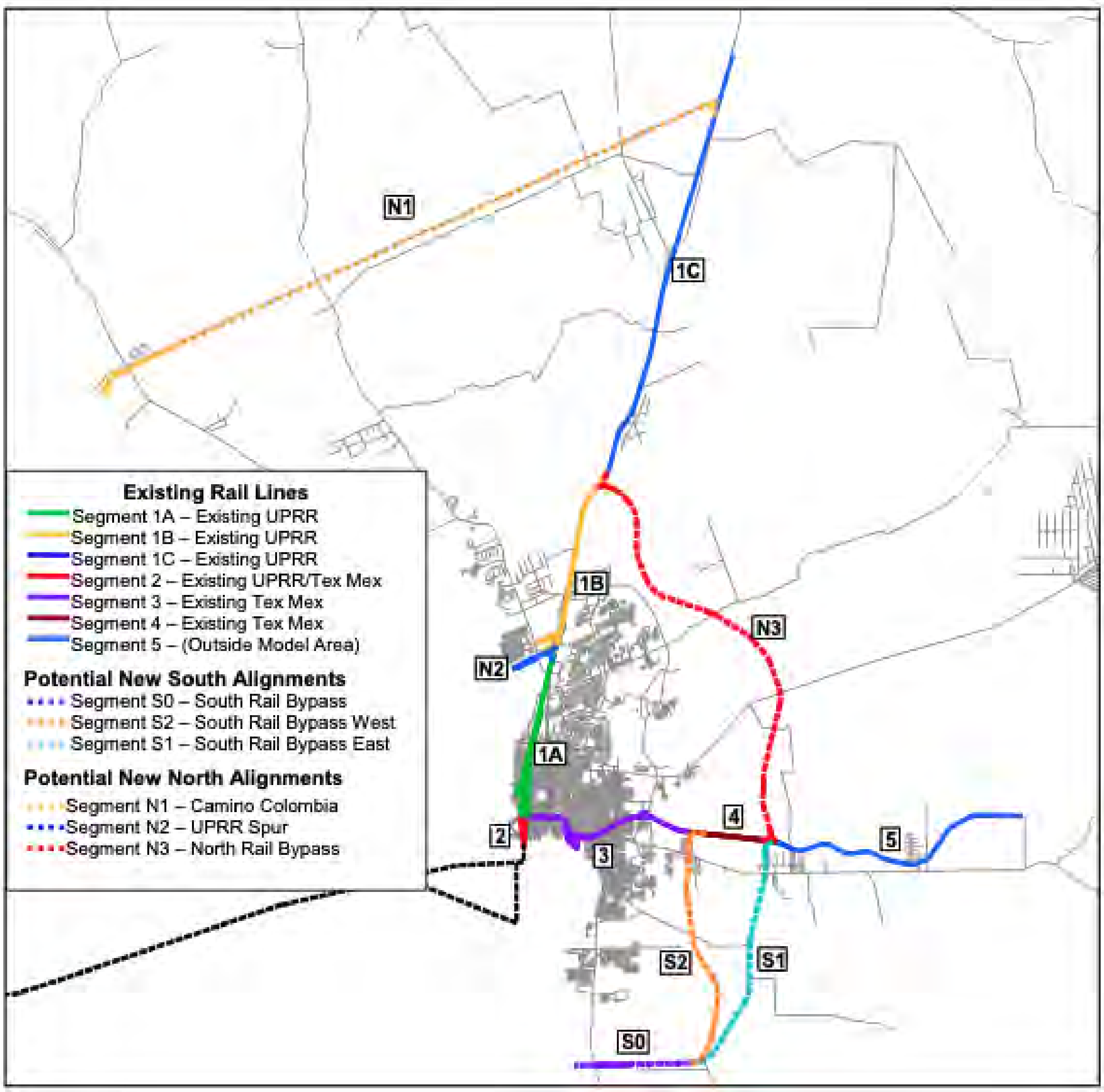
The Sanchez Yard is equipped to handle all Mexican Customs and agricultural inspections, thereby eliminating the need for international traffic to stop on the bridge for inspection. Sanchez Yard has transformed rail operations over the bridge from alternating six-hour northbound/southbound windows to a single-track through right-of-way. Northbound trains staged at the Sanchez Yard can be pre- cleared, pre-blocked, and inspected at the yard. This has doubled the bridge capacity to almost 40 trains per day.

The majority of the trains crossing over the KCS bridge are operated by UP in the US. The second phase of the plan to help alleviate traffic in downtown and west Laredo considers moving most of the rail traffic out of downtown regardless of the new bridge. The South Rail Bypass (S0) is an alternative that is more aligned with the second phase of the plan, as it is located in the outskirts of the urban footprint (away from downtown areas), as illustrated in Figure 7. The S0 alternative might compete with the Laredo Bridge 2 project.

[6] The application for the Presidential Permit process was pending submission of one consolidated application from Webb County and the City of Laredo as requested by the Department of State.

From a macro perspective, there is no rail border crossing alternative near Laredo. The closest two alternatives are Eagle Pass, located more than 110 miles to the West, and Brownsville, located more than 200 miles to the East. As discussed in a later section, the cargo split between trucks and rail has remained stable over the last decade, and we expect this to remain true. Railroads do not typically compete with trucks for the same types of commodities. Low value bulk commodities that are not time sensitive typically move by rail, which is more efficient on a cost per ton-mile basis, and this is especially true for long-distance hauls. Trucks, by contrast, are more flexible, and are used to transport mid- to high-value, time sensitive commodities. While rail is the lower cost mode per ton-mile, most goods require first and last mile haulage to still be done by truck. Thus, savings from rail are diminished (or eliminated altogether) by the additional costs and transit time penalties associated with transferring containers from truck to rail and then from rail back to truck.

Figure 7. Existing and proposed rail corridors and rail-POEs in the Laredo region



Source: Laredo Rail Relocation Feasibility Study, 2006.

2.3 Summary

The main takeaway message from this overview section is that the Laredo-Nuevo Laredo region has a geographic advantage for cross-border supply chains linking Mexico's industrial and logistics clusters to 75% of the US population and the major manufacturing centers in the US Midwest and Southeast.

3. Commercial LPOEs competing with Laredo for top commodity groups

Laredo is at the heart of not only cargo movement between northeastern Mexico and Texas, but the overall trade flows between Mexico and the US. The most recent trends indicate that Laredo's competitive advantages combined with Texas's favorable economic climate will continue to capitalize on shifting trade patterns, nearshoring, and reconfiguration of global supply chains.[7]

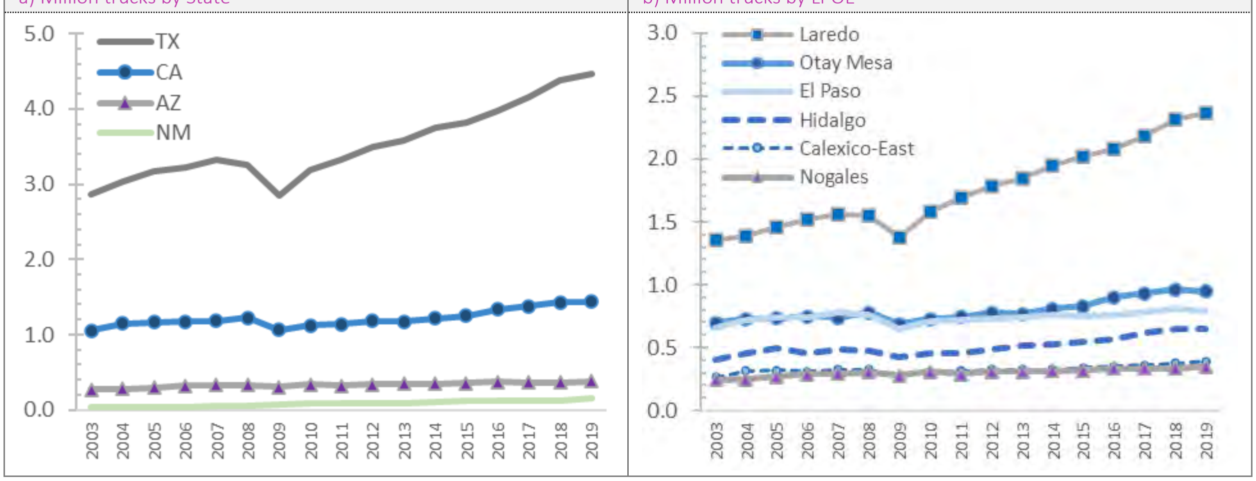
For instance, Texas's 14 commercial vehicle border crossings handled the most northbound truck crossings on the southern border in 2019 at nearly 4.5 million northbound truck crossings, representing a compounded annual growth rate (CAGR) of 3.8% between 2010 and 2019. From these, Laredo has historically reported the highest number of commercial truck-crossings. In 2019, 2.3 million trucks entered the US through Laredo, a 4.5% CAGR from 2010, followed by El Paso with 792,441 truck crossings and a 1.2% CAGR.

California handled the second most northbound truck crossings in 2019 with 1.3 million, which represents a 2.8% CAGR from 2010. From these, 948,630 trucks entered via Otay-Mesa and 389,046 via Calexico-East in 2019. Arizona ranked third with 379,719 northbound truck crossings in 2019, growing at a CAGR of 1.4% from 2010, with most of its traffic entering via Nogales. Lastly, New Mexico handled 150,681 northbound truck crossings, with most of its traffic entering via Santa Teresa near the border at El Paso, TX. The historical trends of northbound truck crossing reported by (a) State and (b) land port of entry are shown in Figure 8.

Figure 8. Northbound truck crossing by State and LPOE, 2003 to 2019

a) Million trucks by State

b) Million trucks by LPOE



Although the massive shock of the coronavirus pandemic (COVID-19) and shutdown measures to contain it have plunged the global economy into a severe contraction, several macro-economic and global events are expected to have a positive effect regarding the major US-Mexico trade in the long-turn. Among these, the most relevant include a shift in trade flow patterns away from China, which was accelerated by the US—China trade war. The US-China trade conflict has benefited Mexico, as was reflected by an additional

[7] https://www.freightwaves.com/news/laredo-texas-becomes-no-1-us-trade-hub
https://comptroller.texas.gov/economy/economic-data/ports/laredo.php

US$3.5 billion of exports to the US market in the agroindustry, transportation equipment, and electrical machinery sectors in the 3Q19. In 2019, Mexico surpassed China as the US' top trading partner, with $614.5 billion in total trade (imports plus exports).[8]

Similarly, the disruptions caused by COVID-19 has led many companies to rethink their supply chains. Several companies have reduced imports of goods from China while increasing imports from Mexico. Furthermore, Texas remains a leader in NAFTA trade and historic ties to Mexico, with strong and diversified economy and strategic location. The recent passage of the USMCA is expected to have positive impacts in terms of economic growth in the US and will likely benefit the auto and manufacturing industries in both countries, which have direct impact on the levels of trade and truck traffic.

Given the geographic configuration of the major US-Mexico trade corridors traversing the study area in relationship with the location of Laredo, these trends indicate that Laredo's competitive advantages combined with Texas's favorable economic climate will continue to capitalize on shifting trade patterns, nearshoring, and reconfiguration of global supply chains. Similarly, the Mazatlán-Durango Highway has proven to be advantageous for the transport of Mexican produce to markets in Texas and the central and eastern US. Substantial time savings attributable to this highway have enabled stakeholders in Laredo and Hidalgo County, Texas to capitalize on a portion of the Nogales fresh produce market that has been captured by Texas's POEs.

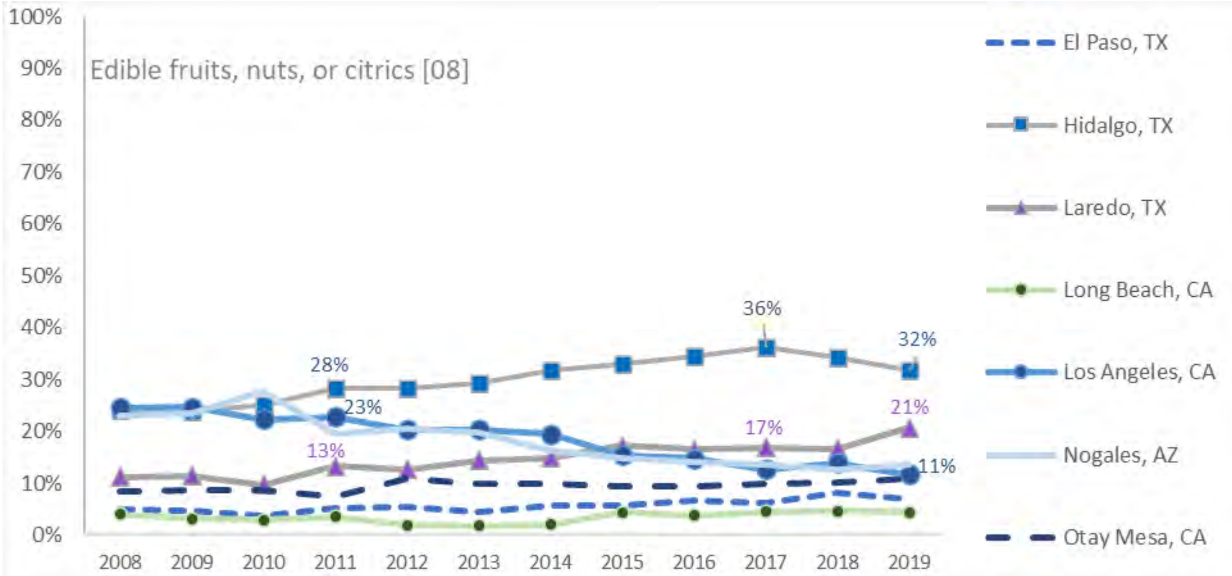
In the remainder of this section, Mercator presents historical volumes imported through the top LPOEs of the following high volume commodity groups currently crossing through the port of Laredo:

- Edible fruits, nuts, or citrus [08]
- Beverages, spirits, vinegar [22]
- Plastics and articles thereof [39]
- Rubber and articles [40]
- Nuclear reactors, boilers, machinery [84]
- Vehicles and parts (except rail) [87]
- Articles of iron or steel [73]
- Electric machinery, equipment, electronics [85]
- Optic, photo, medical instruments [90]
- Furniture, bedding, lamps [94]

For *edible fruit, nuts, citrus fruits, or melons (HS08)*, the share entering through the Laredo LPOE increased from 13% in 2011 (the first normal year after the 2007-09 Great Recession) to 17% in 2015-18 and further to 21% in 2019. During the same years, the share entering through Hidalgo, Texas (located around 150 miles Southeast of Laredo) increased from 28% in 2011 to 36% in 2017, but decreased to 32% in 2019. The evolution of market shares by LPOE for Laredo and Hidalgo, along with major competing ports for this commodity group, such as Nogales, Los Angeles, Otay Mesa, among the most relevant are illustrated in the following figure. This category is comprised primarily of fruits such as avocados, bananas, pineapples, melons, coconuts, and nuts, among others.

[8] United Nations Conference on Trade and Development, "Trade war leaves both US and China worse off," November 6, 2019.

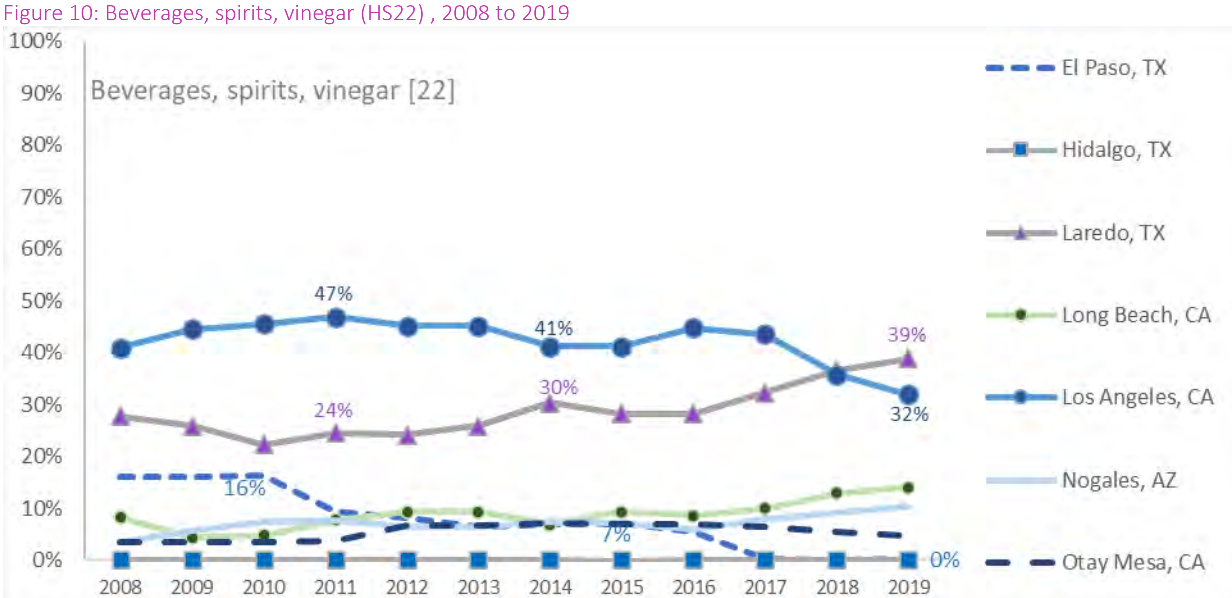
Figure 9: Edible fruit and nuts, peel of citrus fruits or melons (HS08), 2008 to 2019



Source: Mercator International with data from US Census.

Beverages, spirits, vinegar (HS22) traffic share entering through the Laredo LPOE increased from 24% in 2011, to 30% in 2014 and further to 39% in 2019. During the same years, the share entering through Los Angeles decreased from 47% in 2011, to 41% in 2014, and further to 32% in 2019; however, imports via Long Beach also increased market share from 8% in 2011 to 14% in 2019. Traffic share entering through El Paso also decreased from 16% in 2010 to zero in 2019. The evolution of market shares by LPOE for Laredo and Los Angeles, along with ports in Long Beach and El Paso, among other relevant ports are illustrated in the following figure. This category group includes commodities such as soft drinks (carbonated and non-carbonated), beer, wine, liquors and spirits, and vinegars.

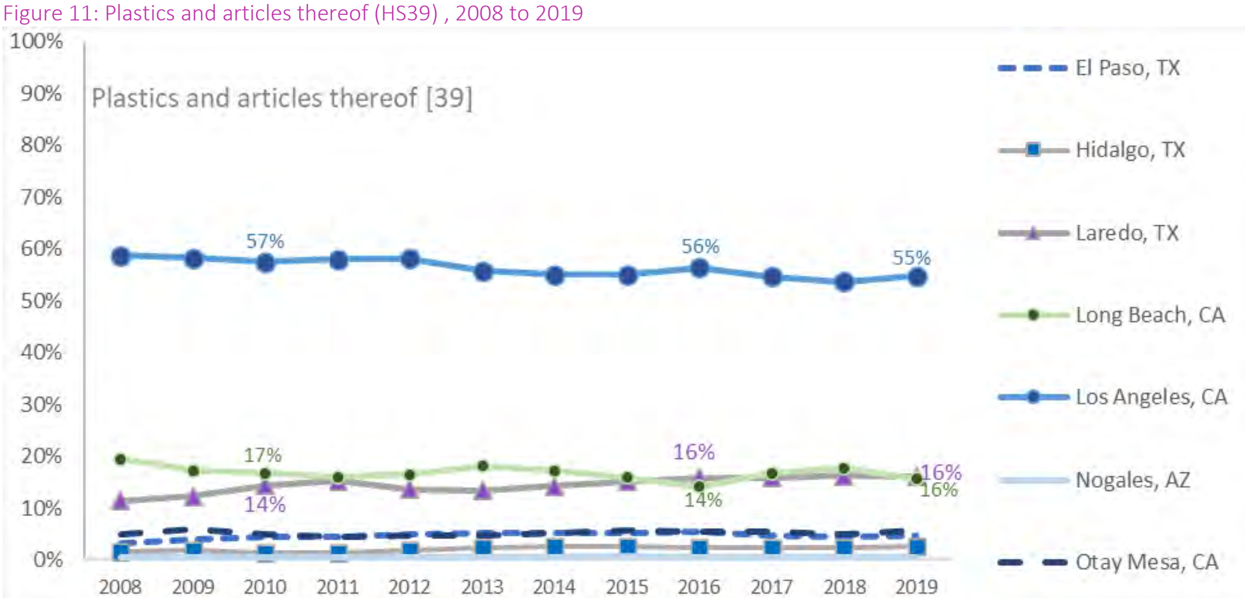
Figure 10: Beverages, spirits, vinegar (HS22) , 2008 to 2019



Source: Mercator International with data from US Census.

The traffic share for *plastics and articles thereof (HS39)* entering through the Laredo LPOE increased only slightly from 14% in 2011 to 16% in 2019. During the same years, the share entering through Los Angeles decreased from 57% in 2011 to 55% in 2019. Imports via Long Beach, the third relevant POE for this commodity group, has remained relatively flat between 17% in 2011 and 16% in 2019. The evolution of these market shares is illustrated in the following figure. This category group includes commodities and products made of plastic, general polymers, styrene, propylene, styrene, vinyl, resins (not considered under Rubbers 40), synthetic silicones, acrylic, in diverse forms such as tubes, pipes, hoses, containers, fittings, plates, sheets, film, foil, strip, floor coverings, among many others.

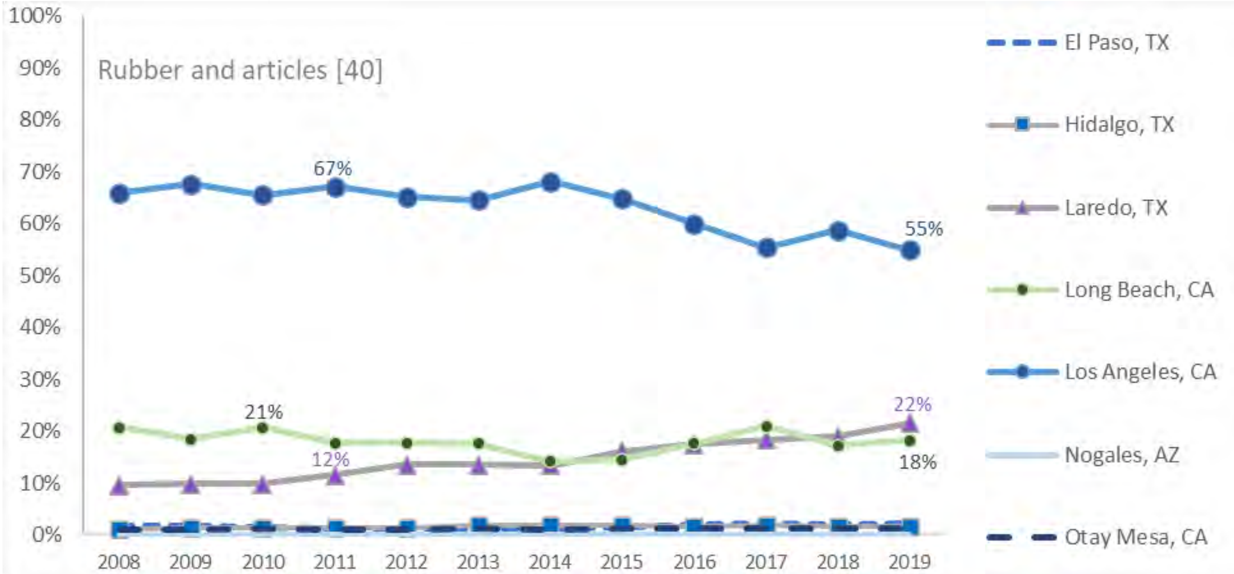
Figure 11: Plastics and articles thereof (HS39) , 2008 to 2019



Source: Mercator International with data from US Census.

For *rubber and articles (HS40)*, the share entering through the Laredo LPOE increased from 12% in 2011 to 22% in 2019. During the same years, the share entering through Los Angeles decreased from 67% in 2011 to 55% in 2019. On a smaller magnitude, the share entering through Long Beach decreased from 21% in 2011 to 18% in 2019. These trends are illustrated in the following figure. This category is comprised primarily of natural rubbers, balata, gutta-percha, chicle, natural gums, vulcanized rubber thread and cord, tires, inner tubes, articles of apparel and clothing, among others.

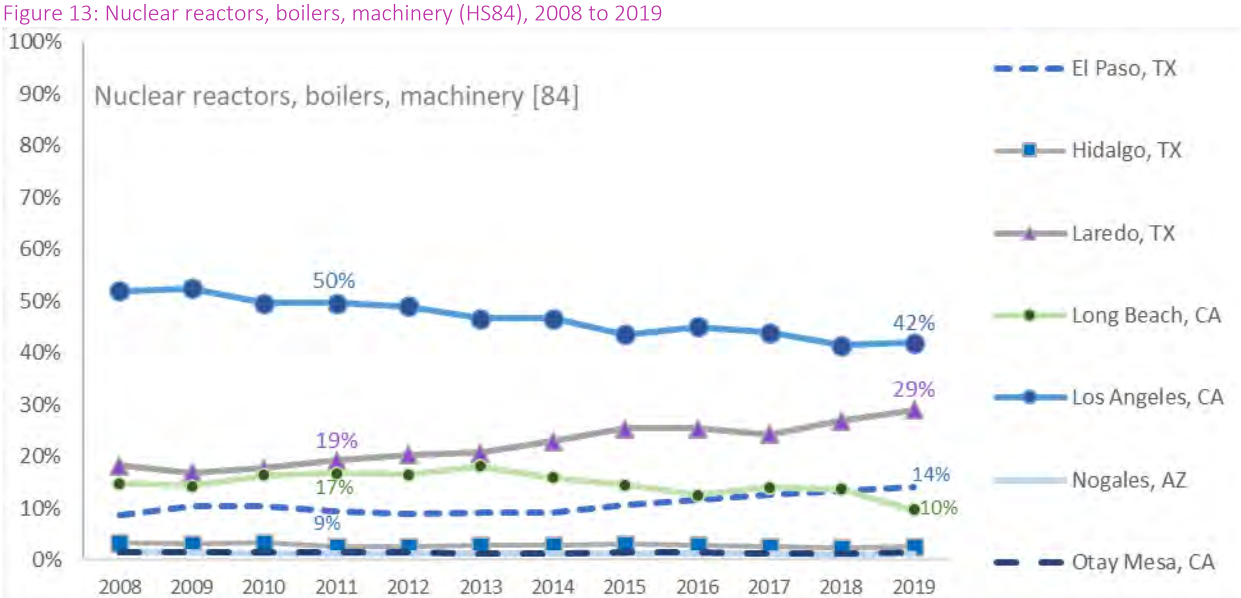
Figure 12: Rubber and articles (HS40), 2008 to 2019



Source: Mercator International with data from US Census.

The traffic share for *nuclear reactors, boilers, machinery (HS84)* entering through the Laredo LPOE increased significantly from 19% in 2011 to 29% in 2019. During this timeframe, the share entering through Los Angeles decreased from 50% in 2011 to 42% in 2019. Imports via Long Beach, the third relevant POE for this commodity group, have also shown a significant decrease from 17% in 2011 to 10% in 2019. Competing with Laredo for these shares, El Paso increase from 9% to 14% during the same time period. The evolution of these market shares are illustrated in the following figure. This category group includes nuclear reactors, boilers, machinery, combustion engines, pumps, transmission shafts, bearings, bulldozers, graders, scrapers, among the most relevant ones.

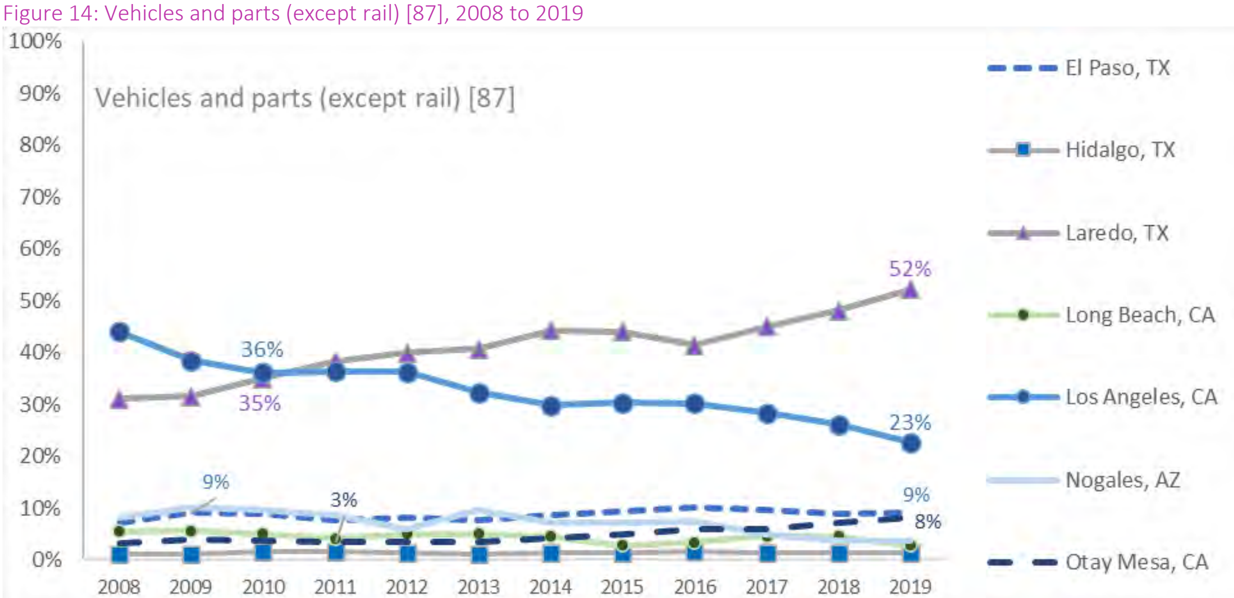
Figure 13: Nuclear reactors, boilers, machinery (HS84), 2008 to 2019



Source: Mercator International with data from US Census.

The *vehicles and parts (except rail) [HS87]* traffic share entering through the Laredo LPOE increased impressively from 35% in 2011 to 52% in 2019. During the same period, the share entering through Los Angeles decreased from 36% in 2011 to 23% in 2019. On a smaller magnitude, imports via Otay Mesa also increased market share from 3% in 2011 to 8% in 2019. Traffic share entering through El Paso, the next relevant POE, remained relatively flat at 9%. These trends are illustrated in the following figure. This category group includes vehicles other than railway/tramway and related parts and accessories (i.e., mainly passenger cars and trucks).

Figure 14: Vehicles and parts (except rail) [87], 2008 to 2019



Source: Mercator International with data from US Census.

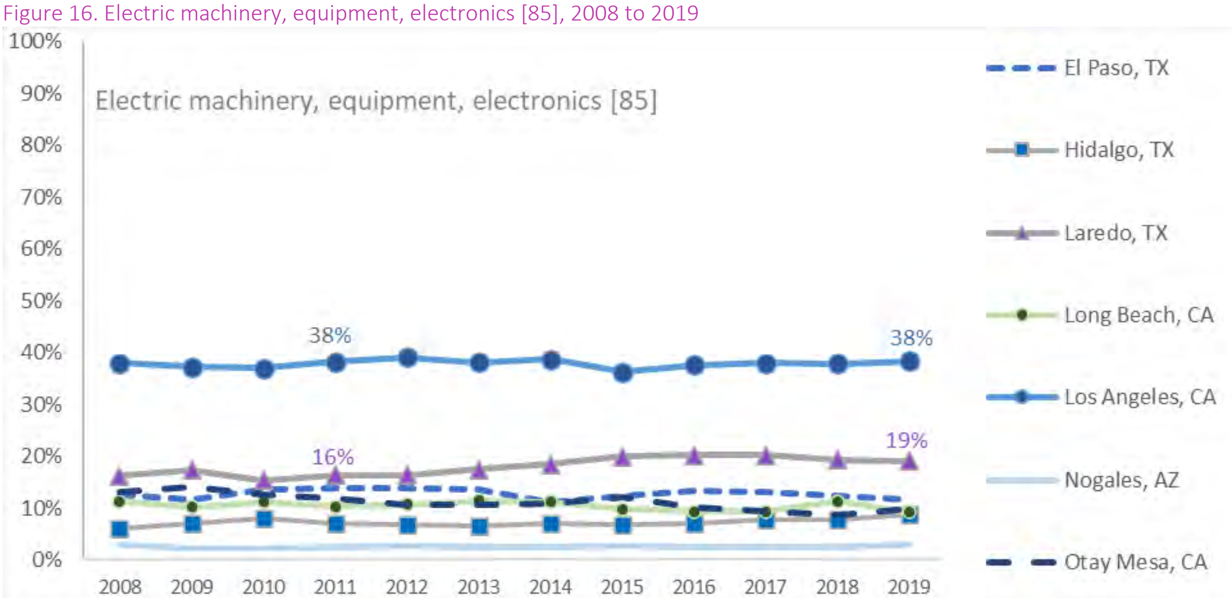
The *articles of iron or steel (HS73)* traffic share entering through the Laredo LPOE increased from 19% in 2011 to 25% in 2019. The share entering through Los Angeles decreased from 60% in 2011 to 52% in 2019. Traffic share entering through Long Beach, the next relevant POE, remained relatively flat at 17%, as shown in the next figure. This group includes sheet piling, railway tracks, tubes, pipes, profiles, and structures, tanks, wire, chains, screws, bolts, nuts, and articles of iron or steel in general among the most relevant.

Figure 15. Articles of iron or steel [73], 2008 to 2019

Source: Mercator International with data from US Census.

Electric machinery, equipment, electronics [85] showed a traffic share via Laredo LPOE with relatively flat trends among all top-seven ports of entry. From 2011 to 2019, Los Angeles remained as the number one gateway for this commodity group with 38% of the traffic share, followed by Laredo with a flat 16%, and El Paso with a flat share around 12%, as shown in the next figure. This category includes diverse electrical and electronic finished products and inventories in progress such as circuits and similar components.

Figure 16. Electric machinery, equipment, electronics [85], 2008 to 2019

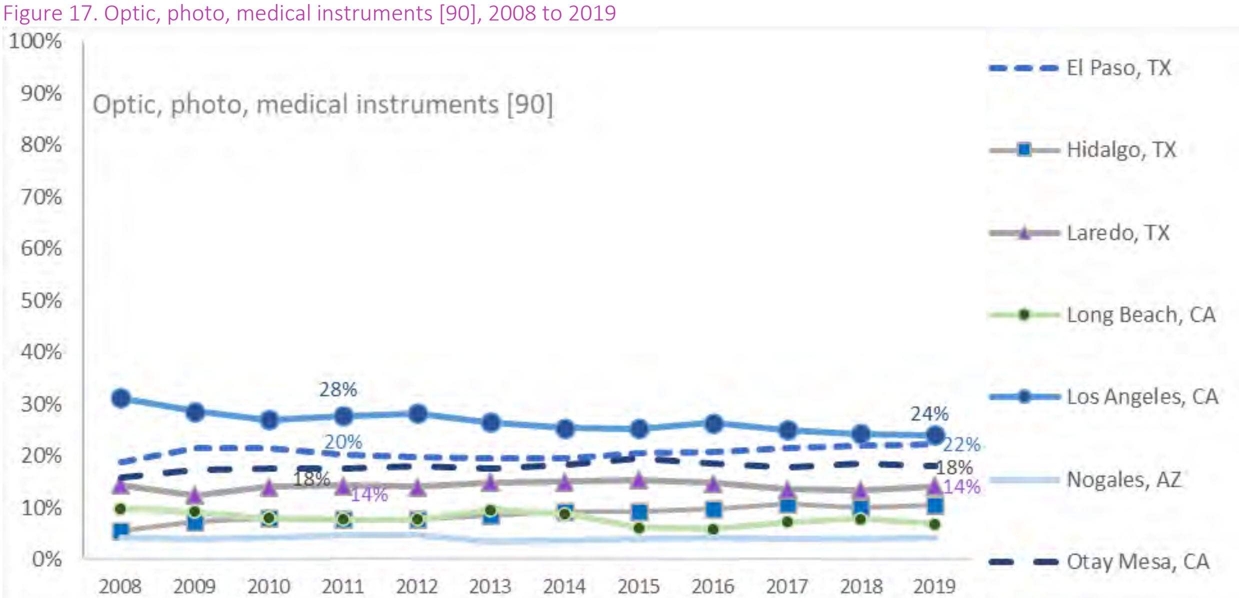


Source: Mercator International with data from US Census.

Optic, photo, medical instruments (HS90) showed a traffic share via Laredo LPOE with a relatively flat trend at 14% from 2011 to 2019. Los Angeles lost a 4% market share, while El Paso gained 2% during the same time period, as shown in the next figure. Most other top ports remained relatively flat over the same period.

This category includes cameras, projectors, lab equipment, surveying instruments, medical equipment, and optical fiber cables and instruments among the most relevant.

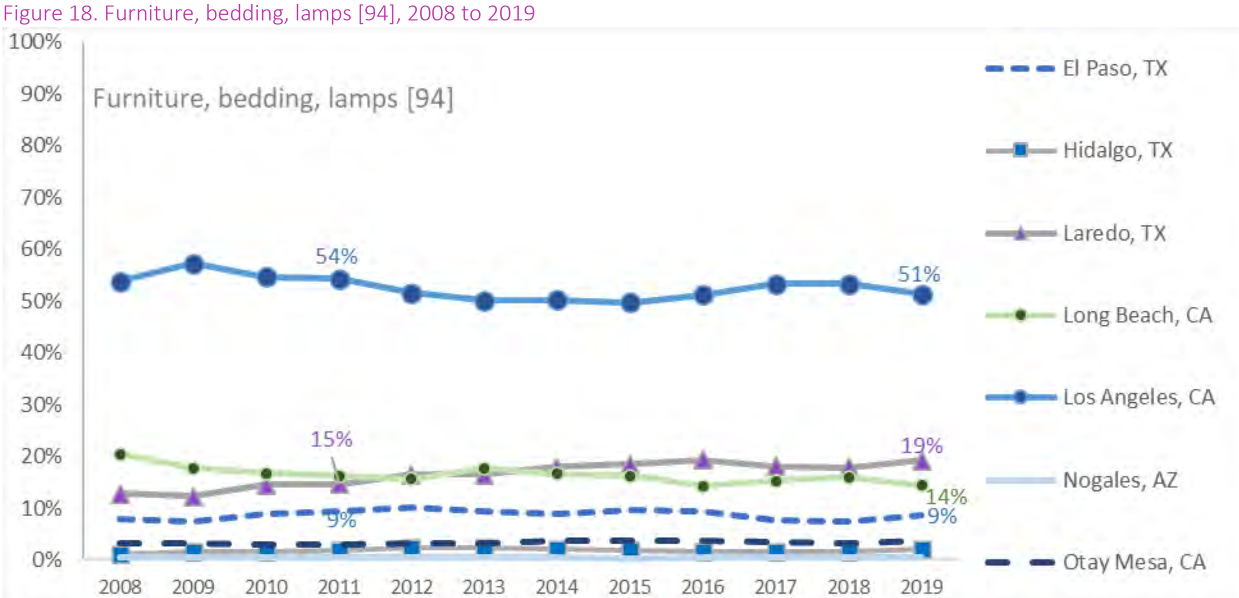
Figure 17. Optic, photo, medical instruments [90], 2008 to 2019



Source: Mercator International with data from US Census.

Furniture, bedding, lamps (HS94) showed a traffic share via Laredo LPOE with a positive trend increasing from 15% in 2011 to 19% in 2019. Meanwhile, Los Angeles lost a 3% market share, followed by Long Beach decreasing 1% during the same time period. Next in the ranking, El Paso remained relatively flat with a 9% market share throughout the same period, as shown in the next figure. Most other top ports remained relatively flat over the same period. This category includes bedding, mattresses, cushions and similar stuffed furnishings, lamps and lighting fittings, office chairs, and furniture in general.

Figure 18. Furniture, bedding, lamps [94], 2008 to 2019



Source: Mercator International with data from US Census.

4. Demand forecast for truck traffic

4.1 Background

Analysis of historical data shows that truck crossings over the US-Mexico border are driven by US business and consumer demand. In this section, US business and consumer demand is analyzed within the context of total US imports of non-energy, non-coin goods (NENC goods)[9], and historical trends in NENC goods imports are analyzed both in relation to US real GDP and from a geographical perspective as well. Regarding the latter, three major periods in which the sources of US imports have been impacted by fundamental shifts in trade policy are identified and analyzed, and within this context, bilateral trade between the US and Mexico is evaluated from multiple perspectives. In addition to analyzing northbound and southbound trade in dollar value terms, US-Mexico trade is analyzed in terms of directional tonnage by major mode of transport, and average tonnage per loaded truck is also analyzed. Because truck volumes compete with rail volumes, additional analysis pinpoints historical trends in truck crossings versus rail crossings.

While a review of historical data reveals much dynamism in past decades, we find that trends were stable and predictable following the US recovery from the global financial crisis in 2008-2009 and the recession that it induced. Data from this period, which is analyzed in detail in the following section, is used to build the top-down econometric model used to forecast commercial truck border crossings.

The recent stability was disrupted by the US-China trade war in 2019 and the COVID-19 pandemic in 2020. These disruptions are briefly discussed below, and they are considered in greater detail in a later section.

The initial shots of the trade war targeted only a handful of specific commodities, but beginning January 1, 2019, the range of commodities subject to tariffs broadened significantly, and the tariffs themselves were increased dramatically – in many cases from 10% to 25%. This caused importers and supply chain managers to shift sourcing elsewhere, and it resulted in a step-down reduction in China's share of US imports of NENC goods. As one of the US's top trade partners, Mexico was among the main beneficiaries of the trade war.

Trade negotiations between the US and China had been progressing through the latter half of 2019. An interim trade deal was agreed upon in late 2019, but the COVID-19 pandemic, which originated in Wuhan, China, caused US-China tensions to further escalate, and it now appears that there will not be a short-term resolution to the trade conflict. A continuation of the trade war is expected to result in two opposing forces impacting US-Mexico trade.

- *On the one hand, US real GDP growth rates are expected to be lower than what would otherwise have been the case, and a reduction in the real GDP outlook would be associated with a reduction in US demand for imports. Holding all else equal, this would result in a reduction of demand for imports from Mexico.*
- *On the other hand, China and Mexico are two of the top three US trade partners, and it is reasonable to expect that Mexico's share of US imports will continue to increase as tariffs on Chinese manufactured goods impact China's cost competitiveness vis-à-vis Mexico.*

In short, total demand for imports will likely decline, but Mexico's share of total imports will increase. Through simulation modeling, we have found that these forces nearly perfectly counteract one another.

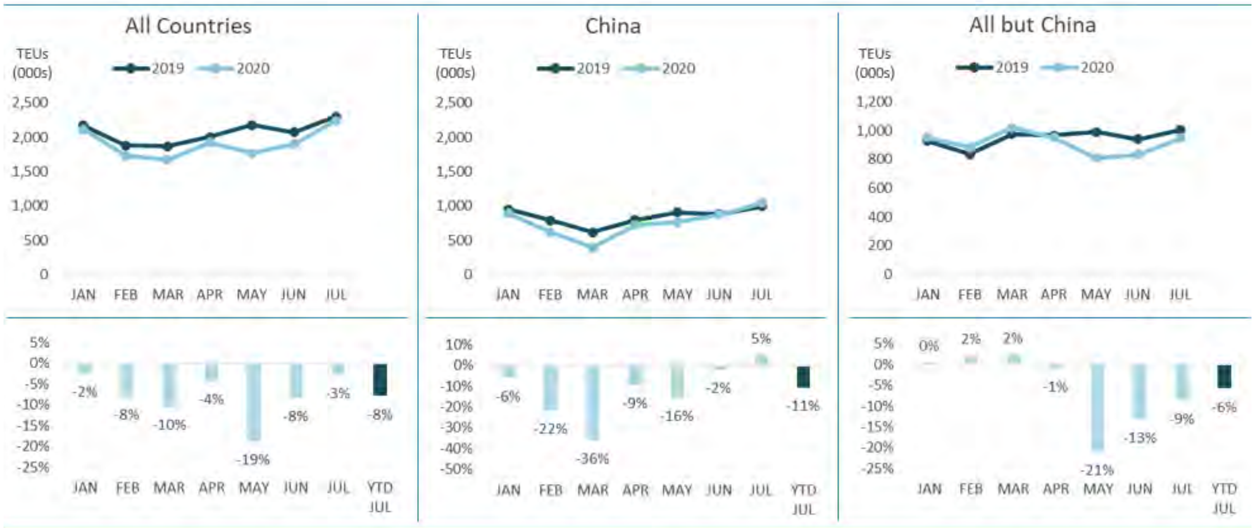
[9] Energy goods include crude oil and refined petroleum products, coal, natural gas, and electricity. The vast majority of these types of commodities are not transported by truck, and they are excluded from the analysis for this reason. Similarly, coin shipments can be of significant value, but of limited impact on cross-border truck crossings.

Approximately half of the forecast simulation runs resulted in imports from Mexico growing faster under a scenario in which the trade war persists (versus the trade war is resolved), and approximately half of the scenarios resulted in imports from Mexico growing more slowly under the same conditions.

The global COVID-19 pandemic has further disrupted trade, not only through impacts on the level of economic activity (real GDP and total employment levels) but also through impacts on the sources of imports and personal consumption expenditure patterns. Seasonally adjusted real GDP contracted 9.1% on a year-over-year basis in the second quarter of 2020, and total non-farm employment contracted by more than 15% from 152 million to 130 million.

As can be seen in the figure below, seaborn container imports from China were impacted primarily in February and March and to a lesser degree in April and May. Chinese imports in June and July combined were in fact 3% higher in 2020 than they were in 2019. By contrast, imports from everywhere but China were higher over the first four months of the year, but they contracted dramatically in May. And while volumes remained low in June and July, they were clearly recovering. The timing of these dips and recoveries reflects the timing of when the pandemic swept over populations living in different countries.

Figure 19: Unitized imports to the US from China and all other countries, 2019 versus 2020



As we will demonstrate in the following section, there is a very strong correlation between imports and real GDP, and at first blush, it is confusing to see that seasonally adjusted advanced retail sales (excluding food service) hit all-time highs in June and July (Figure 19). Retail sales are a main driver of imports, so this is a positive sign, but if real GDP and employment have both contracted at unprecedented rates, how can retail sales (excluding food service) be at all-time seasonally adjusted highs?

Part of the explanation lies in the fact that retail sales fell steeply in March, plummeted further in April, and they had only partially recovered in May. Hence there was a lot of pent-up demand. As retail sales crashed, monthly personal savings (expressed as a percentage of disposable income) spiked from an average of around 7.5% over the last few years to 33.7%, which is a post-WW2 high. As a result, many consumers had additional money in their bank accounts that would otherwise have been spent on durable goods. And, of course, the Federal government bolstered unemployment benefits.

Figure 20: Seasonally adjusted advanced retail sales excluding food services, January 2018 to July 2020

The US-China trade war and pandemic are events without modern day precedent. As such they add uncertainty to the forecast, especially over the near term. This uncertainty is magnified at present by the US presidential election cycle. It is unclear how US-China trade negotiations will develop under a second Trump term, but even less certain under a potential Biden presidency. And while the pandemic has been highly politicized, it is not clear how a response might evolve under a second Trump term or how a response might be different under a Biden first term. That said, new cases in the US have been declining steadily since mid-July, and some places like New York City, where the virus was introduced earlier than in other states have not seen any resurgence since the initial surge in March/April.

The trade war, pandemic, and economic contraction introduce a significant amount of uncertainty to the forecast. Uncertainty is dealt with in two ways. First, we create a set of scenarios centered around expectations of economic performance and trade behavior. Second, within each scenario, Monte Carlo simulation is used to provide a statistical distribution of likely outcomes, which, in this study, is annual cross-border truck crossings over the forecast period.

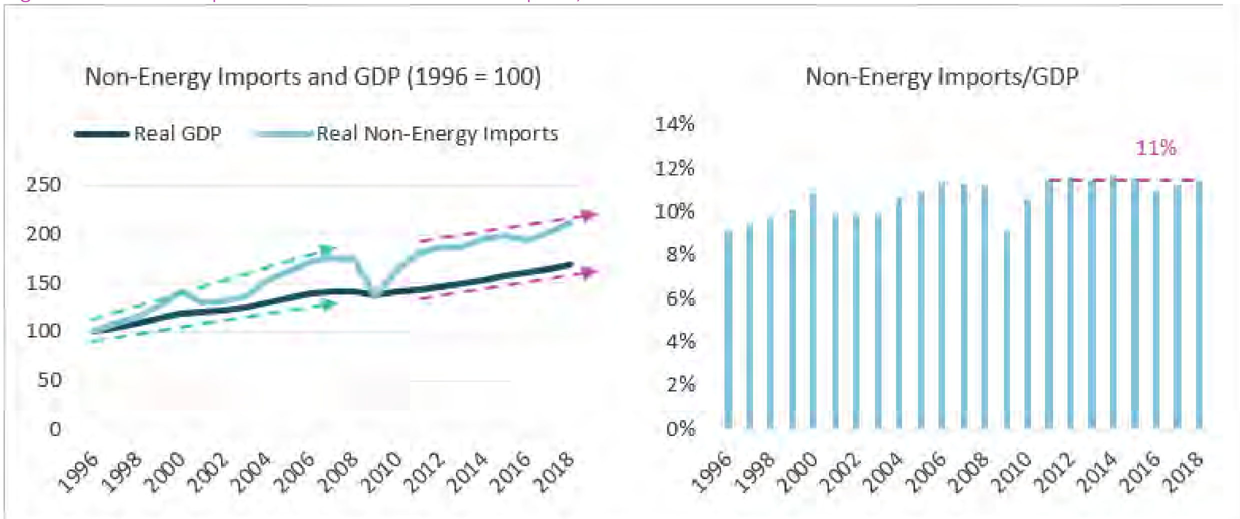
4.2 Macroeconomic context

As previously discussed, 2019 was an outlier year in terms of trade flows. For this reason, we have limited our analysis of historical macroeconomic trends to annual data ending in 2018, leaving analysis of 2019 and year-to-date 2020 for a later section. As we demonstrate throughout this section, 2011 was a pivotal year—the point at which many dynamic relationships departed from previous trends and settled into new or more static patterns that neither trended up nor down.

4.2.1 NENC imports and real GDP

Prior to the global financial crisis, inflation adjusted NENC goods imports to the US were growing faster than real GDP (dollar value basis). Since 2011, however, the two have grown at parallel trajectories, though imports have demonstrated higher year-over-year volatility. Because NENC imports and real GDP have been growing at nearly identical long-term rates, NENC imports expressed as a percentage of US GDP have been stable at around 11% since 2011.

Figure 21: Relationship between US GDP and NENC Imports, 1996 to 2018



4.2.2 Geographic shifts in source of US imports of NENC goods

Three distinct periods emerge from an analysis of NENC import data by major trade area. The three charts below show how shares of US imports from the three major trade areas (i.e., Asia-US, Europe-US, NAFTA-US) have evolved over three distinct periods.

- **Period 1:** Formation of the European Union and ratification and phase in of NAFTA in the early/mid 1990s resulted in US imports from Europe and NAFTA countries rising faster than imports from Asia. Consequently, Asia's share of total imports fell, while the share from Europe and NAFTA increased.
- **Period 2:** China is accepted to the World Trade Organization (WTO) in 2001, and on China's back, Asia's share of total US imports grew rapidly, and primarily at the cost of imports from Mexico, which is similarly characterized as having low-cost labor compared to the US and Canada.
- **Period 3:** A new equilibrium was achieved after the US recovered from the global financial crisis, and shares of imports from Asia, Europe, NAFTA, and elsewhere remained flat.

Figure 22: Regional shares of US NENC goods imports, 1996 to 2018

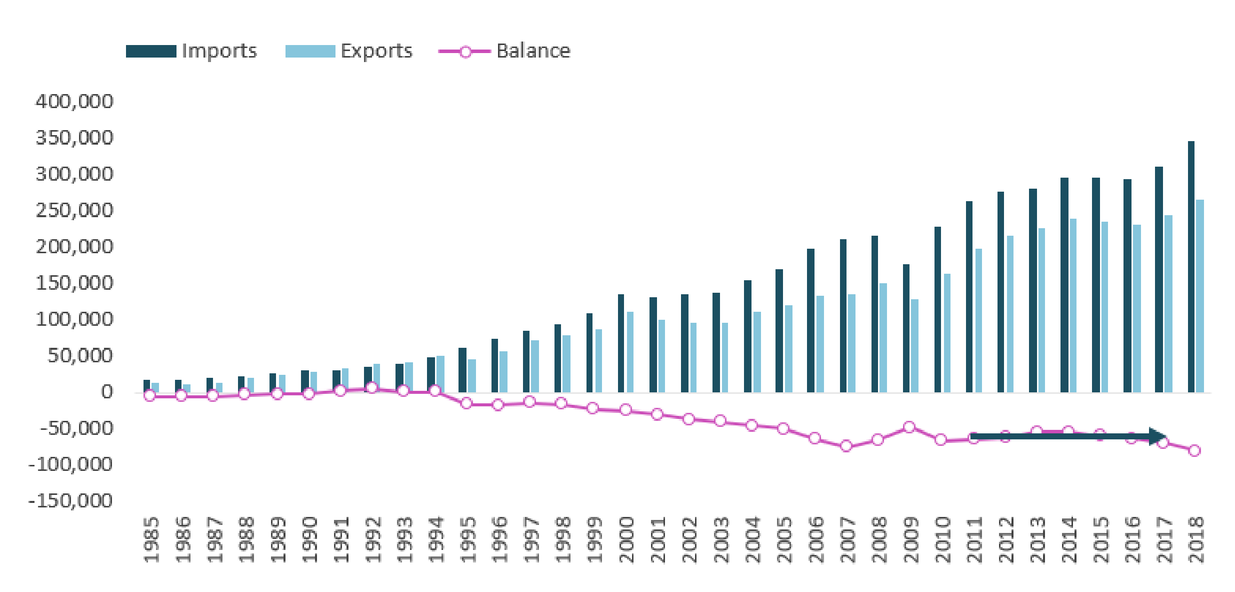
4.2.3 US-Mexico bilateral trade

In terms of total US goods imports on a value basis (USD), the top three sending countries are China, Mexico, and Canada. As a group, these three countries account for nearly half of all US goods imports. The US has maintained a trade deficit with China since China opened its borders as part of the conditions for accession to the WTO, and the US has similarly maintained a trade deficit with Mexico since the ratification of NAFTA in 1994.

The US trade deficit with Mexico grew from essentially zero in 1994 to just under $75 billion in 2007. Over the 2011-2017 period, the deficit was largely flat, at an average of just over $61 billion despite rapid growth in both imports and exports. This means that the trade deficit expressed as a share of total trade has been declining steadily.

Typically, a country's imports are driven by, and strongly correlated with, that country's total level of economic activity (as measured by real GDP). Therefore, one might expect southbound trade to be most highly correlated with Mexican GDP, but this is not the case. Mexico's economy has shown much more volatility than that of the US, and we find that southbound volumes are much more highly correlated with US imports and real GDP than Mexican GDP. The reason for the parallel growth pattern of imports and exports is that **a significant share of US exports to Mexico are used as inputs in the manufacturing of finished goods in maquiladoras that are ultimately shipped back to the US for consumption**.

Figure 23: US-Mexico bilateral trade in goods (nominal USD, billions), 1985 to 2018



In Table 2, we see that trade deals have impacted Mexico's share of NENC goods imports. In 1996, Mexico's share of NENC goods imports was 9.3%, but it rose to 14.8% by 2018. This equates to an average growth rate of 25 basis points (bp) per year. Mexico's share in 2019 jumped further to 15.6% as a consequence of the US trade war with China.

Mexico's share of NENC goods imports grew the fastest after the signing of NAFTA. Over the 1996 to 2001 period, Mexico's share rose from 9.9% to 12.1% of total NENC goods imports. This reflects an average growth rate of 57 bp per year. When China entered the WTO in 2001, Mexico lost an average of 40 bp per year through 2005. Between 2011 and 2018 (the new normal period) Mexico's share has been growing at a rate of 32 bp per year. Mexico's share jumped significantly in 2019 as a direct result of the US imposing large tariffs on Chinese manufactured goods – a subject covered in greater detail in a future section.

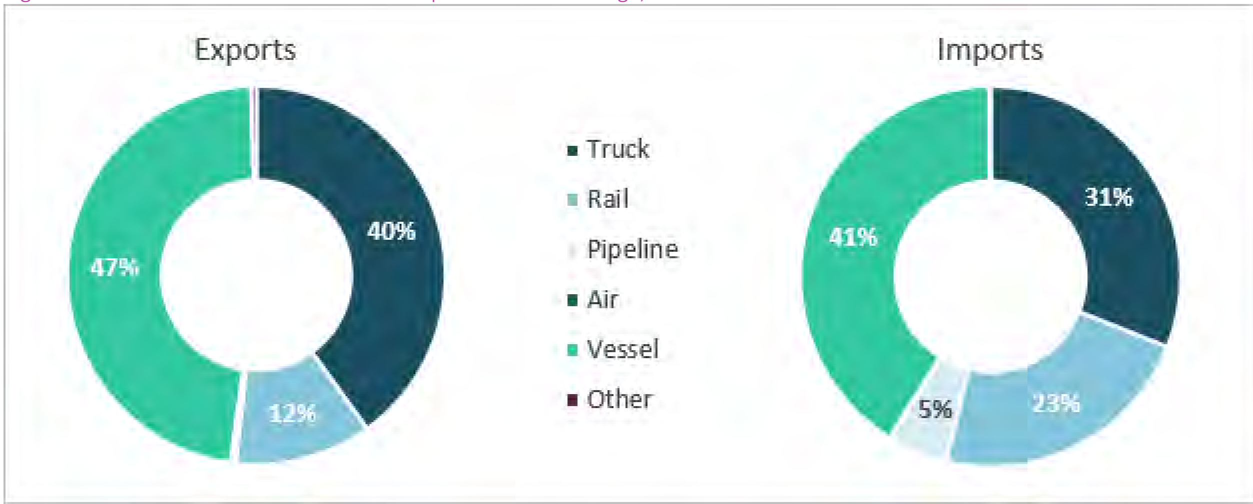
Table 2: Evolution of Mexico's share of US NENC goods imports, 1996-2019

Year	World Total	China	Mexico	Share of Total Percentage: China	Share of Total Percentage: Mexico	Y/Y Share Change Basis Ponts: China	Y/Y Share Change Basis Ponts: Mexico	Avg. Annual Share Shift Basis Ponts
1996	676.5	41.0	62.7	6.1%	9.3%			
1997	743.8	49.9	73.4	6.7%	9.9%	65	61	
1998	802.3	57.4	84.9	7.2%	10.6%	45	72	
1999	890.7	68.3	97.6	7.7%	11.0%	51	37	
2000	1,020.4	85.2	117.4	8.3%	11.5%	68	54	NAFTA effect
2001	952.9	87.1	115.2	9.1%	12.1%	79	59	+57 bp/year
2002	976.1	107.3	115.9	11.0%	11.9%	186	-22	
2003	1,037.3	133.7	116.5	12.9%	11.2%	189	-64	
2004	1,195.2	176.5	129.3	14.8%	10.8%	188	-41	China WTO effect
2005	1,309.8	221.5	137.3	16.9%	10.5%	214	-34	-40 bp/year
2006	1,440.6	263.6	156.6	18.3%	10.9%	139	39	
2007	1,499.6	291.3	168.2	19.4%	11.2%	113	34	
2008	1,516.0	304.6	165.2	20.1%	10.9%	67	-32	
2009	1,191.3	266.8	141.3	22.4%	11.9%	230	96	
2010	1,453.1	334.4	184.4	23.0%	12.7%	62	83	
2011	1,640.5	369.4	205.4	22.5%	12.5%	-49	-17	
2012	1,730.5	394.6	223.4	22.8%	12.9%	28	39	
2013	1,759.6	408.4	233.0	23.2%	13.2%	40	34	
2014	1,877.6	434.7	252.2	23.2%	13.4%	-5	19	
2015	1,917.5	446.2	269.5	23.3%	14.1%	12	62	
2016	1,879.9	423.7	272.0	22.5%	14.5%	-73	42	
2017	1,991.5	463.4	288.3	23.3%	14.5%	73	1	New Normal
2018	2,142.3	496.2	316.6	23.2%	14.8%	-11	30	+32 bp/year
2019	2,116.7	407.7	330.9	19.3%	15.6%	-390	86	

4.2.4 Northbound and southbound tonnage by transportation mode

On a tonnage basis, 40% of southbound cargoes moved by truck in 2018, while only 31% of northbound cargoes moved by truck. By contrast, 23% of northbound tonnage is shipped by rail, while the share of southbound tonnage shipped by rail is only 12%. Truck crossings face competition from rail, but they do not face meaningful competition from pipelines, airplanes, or ships/barges. For this reason, we concentrate our efforts on describing and analyzing shipments by truck and rail.

Figure 24: US-Mexico bilateral trade modal split based on tonnage, 2018



4.2.5 Balance of northbound and southbound truck tonnage

Because a higher portion of southbound tonnage is handled by truck than is the portion of northbound tonnage, total southbound tonnage over roads crossing the US-Mexico border is slightly higher than the tonnage moving northbound even though the US imports far more goods than it exports in terms of value. As can be seen in the table below, northbound and southbound truck tonnage is well balanced, and both northbound and southbound truck tonnage have grown at similar rates since 2007. Through econometric analysis, we find that total truck crossings are driven by US demand for imports, which at first blush is counterintuitive since more tonnage is headed southbound.

Table 3: US-Mexico bilateral truck tonnage, 2007 to 2018

Metric tonnes (mil.)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Imports from MEX	28.6	27.6	24.9	30.0	32.2	33.7	34.4	36.7	37.1	40.4	42.0	47.2
Exports to MEX	28.3	27.3	23.3	35.5	49.9	37.1	35.1	35.0	37.0	39.6	43.3	50.5
Total	56.9	54.9	48.2	65.5	82.1	70.7	69.4	71.7	74.1	80.0	85.3	97.7
NB share	50%	50%	52%	46%	39%	48%	49%	51%	50%	50%	49%	48%

The great majority of cross-border supply chains are oriented to serving the US market. Mexico's export processing plants send the majority of their production to the US, and these factories, which are of a type that first came into existence under the maquiladora program in the 1960s, account for a large share of Mexico's exports to the US. In 2006, when the maquiladora program was replaced by the IMMEX program, maquiladoras accounted for around 20% of Mexican manufacturing value-added and about half of the country's exports.[10] If in 2018, only 1.65 million tons (slightly more than 3%) of US exports to Mexico were used as inputs in Mexican plants and returned to the US as finished products, then the negative balance (in terms of tonnage) would turn positive. While it remains unclear how large this factor is, we are quite confident that the true driver of cross-border traffic is the US market for this reason—a meaningful share of southbound tonnage is ultimately destined for consumption in US markets.

4.2.6 Trends in truck/rail carload ratios and tonnage per truckload

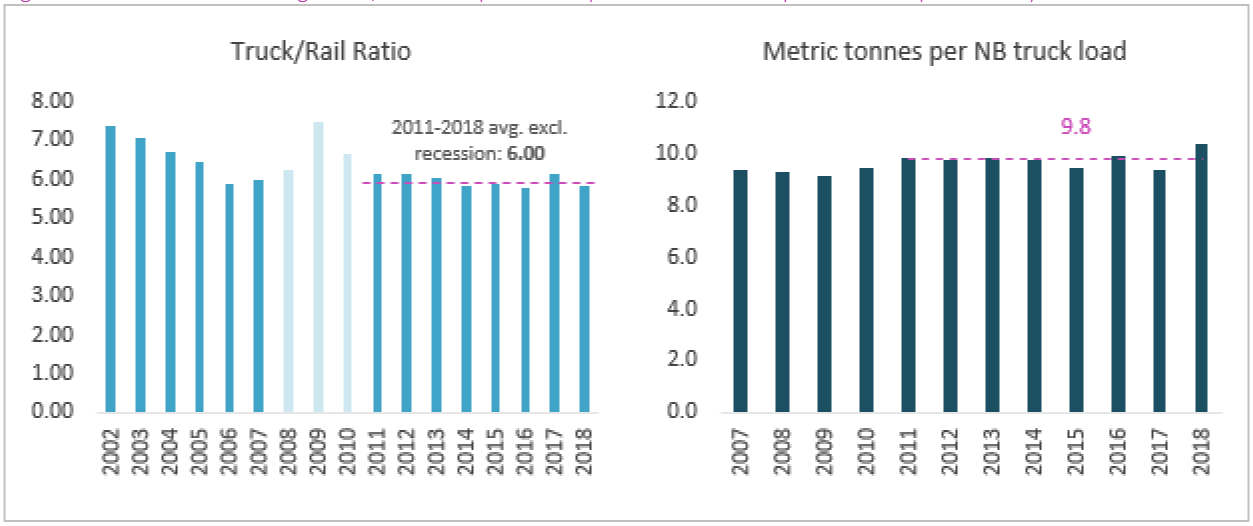
Ultimately, the forecast of truck volumes must account for competition from railroads, therefore, it is important to allow for any shift in the preference between shipping volumes via rail versus by truck. The

[10] Juan Carlos Castillo & Gaaitzen de Vries (2018) The domestic content of Mexico's maquiladora exports: A long-run perspective, The Journal of International Trade & Economic Development, 27:2, 200-219, DOI: 10.1080/09638199.2017.1353125.

historical ratio of northbound containers crossing the border via truck versus by rail (inclusive of all land-based POEs to the US) reveals that after declining steadily, then jumping during the recession, the ratio of northbound containers crossing the border by-truck to by-rail has leveled out. The ratio of northbound containers crossing the border via truck versus rail (truck/rail) has remained relatively flat at an average rate of 6:1.

Of course, it is one thing to forecast tonnage and another to forecast truck crossings, unless, of course, the average tonnage carried per truck load is stable. In the chart below right, this is demonstrated to be the case for northbound truckloads moving over the US-Mexico border. Specifically, the average of all trucks is 9.8 metric tonnes per truckload. While there has been some variation in this figure, there has been no upward or downward trend in the historical data, thus converting between tonnage and truck counts should not introduce any errors that will compound over time.

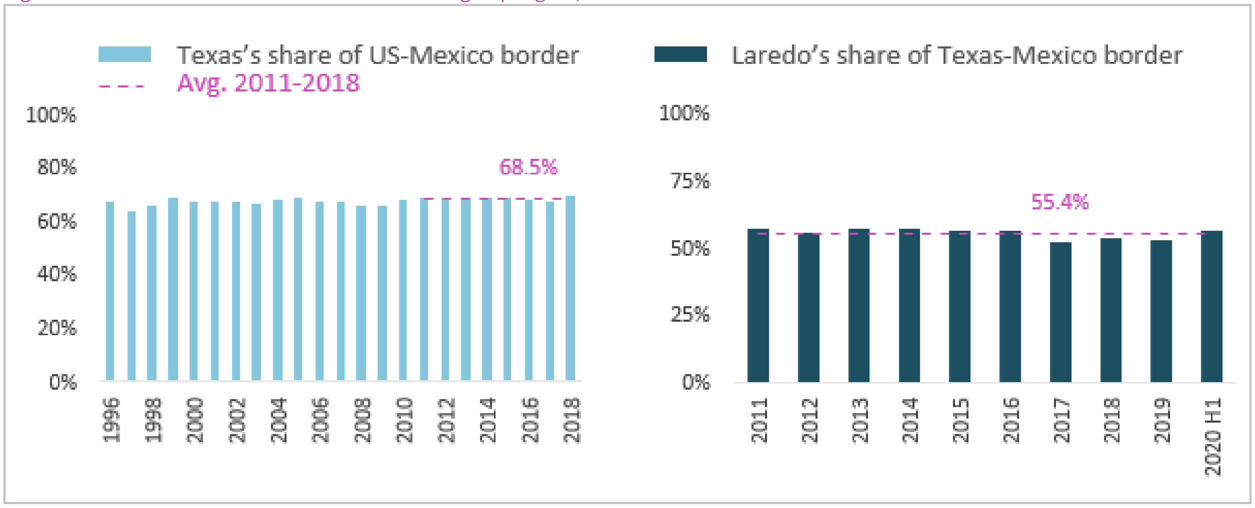
Figure 25: Northbound crossings truck/rail ratios (2002-2018) and metric tonnes per truckload (2007-2018)



4.2.7 Evolution of shares of northbound truck volumes by border crossing

Narrowing the geographic focus from the entire US-Mexico border to northbound moves over the Texas border reveals another static relationship. The share of northbound container truck loads has remained in a very narrow band, and it has averaged 68.5% since 2011. Laredo's share of northbound volumes over the Texas border has been much more dynamic—more than doubling between 1996 and 2005—but since 2011, Laredo's share has remained in a narrow range around 55.4%.

Figure 26: Shares of northbound border crossings by region, 1996-2018



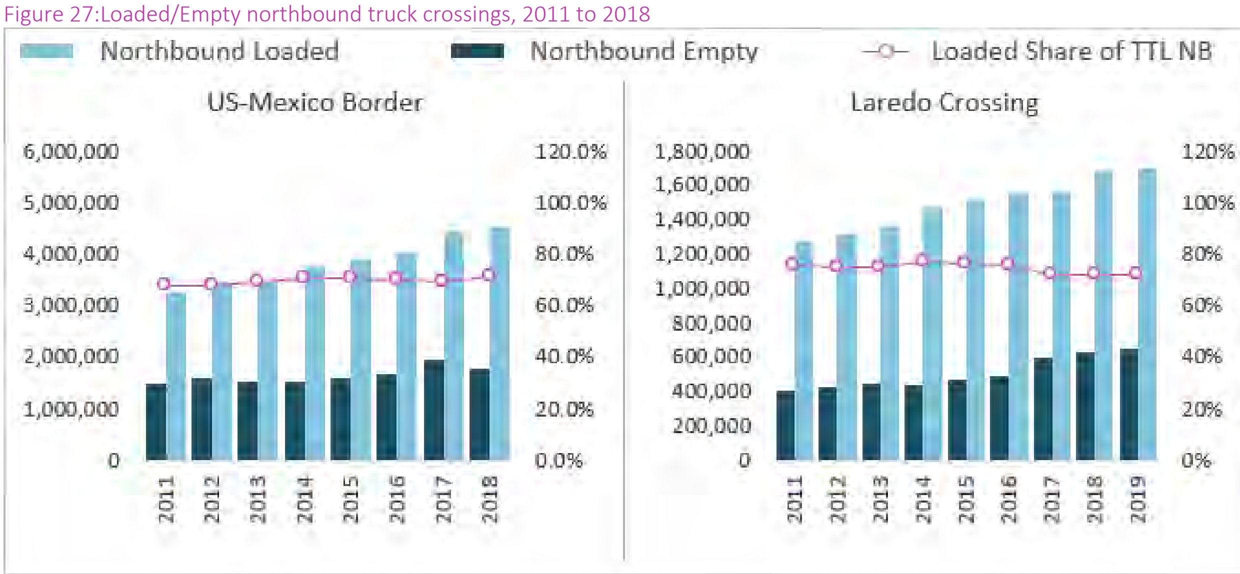
4.2.8 Loaded/empty split for northbound truck crossings

In a perfectly efficient world, the nearly equal northbound and southbound truck tonnage would result in few, if any empty truck crossings because each loaded northbound move would be matched with a loaded southbound move. While this is simple in theory, in practice, it is nearly impossible to accomplish, and empty trucks cross the border for a variety of practical reasons.

Analysis of northbound data at multiple geographic scales reveals that, although the empty crossings are somewhat significant (around three empty trucks cross the border for every eight loaded trucks), the ratio of loaded trucks to empty trucks (loaded/empty) has demonstrated little volatility in recent years, as can be seen in the magenta lines in the charts below. Knowing that northbound truck tonnage has been more or less at parity with southbound tonnage every year, and that tonnage per truckload is a fairly constant figure, it is safe to assume that the number of empty trucks moving in the southbound direction is approximately equal to the number in the northbound direction. There is nothing in the historical data that suggests that the consistency of this relationship will change over time; hence, it is reasonable to assume that:

- *Southbound tonnage and, therefore, loads will grow at the same rate as northbound tonnage/loads.*
- *Northbound empty crossings will grow at same rate as northbound loads.*
- *The ratio of southbound empty to loaded crossings will remain unchanged; so southbound loaded and empty crossings will grow at the same rate as northbound loaded crossings.*

Figure 27:Loaded/Empty northbound truck crossings, 2011 to 2018



4.2.9 Summary

The review of historical data presented in this chapter demonstrates that market drivers and other factors have all been in a state of relative equilibrium since 2011.

- *US imports, the main driver of both northbound and southbound crossings, are tightly correlated with US GDP, and imports expressed as a percentage of US GDP have been flat.*
- *The shares of US imports coming from each of the major trade regions have been flat since the US recovered from the global financial crisis and the recession, and this should remain the case if the US-China trade dispute is resolved; but if it is not resolved, we should expect Asia to lose share, and Mexico to gain share.*
- *The US has maintained a relatively constant trade deficit with Mexico on a dollar basis since 2011, but northbound and southbound truck tonnage is well balanced.*
- *Tonnage per northbound truckload has shown very little deviation around the long-term average.*
- *Texas's share of the total northbound truck crossings has remained flat, as has Laredo's share of the number of northbound crossings over the Texas border.*

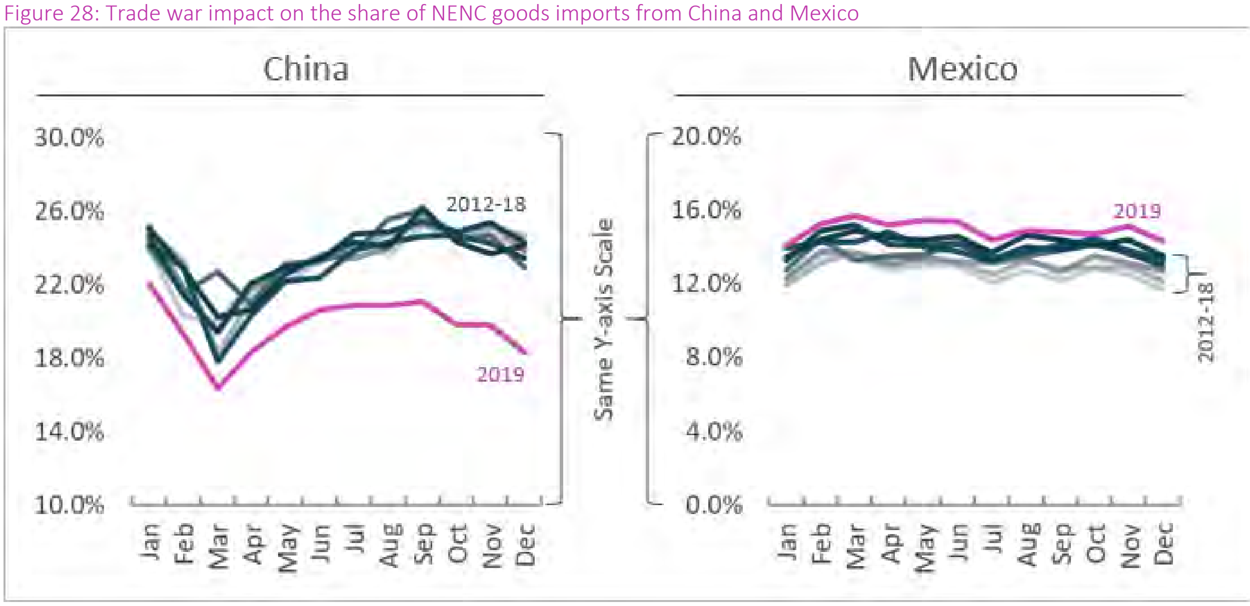
- *The rail/truck split for northbound cargoes has similarly remained flat since 2011, as has the ratio of loaded to empty northbound containers.*
- *Loaded northbound truck crossings are highly correlated to US imports, and loaded northbound and southbound trucks should grow at the same rate.*
- *Empty trucks should grow at the same rate as loaded trucks.*

The stability of historical trends highlighted in this section simplifies the modeling and forecasting processes that are described in a later section.

4.3 Trade war and pandemic impacts

In Figure 28 we see that the imposition of tariffs of up to 25% on a broad swath of Chinese goods caused China's share of NENC goods imports to fall significantly. This share decline grew from just a couple of percentage points in January to more than three percentage points by December.[11] There has been some impact on Mexico's share of NENC goods imports. In the graphic, the y-axis is the same scale in terms of maximum minus minimum values, and this shows that China's loss of share far outweighs Mexico's gain.

Figure 28: Trade war impact on the share of NENC goods imports from China and Mexico



Additional insight into this decline is provided by the data in Table 2 below. In this table we see that on a USD basis, China's share of imports fell by 3.2 percentage points, from 21.5% to 18.3% while Mexico's share increased by 0.7 percentage points. The measures of share by container (both USD and tonnage based) do not apply to Mexico because the great majority of imports from Mexico arrive over land crossings. It is instructive, however, to note that China's share decline in terms of containerized metrics is much greater than in terms of total USD. This reflects the fact that the great majority of imports from China are unitized shipments (rather than bulk/break bulk).

[11] The consistent March dip in annual imports from China is due to the weeks long celebration of the Chinese New Year (CNY) during which all factories were closed for a week, but many, if not most, stay closed for between two and four weeks.

Table 4: Shares of total US imports by sending region, 2018, 2019 and share shift in 2019

	Shares of Total US Imports			Shares of Total US Imports			Share Change (2019 minus 2018)		
	USD All Modes	USD Container	kg Container	USD All Modes	USD Container	kg Container	USD All Modes	USD Container	kg Container
	2018			2019			Delta		
China	21.5%	40.7%	37.1%	18.3%	34.9%	32.4%	-3.2%	-5.8%	-4.7%
Other NE Asia	10.3%	13.1%	8.1%	11.0%	14.2%	8.5%	0.7%	1.1%	0.3%
SE Asia	7.3%	11.5%	10.4%	8.3%	14.0%	12.4%	1.0%	2.5%	2.0%
ISC/ME	5.5%	6.0%	6.8%	5.0%	6.6%	7.7%	-0.5%	0.6%	0.8%
Transatlantic	22.5%	20.1%	19.3%	24.1%	21.4%	19.8%	1.7%	1.3%	0.5%
Lat. Am.	4.8%	6.0%	13.1%	4.4%	6.2%	13.9%	-0.5%	0.2%	0.8%
Afr. & Oceania	2.0%	2.0%	3.1%	1.8%	2.1%	3.2%	-0.2%	0.1%	0.1%
Mexico	13.6%	0.4%	1.3%	14.3%	0.5%	1.4%	0.7%	0.1%	0.0%
Canada	12.5%	0.1%	0.7%	12.8%	0.1%	0.8%	0.2%	0.0%	0.2%

Table 5 on the following page shows how shares have shifted between China and Mexico on a year-to-date basis in both 2019 and 2020. The table is sorted in descending order by Mexico's share of NENC goods imports in each of the SITC-2-digit commodity groups. The cells in this column are conditionally formatted, as are the corresponding values of China's share by commodity in 2018. This was done to help identify which commodities are supplied in meaningful shares by both China and Mexico. In the top row, for instance, we see that in 2018, Mexico provided 45% of the imports of vegetables and fruit to the US. Mexico's share increased by three percentage points in 2019. By contrast, China's share fell two percentage points from 5% to 3% over the same period.

The format of this table also makes it easy to see which commodities are important to both China and Mexico. None of the top-five imports from Mexico accounted for more than 6% of total imports for each commodity. SITC 81 is the first of the commodities to have a significant share coming from both China and Mexico, and Mexico and China are considered to be major competitors for manufactured goods that fall in this category, which is dominated by lighting fixtures, and plumbing.[12] In this commodity group, we see that China's share of imports fell from 58% in 2018 to 55% in 2019 and 51% in 2020. Mexico's share increased by 2 percentage points over the two-year time frame, rising from 22% to 24%.

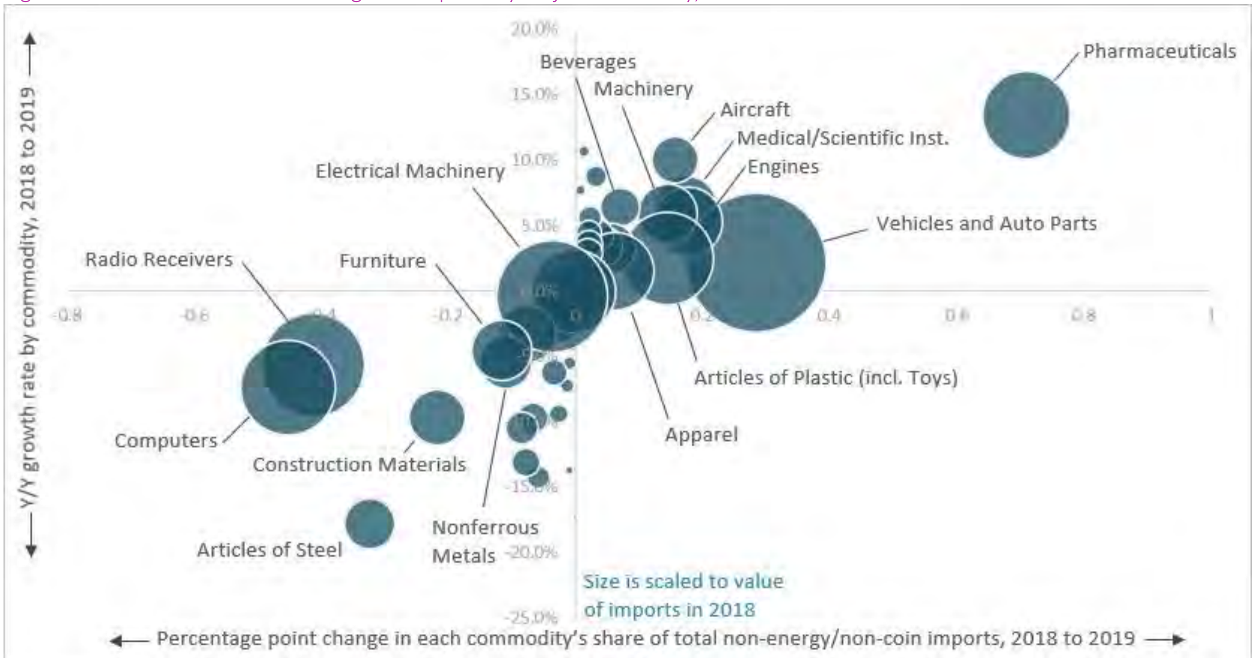
[12] Despite the commodity group description beginning with "pre-fabricated buildings", very few of these types of structures are imported.

Table 5: Year-to-date May imports by commodity group, 2018, 2019, and 2020

		World			China					Mexico			Y/Y Shift	
		USD-Millions			Share			Y/Y Shift		Share			Y/Y Shift	
SITC-2	Commodity Description	2018	2019	2020	2018	2019	2020	2019	2020	2018	2019	2020	2019	2020
XX	**TOTAL OF ALL NON-ENERGY/NON-COIN**	**895,248**	**908,454**	**792,826**	**23.0%**	**19.8%**	**18.0%**	**-3.2%**	**-1.7%**	**14.5%**	**15.4%**	**13.9%**	**0.9%**	**-1.5%**
05	VEGETABLES AND FRUIT -	17,177	17,662	17,874	5%	3%	4%	-2%	1%	45%	49%	48%	3%	-1%
06	SUGARS, SUGAR PREPARATIONS AND HONE -	2,018	1,962	2,174	3%	2%	2%	-1%	-1%	33%	31%	34%	-2%	3%
00	LIVE ANIMALS OTHER THAN FISH, CRUSTACE -	1,153	1,355	1,199	1%	1%	0%	0%	-1%	30%	32%	33%	2%	2%
78	ROAD VEHICLES (INCLUDING AIR-CUSHION V -	119,539	125,858	85,021	6%	5%	6%	-1%	1%	30%	33%	31%	3%	-2%
11	BEVERAGES -	9,794	10,422	9,714	0%	0%	0%	0%	0%	24%	25%	27%	1%	2%
81	PREFABRICATED BUILDINGS; SANITARY, PLU -	5,696	5,552	4,349	58%	55%	51%	-3%	-4%	22%	22%	24%	1%	1%
87	PROFSSIONAL, SCIENTIFIC AND CONTROLLIN -	24,708	26,091	24,086	13%	11%	13%	-2%	2%	22%	22%	21%	1%	-2%
77	ELECTRICAL MACHINERY, APPARATUS AND A -	75,977	75,379	68,560	27%	24%	21%	-3%	-3%	21%	23%	20%	2%	-3%
75	OFFICE MACHINES AND AUTOMATIC DATA P -	53,595	49,483	48,934	56%	44%	41%	-11%	-3%	20%	23%	22%	3%	-2%
71	POWER GENERATING MACHINERY AND EQU -	30,217	33,360	26,064	10%	8%	8%	-2%	1%	19%	18%	17%	-1%	-1%
74	GENERAL INDUSTRIAL MACHINERY AND EQU -	45,639	46,730	39,629	24%	22%	21%	-3%	-1%	17%	18%	17%	0%	-1%
82	FURNITURE AND PARTS THEREOF; BEDDING, -	22,086	21,610	17,538	49%	44%	34%	-5%	-10%	16%	16%	14%	0%	-3%
98	ESTIMATE OF IMPORT ITEMS VALUED UNDEF -	7,363	7,740	6,798	18%	20%	20%	1%	0%	15%	14%	14%	-1%	0%
76	TELECOMMUNICATIONS AND SOUND RECOF -	62,342	58,592	46,374	57%	51%	47%	-6%	-3%	15%	14%	15%	-1%	1%
61	LEATHER, LEATHER MANUFACTURES, N.E.S., -	584	516	391	27%	26%	26%	-1%	0%	14%	10%	10%	-4%	-1%
04	CEREALS AND CEREAL PREPARATIONS -	4,253	4,402	4,659	1%	1%	1%	0%	0%	14%	14%	15%	0%	1%
01	MEAT AND MEAT PREPARATIONS -	3,898	4,120	4,215	0%	0%	0%	0%	0%	13%	14%	16%	2%	2%
58	PLASTICS IN NONPRIMARY FORMS -	4,873	4,977	4,715	17%	12%	11%	-5%	-1%	12%	12%	11%	0%	-1%
69	MANUFACTURES OF METALS, N.E.S. -	23,566	24,488	21,462	40%	37%	34%	-3%	-3%	12%	13%	13%	1%	0%
28	METALLIFEROUS ORES AND METAL SCRAP -	3,754	3,937	3,391	2%	1%	1%	-1%	1%	11%	11%	11%	0%	0%
62	RUBBER MANUFACTURES, N.E.S. -	9,285	9,701	7,901	16%	12%	10%	-4%	-2%	11%	11%	10%	0%	-1%
27	CRUDE FERTILIZERS (IMPORTS ONLY), EXCEP -	1,347	1,324	1,204	16%	13%	8%	-3%	-5%	9%	11%	11%	2%	1%
12	TOBACCO AND TOBACCO MANUFACTURES -	811	836	688	1%	1%	0%	0%	-1%	9%	7%	6%	-2%	-1%
67	IRON AND STEEL -	17,251	15,064	10,711	5%	5%	4%	0%	-1%	8%	8%	11%	-1%	3%
55	ESSENTIAL OILS AND RESINOIDS AND PERFU -	6,813	6,820	6,128	10%	8%	7%	-2%	-1%	8%	8%	10%	0%	2%
57	PLASTICS IN PRIMARY FORMS -	7,418	7,045	6,059	8%	5%	5%	-4%	1%	8%	7%	8%	-1%	0%
64	PAPER, PAPERBOARD, AND ARTICLES OF PAI -	6,973	7,235	6,453	18%	16%	14%	-2%	-2%	8%	8%	8%	-1%	1%
65	TEXTILE YARN, FABRICS, MADE-UP ARTICLES -	12,141	12,594	15,634	39%	38%	55%	-1%	16%	7%	7%	5%	0%	-2%
68	NONFERROUS METALS -	20,303	17,457	17,413	5%	4%	3%	-1%	-1%	7%	8%	8%	1%	0%
07	COFFEE, TEA, COCOA, SPICES AND MANUFA -	5,837	5,852	5,793	2%	3%	2%	0%	-1%	6%	7%	7%	1%	0%
02	DAIRY PRODUCTS AND BIRDS' EGGS -	885	927	933	0%	0%	0%	0%	0%	6%	6%	7%	0%	1%
79	TRANSPORT EQUIPMENT, N.E.S. -	14,320	16,439	12,819	3%	2%	2%	0%	0%	6%	6%	5%	0%	-1%
52	INORGANIC CHEMICALS -	4,851	5,236	4,537	13%	9%	9%	-3%	0%	6%	5%	6%	0%	0%
89	MISCELLANEOUS MANUFACTURED ARTICLES -	47,849	49,224	52,565	42%	41%	28%	-1%	-13%	6%	6%	5%	1%	-2%
53	DYEING, TANNING AND COLORING MATERIA -	1,832	1,814	1,750	14%	10%	9%	-4%	-1%	6%	5%	6%	-1%	1%
09	MISCELLANEOUS EDIBLE PRODUCTS AND PRI -	3,481	3,977	4,383	6%	5%	5%	-1%	0%	6%	5%	6%	0%	0%
72	MACHINERY SPECIALIZED FOR PARTICULAR I -	22,877	24,669	20,407	13%	10%	9%	-2%	-1%	6%	6%	5%	0%	0%
66	NONMETALLIC MINERAL MANUFACTURES, N -	20,529	19,929	12,409	14%	12%	13%	-2%	0%	5%	6%	8%	1%	2%
23	CRUDE RUBBER (INCLUDING SYNTHETIC AND -	1,397	1,404	1,249	2%	1%	1%	-1%	0%	5%	4%	4%	-1%	-1%
84	ARTICLES OF APPAREL AND CLOTHING ACCE -	35,074	36,801	27,976	30%	29%	23%	-2%	-5%	4%	4%	4%	0%	-1%
29	CRUDE ANIMAL AND VEGETABLE MATERIALS -	2,850	2,812	2,488	15%	11%	9%	-4%	-2%	4%	4%	5%	0%	1%
59	CHEMICAL MATERIALS AND PRODUCTS, N.E. -	7,662	7,796	8,130	14%	13%	14%	-1%	2%	3%	4%	5%	0%	1%
43	ANIMAL OR VEGETABLE FATS AND OILS PRO -	95	109	110	8%	8%	5%	0%	-3%	3%	2%	3%	-1%	1%
26	TEXTILE FIBERS (OTHER THAN WOOL TOPS A -	556	596	515	21%	14%	10%	-7%	-5%	3%	2%	1%	-1%	-1%
03	FISH (NOT MARINE MAMMALS), CRUSTACEA -	8,701	8,630	8,120	12%	9%	8%	-3%	-1%	3%	3%	3%	0%	0%
88	PHOTOGRAPHIC APPARATUS, EQUIPMENT A -	6,093	6,234	4,625	23%	22%	21%	-1%	-1%	2%	3%	3%	0%	0%
42	FIXED VEGETABLE FATS AND OILS, CRUDE, RI -	2,862	2,313	2,404	0%	0%	0%	0%	0%	2%	3%	4%	1%	1%
21	HIDES, SKINS AND FURSKINS, RAW -	33	24	32	0%	0%	0%	0%	0%	2%	1%	1%	-1%	0%
22	OIL SEEDS AND OLEAGINOUS FRUITS -	511	493	518	2%	1%	2%	-1%	1%	2%	2%	2%	0%	0%
85	FOOTWEAR -	10,675	11,068	8,401	52%	49%	40%	-3%	-9%	2%	2%	1%	0%	0%
73	METALWORKING MACHINERY -	4,631	4,668	3,782	10%	7%	6%	-2%	-1%	2%	2%	2%	0%	0%
63	CORK AND WOOD MANUFACTURES OTHER T -	5,206	4,577	4,304	29%	25%	19%	-4%	-6%	2%	3%	3%	1%	0%
24	CORK AND WOOD -	3,745	3,194	3,110	4%	4%	5%	0%	1%	2%	2%	2%	0%	0%
51	ORGANIC CHEMICALS -	22,171	22,196	22,183	16%	14%	12%	-2%	-2%	1%	2%	2%	0%	0%
08	FEEDING STUFF FOR ANIMALS (NOT INCLUDI -	1,387	1,394	1,456	7%	6%	7%	-1%	1%	1%	1%	2%	0%	0%
83	TRAVEL GOODS, HANDBAGS AND SIMILAR C -	4,463	4,419	3,315	54%	42%	29%	-12%	-13%	1%	1%	1%	0%	0%
41	ANIMAL OILS AND FATS -	114	143	152	7%	2%	2%	-4%	-1%	1%	1%	1%	0%	0%
56	FERTILIZERS (EXPORTS INCLUDE GROUP 272; -	3,073	3,677	2,788	1%	0%	0%	-1%	0%	1%	1%	1%	1%	-1%
54	MEDICINAL AND PHARMACEUTICAL PRODUC -	49,408	53,723	61,039	3%	2%	2%	-1%	0%	1%	0%	0%	0%	0%
25	PULP AND WASTE PAPER -	1,505	1,805	1,198	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

In Figure 29 below, all NENC goods imports are classified by size (USD), and the Y-axis shows how fast imports of each commodity grew between 2018 and 2019. The X-axis shows how each commodity's share shifted over the period (as measured by percentage points). All commodities will fall within either the upper right or lower left quadrants. Pharmaceuticals stands out as the fastest growing commodity group. The medical and scientific instruments commodity group gained share at the fourth fastest rate. Together these commodity groups, which are associated with the healthcare industry, were already among the fastest growing prior to the pandemic.

Figure 29: Bubble chart of US NENC goods imports by major commodity, 2018 versus 2019



As discussed in the background section, the pandemic has disrupted the economy and trade. Given the unusual nature of the disruption, and the differential impact across geographies and over time, there are not any conclusions that can be made with high confidence over the long term.

There is much talk about reshoring of critical medical supplies and pharmaceuticals, but it is not clear how fast these complex supply chains can migrate production. Moreover, even in cases where manufacturing of critical devices can be brought to the US, components and materials would still need to be imported from elsewhere because there simply is not enough excess capacity to support such a move. And this appears to be the case across the board.

Prior to the trade war, there was excess capacity across the system. Anecdotally, we know that many firms already sourced goods and/or materials from manufacturing plants in different countries or contracted with suppliers in different countries, and when the tariffs were put in place, this allowed these firms to immediately shift a portion of their supply chains away from China. After the initial shift, longer term shifts will require more time to enact because it takes time to build out manufacturing capacity to accommodate additional shifts.

As discussed earlier, Mexico's share of NENC goods imports has been growing at an average rate of 32 bp per year. Immediately following China's accession to the WTO, Mexico's share contracted at an average rate of 40 bp per year. From our perspective, the most important impact of the pandemic is that it greatly reduced the probability that a resolution to the US-China trade war will be achieved in the short or medium term. And the continuation of the trade war will benefit Mexico's manufacturing base, resulting in Mexico's share potentially growing as fast over the next five years as it declined over the 2001 to 2005 period.

4.4 Modeling process overview

A top-down approach has been taken to forecast truck crossings at the Laredo border crossing under three scenarios:

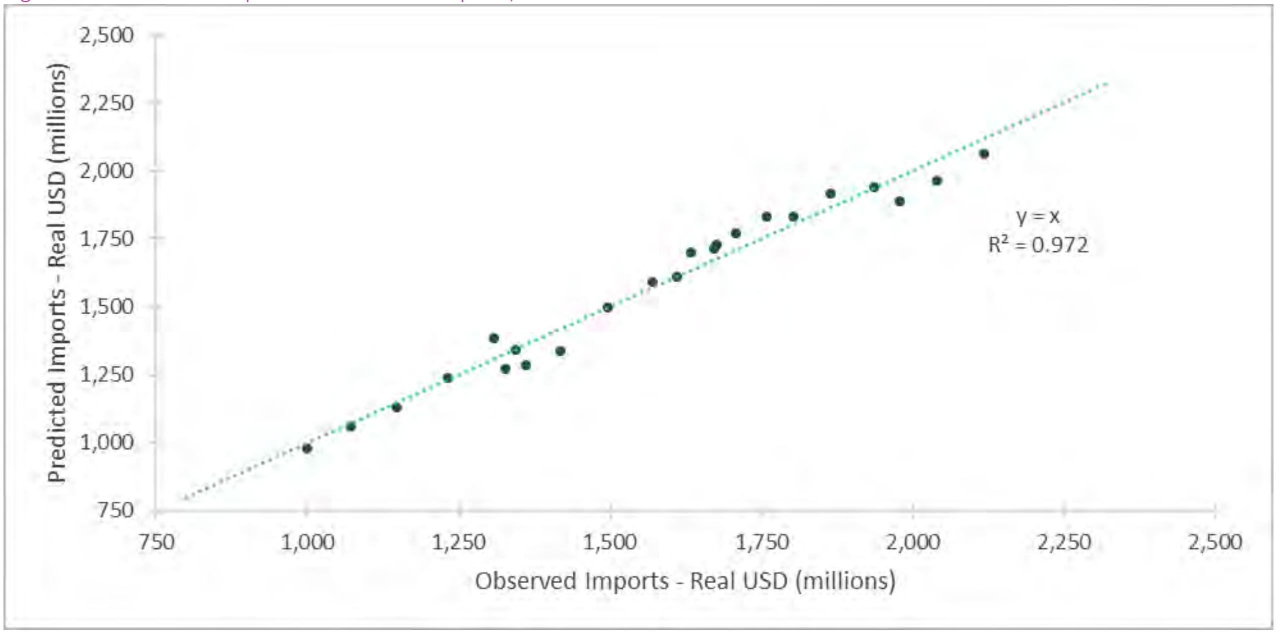
- *Baseline scenario: Real GDP surpasses 2019 level in in 2023 (meaning that quarterly real GDP recovers sometime in 2022), and Mexico's share of NENC goods imports continues to grow initially at a rate of 32 bp per year, but declining asymptotically over the forecast period.*
- *Accelerated recovery scenario: Real GDP surpasses 2019 level in 2022 (meaning that quarterly real GDP recovers sometime in 2021), and Mexico's share of NENC goods imports grows at 40 bp per year, declining asymptotically over time.*
- *Prolonged recovery scenario: Real GDP does not surpass 2019 level until 2024 (meaning that quarterly real GDP does not recover until sometime in 2023), and Mexico's share of NENC goods imports grows at the long-term growth rate of 25 bp per year, declining asymptotically.*

4.4.1 Econometric model of US NENC imports

It is important to consider the end goal when designing econometric models. When the goal of modeling is to *understand* historical relationships and the factors that influence them, it is appropriate to explore a wide range and combination of variables. When the goal is to *forecast* one or more dependent variables, however, the preferred model is one which uses a minimum number of independent variables to drive a high model fit.

After controlling for the effects of the global financial crisis, which impacted international trade to a much greater degree than real GDP, a regression of US real GDP to US real imports of NENC commodities results in a model that is able to explain/predict 97.2% of the observed imports of NENC goods. The strong fit of the model is demonstrated in the scatterplot below, which compares observed imports of NENC goods to those that were predicted.

Figure 30: Observed and predicted US NENC imports, 1996 to 2018



4.4.2 Monte Carlo simulation overview

Uncertainty is involved with every forecast, and we deal with uncertainty in two ways. First, we create scenarios. Second, we utilize Monte Carlo simulations to each of the scenarios. Monte Carlo simulation enables uncertainty to be quantified and endogenized to the model. Each of the independent variables driving the model is sampled from a defined parameter such that after a statistically significant number of iterations of the model are run (in this case, we applied 1,000 iterations), the distribution of values of the independent variables will match the distribution that was defined for each of the input variables.

By way of example, it is unrealistic to assume that real GDP growth in any particular year will be exactly what has been forecasted. So, rather than defining a single input for real GDP growth in any particular year, it is assumed that the probability distribution of real GDP growth rates is normal (i.e., follows a bell curve) with a standard deviation of *x.* The forecasted growth rate becomes the most likely outcome (i.e., it is the mean/median value of a normal distribution). Then each time the simulation is run, real GDP is randomly sampled such that by the 1,000th simulation, the distribution of real GDP growth rates will very closely match a normal distribution with a mean/median value equal to the forecasted variable and a standard deviation of *x*.

For each of the 1,000 simulations, each variable is randomly sampled, and the results of each simulation are summarized and presented as a distribution rather than as a single figure. This allows us to say, for instance, that there is an equal probability that the dependent variable will be above or below the mean/median, and that there is a X% chance of being less than *S* or more than *T*. This is helpful for risk analysis and other planning purposes.

Uncertainty in the following model inputs were addressed using Monte Carlo simulation:

- Estimates of 2020 metrics: Real GDP, total NENC goods imports, Mexico's share of NENC goods imports, and total commercial truck crossings over Laredo.
- For 2020 and beyond under each scenario:
    - *Real GDP growth rates and the associated Beta coefficient*
    - *Mexico's share of NENC goods imports*
    - *Rate of asymptotic annual decline in share gain/loss by commodity*

In the following section, we present the simulation results for each of the baseline scenario, accelerated recovery scenario, and the prolonged recovery scenario.

4.5 Truck crossing forecasts by scenario

4.5.1 Baseline Scenario

The data in the table below summarize the output of the Monte Carlo simulation under the baseline scenario.

Table 6: Monte Carlo output for the baseline scenario

	Real GDP				Laredo Crossings								
	Y/Y %	→	CAGRs	→	Y/Y %	→	CAGRs	→					
from	2019	2020	2021	2021	2019	2020	2021	2021	(000s)				
to	2020	2021	2026	2051	2020	2021	2026	2051	2019	2020	2021	2026	2051
Percentile 10%	-7.1%	3.3%	2.2%	1.6%	-8.6%	8.2%	4.5%	2.6%	4,697	4,292	4,645	5,801	10,025
Percentile 30%	-6.9%	3.3%	2.3%	1.6%	-8.6%	8.4%	4.8%	2.8%	4,697	4,292	4,654	5,873	10,687
Percentile 50%	-6.8%	3.4%	2.3%	1.7%	-8.6%	8.6%	4.9%	3.0%	4,697	4,292	4,663	5,928	11,186
Percentile 70%	-6.7%	3.4%	2.3%	1.7%	-8.6%	8.8%	5.1%	3.1%	4,697	4,292	4,670	5,981	11,685
Percentile 90%	-6.5%	3.5%	2.4%	1.7%	-8.6%	9.0%	5.3%	3.3%	4,697	4,292	4,680	6,056	12,445

In the table below, a forecast of all northbound and southbound commercial truck crossings over Laredo is presented by direction and state (loaded or empty).

Table 7: Baseline scenario forecast of northbound and southbound commercial truck crossings over Laredo

		2019	2020	2021	2022	2023	2024	2025	2026	2031	2041	2051
Northbound	10%	1,706	1,559	1,687	1,787	1,877	1,955	2,035	2,107	2,425	3,036	3,641
Loaded	30%	1,706	1,559	1,690	1,794	1,888	1,971	2,056	2,133	2,481	3,172	3,882
	50%	1,706	1,559	1,693	1,800	1,898	1,983	2,072	2,153	2,523	3,273	4,063
	70%	1,706	1,559	1,696	1,806	1,906	1,995	2,088	2,172	2,563	3,373	4,244
	90%	1,706	1,559	1,700	1,813	1,918	2,012	2,110	2,199	2,622	3,521	4,520
Northbound	10%	659	602	651	690	725	755	786	813	936	1,172	1,406
Empty	30%	659	602	653	693	729	761	794	824	958	1,225	1,499
	50%	659	602	654	695	733	766	800	831	974	1,264	1,568
	70%	659	602	655	697	736	770	806	839	990	1,302	1,638
	90%	659	602	656	700	740	777	814	849	1,012	1,359	1,745
Southbound	10%	2,333	2,131	2,307	2,444	2,566	2,673	2,783	2,881	3,316	4,152	4,978
	30%	2,333	2,131	2,311	2,453	2,582	2,695	2,812	2,917	3,392	4,337	5,307
	50%	2,333	2,131	2,315	2,462	2,594	2,712	2,833	2,944	3,449	4,475	5,555
	70%	2,333	2,131	2,319	2,469	2,606	2,728	2,855	2,970	3,505	4,612	5,803
	90%	2,333	2,131	2,324	2,479	2,622	2,750	2,884	3,007	3,584	4,814	6,180
Grand	10%	4,697	4,292	4,645	4,921	5,168	5,383	5,604	5,801	6,677	8,361	10,025
Total	30%	4,697	4,292	4,654	4,941	5,199	5,427	5,662	5,873	6,831	8,734	10,687
	50%	4,697	4,292	4,663	4,957	5,225	5,460	5,706	5,928	6,945	9,012	11,186
	70%	4,697	4,292	4,670	4,972	5,248	5,493	5,748	5,981	7,058	9,287	11,685
	90%	4,697	4,292	4,680	4,993	5,281	5,539	5,809	6,056	7,218	9,694	12,445

4.5.2 Accelerated Recovery Scenario

The data in the tables below reflects an accelerated economic recovery as well as a situation in which Mexico gains share at an initial rate of 40 bp per year (declining asymptotically to zero).

Table 8: Monte Carlo output for the accelerated recovery scenario

Percentile	Real GDP				Laredo Crossings								
	Y/Y %	→	CAGRs	→	Y/Y %	→	CAGRs	→					
from	2019	2020	2021	2021	2019	2020	2021	2021	(000s)				
to	2020	2021	2026	2051	2020	2021	2026	2051	2019	2020	2021	2026	2051
10%	-6.1%	3.9%	2.2%	1.6%	-6.0%	9.1%	4.8%	2.7%	4,697	4,416	4,819	6,094	10,771
30%	-5.9%	3.9%	2.3%	1.6%	-6.0%	9.3%	5.0%	2.9%	4,697	4,416	4,829	6,170	11,472
50%	-5.8%	3.9%	2.3%	1.7%	-6.0%	9.5%	5.2%	3.1%	4,697	4,416	4,836	6,223	11,990
70%	-5.7%	4.0%	2.3%	1.7%	-6.0%	9.7%	5.3%	3.2%	4,697	4,416	4,843	6,277	12,536
90%	-5.5%	4.1%	2.4%	1.7%	-6.0%	9.9%	5.5%	3.4%	4,697	4,416	4,853	6,354	13,336

In the table below, a forecast of all northbound and southbound commercial truck crossings over Laredo is presented by direction and state (loaded or empty).

Table 9: Accelerated recovery scenario forecast of northbound and southbound commercial truck crossings over Laredo

		2019	2020	2021	2022	2023	2024	2025	2026	2031	2041	2051
Northbound	10%	1,706	1,604	1,750	1,859	1,956	2,043	2,133	2,213	2,569	3,247	3,912
Loaded	30%	1,706	1,604	1,754	1,866	1,968	2,060	2,155	2,241	2,628	3,392	4,167
	50%	1,706	1,604	1,757	1,872	1,977	2,072	2,170	2,260	2,672	3,497	4,355
	70%	1,706	1,604	1,759	1,877	1,985	2,084	2,186	2,280	2,714	3,605	4,553
	90%	1,706	1,604	1,763	1,885	1,997	2,101	2,209	2,308	2,774	3,761	4,843
Northbound	10%	659	619	676	718	755	789	823	854	992	1,254	1,510
Empty	30%	659	619	677	721	760	795	832	865	1,015	1,310	1,609
	50%	659	619	678	723	763	800	838	873	1,031	1,350	1,681
	70%	659	619	679	725	766	804	844	880	1,048	1,392	1,758
	90%	659	619	681	728	771	811	853	891	1,071	1,452	1,870
Southbound	10%	2,333	2,193	2,393	2,541	2,674	2,793	2,916	3,026	3,512	4,440	5,349
	30%	2,333	2,193	2,398	2,552	2,691	2,816	2,946	3,064	3,594	4,638	5,697
	50%	2,333	2,193	2,402	2,560	2,703	2,833	2,967	3,090	3,653	4,781	5,954
	70%	2,333	2,193	2,405	2,567	2,714	2,849	2,989	3,117	3,711	4,928	6,225
	90%	2,333	2,193	2,410	2,577	2,731	2,872	3,020	3,155	3,793	5,142	6,622
Grand	10%	4,697	4,416	4,819	5,118	5,385	5,625	5,872	6,094	7,073	8,940	10,771
Total	30%	4,697	4,416	4,829	5,139	5,419	5,671	5,933	6,170	7,237	9,339	11,472
	50%	4,697	4,416	4,836	5,155	5,443	5,704	5,976	6,223	7,356	9,628	11,990
	70%	4,697	4,416	4,843	5,169	5,466	5,737	6,018	6,277	7,472	9,925	12,536
	90%	4,697	4,416	4,853	5,190	5,499	5,784	6,081	6,354	7,638	10,354	13,336

4.5.3 Accelerated Recovery Scenario

The data in the tables below reflects an accelerated economic recovery as well as a situation in which Mexico gains share at an initial rate of 25 bp per year (declining asymptotically to zero).

Table 10: Monte Carlo output for the prolonged recovery scenario

40

	Real GDP Y/Y % →		CAGRs →		Laredo Crossings Y/Y % →		CAGRs →		(000s)				
from	2019	2020	2021	2021	2019	2020	2021	2021					
to	2020	2021	2026	2051	2020	2021	2026	2051	2019	2020	2021	2026	2051
Percentile 10%	-8.1%	2.3%	2.3%	1.6%	-11.3%	6.9%	4.5%	2.5%	4,697	4,167	4,453	5,541	9,398
30%	-7.9%	2.3%	2.4%	1.7%	-11.3%	7.1%	4.7%	2.7%	4,697	4,167	4,464	5,613	10,028
50%	-7.8%	2.4%	2.4%	1.7%	-11.3%	7.3%	4.8%	2.9%	4,697	4,167	4,471	5,663	10,490
70%	-7.7%	2.4%	2.4%	1.7%	-11.3%	7.4%	5.0%	3.0%	4,697	4,167	4,478	5,714	10,966
90%	-7.5%	2.4%	2.4%	1.7%	-11.3%	7.7%	5.2%	3.2%	4,697	4,167	4,488	5,791	11,691

In the table below, a forecast of all northbound and southbound commercial truck crossings over Laredo is presented by direction and state (loaded or empty).

Table 11: Prolonged recovery scenario forecast of northbound and southbound commercial truck crossings over Laredo

		2019	2020	2021	2022	2023	2024	2025	2026	2031	2041	2051
Northbound	10%	1,706	1,514	1,617	1,711	1,799	1,873	1,947	2,012	2,298	2,856	3,413
Loaded	30%	1,706	1,514	1,621	1,719	1,812	1,889	1,968	2,039	2,354	2,986	3,642
	50%	1,706	1,514	1,624	1,724	1,820	1,900	1,983	2,057	2,392	3,080	3,810
	70%	1,706	1,514	1,626	1,729	1,828	1,912	1,998	2,075	2,432	3,176	3,983
	90%	1,706	1,514	1,630	1,737	1,841	1,929	2,020	2,103	2,489	3,318	4,246
Northbound	10%	659	584	624	661	695	723	752	777	887	1,103	1,318
Empty	30%	659	584	626	664	699	729	760	787	909	1,153	1,406
	50%	659	584	627	666	703	734	765	794	924	1,189	1,471
	70%	659	584	628	668	706	738	771	801	939	1,226	1,538
	90%	659	584	629	671	711	745	780	812	961	1,281	1,639
Southbound	10%	2,333	2,069	2,211	2,340	2,460	2,561	2,663	2,751	3,142	3,905	4,667
	30%	2,333	2,069	2,217	2,350	2,477	2,583	2,691	2,788	3,218	4,083	4,980
	50%	2,333	2,069	2,220	2,357	2,488	2,598	2,711	2,812	3,271	4,211	5,209
	70%	2,333	2,069	2,224	2,365	2,499	2,614	2,732	2,838	3,325	4,342	5,445
	90%	2,333	2,069	2,229	2,376	2,517	2,637	2,762	2,876	3,403	4,537	5,806
Grand	10%	4,697	4,167	4,453	4,712	4,954	5,156	5,362	5,541	6,327	7,863	9,398
Total	30%	4,697	4,167	4,464	4,733	4,988	5,201	5,419	5,613	6,480	8,222	10,028
	50%	4,697	4,167	4,471	4,747	5,010	5,231	5,459	5,663	6,587	8,481	10,490
	70%	4,697	4,167	4,478	4,762	5,033	5,263	5,501	5,714	6,695	8,743	10,966
	90%	4,697	4,167	4,488	4,784	5,068	5,311	5,563	5,791	6,853	9,137	11,691

Appendix A

Major US-Mexico trade corridors

Laredo is the busiest commercial LPOE along the US-Mexico border and one of the most important gateways for US trade. The vast majority of US-Mexico trade is transported by truck. Since the passage of the North American Free Trade Agreement (NAFTA) in 1994, truck traffic has skyrocketed, allowing Laredo to compete with ocean ports, such as Los Angeles, that had traditionally occupied the top rankings as gateways for overall US trade.[13] The majority of northbound and southbound truck cross-border traffic travels along Texas's interstates, given the connectivity and accessibility they provide to the commercial border crossings with Mexico and the transportation infrastructure facilitating US-Mexico trade.

Texas's transportation infrastructure serving the movement of cross-border freight through Laredo includes the following major trade corridors: Ports to Plains Corridor, I-35 NAFTA Corridor, I-69 Corridor, and I-10 Western Corridor, among the most relevant for Laredo. The importance of Laredo as a commercial gateway for US-Mexico trade can also be observed on the Mexican side: Federal Highway 85, Federal Highway 40/40D (Mazatlan-Durango-Torreon-Saltillo-Monterrey), Federal Highway 57, Federal Highway 80, and Federal Highway 37 among the most relevant. The major US-Mexico trade corridors are discussed in more detail next.

Ports to Plains Corridor

The Ports-to-Plains Corridor, formerly known as National Highway System High Priority Corridor 38, is a planned, multimodal transportation corridor including a multi-lane divided highway that will facilitate the efficient transportation of goods and services from Mexico, through Laredo, West Texas, New Mexico, Colorado, and Oklahoma, and ultimately on into Canada and the Pacific Northwest. From Laredo traveling westbound, this corridor connects to Eagle Pass and then to Del Rio by US 277. From Del Rio, the corridor travels north via US 277 to San Angelo, Texas, and then via US 87 to Lubbock, Texas, where it joins with I-27, connecting to Amarillo. The corridor then links on to Denver via US 287. Northbound, the corridor connects to South Dakota, Montana, Alberta, and Saskatchewan.

I-35 NAFTA Corridor (US)

The I-35 Corridor, also known as the NAFTA Corridor, is a major Interstate Highway that stretches from Laredo, near the Mexican border, to Duluth, Minnesota near the Canadian border. I-35 connects three of the four largest cities in Texas—San Antonio, Austin, and Dallas-Fort Worth—before continuing north to other large metropolitan regions such as Oklahoma City, Wichita, Kansas City, and Des Moines before ending in Duluth, Minnesota. I-35 also links to I-29 in Kansas City, which connects to the US–Canada border near Pembina, North Dakota, where it connects with Manitoba Highway 75 in Canada. This corridor serves the Midwest manufacturing centers.

I-69 Corridor (US)

The I-69 Corridor is a planned, multimodal transportation corridor currently consisting of ten disjointed parts that connects Laredo (via US 59 respectively) and the Lower Rio Grande Valley (via US 281/US 77 respectively) to Victoria, Texas, north of Corpus Christi. The I-69 Corridor that connects the Lower Rio Grande Valley consists of two routes that run parallel to each other: I-69 (US 281) and I-69E (US 77). US 281

[13] Port Laredo once again the nation's No. 1 gateway for international trade. FreightWaves. April 7, 2020 https://www.freightwaves.com/news/port-laredo-once-again-the-nations-no-1-gateway-for-international-trade

connects to the Pharr–Reynosa LPOE, approximately 25 miles west of US 77 which connects to the Brownsville–Matamoros LPOE, both of which process commercial traffic. Traveling northbound, these corridors merge into US-59 at Victoria, Texas and continue to Houston (as I-69). From Houston the corridor continues northbound along US 59 to the state limits at Texarkana, and then connecting to Memphis, Indianapolis, and ultimately to the U.S–Canada border at Port Huron, Michigan.

I-10 Western Corridor (US)

Although I-10 does not connect directly to Laredo, most, if not all, commercial traffic traveling between Laredo and the western part of the US is served by I-10. This corridor connects Laredo with major cities such as San Antonio, El Paso, Tucson, Phoenix, and Los Angeles to the west and Houston, Baton Rouge, New Orleans, Mobile, Tallahassee, and Jacksonville to the east. El Paso is also linked to the north via I-25 to Albuquerque and Denver, which are routes also often served by the Laredo LPOE.

Federal Highway 85 (Mexico)

Federal Highway 85 (Carretera Federal 85) connects Mexico City and central Mexico with the Laredo, Texas–Nuevo Laredo, Tamaulipas US–Mexico border. It can be deemed essentially a southern continuation of US I-35. Federal Highway 85 offers an alternate toll route (autopista) named 85D that connects Nuevo Laredo with Monterrey (136 miles). Toll roads in Mexico have wider lanes, offer more direct routes, have higher speed limits, and are maintained on a more continuous matter. This is one of, if not, the most important trade corridor in Mexico, since it consolidates traffic from 16 other major highways that also handle significant truck traffic. Nonetheless, truck traffic and general congestion is a common problem near the Monterrey metropolitan region.

Federal Highway 40 (Mazatlan-Durango-Torreon-Saltillo-Monterrey) (Mexico)

Federal Highway 40 (Carretera Federal 40) connects Reynosa, Tamaulipas, just west of the Port of Brownsville, Texas with Villa Unión, Sinaloa, near the Port of Mazatlán on the Pacific Coast. The state of Sinaloa has two maritime ports: the port of Mazatlán and the Port of Topolobampo. This highway is also called the Interoceanic Highway (Carretera Interoceánica) and the Northern Economic Corridor (Corredor Económico del Norte). Federal Highway 40 provides interoceanic access to the states of Sonora, Sinaloa, Durango, Coahuila, Chihuahua, Nuevo Leon, Tamaulipas, and Zacatecas, as well as connectivity to the LPOEs in the US–Mexico border, particularly those in Texas.

This highway includes the Autopista Durango-Mazatlán (40D), which opened to traffic in October 2013, becoming the only high-performance east-west connection between the Pacific Coast, near Mazatlan, and the Texas border. This 159-mile express highway provides a more direct route through the Sierra Madre Occidental via 63 tunnels and 115 bridges, connecting the main Mexican agricultural zones with Laredo and the Rio Grande Valley in Texas, thereby increasing its competitiveness to attract commercial traffic from the Pacific Coast. With this autopista, the Port of Mazatlan has become the shortest landbridge connecting US and Mexican ports on the Pacific Coast with consumer markets in the US (e.g. the shortest trucking route from Los Angeles to New York City is 2,790 miles vis-à-vis 2,580 from Mazatlan to New York City). This highway connects to Laredo via Federal Highway 85 at Monterrey.

Federal Highway 57 (Mexico)

Federal Highway 57 (Carretera Federal 57) highway connects Mexico City with the Piedras Negras–Eagle Pass border. This road forms the backbone of the road network in Mexico, in the north-south direction, linking many major highways in the country and providing connectivity to highways in the east-west direction. The highway connects major industrial clusters in the states of Mexico and Hidalgo, with states in the prosperous Bajio region such as Guanajuato and Querétaro, and other northern manufacturing clusters of national significance such as San Luis Potosí and Monterrey until ultimately reaching the US–Mexico border. Eight separate tolled segments exist (57D) between Mexico City and the state of Coahuila, most in the form of bypasses of metropolitan regions.

Federal Highway 80 (Mexico)

Federal Highway 80 (Carretera Federal 80) connects Tampico, Tamaulipas in the Gulf to San Patricio, Jalisco, which in turn provides access to the Port of Manzanillo. Federal Highway 80D is the designation for toll highways paralleling Mexican Federal Highway 80. There are two such roads, one between Zapotlanejo and Lagos de Moreno, Jalisco and the other connecting Lagos de Moreno to San Luis Potosí City. Combined, these two corridors provide the routes that serve as the main corridors for imports (originated in Asia and the Middle East-Indian Subcontinent) entering via the Port of Manzanillo, and destined to hinterlands in northern Mexico and primarily in the US. This highway connects to Federal Highway 57 in San Luis Potosi.

Federal Highway 37 (Mexico)

Federal Highway 37 (Carretera Federal 37) runs from Playa Azul, Michoacán near the Port of Lazaro Cardenas to its northern point at Villa de Zaragoza, near San Luis Potosí. It crosses Federal Highway 14 at Uruapan, Michoacán. Federal Highway 37D is a Mexican toll highway in Michoacán and Guerrero that connects Highway 14D from Uruapan to the Port of Lázaro Cárdenas. Highway 14D from Pátzcuaro southwest, along with the entirety of Highway 37D, are together referred to as the Autopista Siglo XXI. Traveling northbound, these corridors provide connectivity between the Port of Lazaro Cardenas and major industrial cities in the Bajio region, such as Guanajuato and San Luis Potosi.

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