Network Effect of Dynamic Routing of Commercial Traffic Through Ports of Entry

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NETWORK EFFECT OF DYNAMIC ROUTING OF COMMERCIAL TRAFFIC THROUGH PORTS OF ENTRY

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Dean of the Graduate School
Dedication

Dedico este estudio a mis hijos, esposa, y padres. Ellos son la razón por lo que hago todo. I dedicate this study to my children, wife, and parents. They are the reason for everything that I do.
NETWORK EFFECT OF DYNAMIC ROUTING OF COMMERCIAL TRAFFIC THROUGH PORTS OF ENTRY

by

ALFREDO SÁNCHEZ, B.S.

THESIS

Presented to the Faculty of the Graduate School of
The University of Texas at El Paso
in Partial Fulfillment
of the Requirements
for the Degree of

MASTER OF SCIENCE

Department of Civil Engineering
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I extend my sincere appreciation to all my thesis advisors for their expertise and patience in greatly increasing my knowledge of the subject matter: Dr. Ruey Long “Kelvin” Cheu, Dr. Yi-Chang Chiu, and Dr. Salvador Hernandez. I also thank Mr. Jeffrey Shelton who greatly assisted me in furthering my understanding of the processes involved. Lastly, I thank Mr. Swapnil Samant and Mr. Eric Nava for their assistance in furthering my understanding of DynusT traffic simulation software.
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Chapter 1: INTRODUCTION

1.1 Background

The El Paso, TX/Juárez, Chihuahua, Mexico region is made up of more than twenty municipalities (cities, towns, and villages) that have access to a total of six international Ports of Entry (POE) between the United States and Mexico. Due to the area’s population and number of trans-border crossings growth, the delay to travel northbound from Mexico into the U.S. has also increased. This is causing increased congestion at the POEs and at the areas adjacent to the POEs. Increased security measures at the POEs due to national security are also a major factor in this increased congestion. The movement of people and goods is being affected as well air quality.

In 2004 (the most recent year for which data is available), nearly $43 billion worth of goods crossed between El Paso’s POEs, $18.3 billion southbound and $24.4 billion northbound (Wilbur Smith Associates, 2006). The trans-border movement of goods is a major aspect of the region’s economic well-being. The El Paso/Juárez freight movement is driven by Juárez maquiladora industry. A maquiladora is an assembly plant in Mexico, especially along the border between the U.S. and Mexico, to which foreign materials and parts are shipped and from which the finished product is returned to the original market (The Free Dictionary/maquiladora, 2008). A large part of El Paso’s economy is driven by the need for efficient freight mobility at the POEs and beyond.

Local officials have looked at both types of POE traffic, passenger and commercial vehicles, to determine POE deficiencies, sources of delay, bottlenecks, and possible solutions. Because of the economic importance, greater emphasis was placed on studying commercial traffic in more detail. This included POE freight surveys that identified information such as vehicle type, commodity type, and origin destination points.
In order to maintain and try to improve El Paso’s economy related to trans-border traffic (passenger and commercial traffic), various types of improvements are being considered:

1. Policy changes
2. Capacity improvements to POE facilities
3. Improvements to transportation infrastructure (both sides of the border)
4. Intelligent Transportation Systems (ITS)
5. Transportation systems that can move cargo instead of using commercial trucks
6. Additional POE(s)

1.2 Objective

The primary objective of this research is to determine the bottlenecks, if any, in the vicinity of POE’s in El Paso, will be caused by shifting the northbound commercial border crossing trips from the Bridge of the Americas (BOTA) POE to Ysleta-Zaragoza and Santa Teresa POEs. That is, the proposed scenario to be studied is the closing of BOTA to commercial traffic and having the Ysleta-Zaragoza POE become the only access to commercial traffic within the City of El Paso, supplementary by the Santa Teresa POE. Computer traffic simulation will be used determine the various traffic patterns, in year 2015 (base model) and year 2035. To achieve the primary objective, the secondary objective is to develop a traffic model that incorporates a shift of commercial traffic and determine how the El Paso transportation network is affected.
Chapter 2: PORTS OF ENTRY IN THE EL PASO, TX REGION

The City of El Paso, TX and more than fifteen neighboring municipalities (cities, towns, and villages) have access to a total of six international Ports of Entry (POE) between the United States and Mexico. The following is a listing of the POE’s (see Figure 2.1):

1. Santa Teresa Port – 170 Pete Domenici Hwy, Santa Teresa, NM (Ports of Entry - Santa Teresa, 2010)
3. Good Neighbor Port (Stanton St. Bridge), 1090 S. Mesa
5. Ysleta-Zaragoza Port, 797 S. Zaragoza Rd.
6. Fabens-Caseta Port – 18051 Island Guadalupe, Fabens, TX (Ports of Entry - Fabens, 2010)

Figure 2.1: Ports of Entry Location Map (Source: Google, Inc.)
Tables 2.1 and 2.2 show the estimated population for 2005 and projected for 2020 (City of El Paso, 2005). The City of El Paso is the 5th largest city in Texas and 23rd largest city in the United States. The City of Juárez is the 5th largest city in Mexico. Due to the recent turmoil in Juárez, the Instituto Municipal de Investigación y Planeación (IMIP), the City of Juárez planning agency, has not provided reasonable estimates as to how many people have left the area (City Stats, 2010).

Table 2.1: Estimated Population to January 1, 2005

<table>
<thead>
<tr>
<th>Location</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of El Paso, Texas</td>
<td>604,156</td>
</tr>
<tr>
<td>Remainder of El Paso County</td>
<td>125,635</td>
</tr>
<tr>
<td>Total for County of El Paso</td>
<td>729,791</td>
</tr>
<tr>
<td>Ciudad Juárez, Mexico</td>
<td>1,368,175</td>
</tr>
<tr>
<td>Total Metro</td>
<td>2,097,966</td>
</tr>
</tbody>
</table>

Table 2.2: Projected Population to 2020

<table>
<thead>
<tr>
<th>Location</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of El Paso, Texas</td>
<td>767,750</td>
</tr>
<tr>
<td>Remainder of El Paso County</td>
<td>169,497</td>
</tr>
<tr>
<td>Ciudad Juárez, Mexico</td>
<td>2,458,789</td>
</tr>
<tr>
<td>Total Metro</td>
<td>3,396,036</td>
</tr>
</tbody>
</table>

These POE’s provide a vital link to the more that 2 million people between the two countries and the communities on both sides of the border. These communities have several critical ties: family, education, and economy. These ties involve a daily commute across a POE for many.
2.1 Ports of Entry Current Operations

2.1.1 Bridge of the Americas (BOTA) Port

The BOTA POE provides access to commercial, passenger, and pedestrian traffic. This POE also provides the following services: Customs & Border Protection (Railroad and Canine), Immigration & Citizen, United States Department of Agriculture (USDA), and Food and Drug Administration (FDA) (Ports of Entry in El Paso, TX, 2010). The passenger and pedestrian traffic have access to this POE 24 hours, seven days a week. Commercial traffic only has access from 6:00 a.m. to 6:00 p.m. Monday through Friday and from 6:00 a.m. to 2:00 p.m. on Saturday. Commercial traffic shifts to the Ysleta-Zaragoza POE after this POE closes each evening. BOTA is the only toll-free POE within the El Paso city limits. This POE may be accessed through IH-110 or US 62 (E. Paisano Dr.). BOTA provides access to El Paso major thoroughfares: US 54 (via IH-110), IH-10 (via IH-110 & US 54), and eastbound LP 375 (via US 62 & US 54 frontage road) (see Figure 2.2).

![BOTA POE Location Map](Source: Google, Inc.)
The BOTA POE consists of four separate bridge structures, two bridges for northbound (NB) traffic and two for southbound (SB) traffic. Two bridges provide four lanes each for passenger vehicles, and the other two bridges provide two lanes for commercial traffic and one sidewalk for pedestrians each. The bridge length is approximately 506 ft. This POE has fourteen inspection stations for passenger vehicles and six inspection stations for commercial vehicles on the U.S. side.

Table 2.3 shows the annual average daily traffic (AADT counts for IH-110 in vicinity of the BOTA POE (El Paso District Highway Traffic Maps, 2003-2009). Figure 2.3 shows the count location on IH 110 for this AADT determination. The AADT shows a trend, except for 2006, of decreased vehicle usage between 2003 and 2009. In 2009, a general decrease in U.S. vehicle usage of all POE’s was to be expected due to the increased violence in the neighboring City of Juárez, Chihuahua, Mexico. Table 2.4 shows the vehicle and pedestrian counts from 2001 to 2009 (counts for 2010 have not been compiled at the time of this study) (El Paso MPO, Northbound Border Crossings: From Juarez to El Paso, 2010). There are some variations among the various modes but the general trend for the passenger vehicles or privately owned vehicles (POV) is a decline.

Table 2.3: AADT at IH-110, 2003-2009

<table>
<thead>
<tr>
<th>AADT Location</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>IH-110</td>
<td>31,000</td>
<td>34,000</td>
<td>32,000</td>
<td>84,000</td>
<td>24,000</td>
<td>25,000</td>
<td>17,300</td>
</tr>
</tbody>
</table>
Figure 2.3: Traffic Count Location, BOTA POE

Table 2.4: Vehicle and Pedestrian Counts for BOTA, 2001-2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Trucks</th>
<th>Buses</th>
<th>Privately Owned Vehicles</th>
<th>Pedestrians</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>334,918</td>
<td>8,415</td>
<td>7,019,000</td>
<td>769,217</td>
</tr>
<tr>
<td>2002</td>
<td>375,303</td>
<td>12,667</td>
<td>4,749,474</td>
<td>1,207,690</td>
</tr>
<tr>
<td>2003</td>
<td>345,896</td>
<td>13,351</td>
<td>4,679,772</td>
<td>1,021,293</td>
</tr>
<tr>
<td>2004</td>
<td>382,662</td>
<td>10,904</td>
<td>6,124,893</td>
<td>784,099</td>
</tr>
<tr>
<td>2005</td>
<td>393,442</td>
<td>12,969</td>
<td>8,065,901</td>
<td>612,021</td>
</tr>
<tr>
<td>2006</td>
<td>387,281</td>
<td>12,891</td>
<td>7,686,204</td>
<td>586,520</td>
</tr>
<tr>
<td>2007</td>
<td>398,483</td>
<td>13,923</td>
<td>5,634,864</td>
<td>736,978</td>
</tr>
<tr>
<td>2008</td>
<td>414,556</td>
<td>14,984</td>
<td>6,234,097</td>
<td>809,578</td>
</tr>
<tr>
<td>2009</td>
<td>316,731</td>
<td>11,918</td>
<td>4,338,255</td>
<td>902,311</td>
</tr>
</tbody>
</table>
2.1.2 Ysleta-Zaragoza Port

The Ysleta-Zaragoza POE provides access to commercial, passenger, and pedestrian traffic for a toll. This POE also provides the following services: Customs & Border Protection (Airport Support and Canine), Immigration & Citizen, and Dedicated Commuter Lane Enrollment Office (express entry to U.S.). The passenger and pedestrian traffic have access to this POE 24 hours, seven days a week. Commercial traffic only has access from 6:00 a.m. to 12:00 midnight Monday through Friday and from 8:00 a.m. to 4:00 p.m. on Saturday. Commercial traffic shifts to this POE after the BOTA POE closes access to commercial traffic in the evenings. The Ysleta-Zaragoza POE may be accessed through S. Zaragoza Rd. and LP 375. This POE provides access to El Paso major thoroughfares: US 54 (via eastbound LP 375) and IH-10 (via NB LP 375)(see Figure 2.3).

The Ysleta-Zaragoza POE consists of two separate bridge structures. One bridge is for NB and SB passenger and pedestrian traffic. The other bridge is for NB and SB commercial traffic. The bridge length is approximately 804 ft. This POE has twelve passenger traffic inspection stations and eight commercial traffic inspection stations on the U.S. side.
Table 2.5 shows the AADT counts for LP 375 in vicinity of the Ysleta-Zaragoza POE. Figure 2.5 shows the count location on LP 375 for this AADT determination. The AADT shows a trend of increased vehicle usage between 2003 and 2008. In 2009, a general decrease in U.S. vehicle usage of all POE’s was to be expected due to the increased violence in the neighboring City of Juárez, Chihuahua, Mexico. Table 2.6 shows the vehicle and pedestrian counts from 2001 to 2009. The number of commercial trucks showed growth in earlier years but has declined in the last four years. The number of POVs has fluctuated within this time period. After a decline in pedestrian numbers in earlier years, pedestrian numbers have been growing steadily during the last 5 years.

Table 2.5: AADT at LP 375, 2003-2009

<table>
<thead>
<tr>
<th>AADT Location</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>LP 375</td>
<td>32,000</td>
<td>34,000</td>
<td>34,660</td>
<td>30,000</td>
<td>56,000</td>
<td>58,000</td>
<td>42,000</td>
</tr>
</tbody>
</table>
Figure 2.5: Traffic Count Location, Ysleta-Zaragoza POE

Table 2.6: Vehicle and Pedestrian Counts for Ysleta-Zaragoza POE, 2001-2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Trucks</th>
<th>Buses</th>
<th>Privately Owned Vehicles</th>
<th>Pedestrians</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>331,082</td>
<td>263</td>
<td>3,936,633</td>
<td>503,898</td>
</tr>
<tr>
<td>2002</td>
<td>328,956</td>
<td>341</td>
<td>3,552,869</td>
<td>841,173</td>
</tr>
<tr>
<td>2003</td>
<td>313,737</td>
<td>541</td>
<td>3,370,044</td>
<td>797,457</td>
</tr>
<tr>
<td>2004</td>
<td>336,883</td>
<td>617</td>
<td>3,330,288</td>
<td>748,033</td>
</tr>
<tr>
<td>2005</td>
<td>347,212</td>
<td>712</td>
<td>3,200,246</td>
<td>682,259</td>
</tr>
<tr>
<td>2006</td>
<td>387,360</td>
<td>438</td>
<td>3,319,723</td>
<td>724,766</td>
</tr>
<tr>
<td>2007</td>
<td>383,886</td>
<td>796</td>
<td>3,575,134</td>
<td>822,354</td>
</tr>
<tr>
<td>2008</td>
<td>344,300</td>
<td>276</td>
<td>3,527,551</td>
<td>980,574</td>
</tr>
<tr>
<td>2009</td>
<td>315,947</td>
<td>82</td>
<td>2,395,551</td>
<td>1,203,861</td>
</tr>
</tbody>
</table>
2.1.3 Paso del Norte Port

The Paso del Norte POE provides access to NB passenger traffic for a toll. SB passenger traffic uses the Good Neighbor POE which is approximately 1310 ft east of the Paso del Norte POE. This POE also provides NB and SB pedestrian traffic access for a fare. This POE also provides the following services: Customs & Border Protection (Canine) and Immigration & Citizen Services. The passenger and pedestrian traffic have access to this POE 24 hours, seven days a week. This POE is located in downtown El Paso. The Paso del Norte POE provides access to El Paso major thoroughfares: LP 375 (via Oregon St.) and IH-10 (via S. El Paso St and Oregon St.)(see Figure 2.4).

The Paso del Norte Bridge is a four-lane structure, approximately 982 ft in length. The POEs traffic exits to El Paso St., a one-way street consisting of three 12 ft lanes with 6 ft shoulders. This POE has ten passenger vehicle inspection stations on the U.S. side.

Figure 2.6: Paso del Norte and Good Neighbor POEs Location Map (Source: Google, Inc.)
Table 2.5 shows the AADT counts for US 62/85 and LP 375 in vicinity of the Paso del Norte POE. Figure 2.7 shows the count locations on US 62/85 and LP 375 for these AADT determinations. The AADT shows a trend of increased vehicle usage between 2003 and 2008. In 2009, a general decrease in U.S. vehicle usage of all POE’s was to be expected due to the increased violence in the neighboring City of Juárez, Chihuahua, Mexico. Table 2.8 shows the vehicle and pedestrian counts from 2001 to 2009. Since 2003, the number of POVs has steadily declined. There have been some fluctuations in pedestrian counts but the general trend has been a decline.

Table 2.7: AADT at US 62/85 and LP 375, 2003-2009

<table>
<thead>
<tr>
<th>AADT Location</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>US 62/85</td>
<td>11,200</td>
<td>10,200</td>
<td>10,400</td>
<td>11,000</td>
<td>11,200</td>
<td>11,700</td>
<td>11,700</td>
</tr>
<tr>
<td>LP 375</td>
<td>11,800</td>
<td>10,800</td>
<td>12,010</td>
<td>13,000</td>
<td>7,800</td>
<td>12,100</td>
<td>11,500</td>
</tr>
</tbody>
</table>

Figure 2.7: Traffic Count Location, Paso del Norte and Good Neighbor POEs
Table 2.8: Vehicle and Pedestrian Counts for Paso del Norte Port, 2001-2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Trucks</th>
<th>Buses</th>
<th>Privately Owned Vehicles</th>
<th>Pedestrians</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0</td>
<td>1,878</td>
<td>4,631,951</td>
<td>5,928,055</td>
</tr>
<tr>
<td>2002</td>
<td>0</td>
<td>19,303</td>
<td>3,371,252</td>
<td>7,551,991</td>
</tr>
<tr>
<td>2003</td>
<td>0</td>
<td>16,138</td>
<td>4,173,265</td>
<td>7,080,194</td>
</tr>
<tr>
<td>2004</td>
<td>0</td>
<td>6,010</td>
<td>3,909,771</td>
<td>6,918,970</td>
</tr>
<tr>
<td>2005</td>
<td>0</td>
<td>2,176</td>
<td>3,447,088</td>
<td>6,344,521</td>
</tr>
<tr>
<td>2006</td>
<td>0</td>
<td>1,534</td>
<td>3,393,000</td>
<td>6,188,488</td>
</tr>
<tr>
<td>2007</td>
<td>0</td>
<td>3,169</td>
<td>2,997,897</td>
<td>6,846,500</td>
</tr>
<tr>
<td>2008</td>
<td>0</td>
<td>9,454</td>
<td>2,169,071</td>
<td>6,238,781</td>
</tr>
<tr>
<td>2009</td>
<td>0</td>
<td>7,474</td>
<td>2,010,814</td>
<td>5,383,324</td>
</tr>
</tbody>
</table>

2.1.4 Good Neighbor Port (Stanton St. Bridge)

The Good Neighbor POE primarily provides access to SB passenger traffic into Mexico for a toll. One lane of the bridge structure is dedicated as a Dedicated Commuter Lane (DCL) in the NB direction into El Paso. The DCL employs the Secure Electronic Network for Travelers’ Rapid Inspection (SENTRI) system and it has been in service since 1999. The DCL processing facility is located west of the bride adjacent to LP 375 (Cesar E. Chavez Border Highway). This POE also provides Customs & Border Protection (Canine) service. The Good Neighbor POE provides access to El Paso major thoroughfares: LP 375 (via 8th Ave. & Kansas St.) and IH-10 (via US 85, Stanton St.) (see Figure 2.6).

The Good Neighbor Bridge is a four-lane structure and approximately 880 ft in length. This POE is accessed via US 85 (Stanton St.). US 85 consists of three 12 ft lanes, two SB and one NB lane), with 6 ft shoulders.

Table 2.6 shows the AADT counts for US 62/85 and LP 375 in vicinity of the Good Neighbor POE. Figure 2.8 shows the count locations on US 62/85 and LP 375 for these AADT determinations.
The AADT shows a trend of increased vehicle usage between 2003 and 2008. In 2009, a general decrease in U.S. vehicle usage of all POE’s was to be expected due to the increased violence in the neighboring City of Cd. Juárez, Chihuahua, Mexico. Table 2.10 shows the vehicle and pedestrian counts from 2001 to 2009. There have been some fluctuations in POV counts through the years, but the general trend has been a decline.

Table 2.9: AADT at US 62/85 and LP 375, 2003-2009

<table>
<thead>
<tr>
<th>AADT Location</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>US 62/85</td>
<td>11,200</td>
<td>10,200</td>
<td>10,400</td>
<td>11,000</td>
<td>11,200</td>
<td>11,700</td>
<td>11,700</td>
</tr>
<tr>
<td>LP 375</td>
<td>11,800</td>
<td>10,800</td>
<td>12,010</td>
<td>13,000</td>
<td>7,800</td>
<td>12,100</td>
<td>11,500</td>
</tr>
</tbody>
</table>

Figure 2.8: Traffic Count Location, Paso del Norte and Good Neighbor POEs
Table 2.10: Vehicle and Pedestrian Counts for Good Neighbor Port, 2001-2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Trucks</th>
<th>Buses</th>
<th>Privately Owned Vehicles</th>
<th>Pedestrians</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0</td>
<td>0</td>
<td>386,170</td>
<td>0</td>
</tr>
<tr>
<td>2002</td>
<td>0</td>
<td>0</td>
<td>1,033,739</td>
<td>0</td>
</tr>
<tr>
<td>2003</td>
<td>0</td>
<td>0</td>
<td>1,475,372</td>
<td>0</td>
</tr>
<tr>
<td>2004</td>
<td>0</td>
<td>0</td>
<td>1,451,299</td>
<td>0</td>
</tr>
<tr>
<td>2005</td>
<td>0</td>
<td>0</td>
<td>1,244,356</td>
<td>0</td>
</tr>
<tr>
<td>2006</td>
<td>0</td>
<td>0</td>
<td>1,068,397</td>
<td>0</td>
</tr>
<tr>
<td>2007</td>
<td>0</td>
<td>0</td>
<td>1,388,402</td>
<td>0</td>
</tr>
<tr>
<td>2008</td>
<td>0</td>
<td>0</td>
<td>1,259,235</td>
<td>0</td>
</tr>
<tr>
<td>2009</td>
<td>0</td>
<td>0</td>
<td>1,219,274</td>
<td>0</td>
</tr>
</tbody>
</table>

2.1.5 Fabens-Caseta Port

The Fabens-Caseta POE provides access to passenger and pedestrian traffic. This POE provides the following service: Customs & Border Protection. Passenger and pedestrian traffic have access from 6:00 a.m. to 10:00 p.m. seven days a week. Fabens-Caseta POE is toll-free. This POE provides access to major a thoroughfare, IH-10 (via FM 1109)(see Figure 2.4).

The Fabens-Caseta POE is a two lane structure, approximately 510 ft in length. This POE has two passenger traffic inspection stations on the U.S. side.

Table 2.7 shows the AADT counts for FM 1109 in vicinity of the Fabens-Caseta POE. Figure 2.10 shows the count location on FM 1109 for this AADT determination. The AADT shows a trend of decreased vehicle usage between 2003 and 2009. In 2009, a general decrease in U.S. vehicle usage of all POE’s was to be expected due to the increased violence in the neighboring City of Juárez, Chihuahua, Mexico and adjacent border towns. Table 2.11 shows vehicular and pedestrian counts from 2001 to 2009. 2001 was the last year that commercial traffic was allowed to access this POE. 

number of POVs has been declining since 2004. Since 2005, the pedestrian counts have been increasing with a considerable increase of more than 70% for both 2008 and 2009 consecutively.

Figure 2.9: Fabens-Caseta POE Location Map (Source: Google, Inc.)

<table>
<thead>
<tr>
<th>AADT Location</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM 1109</td>
<td>2,600</td>
<td>2,900</td>
<td>2,530</td>
<td>2,400</td>
<td>2,200</td>
<td>2,300</td>
<td>1,850</td>
</tr>
</tbody>
</table>
Figure 2.10: Traffic Count Location, Fabens-Caseta POE

Table 2.12: Vehicle and Pedestrian Counts for Fabens-Caseta Port, 2001-2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Trucks</th>
<th>Buses</th>
<th>Privately Owned Vehicles</th>
<th>Pedestrians</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>108</td>
<td>0</td>
<td>556,348</td>
<td>29,101</td>
</tr>
<tr>
<td>2002</td>
<td>0</td>
<td>0</td>
<td>548,338</td>
<td>31,293</td>
</tr>
<tr>
<td>2003</td>
<td>0</td>
<td>0</td>
<td>494,384</td>
<td>23,983</td>
</tr>
<tr>
<td>2004</td>
<td>0</td>
<td>0</td>
<td>505,357</td>
<td>18,098</td>
</tr>
<tr>
<td>2005</td>
<td>0</td>
<td>0</td>
<td>480,194</td>
<td>14,856</td>
</tr>
<tr>
<td>2006</td>
<td>0</td>
<td>0</td>
<td>459,292</td>
<td>15,726</td>
</tr>
<tr>
<td>2007</td>
<td>0</td>
<td>0</td>
<td>446,265</td>
<td>19,694</td>
</tr>
<tr>
<td>2008</td>
<td>0</td>
<td>0</td>
<td>426,962</td>
<td>33,752</td>
</tr>
<tr>
<td>2009</td>
<td>0</td>
<td>0</td>
<td>415,918</td>
<td>58,638</td>
</tr>
</tbody>
</table>
2.1.6 Santa Teresa Port

The Santa Teresa POE is the only POE in this document that is in the state of New Mexico and is an at-grade land crossing POE. The Rio Grande River is no longer the U.S./Mexico boundary at this location. The Santa Teresa POE provides access to commercial, passenger, and pedestrian traffic. This POE provides the following services: Customs & Border Protection and Vehicle Exports. Passenger and pedestrian traffic have access from 6:00 a.m. to 12:00 a.m. seven days a week. Commercial traffic has access from 8:00 a.m. to 8:00 p.m. Monday through Friday and from 9:00 a.m. to 2:00 p.m. on Saturday. Santa Teresa POE is toll-free. This POE provides access to a major thoroughfare, IH-10 (via NM 136, Pete V. Domenici Memorial Hwy.)(see Figure 2.5)

Table 2.13 shows the AADT counts for NM 136 north of the Santa Teresa POE. Figure 2.12 shows the count location for this AADT determination.

Figure 2.11: Santa Teresa POE Location Map (Source: Google, Inc.)
Table 2.13: AADT at NM 136, 2007-2009

<table>
<thead>
<tr>
<th>AADT Location</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>NM 136</td>
<td>2,946</td>
<td>2,914</td>
<td>2,881</td>
</tr>
</tbody>
</table>

Figure 2.12: Traffic Count Location
Table 2.14: Vehicle and Pedestrian Counts for Santa Teresa Port, 2001-2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Trucks</th>
<th>Buses</th>
<th>Privately Owned Vehicles</th>
<th>Pedestrians</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>29,820</td>
<td>32</td>
<td>204,799</td>
<td>3,772</td>
</tr>
<tr>
<td>2002</td>
<td>28,054</td>
<td>137</td>
<td>381,843</td>
<td>13,197</td>
</tr>
<tr>
<td>2003</td>
<td>28,673</td>
<td>248</td>
<td>293,457</td>
<td>16,864</td>
</tr>
<tr>
<td>2004</td>
<td>29,185</td>
<td>84</td>
<td>227,776</td>
<td>13,927</td>
</tr>
<tr>
<td>2005</td>
<td>34,072</td>
<td>116</td>
<td>257,345</td>
<td>15,027</td>
</tr>
<tr>
<td>2006</td>
<td>36,905</td>
<td>122</td>
<td>318,095</td>
<td>33,169</td>
</tr>
<tr>
<td>2007</td>
<td>41,355</td>
<td>267</td>
<td>440,857</td>
<td>23,824</td>
</tr>
<tr>
<td>2008</td>
<td>45,856</td>
<td>341</td>
<td>373,905</td>
<td>21,577</td>
</tr>
<tr>
<td>2009</td>
<td>57,409</td>
<td>329</td>
<td>473,627</td>
<td>37,312</td>
</tr>
</tbody>
</table>

2.1.7 Vehicle and Pedestrian Distribution

The various modes of trans-border crossings were compared for the POEs within the City of El Paso. Within the City of El Paso, only two POEs may be accessed by commercial traffic: BOTA and Ysleta-Zaragoza. Figures 2.13 and 2.14 show the truck distribution for years 2005 and 2006 respectively. It can be observed that the distribution is nearly 50/50 for both POEs. It appears that the BOTA POE being a non-toll facility has minimal bearing as a factor for trucking companies to decide to take it as a primary crossing point.

It seems to be just the opposite for passenger cars or privately owned vehicles (POV). Figures 2.15 and 216 show the POV distribution for years 2005 and 2006 respectively. Economics appears to
Figure 2.13: 2005 Truck Distribution among POEs

Figure 2.14: 2006 Truck Distribution among POEs
play more of a role for non-commercial POE users. Approximately 50% of POVs crossed BOTA for both 2005 and 2006. The Paso del Norte and Ysleta-Zaragoza POEs split approximately 43% of the POVs almost evenly. The POE used the least by POVs was the Good Neighbor POE since it is only for southbound travel, approximately 8%.

Figure 2.15: 2005 POV Distribution among POEs
Figures 2.17 and 2.18 show the pedestrian distribution for years 2005 and 2006 respectively. It can be seen that the majority of pedestrian traffic crossed the Paso del Norte POE, approximately 83% for both years. This can be attributed to the majority of these pedestrian coming to El Paso for shopping purposes in downtown El Paso. The rest of the pedestrians use BOTA and Ysleta-Zaragoza. These two POEs split about 20% of the pedestrians almost evenly. The majority of the pedestrians that cross at these POEs have to be picked up and they take advantage of makeshift pedestrian pick-up areas where pay phones are located.
Figure 2.17: 2005 Pedestrian Distribution among POEs

Figure 2.18: 2006 Pedestrian Distribution among POEs
2.2 Past POE Findings

2.2.1 RJ Rivera Associates, Inc.

The Transportation Planning and Programming Division of the Texas Department of Transportation acquired the services of RJ Rivera Associates, Inc. to conduct a Border Crossing Travel Time Study (RJ Rivera Associates, Inc., 2008). The purpose of this study was to conduct a targeted assessment of short-term improvement options for passenger and freight flow on roadways within the immediate study area of each POE. The consultant team, through field reconnaissance; local officials; POE operators; and other data available on-line, developed an initial set of alternatives. The consultant team’s strategy was to introduce these initial alternatives at the various Regional Technical Work Group (RTWG) meetings and address the issues observed by the team. At the same time, meeting participants were encouraged to provide input and develop additional alternatives. Final recommendations are described in section 2.3, Future POE Proposals.

2.2.2 Wilbur Smith Associates

In the interest of understanding the issues surrounding the POE’s and be better able to develop viable solutions, the El Paso Metropolitan Planning Organization (MPO) acquired the services of Wilbur Smith Associates to study the POE’s of the region and develop a Border Improvement Plan (BIP) (Wilbur Smith Associates, 2006). This study looks at commercial and non-commercial traffic. Data collection included interviews with stakeholders, shippers (Maquiladora), and carriers (Trucking Companies). Through these interviews, the specific issues, concerns, and operational difficulties experienced by the various stakeholders and the POE users themselves were identified. Wilbur Smith Associates, to complement the BIP study, also developed a Border Queuing Analysis Tool (BQAT) (Wilbur Smith Associates, 2006). The BQAT was developed to simulate the queues in the POEs under
consideration based on the input traffic and inspection booth data collected to analyze the current queuing scenarios.

The shippers, during maquiladora interviews, specified that the decision to use a specific POE came specifically from the location of the maquiladora in relation to the receiving facility. The fact that there is not toll to access the BOTA POE is not considered. This is also shown in Figures 2.13 and 2.14, almost a 50/50 distribution between BOTA and Ysleta-Zaragoza POE’s. Other issues identified during the various interviews include the following:

- Examining the need and possible location for an additional commercial POE
- Place focus on increasing efficiency at existing POEs
- Increase POE hours of operation. A 24-hour a day, seven days a week commercial POE would significantly increase freight flow and diminish delays. Most cited need for Mexican shippers.
- Various entities control shipping within the maquiladora’s freight operations, from the company, customers, suppliers, or a mix of each
- Peak traffic periods (month, day of week, and hourly) vary depending on carrier and their respective client base. However, the following patterns were discovered among all carriers interviewed:
  - October to mid-December peaks
  - End of month/end of quarter peaks
  - 3-6pm are common hours of peak activity
- No specific congestion points or bottlenecks were identified as requiring driver detours on a regular basis

The El Paso carrier networks and routing for each carrier remains fluid and responsive to variations in demands required by the various shippers. A constant finding regarding carrier operations
is that all carriers rely heavily on local drayage operations. A single shipment is usually transferred twice locally before it leaves the El Paso area.

2.2.3 Cambridge Systematics

The El Paso MPO’s BIP study brought many important findings and issues to the surface. The technical results showed that physical capacity will ultimately be needed at the high rate of growth that the El Paso/Juárez region is experiencing. The BIP study attempted to look at several possible locations for a new POE(s). The MPO received such a negative response to what many respondents termed as arbitrary locations to a POE that may not even be needed. The Texas Department of Transportation is trying to answer these questions by developing a Regional Ports of Entry Operations Plan. TxDOT acquired the services of Cambridge Systematics to develop this plan. A very important element of the development of this plan is to perform extensive public outreach to ensure that all interested groups in the El Paso/Juárez region are actively engaged in the planning, development, and implementation of the Operations Plan. This study was begun recently and is not expected to be completed until early 2011 (Cambridge Systematics, Inc., 2010).

Just like in the previous studies discussed, public outreach is critical. Many of the same issues already mentioned were noted during the stakeholder meetings held for this study. In order to supplement stakeholder input, Cambridge Systematics took an additional step of conducting surveys within the region to understand public attitudes and perceptions concerning the region’s border POE needs. The survey also measured support for a variety of possible strategies or solutions that could improve cross-border efficiency and mobility (Cambridge Systematics, Inc., 2010).

One thousand completed surveys were collected. The surveys were conducted by telephone and on-line in both English and Spanish, approximately 80% responded by telephone and the rest on-line. The combination of telephone and on-line surveys allowed for an increase in sample coverage and
enhance regional representativeness. Approximately 40% of the respondents were from Texas (El Paso and Hudspeth Counties), 40% from Mexico (municipalities of Juárez, Práxedis G. Guerrero, and Guadalupe), and 20% from New Mexico (Doña Ana County). Approximately three out of five respondents of the 1000 residents polled stated they had used at least one of the region’s POEs in the last year. The survey results are summarized below:

Most respondents agree that **Safety and Security are Regional Priorities** and improvements to POEs should not come at the expense of national security. These views are generally shared among POE users and nonusers alike, throughout the region, and on both sides of the international border.

A majority of respondents believe that **Efficient POEs Support the Region’s Economic Vitality**. Even though three quarters of the respondents from the Mexican municipalities use the regions POEs for the main purpose of shopping and recreation in El Paso, the majority had to endure wait times in excess of one hour on average. The survey also revealed that **Wait Times are Affecting Travel Behavior for Cross-border Trips**. Wait times influenced the time of day, day of the week, and the specific POE used to cross the border for the majority of the respondents. Frequency of cross border trips is also being influenced by wait times. If wait times discourage people from making cross border trips, the regional economy may suffer.

The survey revealed that 75% of respondents that used one or more of the region’s POE last year, **Used the POE That was Closest to their Starting or Ending Location**. Proximity far outweighs toll prices, wait times, safety, and other factors that influence POE selection.

Physical infrastructure capacity and the number of inspection agents staffed at each POE affect the throughput and wait times of vehicles and pedestrians crossing the border each day. Overall, **Opinions of Existing Capacity Related to the Number of Border Crossings and the Number of Agents and Booths for Inspection and Processing are Generally Divided Within the Region**. Many
respondents are dissatisfied with the existing capacity, but at the same time, a similar proportion is satisfied.

A large majority of respondents agree that The Region Should Invest in Operational Improvements First to Make Existing POEs More Efficient Before Investing in a New POE. A variety of operational improvement strategies are supported by a large majority of the population, the most popular being making use of all available inspection booths during peak hours. Strategies to implement technology to provide real-time traffic information or improve inspection capabilities are also popular. Among respondents from Juárez, 90% of residents favor moving commercial traffic to specific POEs.

The survey revealed that The Least Popular Operational Strategy was Implementing Tolls or Congestion Pricing on POEs that are currently free: Santa Teresa, BOTA, and Fabens-Caseta. However, within the region, opinions about tolling are mixed.

Long-Term Operational Goals are Divided Along the International Border. There are considerable differences in opinion among U.S. and Mexican respondents when considering the long-term operational goal for the region’s POEs. The majority of the U.S. residents indicated that wait times should be as long as they need to be to ensure national security and law enforcement. The Mexican residents have the opposite view. More than half of the Mexican respondents wish to see wait times reduced and kept low even as the region’s population grows.
2.3 Future POE Proposals

2.3.1 RJ Rivera Associates, Inc.

The Border Crossing Travel time Study developed various alternatives for the POEs through data collection, initial alternatives development, RTWG meetings, stakeholder meetings, constraints analysis, traffic modeling, screening analysis, and alternative refinement. The following are the studies recommended alternatives:

1. Paso del Norte and Good Neighbor POEs Proposed Improvements:
   a. Proposed pedestrian pick-up and drop-off area located on the railroad parking lot and accessed by Santa Fe St.
   b. Redesign the concrete median and reassign lane assignments, removing the forced right-turn into the toll booth, at the intersection of Stanton St. and 8th Ave.

2. BOTA POE Proposed Improvements:
   a. Install ITS devices to redirect traffic to the Ysleta-Zaragoza (commercial traffic) and the downtown bridges (passenger vehicles) if the bridge wait times are excessive
   b. Close Stevens St. access to the southbound IH-110 ramp
   c. Designate lane assignments at the intersection of IH-110 and Paisano Dr.
   d. Construct a cable barrier along the median between southbound IH-110 and the frontage road to prevent vehicles from crossing onto the frontage road over the raised median
   e. Improve timing of signals along Paisano Dr.

3. Ysleta-Zaragoza POE Proposed improvements:
   a. Relocate the pedestrian pick-up area, along with telephones, from the LP 375 eastbound frontage road to a new location
b. Re-use the old Border Safety Inspection Facility (BSIF) location for commercial vehicle queuing

c. Add an additional left-turn lane of the LP 375 westbound frontage road for more queue length and relocate the concrete traffic barrier. This improvement will allow for a left-turn lane only and a left/through optional middle lane.

d. Convert current pedestrian pick-up area to shuttle bus stop to take pedestrians to the bus terminal proposed by Sun Metro (City of El Paso Transit), eliminate car pick-up

4. Fabens-Caseta POE Proposed improvements:
   a. Improve signage to and from the POE from IH-10
   b. Improve signage from Ysleta-Zaragoza POE

Traffic analysis of the proposed improvements was done using Synchro traffic analysis software. Synchro is a macroscopic traffic signal timing tool that can be used to optimize signal timing parameters for isolated intersections. This means that the improvements to each POE were analyzed independent of each other and not as a network.

2.3.2 Wibur Smith Associates

The El Paso MPO BIP study considered the following types of improvements (Wilbur Smith Associates, 2006):

- Policy changes
- Capacity improvements to border facilities
- Improvements to transportation infrastructure
- Intelligent Transportation Systems
- The exploration of technology or transportation systems that can move cargo instead of using commercial trucks
The recommendations for improvements at existing POEs are based on input from the stakeholders and the technical analysis. The following are short term strategies.

**Recommendation No.1: Conduct an in-depth analysis of the impacts of technology based operational improvements on delay using the data collected during this study and the newly acquired simulation software.** Changes at existing facilities that could reduce delay and increase operational throughput include increasing the number of inspection booths open throughout the day, extending the hours of operation, and employing technologies that reduce the processing time. It appears that the most promising operational improvement in terms of reducing delay and increasing efficiency is the deployment of technology.

**Recommendation No. 2: Coordinate with Mexican Officials on improving access to northbound FAST lanes.** The Free and Secure Trade (FAST) Program for commercial traffic is similar to the Dedicated Commuter Lane for passenger traffic. Of the shippers interviewed, all were already enrolled or in the process of obtaining certification at the time of the interview. The effectiveness of this program is limited by the fact that there is no designated queuing lane for commercial vehicles using the FAST lane and are forced to wait in queue until right before they approach the bridge. Therefore, a separate queuing lane on the Mexican side of the POEs would allow the program to function as intended and further reduce delay, as well as truck idling and emissions, at the commercial crossings.

**Recommendation No. 3: Develop a long range land use plan and incentive program for promoting location of commercial users of the POEs to locate to the less congested port of Santa Teresa and Fabens (Fabens currently does not provide access to truck traffic).** The technical analysis established that trucks cross at bridges closest to their pick-up and/or drop-off point. The land use planning and incentive program should be a coordinated effort among New Mexico, El Paso, and Juárez and it should focus on quantifying the benefits on a regional basis.
Recommendation No. 4: Examine the feasibility of extending the hours of operation for commercial crossings. A major obstacle to the prospect of extending hours for commercial crossings to reduce delay and increase capacity of the existing bridges is the fact that most of the businesses on the U.S. side of the border restrict their hours in which they will accept deliveries. A Pilot program should be explored with mayor trans-load centers, distribution centers, and intermodal yards. If there is sufficient buy-in from the private-sector, actions should be taken to coordinate with other government agencies to implement a Pilot program to extend commercial crossing hours. If significant benefits are observed, steps should be taken to make the extended hours permanent.

Recommendation No. 5: Explore the possibility of opening more processing booths throughout the day. Since all the booths are open during peak times, a Pilot program aimed at demonstrating benefits of additional booth opening and working with local employers to introduce flex-time schedules should be explored. The following recommendation is a more medium to long term strategy.

Recommendation No. 6: Develop new ports of entry. All previous recommendations relate to increasing capacity by reducing delay and increasing operational throughput. However, the analysis predicts that delay will be more than double current levels by 2030. Implementing any of the previous strategies will enhance operational capacity, but the need for additional physical capacity will only be postponed and not eliminated.

2.3.3 Cambridge Systematics

Many alternatives were proposed through the surveys and stakeholder meetings for the Regional Ports of Entry Operations Plan. The master list includes more than 100 unique solutions, ranging from projects affecting the physical condition or capacity of the transportation infrastructure, to operational
strategies that could improve how the transportation system is utilized (Cambridge Systematics, Inc., 2010). To steer the scenario development process, guiding principles for screening and grouping potential solutions were defined. This was even more critical due to the large number of unique solutions that are being considered. The following are the screening guiding principles:

- Comprise logical groupings of operational, infrastructure, and policy-level solutions, leveraging technology where feasible
- Include a mix of immediate, short-, mid-, and long-term solutions
- Be realistic, implementable, and cost-effective
- Facilitate trade and reduce the cost of doing business
- Reduce crossing times and alleviate bottlenecks without sacrificing security and enforcement
- Optimize the use of existing infrastructure
- Provide economic, environmental, and quality-of-life benefits on a regional scale
- Minimize impacts to the health, safety, function, and character of surrounding neighborhoods

The following alternatives are the ones that are believed, though the use of the guiding principles, that are a set of project solutions that best address the regional transportation system needs and deficiencies and will be carried forward for scenario testing for the various POEs:

1. General POE Proposed Improvements:
   a. Extend commercial operating hours or allow 24-hour commercial operations at one or more crossings
   b. Prioritize adequate staffing at the POEs
   c. Expand DCL enrollment to 50,000
   d. Use Intelligent Transportation Systems (ITS) and/or dynamic message signs (DMS) on the bridges and approaches to alert drivers of lane closures, crossing times, and lane assignments
e. Implement queue monitoring technology
f. Implement non-invasive inspection technology for cargo
g. Provide DCLs at all POEs
h. Provide variable designated lanes during peak periods

2. Santa Teresa POE Proposed Improvements:
   a. Extend commercial operating hours

3. Paso Del Norte/Good Neighbor POEs Proposed Improvements:
   a. No single recommendation met all guiding principles. Most recommendations include improvements to the roadway system in the vicinity of the POEs.

4. BOTA POE Proposed Improvements:
   a. Extend commercial operating hours
   b. Improve Paisano signal timings on approach
   c. Close Stevens Street access to the southbound IH-110 ramp
   d. Prevent crossover movements from IH-110 main lanes to frontage road
   e. Variable message signs
   f. Designate or reassign lanes at the intersections of IH-110 and Paisano Dr.
   g. Passenger and commercial vehicle traffic circulation reconfigurations – Eastbound and Westbound Paisano
   h. Passenger and commercial vehicle traffic circulation reconfigurations – Southbound US 54
   i. Passenger and commercial vehicle traffic circulation reconfigurations – Southbound IH-110
   j. Widen southbound IH-110 exit from one lane to two

5. Ysleta-Zaragoza POE Proposed Improvements:
   a. Extend commercial operating hours
   b. Use old BSIF for commercial vehicle staging and queuing
   c. Add additional DCLs
d. Add additional left turn lane on LP 375 westbound approach

6. Fabens POE Proposed Improvements:
   a. Improve signage from Ysleta POE

2.3.4 Comparison of POE Proposals from the Various Studies

The three studies previously discussed agree on several possible solutions and provide additional supporting documentation on their validity. The following are general solutions that the studies have in common:

1. Implement ITS in conjunction with DMSs on the POEs and approaches to alert drivers of lane closures, crossing times, and lane assignments
2. Improving physical access to the Free and Secure Trade (FAST) lanes for commercial vehicles and having Dedicated Commuter Lanes for passenger vehicles at all POEs
3. Extend commercial operating hours or allow 24-hour commercial operations at one or more POEs

The following are specific POE solutions that the studies have in common:

1. BOTA
   a. Close Stevens St. access to the southbound IH-110 ramp
   b. Designate lane assignments to improve passenger and commercial traffic at the various access routes (IH-110 and Paisano Dr.)
   c. Prevent crossover movements from IH-110 main lanes and frontage road

2. Ysleta-Zaragoza
   a. Re-use the old Border Safety Inspection Facility (BSIF) location for commercial vehicle queuing
All three studies also agree that additional physical capacity is needed. There is some disagreement in whether additional capacity may be reached through improvements to existing POEs or if a new POE is required. The latest study by Cambridge Systematics (this study is still ongoing and is expected to be completed in early 2011) is attempting to do just that. Many stakeholders have requested much more convincing documentation that a new POE is needed in order for local officials to pursue serious studies to determine the best location for it.
Chapter 3: METHODOLOGY

A structured methodology was developed in order to conduct this research. The following is a summary of the methodology:

1. Conduct literature review
2. Code the POE northbound links in the El Paso network to reflect actual conditions as close as possible. This includes vehicle generation links and travel zone verification.
3. Revise truck demand to remove any travel zone irregularities
4. Revise truck demand to shift BOTA truck traffic to Ysleta-Zaragoza and Santa Teresa POEs in existing proportions
5. Run the following travel simulations (total of eight runs):
   a. Base travel model without truck shift, 2015 (a.m. peak & p.m. peak)
   b. Travel model without truck shift, 2035 (a.m. peak & p.m. peak)
   c. Travel model with truck shift, 2015 (a.m. peak & p.m. peak)
   d. Travel model with truck shift, 2035 (a.m. peak & p.m. peak)
6. Analyze results

The traffic simulation software and several methodology items will be discussed in more detail in the paragraphs below.

3.1 DynusT

Dynamic Urban Systems for Transportation (DynusT) is a dynamic traffic simulation and assignment tool for regional operational planning analysis (DynusT Online User's Manual, 2010). DynusT is a mesoscopic model which combines some of the properties from both macroscopic and microscopic models. One important characteristic of mesoscopic models is that it simulates vehicles
individually, but also describes their behavior based on macroscopic relationships. Furthermore, mesoscopic models have the ability to limit the traffic flow to the estimated capacity of a roadway. As a result, the vehicle volume in a link cannot exceed the given capacity as opposed to other software such as TransCAD where volume to capacity ratio can be greater than one. This DynusT feature is critical since volume to capacity ratios greater than one may contribute to overestimation of network capacity. DynusT uses time-dependent routing methodology, dynamic traffic assignment (DTA), to capture motorists’ route choice behavior as they traverse from origin to destination. Motorists find their shortest path from origins to destinations taking into account cost, roadway connectivity, capacity, and link travel time. The software accomplishes this shortest path by providing the motorists experience in the traffic network thorough various iterations and assigning various routes to all motorists to ensure that the shortest path or very close to it is found.

3.2 Coding of POE Links

DynusT employs traffic flow models based on traffic flow theory to simulate following distances and stopping criteria among other factors for the traveling vehicles. This is based on a speed-density (v-k) relationship (DynusT Online User's Manual, 2010). The typical v-k relationship used in DynusT is Greenshield’s type equation, Equation 3.1.

\[ v = v_f \left(1 - \frac{k}{k_j}\right) \]  

\[ v = Velocity \]
\[ v_f = Velocity\ Final \]
\[ k = Density \]
\[ k_j = Jam\ Density \]

The network uses typically two traffic flow models, one for arterials and one for freeways. Currently the POE links in the networks are linked as arterials without any traffic control, i.e. traffic signals. In
order to simulate the queue or the lower speeds that develop at the POE, a third traffic model was
created and applied to the northbound POE links.

3.3 POE Travel Zone Irregularities

During the review of the POE links, several irregularities were noted. The POE links are vehicle
generation links. The BOTA and Ysleta-Zaragoza links were not only generating traffic from the
external zone (Mexico), but also from the small adjacent travel zone to the north. Due to these adjacent
travel zones generating relatively small truck demand, the truck demand was removed from these
adjacent zones and added to the external zone in the case of Ysleta-Zaragoza, see Figure 3.1. In the case
of BOTA, the network is coded with separate links for the passenger vehicles and commercial trucks.
As a result, the truck demand was moved from the external zone and added to the adjacent travel zone,
see Figure 3.2.

Figure 3.1: BOTA Network Links
3.4 BOTA Truck Traffic Shifted to Ysleta-Zaragoza and Santa Teresa POEs

The objective of this research is to see the effect on the El Paso transportation network of shifting all commercial traffic from BOTA to Ysleta-Zaragoza and Santa Teresa POEs. The El Paso metropolitan network is made up of 690 traffic zones, thus creating an origin-destination matrix 690 x 690. Each zone generates traffic and that traffic goes to other zones in the network. The zone receiving this traffic now becomes a destination zone. All zones are both origin and destination zones for other zones in the network. BOTA’s commercial traffic demand (the commercial traffic that originates at the BOTA POE) was shifted to the other two POEs in existing proportions on a destination zone basis. Existing proportions means that the sum of the current commercial traffic at Ysleta-Zaragoza and Santa Teresa’s destination zones is 100%. Of that 100%, for example, 90% cross at Ysleta-Zaragoza and the remaining 10% cross at Santa Teresa. In the case of the scenario, a similar distribution is used to shift all the commercial traffic to the two POEs in question. Ninety percent of all the BOTA commercial traffic would be shifted to Ysleta-Zaragoza’s destination zone and the remaining 10% would be shifted
to Santa Teresa’s destination zone. The total number of commercial trucks shifted would the sum of all the destination zones’ demand originating from the BOTA POE.

### 3.5 Inspection Areas

As noted in previous sections, new technologies play an important role in maintaining increased national security and protection of the U.S. economy. The following are current programs that are being considered for implementation or are being implemented at some level that improve inspection and enforcement processes (Conway, 2010):

- Automated Commercial Environment (ACE) – This system will provide interagency information sharing and real-time, cross-government access to more accurate trade information. By centralizing the collection and analysis of this information, ACE will enhance the ability to target illicit cargo, illegal persons, and unsafe conveyances.

- Automated Manifest Systems (AMS) – This system allows for the advanced transmission of electronic cargo information to Customs and Border Protection (CBP) as required by the Trade Act of 2002, Advance Electronic Information.

- NEXUS – This program is an alternate inspection program that allows pre-screened, low-risk travellers to be processed with little or no delay by U.S. and Canadian border officials. Participants cross the border in a dedicated lane where they present their membership identification, proximity card, and make a declaration. The NEXUS program will ultimately replace other frequent crosser programs such as the SENTRI.

- Container Security Initiative (CSI) – High-risk maritime cargo containers are identified and examined for weapons of mass destruction (WMD) at foreign ports before they are shipped to the U.S. CSI consists of four components:
  1. Establish security criteria for identifying high-risk containers based on advance information
  2. Pre-screen containers at the earliest possible point
3. Use technology to quickly pre-screen high-risk containers

4. Develop secure and “smart” containers.

- Under the CSI program, the screening for WMDs in cargo containers is accomplished by teams of highly skilled CBP officials working in collaboration with their equally proficient host nation counterparts.

- FAST Commercial Driver Program – Commercial truck drivers who transport goods across the U.S./foreign border may apply for membership in this program. This program allows truck drivers who transport qualifying commercial shipments to cross the international border through an expedited process.

- License Plate Reader System (LPR) – The readers are installed prior to the primary inspection booths. The readers detect and read license plates from vehicles entering and departing form the U.S. The license plate information is then compared electronically with the Treasury Enforcement Communications System (TECS) and the National Crime Information Center (NCIC) databases for possible matches with potential criminal suspects. The license plate readers consist of infrared detectors, a compact strobe illuminator system, a video camera, processor, and a protocol converter that allows communication among the various databases.

- Radiation Portal Monitors – Every POE employs radiation sensing equipment to detect radioactive and nuclear material that may be smuggled into the U.S. for construction of WMDs. These radiation monitors are being placed at each primary lane to scan passing vehicles for radioactive materials.

- Vehicle and Cargo Inspection Systems (VACIS) – VACIS is a gamma ray imaging system that uses radiographic images to help inspectors examine the contents of trucks, containers, cargo, and passenger vehicles for hidden compartments containing contraband.
Technology is an important aspect to decreasing delay for commercial traffic at the POEs. Even though it is a critical aspect, it is only one factor of many that has to be considered within the U.S. and in cooperation with Mexico, Canada, and other host nations.

3.6 Assumptions

The following are the assumptions made during this research:

- Traffic flow model – There is no data at the POE to be able to calibrate a flow model at that location. The assumed values were 1 mph for minimal speed, 50 pcphpl for jam density, and 5 for shape term alpha. These parameters are based on trial and error simulations until lower speeds and queues were observed at the POE links.

- The POE link flow model was not applied to the southbound direction. It is assumed that not applying the same flow model to southbound traffic flow into Mexico does not affect the northbound traffic flow.

- It is assumed that the non-commercial and commercial traffic demands grow at the same rate. The various sections of the City grow at different rates. Since this specific future planning information is not yet developed by the El Paso MPO, current traffic demand was raised by 6% for the base year of 2015 and 16% for the future year 2035 equally throughout all City traffic zones.
Chapter 4: RESULTS

DynusT traffic simulation software produces various results such as queue length, density, speed, and volume for analysis. A new and powerful external analysis tool is the time-space profile graph. This is a very powerful visual tool because it provides an instant look at the speed of a selected roadway segment (group of links) through the entire time interval of analysis. Further detail will be provided below. In order to determine the state of the transportation network in the vicinity of each POE where the commercial truck demand was modified, several critical segments of the network were selected for presentation in this Chapter. These segments were selected because they are major thoroughfares that connect to Interstate Highway 10, a major east to west route within the city and the southern United States. If bottlenecks develop on these connecting highways, these sections of the network could be seriously hindered.

4.1 Bridge of the Americas (BOTA) POE

Figures 4.1 indicates the roadway segments to be analyzed in the vicinity of BOTA. Figures 4.2 and 4.3 show the time-space profiles for the US 54 NB to I-10 EB segment for base year 2015 without and with truck shift respectively. A vertical line on the time-space profile represents the speed at certain locations on the segment (y-axis) at a particular time (x-axis) of the simulation. In Figure 4.2, for example, a vertical line at time 6:00 p.m. shows red from the beginning of the segment meaning that speed is less than 20 mph. At approximately 150 ft into the segment, speed raises to less than 30 mph to up to about 250 ft into the segment. The speed goes to almost 50 mph for the rest of the segment shown by the sky blue. Speed is inversely proportional to density. This means that the slower the speed, the higher the vehicular density, and thus congestion.
When the commercial vehicles are removed in base year as shown in Figure 4.3, a decrease in speed is shown specifically in the second half of the segment. This decrease in speed is an increase in congestion. It appears that removing commercial vehicles has made it a more attractive route for other vehicles. This is reflected by the fact that the model shows a 12% increase in vehicular volume even though the commercial traffic was removed from the BOTA POE.

Comparing the US 54 NB segment in base year and 2035 without the commercial truck shift, in 2035 there are more times where the entire segment experiences congestion but it is not significant. Speeds do decrease overall in 2035, especially during the last hour of simulation. Comparing the same segment in 2035 without and with the truck shift, the speeds are very similar. There is a slight increase in speed during the last 45 minutes of the simulation with the truck shift. This increase in speed shows that there is only a minimal decrease in vehicular volume even though the trucks were removed from BOTA.
Figure 4.2: Time-Space Profile, US 54 NB to I-10 EB – PM 2015

Figure 4.3: Time-Space Profile, US 54 NB to I-10 EB with Truck Shift – PM 2015
Figures 4.4 and 4.5 show the time-space profiles for the US 54 NB to I-10 EB segment for year 2035 without and with truck shift respectively. The speeds look very similar in both profiles. There is an increase in speed after the truck shift at about 250 ft into the segment during the last 45 minutes of the simulation. There is a 2% drop in vehicular volume after the truck shift.

The I-10 EB segment shows various levels of congestion in base year and 2035. The models show that the BOTA traffic does not affect that congestion directly since the congestion develops before or after the US 54 NB to EB I-10 connection.
Figure 4.4: Time-Space Profile, US 54 NB to I-10 EB – PM 2035

Figure 4.5: Time-Space Profile, US 54 NB to I-10 EB with Truck Shift – PM 2035
4.2 Ysleta-Zaragoza POE

Figures 4.6 indicates the roadway segments to be analyzed in the vicinity of the Ysleta-Zaragoza POE. The afternoon peak hour is more congested than the morning peak hour. In the base year, the truck shift does produce a slight decrease in speed specifically in the 3rd hour of simulation and closer to the end of the segment. The rest of the simulation shows similar speeds without and with the truck shift.

Figures 4.7 and 4.8 show the time-space profile for NB LP 375 in year 2035 without and with the truck shift respectively. Figure 4.8 shows that even though approximately 96% of the BOTA commercial traffic was shifted to this POE, the speeds improved. There is an 8% decrease in vehicular volume. The opposite is occurring from BOTA. The increase in truck traffic is making this a less desirable route for passenger vehicles in the simulation.

Figure 4.6: Ysleta-Zaragoza POE Roadway Segments to be Analyzed (Source: Google, Inc.)
Figure 4.7: Time-Space Profile, LP 375 NB – PM 2035

Figure 4.8: Time-Space Profile, LP 375 NB with Truck Shift – PM 2035
Figures 4.9 and 4.10 show the time-space profile for WB LP 375 non-toll in year 2035 without and with the truck shift respectively. A toll facility will be constructed in this portion of LP 375 within a few years. This study will not look at the toll section of LP 375. A decrease in speed is shown in Figure 4.10 around 5:30 p.m. An increase of 8% in vehicular traffic is observed with the truck shift. The rest of the speed profiles are very similar with not much change in speed.
Figure 4.9: Time-Space Profile, LP 375 WB Non-toll – PM 2035

Figure 4.10: Time-Space Profile, LP 375 WB Non-toll with Truck Shift – PM 2035
4.3 Santa Teresa POE

Figure 4.11 indicates the roadway segment to be analyzed in the vicinity of the Santa Teresa POE. This segment of NM 136/Artcraft Rd. was analyzed in the various base year and year 2035 models. The additional shift in truck traffic from BOTA had no real impact on this segment. Figures 4.12 and 4.13 show the time-space profiles for EB NM 136/Artcraft Rd. without and with the truck shift respectively. It can be observed that there is some minor speed decrease throughout the simulation, but not very significant.

Figure 4.11: Santa Teresa POE Roadway Segment to be Analyzed (Source: Google, Inc.)
Figure 4.12: Time-Space Profile, NM 136/Artcraft Rd. EB – AM 2035

Figure 4.13: Time-Space Profile, NM 136/Artcraft Rd. EB with Truck Shift – AM 2035
Chapter 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The results have shown that the TxDOT and City of El Paso transportation network in the El Paso area can handle northbound commercial truck access between the POEs even into future year 2035.

On the northbound US 54 to eastbound I-10 segment north of the BOTA POE, congestion is increased even after the trucks are shifted to Ysleta-Zaragoza for the base year (2015). It appears that removing commercial vehicles has made it a more attractive route for other vehicles. The model shows a 12% increase in vehicular volume. The similar effect is observed in 2035 where only a minimal increase in speed is observed towards the end of the simulation.

The results near the Ysleta-Zaragoza POE match the results at BOTA, but in a reverse manner. Even though the majority of the BOTA commercial traffic was shifted to this POE, the speeds improve on northbound LP 375. There is an 8% decrease in vehicular volume. It appears that the increase in truck traffic is making this section of LP 375 a less desirable route for passenger vehicles in the simulation. A slight decrease in speed is observed for a short interval in year 2035 after the truck shift on WB LP non-tolled. An increase of 8% in vehicular traffic is observed with the truck shift. The rest of the speed profiles are very similar with not much change in speed.

The additional shift in truck traffic from BOTA had no real impact on the EB NM 136/Artcraft Rd. segment for the Santa Teresa POE. It can be observed that there are some minor speed reductions throughout the simulation, but the changes are not very significant.
5.2 Recommendations

It is further recommended that this single commercial traffic POE concept be implemented in conjunction with other previously recommendations such as:

- Twenty-four hour access
- Deployment of additional technology such as information sharing technology and Vehicle and Cargo Inspection Systems

Having 24 hour access to the POE should decrease current peak hour volumes and have less strain on the City transportation network. Having a single commercial vehicle POE should allow for more technology since funding would not be required to have redundant systems in various POEs.

5.3 Contribution of Thesis

Previous studies except for the one being performed by Cambridge Systematics have only studied POE improvements independently of each other or only with static traffic assignment. A mesoscopic model provides the best of both worlds between macroscopic and microscopic for regional planning. It allows for and provides a more realistic output as simulated vehicles find, through various iterations, the time-dependent shortest path considering the cost of time. This research has provided a positive addition to the local goal of improving commercial truck traffic coming into the U.S. from Mexico.

5.4 Recommendations for Future Research

In order to verify the non-expected results in terms of vehicular volumes increase near BOTA when traffic demand was actually decreased, other segments near the POE should be analyzed in detail to determine where the increased demand came from. The same would apply at the Ysleta-Zaragoza POE. If traffic demand was decreased, this means that it had to increase at other segments of the
network. These segments with additional traffic demand should be identified as well as the extent of the increases.

A complementary traffic study should be done at Ysleta-Zaragoza in order to improve the model calibration, POE link traffic flow model. This would allow for improved traffic simulation, especially in conjunction with simulation of other technologies being considered.
Bibliography


Vita

Alfredo Sánchez received his Bachelors of Science degree in Civil Engineering from the University of Texas at El Paso (UTEP) in December, 1992. In early 1993, he began employment with the City of Dallas, TX Public Works Department. In October, 1994, he transferred to the Texas Department of Transportation (TxDOT), El Paso District. In TxDOT, he has worked with the Design Section and currently is part of the Advance Project Development Section. At TxDOT he has gained experience in roadway design, hydraulic design, and development of schematic and construction plan documents. In the summer of 1998 he began teaching on a part-time basis at the El Paso Community College. He taught basic mathematics and algebra continuously until 2005 and has taught intermittently after that. He received his Professional Engineering license in July, 2001. In 2005, he joined the Navy Reserves and received an Officer Commission, Civil Engineering Corps. He is attached to Naval Mobile Construction Battalion 22 and served under various functions including Officer in Charge for the El Paso, TX Detachment. He deployed to Kuwait in 2009 in support of Operation Iraqi Freedom and Operation Enduring Freedom.