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16. Abstract

Proper transportation planning for the 1,230-mile (1,980-km) long Texas-Mexico border requires special approaches that take into account the complexities of a binational environment, which now include the impacts of the North American Free Trade Agreement (NAFTA) and the need for inspection procedures that affect traffic circulation. Of special interest to transportation planners are the capacity utilization of binational entry systems and the identification of possible border sectors where new international bridges are either needed or likely to be constructed. Current literature on capacity of traffic facilities does not include methods to analyze binational environments attributes, and current literature on revenue and demand analysis is restricted to site-specific revenue forecasts that interest almost exclusively the investors. New methods of capacity and demand analyses were developed in this project to address transportation planning needs, and this report documents their development and application in the analysis of the Texas-Mexico border Segment 2, which begins immediately west of Colombia Bridge in Laredo, and ends at the New Mexico border west of El Paso.

This report supplements Research Report 1976-4, which presents the results for Segment 1 (from the Gulf to Laredo). For each sector, the current capacity utilization of each binational entry system component was assessed, using a methodology that takes into account all possible interruptions in transborder traffic circulation. The capacity analysis is complemented by estimates of potential demand and revenues of new toll bridges in each sector. Recommendations on the potential feasibility of new toll bridges were developed using a financial analysis model that simulates the effect of managerial decisions upon the predicted gross revenues and estimated costs. Together, the capacity and feasibility analyses provide a comprehensive picture of border transportation needs, including identification of the sectors where new toll bridges are financially attractive. The findings of this and the previous reports provide the basis for effective transportation planning and policies, as well as for future studies on border transportation issues.

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OVERVIEW OF THE TEXAS-MEXICO BORDER: CAPACITY, DEMAND, AND REVENUE ANALYSES OF BORDER SEGMENT 2 (EAGLE PASS TO EL PASO)

by

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Research Report 1976-5

Research Study 7-1976
"Texas-Mexico Toll Bridge Study"

conducted for the

Texas Department of Transportation
and the
Texas Turnpike Authority

by the

CENTER FOR TRANSPORTATION RESEARCH
Bureau of Engineering Research
THE UNIVERSITY OF TEXAS AT AUSTIN

March 1994

IMPLEMENTATION STATEMENT

This report makes recommendations for border transportation planning along Texas-Mexico border Segment 2, which begins immediately west of the Colombia Bridge in Laredo, and ends at the Texas-New Mexico-Chihuahua border. The observations provided in this study can serve as guidelines for present transportation planning and for future studies of border transportation needs. However, it should be understood that the ever-shifting dynamics of the Texas-Mexico border region (especially in the wake of NAFTA) effectively limit the study's recommendations and conclusions. Thus, assumptions related to the Texas-Mexico border must be carefully evaluated when considering any implementation of the results reported in this study.

Prepared in cooperation with the Texas Department of Transportation
and the Texas Turnpike Authority

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Prepared in cooperation with the Texas Department of Transportation and the
Texas Turnpike Authority

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The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Texas Department of Transportation or the Texas Turnpike Authority. This report does not constitute a standard, specification, or regulation.

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OR PERMIT PURPOSES

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SUMMARY

Proper transportation planning for the 1,230-mile (1,980-km) long Texas-Mexico border requires special approaches that take into account the complexities of a binational environment, which now include the impacts of the North American Free Trade Agreement (NAFTA) and the need for inspection procedures that affect traffic circulation. Of special interest to transportation planners are the capacity utilization of binational entry systems and the identification of possible border sectors where new international bridges are either needed or likely to be constructed. Current literature on capacity of traffic facilities does not include methods to analyze binational environments attributes, and current literature on revenue and demand analysis is restricted to site-specific revenue forecasts that interest almost exclusively the investors. New methods of capacity and demand analyses were developed in this project to address transportation planning needs, and this report documents their development and application in the analysis of the Texas-Mexico border Segment 2, which begins immediately west of Colombia Bridge in Laredo, and ends at the New Mexico border west of El Paso.

This report supplements Research Report 1976-4, which presents the results for Segment 1 (from the Gulf to Laredo). For each sector, the current capacity utilization of each binational entry system component was assessed, using a methodology that takes into account all possible interruptions in transborder traffic circulation. The capacity analysis is complemented by estimates of potential demand and revenues of new toll bridges in each sector. Recommendations on the potential feasibility of new toll bridges were developed using a financial analysis model that simulates the effect of managerial decisions upon the predicted gross revenues and estimated costs. Together, the capacity and feasibility analyses provide a comprehensive picture of border transportation needs, including identification of the sectors where new toll bridges are financially attractive. The findings of this and the previous reports provide the basis for effective transportation planning and policies, as well as for future studies on border transportation issues.

CHAPTER 1. INTRODUCTION

BACKGROUND

This study comprehensively investigates the Texas-Mexico border area from a binational perspective. It is defined as a planning-level needs study, and its main objective is to help TxDOT and TTA achieve a better understanding of transportation demand and infrastructure needs at the Texas-Mexico border. This goal is addressed by pursuing three main objectives, which translate into four deliverables:

1. a comprehensive overview of the border transportation infrastructure;
2. an automated data base of Mexican and U.S. transportation-related information;
3. an assessment of NAFTA impacts on maquiladora activity and on U.S.-Mexico trade; and
4. capacity, demand, and revenue analyses of the binational entry systems.

The first deliverable is a comprehensive overview of the transportation infrastructure on both sides of the Texas-Mexico border, and a supporting data base containing Mexican as well as U.S. data that define the binational border area. A primary goal of this data base, termed TRANSBORDER in this study, is to provide information for coordinated transportation planning along the Texas-Mexico border. The TRANSBORDER data base can be utilized by other agencies for planning purposes, thus avoiding redundant data collection efforts. This first deliverable is described in the first two reports of this series. Research Report 1976-1 documents the overview of the border, while Research Report 1976-2 documents the development of the TRANSBORDER data base.

The second deliverable is an assessment of NAFTA impacts on the maquiladora industry and on the U.S.-Mexico trade; the third deliverable is the identification of transborder traffic flow patterns, which includes a significant amount of origin and destination information collected at border bridges. These two deliverables are documented in the third report of this series.

A bridge over the Rio Grande is more than an urban bridge. It links two different countries, serves two different economies, addresses two different travel behaviors and, in the case of toll facilities, obtains the toll revenue in two different currencies. The border crossing procedures, and not bridge structure, are in many cases the main constraint to free flow, and they must be considered when estimating the binational entry system capacity as well as when modeling bridge alternatives. This study developed approaches to assess the current capacity of binational entry systems, and the potential demand and revenues of new toll sites along the Texas-Mexico border. Together, these reports can serve as guidelines for assessing transborder infrastructure needs. The capacity, demand, and revenue analyses are discussed in the fourth and fifth reports of this series. All study findings, conclusions, and recommendations are briefly discussed in the last report of this series.

Study Organization

In accordance with the project objectives, this study is divided into two segments. Segment 1 begins at the Gulf of Mexico and ends west of Laredo at the Colombia Bridge. Segment 2 begins immediately west of the Colombia Bridge and ends at the New Mexico border west of El Paso. The two study segments are shown in Figure 1.1. The study objectives, methodology, and research approach were the same for both segments. The two segments reflect Texas trade corridors and facilitate the presentation of study results.

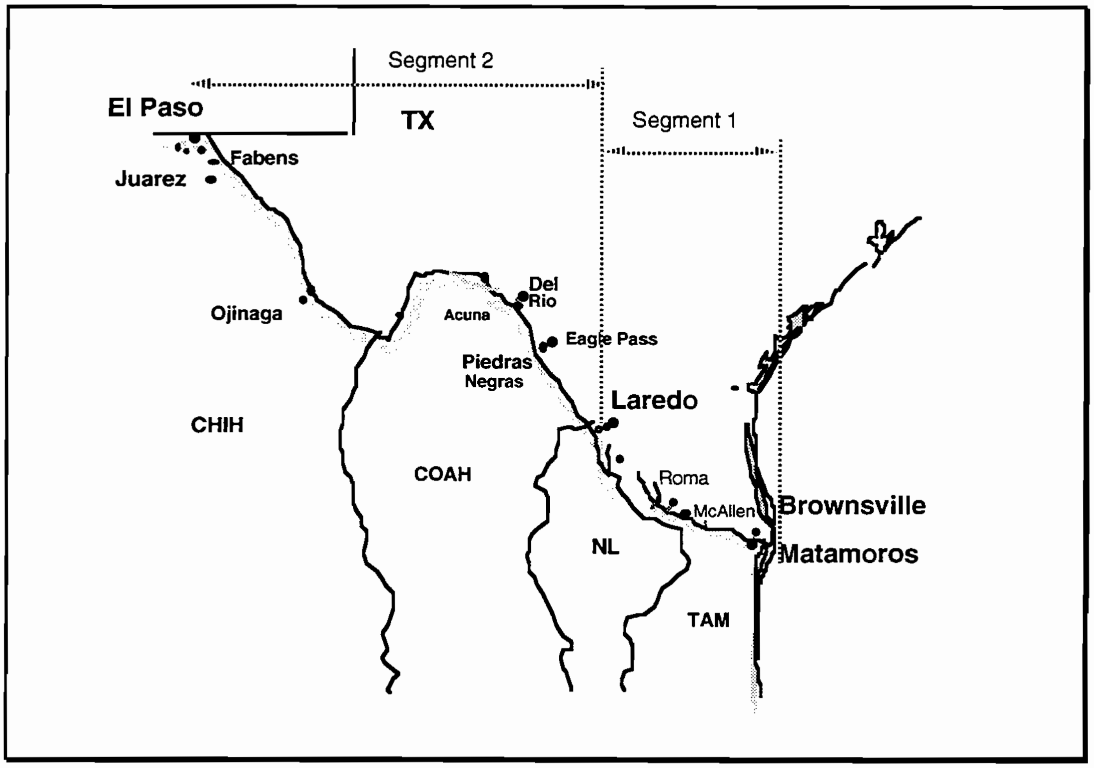

Figure 1.1. Geographical division of border into two segments for study purposes

The capacity and revenue analyses are documented in two separate reports, Report 1976-4 for Segment 1, and Report 1976-5 for Segment 2. The methodology used to analyze the capacity of binational entry systems was developed by CTR, and is exactly the same for both segments. The revenue analysis provides an indication of the potential feasibility of a new binational entry system in the sectors. The revenue analysis includes four steps, which are:

(1) estimate of future traffic for the entire sector;

(2) estimate of traffic demand for the new (hypothetical) facility;

(3) estimate of potential gross revenues; and

(4) estimate of potential net revenues of the new facility, which indicate its feasibility.

The current capacity utilization assessment, coupled with the revenue analysis described above, provide guidelines to assess the need for and feasibility of new binational entry systems along the entire border. The capacity analysis diagnoses the traffic circulation problem, while the demand and revenue analyses help evaluate the probability of a new toll bridge in the sector.

CTR developed an analysis methodology to assess the four estimates that make up the demand and revenue analysis. CTR's approach was comprehensively used in all sectors but El Paso and Eagle Pass. In these sectors, CTR estimated only the potential net revenues (item 4 of the list above), while the other three steps of the revenue analysis were subcontracted to Wilbur-Smith Associates (WSA), a Wall Street accredited specialist in traffic demand forecasts. WSA had previous experience with a revenue analysis for the replacement of the Zaragoza Bridge in El Paso, using a traffic assignment model that gave good results (Ref 22). WSA was contracted to perform the analysis of these two sectors in Segment 2 because of their knowledge gained in this study and because we believed that improving an already calibrated model would be more accurate than developing a new one.

The sensitivity of a traffic diversion analysis to a specific bridge location depends upon several factors, one of which is the level of disaggregation of the analysis. A revenue analysis of a specific project provides results that cannot be extrapolated to other sites. This approach would limit the scope of the study and have little value to transportation planning. The sector analysis concept, discussed in the next section, is an aggregated approach for revenue and demand analyses that widens the scope of the study results and provides guidelines for new binational entry systems along the Texas-Mexico border.

The Sector Analysis Concept

The sector analysis concept was developed as an analysis methodology to estimate traffic demand and revenue for use in regional transportation planning. It was designed to work in conjunction with traditional trip assignment methods used in traffic demand estimates. Sectors are defined based on major traffic diversion areas, which in turn depend on the socioeconomic indicators of the areas spanned by major origin and destination zones. The area of economic activity that can generate and/or attract traffic was termed "economic activity center."

Because border bridges serve traffic demand, they are naturally located within economic activity centers. A site far from any economic activity center would attract very little traffic. As this hypothetical site approaches the boundaries of an economic activity center, the traffic demand increases until it reaches either the peak traffic volume the binational entry system can process, or the maximum demand it can divert from nearby facilities. Within the economic activity center, each specific site has its own individual capability to attract traffic (within a certain range) and can be represented by an "average" potential demand anywhere within a certain subset of the economic activity center, which is termed *sector*. Sector is thus defined as the sphere of influence of an economic activity center where the potential demand of any transportation artery will fall within a certain interval whose extremes have no elasticity with respect to specific site location. Average demand by sector indicates the overall potential demand, while the interval limits give an idea of the maximum and minimum potential demand at a generic new site within any specific sector.

The sector analysis concept was developed to provide answers to questions pertaining to regional transportation planning, rather than to individual proposed sites. It works effectively in conjunction with trip assignment models because it is technically unsound to predict traffic demand at a specific site without taking into account all other facilities within a certain area that generates traffic willing to use the new site. Because of the uncertainties inherent in models using data from random samples, the sensitivity of the trip assignment model output with respect to specific site location is limited to a certain area. In this study, this area of sensitivity is termed *sector*. These sectors are always within economic activity centers — that is, areas that have approximately the same range of socioeconomic development and traffic generating capability. The next section summarizes the Texas-Mexico border sectors in study Segment 2.

Border Sectors in Segment 2

Report 1976-3 identified nine economic activity centers and boundaries of eighteen sectors along the Texas/Mexico border. Table 1.1 summarizes the economic activity centers, while Table 1.2 summarizes the sector boundaries, along with existing and proposed bridges that fall within the Segment 2 geographical division. All sectors located within economic activity centers were analyzed in this study to fulfill the objectives discussed below.

Table 1.1. Texas-Mexico border economic activity centers — Segment 2

Economic Activity Center	U.S. Border City	Mexico Border City
6	Eagle Pass, Maverick County	Piedras Negras, Coahuila
7	Del Rio, Val Verde County	Cd. Acuña, Coahuila
8	Presidio, Presidio County	Ojinaga, Chihuahua
9	El Paso, El Paso County	Cd. Juárez, Chihuahua

REPORT OBJECTIVES

The analyses presented in this report provide a quantitative assessment of existing binational entry systems in terms of their ability to accommodate transborder traffic along Segment 2 of the Texas/Mexico border. In addition, they provide a preliminary assessment of potential demand for and revenue of new binational entry systems in the border sectors that are located within economic activity centers.

For each sector, the report contains a comprehensive assessment of the capacity of each binational entry system, which includes identification of main causes of congestion. This analysis is complemented by an assessment of potential demand and revenue at a hypothetically proposed binational entry system in the sector. The objective of this demand and revenue analysis is to identify sectors of the border that are strong candidates for new binational entry systems that charge tolls. Accordingly, the revenue analyses performed by CTR include a preliminary cost analysis that is meant to suggest project feasibility.

Table 1.2. Description of the Texas-Mexico border sectors — Segment 2

Sector Number	Sector Name	Existing Binational Entry Systems	Proposed Binational Entry Systems
9	Guerrero	None	None
10	Eagle Pass /Piedras Negras	Eagle Pass /Piedras Negras #1	Eagle Pass/Piedras Negras #2a & #2b
11	Quemado	None	None
12	Del Rio/Ciudad Acuña	Del Rio /Ciudad Acuña	None
13	La Linda	La Linda Bridge	None
14	Big Bend National Park	1. Boquillas Ferry 2. Santa Elena Ferry	None
15	Terlingua	None	None
16	Presidio/Ojinaga	Presidio/Ojinaga	None
17	Ft. Hancock/El Porvenir	Ft. Hancock/El Porvenir	None
18	El Paso/Ciudad Juárez	1. Fabens 2. Ysleta 3. BOTA 4. GNB 5. PDN	1. Fabens Replacement 2. Socorro 3. BOTA Replacement

REPORT SCOPE

This report is divided into eight chapters and one appendix. Chapter 1 discusses the background, the report objectives, and the report scope. In addition, it briefly summarizes the sector analysis concept, fully described in Report 1976-3 and briefly repeated here to facilitate comprehension of this report.

Chapter 2 describes the methodology developed by CTR to assess the binational entry systems' current capacity. It also discusses the results of some preliminary assessments needed to further develop the capacity analysis of each sector.

Chapter 3 discusses the methodologies developed by CTR to assess the potential revenue and the prefeasibility of a new binational entry system. This methodology includes a cash flow projection based on certain hypotheses, the major one being that the bridge owner will sell revenue bonds to obtain the initial capital. This chapter also discusses the methodology used by WSA to estimate the demand and gross revenues of the El Paso and Eagle Pass sectors.

Chapters 4 through 7 document the capacity, demand, and revenue analyses for each Segment 2 sector that is located within an economic activity center. Finally, Chapter 8 summarizes the conclusions, findings, and recommendations of this report, while Appendix A contains a bilingual glossary of border-related terminology.

CHAPTER 2. CAPACITY ANALYSIS APPROACH

The bridges, dams, and ferries crossing the Texas-Mexico border form an interrelated system of transportation whose main objective is to move people and commodities from one country into the other. This system, which includes the inspection facilities as well as the links with the rest of the infrastructure of both countries, cannot be properly studied in a disaggregated manner. The traditional capacity analysis methodology (Ref 18) does not include the complexities inherent in binational entry systems. This chapter discusses a capacity analysis approach developed to take into account all factors that influence the traffic processing output of a binational bridge entry system.

BACKGROUND AND OBJECTIVES

A bridge crossing the Rio Grande at the Texas-Mexico border must include facilities for inspections and enough personnel to staff such facilities. Inspection procedures in binational bridge entry systems have the potential to cause congestion. While simple measures that consider the influence of inspection procedures on traffic circulation can sometimes improve the operation of existing bridges and avoid the same problems in new ones, these procedures will always have a major influence on binational entry system capacity. For example, the design of inspection facilities may cause unnecessary delays. In some binational bridge entry systems, the primary truck inspection booth is always immediately to the right of the bridge exit. Since trucks are longer in size than autos and take more space, they occupy the right lane of the bridge, causing traffic backup at the toll booths, which in turn causes congestion on the connecting infrastructure. The commercial lot primary inspection booths should be located further away from the bridge to provide room as a "waiting area" for trucks. While some newer bridges (e.g., the Bridge of the Americas in El Paso) take this problem into consideration, older bridges located near or in downtown areas may not have access to the additional space required for relocating the primary inspection booths.

Regardless of the inspection facility design, the potential for congestion grows as the staffing capability decreases. If no inspections were necessary, the addition of new bridges with good access roads would be enough to improve the traffic circulation across the Rio Grande. This is schematically shown by the dashed line in Figure 2.1. This line shows that the level of service improves with the addition of new traffic lanes until it reaches the asymptote that corresponds to free flow. However, the traffic flow across an international bridge can never be unimpeded, as it will always be stopped for a number of inspection procedures. The staffing capabilities of U.S. and Mexican inspection agencies is limited, and the solid line in Figure 2.1 shows the real situation created by the addition of more bridges to the border area. As long as the federal agencies can fully staff the new facility, the overall traffic flow will improve, and the real situation (solid line) will be the same as the hypothetical (dashed line). As the staffing capability approaches its peak, however, the traffic circulation will show little improvement. When the number of binational entry systems exceeds the staffing capabilities, federal agencies will resort to relocating staff from one entry system to another, thus creating two inspection bottlenecks instead of one. As the staff is spread thinner, the addition of new facilities will decrease rather than increase the overall level of traffic service. This situation is shown by the descending part of the solid line in Figure 2.1 (segment bc).

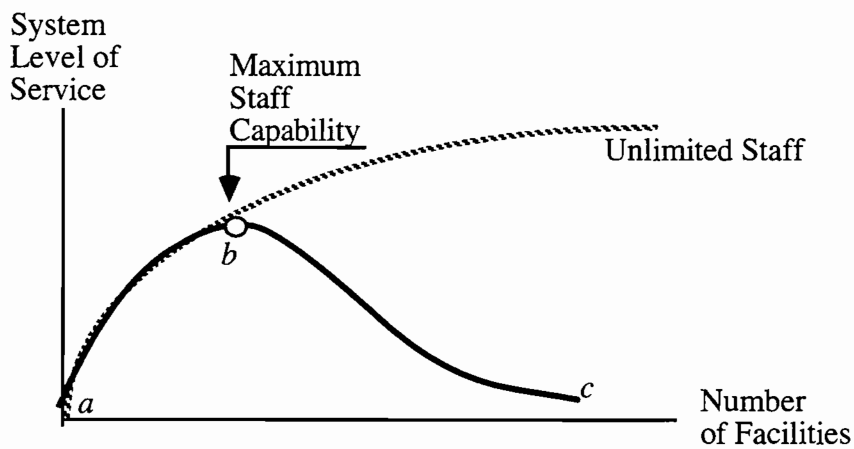

Figure 2.1. Staffing capabilities and level of service at the border

According to several staff members from U.S. agencies (e.g., General Services Administration and U.S. Customs), staffing is a major problem at the Texas-Mexico border area — a concern shared by some of their Mexican counterparts. In addition, customs inspections are expected to become more complex and to require more personnel as NAFTA lifts the trade barriers. Under pre-NAFTA regulations there was no need to verify the origin of product components for taxation, while under NAFTA this new need exists. This type of inspection became routine at the Canadian border after the U.S.-Canada free-trade agreement took effect. As the traffic between the U.S. and Mexico grows, the staffing problem will become more critical, especially if the traditional solution of building new bridges continues to take precedence over innovative solutions based on coordinated binational planning. There is an urgent need for coordinated binational planning, and the capacity analysis methodology outlined later in this chapter can be seen as a step towards addressing the border transportation planning issue in this manner.

Capacity assessments are basically comparisons between the existing traffic and the facility processing capability. Since the existing traffic fluctuates within any given time interval, the first step towards identifying capacity is defining the numbers that will represent the traffic using the facility.

TRAFFIC ANALYSIS

A capacity analysis result is usually expressed in a volume-to-capacity ratio (v/c), which captures the percentage of the total capacity being utilized by the current traffic demand. This demand fluctuates hourly, weekly, monthly, and seasonally, and these variations must be captured by the number chosen to represent the "volume" in the v/c ratio. These volumes are usually represented by the Annual Average Daily Traffic (AADT, also abbreviated as ADT), and the hourly volume is usually summarized in terms of the k-factor, which represents the ratio between the hourly volume of interest and the AADT. AADT and k-factor values were estimated for each binational entry system to use in the capacity analysis, and the results are discussed in this section.

Annual Average Daily Traffic Estimates

Traffic data were collected in both traffic directions, from agencies such as bridge owners, U.S. Customs, and Caminos y Puentes Federales (CAPUFE) in Mexico, in each binational entry system. While the ideal AADT would be averaged over continuous counts taken during the entire year, in most cases only samples of the year were available. Whenever possible, federal guidelines (Ref 4) were used to estimate the weekly and seasonal fluctuations based on limited data. The AADT estimates used in this analysis are based on 24-hour traffic counts collected Monday through Friday for private vehicles and commercial trucks (the analysis thus targets primarily weekday traffic). Table 2.1 presents the results of the auto and truck AADT estimates for Segment 2 binational entry systems. Owing to the limited availability of data, values in parenthesis were estimated based on data for the opposite direction. Bridge of the Americas (BOTA) southbound AADT was estimated by assuming that southbound and northbound volumes balance for all binational entry systems in the El Paso sector.

Hourly Volume Estimates

Traffic fluctuates hourly, and since some hours are more congested than others, some level of congestion must always be tolerated to ensure efficient utilization of the facility. A detailed analysis of traffic hourly volume to identify different congestion levels based on statistical analysis of detailed hourly data would provide a probability distribution of volumes over the typical day. Such comprehensive analysis is beyond the scope of this study; nevertheless, some assessment of the capacity utilization at peak hours is important to give an idea of the worst level of congestion in a typical day. This involves converting the average daily traffic to a peak hour volume by estimating the peak hour k-factor. Based on samples of hourly volumes collected at several binational entry systems, peak hour k-factors were calculated for transborder traffic. A peak hour k-factor is the fraction of daily volume represented by the peak hour. It is calculated by dividing the hourly counts observed at the peak hour by the total daily count. Twelve-hour average k-factors were also calculated to be used as a comparison with the worst congestion of the day. Table 2.2 summarizes the results of these k-factor calculations.

Table 2.1. 1992 AADT estimates (Monday – Friday)

Binational Entry System	Non-Commercial Vehicles		Commercial Trucks	
	Northbound	Southbound	Northbound	Southbound
Eagle Pass	7,000	7,000	140	200
Del Rio	3,300	3,000	80	60
Presidio	1,600	(1,600)*	20	(20)*
Fabens	930	(930)*	n.a.	n.a.
Ysleta-Zaragoza	5,100	5,900	200	650
Bridge of the Americas (BOTA)	19,000	23,100	1,700	1,250
Good Neighbor Bridge (GNB)	n.a	7,700	n.a	n.a
Paso Del Norte (PDN)	12,600	n.a	n.a	n.a

*Estimates based on data for opposite direction

Table 2.2. 1992 peak hour k-factors

Binational Entry System	K Factor	
	Peak Hour	14-Hour Average
Eagle Pass (SB, Autos and Trucks Combined)	8.9%	6.6%
Ysleta (NB Trucks)	18%	15.3%
BOTA (NB Trucks)	13%	10.8%

The k-factor estimates shown in Table 2.2 are based on limited hourly data collected and can only be considered as a "snapshot" of a situation that varies continuously. However, the auto peak hour factors for the entire border (including those for Segment 1) consistently stay within the 7.5-10 percent interval, while the 12 or 14-hour average factors stay in the 5.5-7.5 percent interval. Therefore, a single peak hour and a single average-hour 'k' factor were estimated for all of the binational entry systems for each vehicle type (when applicable).

For autos, the peak hour k-factor was assumed as 9 percent, and the 12-hour average k-factor was assumed as 7 percent. For trucks, the situation required more consideration. Field interviews with U.S. Customs officials indicated that northbound freight carriers are released in batches from the Mexican export lot throughout the day. Truck-only hourly data collected at Bridge of the Americas and Ysleta Bridge in El Paso indicate that the peak hour k-factor for trucks ranges from 13 percent to 18 percent. The capacity analysis discussed in this report utilized a k-factor of 15 percent in both directions for trucks. Table 2.3 presents the peak hour volume estimates made at the binational entry systems along Segment 2 of the Texas/Mexico border, by correcting the AADT estimates depicted in Table 2.1 with the k factors described above.

Table 2.3. 1992 peak hour volume estimates

Binational entry system	Autos		Trucks	
	Northbound	Southbound	Northbound	Southbound
Paso Del Norte	1,134	-	-	-
Good Neighbor	-	693	-	-
Bridge of the Americas	1,710	TOLL-FREE (2,079)	255	TOLL-FREE (188)
Ysleta	459	531	30	98
Fabens	84	TOLL-FREE (84)	-	-
Presidio	144	TOLL-FREE (144)	3	TOLL-FREE (3)
Del Rio	297	270	12	9
Eagle Pass	630	630	21	30

The traffic volumes estimates discussed in this section were used with the capacity analysis methodology discussed in the next sections to provide an assessment of the capacity utilization in the binational entry systems along the Texas-Mexico border.

BINATIONAL ENTRY SYSTEM CAPACITY ANALYSIS METHODOLOGY

The traditional concept of capacity as defined by the *Highway Capacity Manual* is based on traffic volumes; it is appropriate to conditions where a free flow is theoretically possible (Refs 18, 14). However, as discussed before, the concept of free flow is not applicable to binational entry systems, because vehicles must always stop for border inspection routines. This project developed a capacity analysis approach that takes this fact into consideration, and can provide assessment of the overall available capacity of each binational entry system along the Texas-Mexico border.

Background

In general, the capacity of a facility is defined as the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions (Ref 18). Roadway conditions consist of geometric parameters, such as design speed, lane width and lateral clearance. Traffic conditions refer basically to the vehicle type(s) in the traffic stream, since vehicle operations on a roadway vary significantly between an automobile and a heavy truck. Control conditions refer to the mechanisms used on a facility where traffic flow is interrupted, such as a signalized or stop control intersection.

Capacity analysis results are given in terms of traffic processing output; and since traffic volumes continually change, the capacity needs to be analyzed in terms of some representative volume. Three concepts are used for this purpose: the average daily traffic, the average hourly volume, and the k-factor, as discussed in the previous section of this chapter.

Another concept used in this analysis is the level of service, a measure of the quality of traffic flow as it is affected by a number of factors, such as average vehicle speed, travel time, traffic interruptions, freedom of maneuver, and others. Levels of service range from "A" to "E," "A" corresponding to free flow, and "E" corresponding to congestion. Table 2.4 illustrates the levels of service and the corresponding average daily traffic (ADT) ranges for a four-lane undivided urban street, which can approximately represent some binational entry systems' access and egress components (Ref 18).

Table 2.4. Levels of service and ADT ranges

Type of Flow	Good	Tolerable	At or Over Capacity
Level of Service	A-B	C-D	E
ADT	<12,600	12,601-14,900	14,901-18,000

Capacity estimates of binational entry systems developed in this study are based upon these concepts. Geometric conditions and vehicle types at a binational entry system affect the capacity, and so do control conditions, which consist of toll booths and customs inspections, in addition to control mechanisms on the approaches to and exits from the binational entry system. Accordingly, capacity at each of these components was studied separately, and the overall binational entry system capacity is determined by the smallest value of all components.

Components of a Binational Bridge Entry System

There are four major components (for vehicles) that compose a binational entry system. These four components are:

(1) Access/Egress

(2) Toll Collection

(3) Bridge

(4) Inspection facilities

The access and egress are the connecting infrastructure, which vary from major highways to narrow streets in a historical downtown area. While the former usually has little potential for congestion, it will be shown later in this report that often the latter sometimes determines the binational entry system capacity. The bridge span capacity can be analyzed using the traditional methodology outlined in Ref 18. Finally, the toll and inspection facilities capacity depends on the facility layout and on the staffing capabilities, as discussed previously.

The first step in the development of the capacity analysis methodology consisted of identifying fourteen separate processes (not including secondary inspection) that transborder commercial and non-commercial vehicles can be subject to within the four components listed above. These processes are:

(1) Southbound Access,

(2) Southbound Toll (trucks),

(3) Southbound Bridge Span,

(4) Southbound Mexican Primary Inspection (trucks),

(5) Southbound Egress,

(6) Southbound Toll (autos),

(7) Southbound Mexican Primary Inspection (autos),

(8) Northbound Access,

(9) Northbound Toll (trucks),

(10) Northbound Bridge Span,

(11) Northbound U.S. Primary Inspection (trucks),

(12) Northbound Egress,

(13) Northbound Toll (autos), and

(14) Northbound U.S. Primary Inspection (autos).

Figure 2.2 depicts a scheme of these fourteen components of a binational bridge entry system. Each of the fourteen processes displayed in Figure 2.2 were analyzed for all major binational entry systems along the Texas-Mexico border, and a clear understanding of the scheme shown in Figure 2.2 is helpful in clarifying the analysis results discussed in this report.

All components are very complex, and a detailed capacity analysis of each one of them would require a myriad of data that are only partially available, since their level of detail by far exceeds the scope of this study. Nevertheless, a clear picture of a binational entry system capacity was achieved based on the methodology developed in this project, which takes into account all major sources of delays that affect traffic flow.

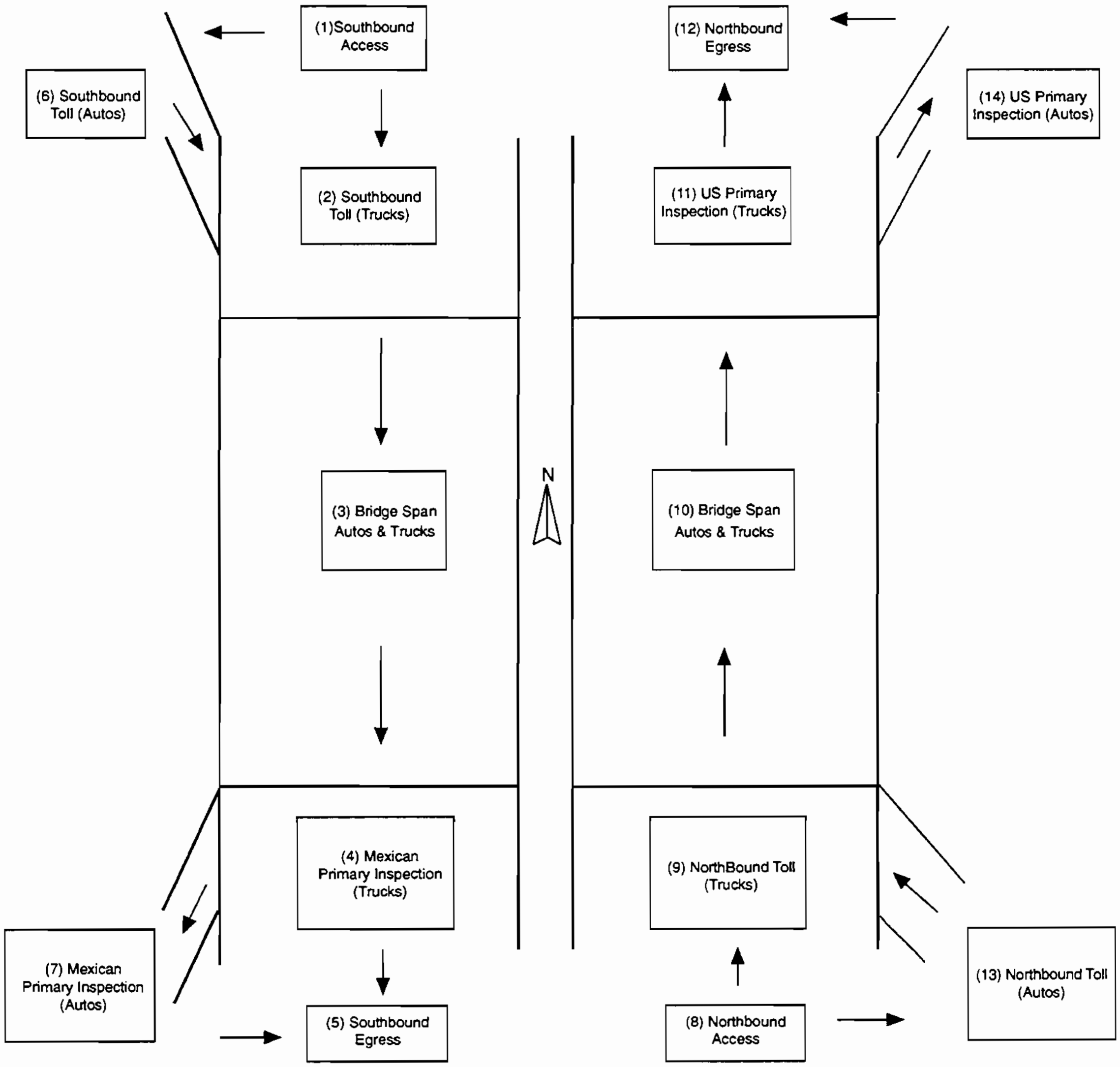

Figure 2.2. Components of a binational entry system

Processing Rates of a Toll or Inspection Lane

The processing rate of a binational entry system toll or inspection lane is equivalent to the vehicle delay due to the toll or inspection process. This vehicle delay can be divided into four time elements:

(1) Deceleration time when approaching the queue behind the booth,
(2) Time to move towards the booth once queued,
(3) Time stopped at the booth, and
(4) Acceleration time to clear the booth for the next vehicle.

Under ideal conditions, the vehicle coming immediately behind the one stopped at the booth would not be queued; instead, it would arrive at the booth just as the vehicle in front clears it, thus avoiding the delay from waiting in a queue (item 2 of the list above). In other words, the headway between vehicles would be equal to the stop delay of the toll or inspection facility. However, this is an idealized situation, nearly impossible to observe in the field. The headways of arriving vehicles are generally less than the processing time of the toll or inspection booth because the vehicles usually arrive in platoons or batches. Thus, even when the average hourly arrival rate is less than the average hourly capacity, some queuing is usually observed. It must also be noted that some of these delay times overlap, because while one vehicle is still accelerating to leave the booth, the one immediately behind is already accelerating towards the booth.

It was necessary to devise a method for measuring the four delay components discussed above in a meaningful way and the processing rates were obtained counting the number of vehicles that pass by the booths over a period of time while a queue exists behind the booths. The total number of vehicles counted was divided by the number of booths and then divided into the total time elapsed, to calculate the average processing rate of each booth in seconds or minutes per vehicle. This method takes into consideration all four vehicle delay components, namely, the delay to approach the queue just behind the booth, the waiting time in the queue, the time stopped at the booth, and the time to clear the booth for the next vehicle.

Processing rate data were collected on four binational entry systems along the border: Laredo 1, Laredo 2, Hidalgo, and Eagle Pass. Data were collected at the toll booth and at inspection facilities on both sides of the border, for autos and trucks, in northbound and southbound directions. The available data are summarized in Table 2.5, in terms of observed average delays. These results were used to represent the toll and customs facility processing rates for the entire border. It was necessary to use some data collected for Segment 1 (Gulf to Laredo) to obtain a better average processing rate.

Table 2.5. Average processing rates (time per vehicle)

Binational Entry System	Vehicle Type	Southbound		Northbound	
		Toll	Inspection	Toll	Inspection
Laredo 1	Autos				37 sec
	Trucks	27.4 sec			
Laredo 2	Autos	10.3 sec			
	Trucks	23.6 sec			
Hidalgo-Reynosa	Autos	8.3 sec	3.6 sec	6.2 sec	20 sec
	Trucks	20 sec	1min 35 sec		2 min 10 sec
Eagle Pass-Piedras Negras	Autos	15 sec		12.5 sec	

Capacity of the Toll Collection Component

The capacity of the toll collection facility is a function of the number of toll booth lanes, processing time per vehicle, and lane utilization by vehicle type. Field data for autos indicate that the average processing time per vehicle is approximately 14 seconds, or 257 vehicles per hour per toll booth lane (vphpl) on the U.S. side, and 12 seconds, or 300 vphpl, on the Mexican side. For trucks, data indicate an average toll processing rate of 21 seconds per truck in the U.S., The same rate was assumed for the northbound toll in Mexico.

The data collected for southbound autos at several different sites revealed a significant difference in processing time between a facility charging a toll that is a multiple of a whole dollar ($1.00), as opposed to a toll that is a fraction of a dollar, such as $1.25 or $1.50. The data collected at the Hidalgo bridge ($1.00) resulted in an average processing rate of 8 sec/veh, while the data collected at Eagle Pass ($1.50) and Laredo Sector ($1.25) resulted in an average of 14 sec/veh processing rate, as shown in Table 2.2. This difference is a result of the additional time required for the toll booth operator to make change for a $1.25 or $1.50 toll, implying that the use of whole-dollar tolls or pre-paid coupons can significantly improve the processing rate of toll facilities. The 14-seconds-per-vehicle processing rate was used as a conservative estimate for all border toll facilities, to take into account possible increases in toll fares.

Capacity of the Inspection Facilities Component

Customs in both countries include primary and secondary inspection of incoming private and commercial vehicles, as well as inspection of outgoing private and commercial vehicles at some ports of entry. The capacity analysis presented in this chapter will only address the primary inspection process of incoming vehicles to both countries, since the secondary inspection facility does not interfere with traffic circulation when a convenient geometric design is used (Ref 8).

Primary inspection lanes are assumed to be fully staffed for both countries. In reality, not all lanes are staffed, and this assumption implies that the analysis results estimate the maximum potential capacity available in the binational entry system.

Based on field data and on field interviews of U.S. customs officials, the analysis assumes a processing rate of 33 sec/veh (109 vphpl) for autos, and of 2 minutes per trucks, for the U.S. primary inspection. As for the Mexican primary inspection processing rates, the analysis assumes the values of 8 seconds per auto, and 2 minutes per truck.

Field data collected for Mexican truck primary inspection yielded an average processing rate at the booth of 1 minute and 13 seconds when a pre-clearance procedure was being applied. It was concluded that the pre-clearance activity shortened the process rate; but since this is not a border-wide policy of Mexican customs, the capacity analysis uses a conservative value of two minutes per truck.

At a v/c ratio less than 100 percent, the departure rate (capacity) is greater than the arrival rate (traffic volume) and no queuing should occur. The toll collection or the primary inspection facility should be able to accommodate all the arriving traffic within a given hour, if the vehicles arrived fairly uniformly at the booth. However, field observations indicate that in reality, vehicles do not arrive at a uniform rate. Instead, they usually arrive in platoons, which basically replicate the platoon pattern of the nearest intersection. Thus, some queuing and delay waiting in the queue does occur even with a v/c ratio less than 100 percent.

Capacity of the Bridge Component

The capacity of the bridge component is a function of the number of lanes, lane utilization, grade, lane width, and percent of trucks in the vehicle mix. An ideal saturation flow rate of 1,800 vehicles per hour per lane (vphpl) is used for a typical four-lane cross-section, while 1,400 vphpl is used for two-lane cross-sections. The ideal saturation flow rate is adjusted by the following factors:

(1) Percent of trucks in vehicle mix,

(2) Exclusive truck lanes or non-exclusive truck lanes due to congestion, and

(3) Narrow lanes.

An exclusive truck lane is estimated to have a capacity of 450 vphpl. This estimate is based on dividing an ideal saturation flow rate of 1,800 vphpl by the passenger car equivalent for heavy trucks on rolling terrain ($E_T = 4$). The ideal saturation flow rates and adjustment factors utilized were taken from the *Highway Capacity Manual* (Ref 18).

Capacity of the Access/Egress Component

The approaches to and exits from binational entry systems vary from a city street to a major arterial or a freeway, with intersection control mechanisms that vary from a stop sign to a signalized intersection. The parameters required to estimate capacity vary significantly by facility and intersection control type. A rigorous assessment of the access/egress components is beyond the scope of this study, due to the type of detailed analysis and amount of data required (e.g., intersection turning movement counts, signal timing data). In addition, a significant portion of a border city may need to be analyzed, due to the possibility that the approaches and intersections located immediately upstream from a binational entry system may not be the critical links leading to or from a binational entry system. This type of analysis is more akin to a detailed traffic circulation study than to a transportation needs study. However, to completely disregard the immediate approach facilities of a binational entry system would result in an incomplete capacity utilization analysis, because the access to or the egress from the toll or inspection facilities may either be the bottlenecks, or have a potential to become the major bottleneck in the future, especially if all other components (toll booth, bridge span, and inspections) are operating efficiently. Therefore, a capacity utilization analysis was conducted for the approaches with limited data and by making some assumptions. The approach to estimate the capacity of the access/egress component is based on guidelines for controlled intersections documented in the *Highway Capacity Manual* (Ref 18). Pignataro (Ref 14) can also be consulted for a brief but clear summary of this methodology.

A signalized intersection is most often assumed to be the constraining factor in the amount of capacity available for a connection to and from the bridge. The analysis of a signalized intersection (as described in Ref 18) involves estimating stopped delay per vehicle in order to assign a level-of-service for a particular approach or movement of the intersection. The level-of-service may range from "A" (very low delay, less than 5 seconds per vehicle) to "F" (very high delay, greater than 60 seconds per vehicle). The v/c ratio is related to this stopped delay but not in a simple one-to-one fashion. It is possible, for example, to have delays in the level "F" range, while the v/c ratio of the signalized intersection is below 100 percent. The reverse is also possible. A v/c ratio of 100 percent does not automatically imply delays in the level "F" range. The signal's cycle length and signal progression of multiple signals play a significant role in determining vehicle delay than the v/c ratio. A v/c ratio less than 100 percent does not imply zero vehicle delay, zero queuing or free-flow conditions. Rather, it means that the traffic volume of the particular movement being analyzed can be processed through the intersection without having to wait for more than one red light.

Analogous interpretation is valid for unsignalized intersections. A v/c ratio greater than 100 percent implies queuing and extreme delays, while a v/c less than 100 percent implies only the inevitable delay due to the existence of a stop sign, or due to slowing down at an uncontrolled intersection.

SUMMARY AND CONCLUSIONS

The capacity analysis approach developed in this study provides estimates of the volume-to-capacity ratio (v/c) of each binational entry system component depicted in Figure 2.2. The capacity analysis is based on the following assumptions:

(1) All existing lanes are staffed for toll collection and primary inspection facilities.

(2) AADT estimates shown in Table 2.1 represent the annual average daily traffic for 1992.

(3) The peak hour volumes are 9 percent of the auto AADT (k_a=0.09), and 15 percent of the truck AADT (k_t=0.15), for the entire border.

(4) The average processing rates collected for the toll booths, northbound inspections, and southbound inspections are representative of all binational entry systems along the Texas-Mexico border.

(5) The analysis of the access and egress facilities on both sides of the border is based on limited data, and on additional assumptions made on a case-by-case basis concerning signal timing and turning movements at intersections.

(6) Signal timing phases are estimated for signalized intersections, and green time proportions are estimated based upon the critical flow rates for each assumed phase. Whenever appropriate, minor cross streets were assumed to be actuated, and a

minimum green time was allocated to the minor street movements. Elsewhere, green times were estimated based upon equal degrees of saturation per assumed phase.

The capacity utilization analysis was undertaken for all binational entry systems along the border except for those with very little traffic, such as the dam crossings, the ferries and the Ft. Hancock binational entry systems. Field data collected at several binational entry systems were used to estimate processing rates of toll booth and customs inspection facilities, as well as to verify the results of the analysis.

The capacity utilization analysis does not yield future demand or revenue predictions; rather, it gives an assessment of the total available capacities (i.e., all lanes open) of the binational entry systems along Segment 2. In other words, it gives an indication of where in the border additional infrastructure is needed. This result is complemented by the analyses of future demand in the sector and potential revenue of additional binational entry systems. The next chapter discusses the methodologies developed in this project to perform the demand and revenue analyses.

CHAPTER 3. APPROACHES FOR DEMAND AND REVENUE ANALYSES

INTRODUCTION AND OBJECTIVE

The tradition of serving the international traffic demand with the provision of toll bridges along the border has created a pervasive impression that additional binational entry systems are always the best solution for improving transborder traffic circulation. While in Mexico the international toll bridges are federally owned, in the U.S. they are locally owned, and there is fierce competition for these revenues. These impressions and considerations which are irrelevant to coordinated transportation planning have affected and may continue to affect the decision to build a new toll bridge (Ref 8).

The U.S. presidential permit application calls for a justification for the additional bridge, which can be accomplished based on the fact that traffic circulation is actually poor on many binational entry systems along the border. However, poor traffic circulation is rarely a result of insufficient lane capacity. Rather, it is caused by delays in the access network or at inspection facilities. In the latter case, conditions may actually worsen if the inspection agencies cannot provide adequate staff for the new bridge (Ref 8). The results of the capacity analysis documented in the next chapters of this report discuss this issue in detail. The important point at this time is the fact that, in order to plan the need for new border infrastructure, including new access roads, the transportation planner must consider two elements:

(1) At which points on the border would additional binational entry systems be the better solution for improving traffic circulation, and/or

(2) At which points on the border are there traffic circulation problems that may or may not be owing to a geometrically deficient bridge.

The capacity analysis methodology, explained in the previous chapter of this report, was developed to screen for the first element listed above, as well as to indicate other traffic circulation problems that may lead to a proposal for a new binational bridge entry system. However, a better indication of the possibility of a new binational entry system in the sector requires additional information on its potential feasibility as a toll facility; a methodology was developed by CTR to address this issue. Together, the capacity, demand, and revenue analyses provide answers to the two complementary questions discussed above, which in turn are valuable guidelines for transportation planning along the Texas-Mexico border.

FEASIBILITY ANALYSIS METHODOLOGY

A detailed feasibility analysis can only be made on a project-by-project basis, and in the presence of a considerable amount of data on the particular project. On the other hand, an estimate of potential feasibility of a new binational entry system is a useful indicator for transportation planning, and CTR developed a simplified feasibility analysis methodology to address this issue. The feasibility analysis includes the following four steps:

(1) Traffic analysis, which provides an estimate of future traffic for the entire sector;
(2) Demand analysis, which provides an estimate of traffic demand for the new (hypothetical) binational entry system;
(3) Estimate of potential gross revenues; and
(4) Financial analysis, which provides an estimate of potential net revenues of the new facility, an indication of its feasibility.

A new binational bridge entry system can be financed through a variety of schemes, and revenue bonds have been used to partly or totally obtain the funds. It will be assumed throughout this report that funds for implementing any new binational bridge come from the sales of revenue bonds. A brief background on some financial analysis concepts, including the characteristics of revenue bonds, is beneficial to clarify the feasibility analysis methodology discussed in this section.

Present Value of Money

The concept of present value is very important for long-term financial analysis of the type required to analyze the potential feasibility of a new binational entry system. This concept is based on the idea that it is better to receive money now than to receive it later, because in the meantime it could be accruing interest. The present value is always less than the corresponding future amount, and its exact value depends on the amount, the time frame, the market interest rates, and the risk of the investment (Refs 9, 13). A long-term financial analysis that does not take into account this concept, and instead works with nominal values, might be wrong by a factor of more than 2, for discount rates as low as 4 percent a year (Refs 6, 9, 12).

Characteristics of Revenue Bonds

A revenue bond is an instrument used by corporations and government agencies to obtain funds needed for long-term purposes, such as the construction of a new facility. A revenue bond allows time for the increased earnings from the new facility to be used in retiring the debt. A bondholder is a creditor of the corporation, unlike a stockholder, who is an owner (Ref 12). Generally, the obligations of the corporation with the bondholder are restricted to paying the face value at the end of the maturity period, and the interest at the rate and periods stated in the bond.

When the interest rate of a revenue bond is greater than the market rate, it can be sold at face value. However, since revenue bonds are issued primarily when the corporation is interested in delaying the retiring of the debt, they are usually sold at a discounted price, and they pay a smaller annual or semi-annual interest. Maturity periods vary, and some bonds are serial, i.e., they provide for varying maturity rates to lessen the problem of accumulating cash for payment.

A common maturity time is twenty years, though usually the investor does not keep the bond that long. There is an active secondary market of revenue bonds, where buying prices fluctuate according to the performance of the corporation issuing the bond and to stock market indicators. This secondary market does not affect the feasibility analysis methodology, because the bridge owners will need to pay the same interest and repay the same face value at the end of the maturity period, regardless of how many times the bond has been resold in the secondary market.

The bondholders' profit is the difference between the discounted price and the face value, plus the interest accrued during the liability period, paid at a nominal rate printed on the bond, which functions as a legal contract. For the corporation, the effective interest rate of the bond is calculated as shown in equation 3.1 (Ref 12).

$$EIR = \frac{FV + [FV * NIR * MP] - DP}{DP * MP} \tag{3.1}$$

where:

EIR	=	effective interest rate,
FV	=	face value of the bond,
DP	=	discounted price of the bond,
MP	=	maturity period, and
NIR	=	nominal interest rate.

The bond discount and the interest consist of additional costs of the new binational entry system that have to be covered by toll revenues. The effective interest rate of the bond is actually reflecting the combination of the interest accrued at the nominal rate, plus the difference between the face value and the discounted value. It is a helpful tool to allocate a bond expense in a cash flow analysis.

One way to evaluate bonds for rating is the "coverage ratio," which is the ratio between the present value of the monthly revenue and the annualized bond liability, which includes the annualized face value and the yearly interest. A coverage ratio of at least 1.5 is desirable, although bonds have been issued at lower coverage ratios.

Cost Analysis

The feasibility of an investment can only be properly assessed when gross revenues are compared with costs. This section discusses some estimates of the main components of the costs of providing and operating a binational entry system.

In terms of design and construction plans, a binational bridge entry system can be divided into the following components: (1) bridge structure; (2) approaches; (3) inspection facilities; (4) toll area facilities, (5) fencing and security gates; (6) off-site utilities; and (7) landscaping.

The binational entry system proponents have to pay for the design and construction, including engineering, surveying, right-of-way, legal fees, and insurance. In addition, they must pay for the bond issuance fees in the case of a bond-financed facility. A detailed cost analysis of each of these components is possible only after the design is made and all plans are available. However, an estimate of the current cost of each item is necessary to discuss the pre-feasibility of the new toll facility. The costs are divided into implementation, maintenance, and bond repayment.

Implementation Costs

An average value was estimated for the amount of facilities that provide adequate service, based on recent presidential permit applications and other literature. This study assumes that the cost of the U.S. inspection facilities is always the responsibility of the General Services Administration (GSA) (Refs 5, 8). It also assumes that the main approach road will be TxDOT's responsibility, and that the bridge owner's responsibility is restricted to linking the bridge to the new access road, if necessary. The average costs are listed in Table 3.1.

Table 3.1. Average implementation costs of binational entry system support facilities

Item	**Cost**
Services[1]	$2,000,000
Approaches (four-lane)	$200,000
Toll area facilities	$425,000
Fencing and security gates	$105,000
Off-site utilities	$600,000
Landscaping	$150,000
Total	$3,480,000

[1]Engineering fees, legal fees, bond issuance fees, right-of-way.
Source: Refs. 2, 13, 15, 16, 22.

The average cost figure for bridges utilized by TxDOT in its planning analyses is about $45 per square foot ($500/m^2). This figure closely matches the cost predictions for the Anzalduas Bridge, a sophisticated binational entry system that is being proposed in the Hidalgo sector (Ref 13). This figure is thus somewhat conservative, and it will be used as the typical cost of an international bridge. The bridge width was assumed as 63 ft (19 m) which corresponds to a four-lane bridge with one pedestrian lane on each side. The bridge length was assumed as equal to the average length of all bridges in each sector, both proposed and existent. It was also assumed that 40 percent of this length is Mexican and will not be paid by U.S. owners with revenue bonds. These bridge costs were then added to the costs shown on Table 3.1, and the total U.S. costs for implementing a new binational bridge entry system in each Segment 2 sector are summarized in Table 3.2.

Table 3.2. Average implementation cost of new binational bridge entry systems

Sector	Existing Binational Entry Systems	Proposed Binational Entry Systems	Average Cost to U.S. Owner
10. Eagle Pass - Piedras Negras	Eagle Pass # 1	Eagle Pass #2	$8,300,000
12. Del Rio - Cd. Acuña	Del Rio Bridge Amistad Dam	none	$8,300,000
16. Presidio - Ojinaga	Presidio - Ojinaga	none	$8,200,000
18. El Paso - Cd. Juarez	Fabens Ysleta-Zaragoza BOTA GNB PDN	Fabens replacement Socorro BOTA replacement	$8,800,000

Operation and Maintenance Costs

Costs of operation and maintenance (O&M), usually paid with toll revenues, need to be considered in the feasibility analysis. A detailed prediction of true O&M costs depends on local conditions, and can only be made on a case-by-case basis in the presence of very detailed data. A typical O&M cost value cannot be estimated based on the current costs of existing binational entry systems because the older the facility, the more maintenance it requires, and these figures are not applicable to new facilities. Since O&M cost histories are not available, a range of values was obtained from literature on proposed binational bridge entry systems, assuming an increasing maintenance need. These ranges are shown in Table 3.3. The feasibility analysis uses the mid-point of these intervals as O&M costs.

Table 3.3. Estimated operation and maintenance costs history (1994 dollars)

Year of Operation	Cost ($1,000)	Year of Operation	Cost ($1,000)
1st	349-465	11th	439-665
2nd	357-482	12th	450-690
3rd	365-500	13th	460-715
4th	374-518	14th	471-740
5th	382-536	15th	482-767
6th	390-557	16th	493-796
7th	400-576	17th	505-824
8th	410-598	18th	516-854
9th	419-620	19th	528-886
10th	429-642	20th	541-918

Other Considerations

Two other sources of costs and revenues have to be considered in the analysis, namely the income tax, and accrued interest on the toll surplus. If there is a surplus between toll revenues and bridge expenditures, the management should invest this money in some conservative way, such as a blue chip portfolio, to gain interest on the surplus and improve the cash flow. This surplus is taxable, and so is the profit on any other investment. It will be assumed in this analysis that a net interest rate of 4 percent a year on the net revenue represents the accrued interest minus any taxes that may apply. It is also assured that a 4 percent yearly rate represents the average net rate in the next twenty years.

Summary of Assumptions

In addition to the assumptions discussed above, which were necessary to arrive at estimates for the binational entry system costs, revenue sources, and management decisions, the following assumptions were used in the feasibility analysis:

(1) Depreciation costs are included in operations and maintenance (O&M) costs;

(2) The O&M costs discussed in Chapter 3 represent the expected values of these costs over the entire analysis period;

(3) The revenues from the hypothetical binational entry system do not need to be shared with other expenses;

(4) Funding for implementing the project will come from revenue bond sales;

(5) Revenue bonds are sold at 8 percent effective interest rate, with a 20-year maturity period;

(6) Throughout the analysis period, the existing toll structure in the sector will remain in effect for the all facilities, keeping up with inflation so that its present value at any time is exactly the same as the base year value;

(7) The majority of pedestrian traffic in every sector will always prefer the old bridges because of their convenient downtown location;

(8) All bridges were considered as open and operating in 1995;

(9) Only one additional facility will be constructed in the sector during the analysis period;

(10) New bridges are effectively designed, efficiently operated, fully staffed, and clearly identified in all access routes, in order to promote maximum utilization of the new facilities;

(11) Motor fuel will remain in adequate supply and future price increases will not substantially exceed the overall rate of inflation; and

(12) There will be no national, regional or local emergency that will abnormally restrict the use of motor vehicles in either country.

Departure from any of these assumptions may substantially change the conclusions about the feasibility of a new binational entry system in the sector. In addition, departures from the assumptions and results discussed in the previous sections may also cause changes in the conclusions.

DEMAND ANALYSIS METHODOLOGY

The demand forecast methodology for a new binational entry system in a Texas-Mexico border sector is twofold. First, it is necessary to project the sector traffic into the entire maturity period of the bonds (assumed 20 years in this study). Next, an appropriate part of this projected traffic needs to be assigned to the new binational entry system, based on origin and destination information and traffic diversion considerations. CTR developed a simplified methodology to assess the potential auto and truck diversion to a new binational bridge in the future, which is discussed in this section.

Traffic Forecast Methodology

Traffic is a function of land use and other socioeconomic indicators, such as population, vehicle ownership ratio, employment, auto occupancy rate, and percentage of loaded trucks. These relationships are not simple, and attempts to correlate existing traffic to these variables using regression were not successful, as they could only explain at most 60 percent to 70 percent of the relationship, and gave poor residual plots. The latter is a measure of lack-of-fit, which is especially important in forecasting, where the model must be extrapolated well beyond the range of calibration. All this indicates that traffic forecasts as usually seen in the literature cannot be made at this point without a considerable amount of error. Sensible traffic predictions have to be based mainly on qualitative discussions of NAFTA impacts on traffic, which can be found in various publications (Refs 10, 11, and 21).

NAFTA can be expected to generate three general types of economic impact: high impact, moderate impact, or low impact. Proponents of the high impact scenario state that the pre-NAFTA situation is characterized by excess regulations and protectionism that hinder economic development, the first by overwhelming the free enterprise to a point of discouraging investment in new businesses and the latter by hampering competition, which is seen as the main propeller of economic progress. According to the high impact scenario, NAFTA would, by gradually lifting all trade barriers, encourage new business and foster competition. As a result, the border economy would grow.

The moderate impact scenario starts out with almost the same arguments as the high impact scenario, but it suggests that the General Agreement on Trade and Tariffs (GATT) lifted the main barriers that were hindering economic growth, and that impacts of further deregulation would be minimal. A slight dampening of current upwards trends would be observed until the economic situation reaches a new equilibrium.

The low impact scenario referred to here has little to do with the arguments of NAFTA opponents on both sides of the border. It is pessimistic with respect to the NAFTA effects on the economies of border cities and counties. This scenario states that NAFTA would motivate a considerable part of the maquiladora activity to move south away from the border. It also states that once American products can enter Mexico without taxation, there will be no need for Mexican nationals to shop in the U.S., causing much of the border retail activity to suffer. In the low impact scenario, only long-haul traffic would increase.

Although it is widely recognized that protectionism and excess regulations usually hinder economic progress, the effects of removal of these hindering forces on a particular region are not known at this point. Any recommendations for transportation planning policies based on the choice of a theory might become obsolete in the near future. This inconvenience can be circumvented by broadening the study scope to take into account the possible effects of the high, low, and moderate impact scenarios, leading to the three traffic forecasts depicted in Table 3.4.

Table 3.4. Traffic forecasts scenarios

Scenario	Effect on Auto Traffic	Effect on Truck Traffic
High Impact	Growth rate will initially show high increase, then less increase, to reflect equilibrium after an initial NAFTA boom.	Growth rate will initially increase, then become steady to reflect competition from other modes.
Moderate Impact	Growth rate will show moderate increase.	Growth rate will initially increase, then become steady to reflect competition from other modes.
Low Impact	Growth rate will decrease.	Growth rate will initially increase, then become steady to reflect competition from other modes.

The scenarios shown in Table 3.4 were used in all traffic forecasts discussed later in this report. Local conditions, previous studies, and historical growth rates were also taken into account for each sector, on a case-by-case basis. In addition, there are two other factors that may affect the border transportation infrastructure. One is ISTEA in the U.S., and the other is the Mexican program to obtain funds for seaports and for rail started by the Salinas administration. The more optimistic the economic growth scenarios, the less transborder commercial traffic should continue to depend primarily on trucks. This study assumes that other modes would be indicated to address increasing trade, and that ISTEA, coupled with the Mexican programs, would gradually transfer potential truck demand to other modes.

Traffic Assignment Methodology

Throughout the border, transborder auto traffic is primarily local, consisting mostly of business, shopping and school-related trips. A detailed traffic diversion analysis requires availability of origin and destination data by each border city zone, together with land use forecasts for each of these small zones of both border cities. This is well beyond the scope of a transportation needs study.

For trucks, the situation is even more complicated. Pre-NAFTA truck regulations prohibit foreign commercial traffic beyond the commercial zones of both countries (a narrow strip about 48.3 miles [30 km] wide on both sides of the border). This caused commercial traffic to stop at a minimum of one commercial zone, which in turn causes most truck origins and destinations to be local. Moreover, actual cargo origins and destinations cannot be captured by a traditional survey at the bridge. NAFTA will gradually lift these regulations. In January 1997, trucks will be allowed in border states, and in January 1999, they will be allowed anywhere within NAFTA territory. Therefore, a trip assignment model developed with current truck information would be obsolete in less three years, and the most useful origin and destination data at this point are qualitative, based on interviews with trucking companies and U.S. Customs' offices.

The objectives of this study can be met with a sector analysis of the border, in which the already defined sectors are based on traffic diversion areas, and as such they encompass the major traffic diversion area spanned by the sector demand. The traffic assignment methodology developed by CTR is based on a spreadsheet model that takes advantage of existing origin and destination data, and land use data when available. The model is calibrated on a case-by-case basis, to reflect boundary conditions prevalent in each sector. Model assumptions thus vary with sectors, except the following, which are present in the basic spreadsheet used in all sectors:

(1) Currently identified O&D patterns for autos will not change during the analysis period;

(2) Traffic generation potential of the new facility is negligible;

(3) The route reconnaissance data discussed in Refs. 4A and 4R2 represent the average network characteristics over the entire analysis period;

(4) The new binational entry system is fully staffed, efficiently operated, and each one of its components will operate at full capacity during the entire analysis period, and

(5) The binational entry system being analyzed will be the only additional one in the sector during the entire analysis period.

The second assumption is conservative in terms of demand and revenue estimates, while the fourth and fifth are not. However, they are widely used in the literature, because introduction of a second binational entry system and/or all possible under utilization of facilities would complicate the analysis and require a myriad of additional assumptions that would introduce too much error in the analysis.

REVENUE AND DEMAND ANALYSIS METHODOLOGY FOR THE EL PASO AND EAGLE PASS SECTORS

The previous sections discussed the methodologies for demand and revenue analyses developed by CTR. These methodologies were used in all sectors except two: El Paso and Eagle Pass, which were subcontracted to Wilbur-Smith Associates (WSA), a Wall-Street accredited specialist in revenue forecasts for bond issuance. This subcontract was made in the belief that better predictions would be obtained with WSA's previously calibrated models for the El Paso sector developed during a recent study of the replacement of the Zaragoza Bridge (Ref 22). This section was extracted from the report provided by WSA at the end of the contract.

Methodology for Revenue Projections

Wilbur Smith Associates, as part of the preliminary analysis for the Texas-Mexico Toll Bridge Study, was assigned the task of identifying the current and future travel patterns and projecting toll revenues realized from potential new toll bridge crossings. Efforts focused on determining demand and revenue potential at two sectors: Sector 10 (city limits of Eagle Pass) and Sector 18 (Tornillo to Texas/Chihuahua/New Mexico Border).

The analysis performed by WSA for these sectors was preliminary in nature and not intended to provide study results in sufficient depth and reliability for final feasibility analysis. The results of this effort, therefore, require additional data updating before investment grade studies can be conducted for any final project analysis.

Raw data for the development of the network spreadsheet model used in the assignment process was gathered from several sources. Information on roadway characteristics for an extensive corridor network was collected during a route reconnaissance survey conducted by WSA on the U.S. side of the border and by CTR on the Mexican side in 1993. Data on travel time and delay, speed limits, and roadway physical and operating characteristics, described in detail in the first and second reports of this study, were recorded as input into the model development.

The original model developed by WSA encompassed an extensive network of highway routings and traffic generators along the entire Texas-Mexico border (Ref 22). Maximum network and route detail was developed for the sectors identified for further study. Areas outside these sectors were represented by larger traffic zones and less detailed networks of major freeway links.

As a result of the use of the sector analysis concept developed by CTR, the general network was downsized to a more focused network using a traditional capacity restrained assignment for the network in the El Paso area only. Minimum time travel paths created by this assignment were saved and cordon stations around the boundaries of the sector were determined. Trip patterns on links entering and leaving each sector, as well as trips generated within the sector were retained. The remainder of the network, including trips not beginning, ending, or passing through the sector, were eliminated from the final modeling process. Creating these windows within each sector greatly reduced the scope of the network and, consequently, the size of the model.

Once the focused network was established, trip tables were generated utilizing the available data from the O&D surveys. After reviewing the results and calibrating the model, trip assignments were run and checked for reasonableness. Manual adjustments were then made to the output based on capacity considerations of parallel routes and any trips that appeared to be superfluous. Trip assignments were then developed using a spreadsheet matrix developed for this project. Growth schedules for the Eagle Pass sector were developed based on guidelines provided by CTR for NAFTA impacts (basically, Table 3.4 and pertaining discussions). Growth schedules for the El Paso sector were obtained from WSA's original Zaragoza Bridge study report (Ref 22).

Basic Assumptions

For the El Paso and Eagle Pass sectors, WSA provided traffic and revenue estimates based on the following assumptions:

(1) All bridges were considered open and operating at the base year of 1993;

(2) Toll rate schedules for the new bridges are the same as those established for the existing bridges in the respective sectors;

(3) No new competing limited-access facilities, toll or toll-free, will be constructed in any sector;

(4) Any new bridges would be effectively signed and efficiently operated in order to promote maximum utilization of the new facilities;

(5) Motor fuel will remain in adequate supply and future price increases will not substantially exceed the overall rate of inflation;

(6) There will be no national, regional or local emergency that will abnormally restrict the use of motor vehicles; and

(7) The existing toll rate structure now in effect on the present bridges will remain in effect over the projection period.

SUMMARY AND CONCLUSIONS

This chapter discussed the approaches developed by CTR to estimate the demand and revenues for additional binational entry systems along the Texas-Mexico border. These approaches were applied to every Segment 2 sector that is located within an economic activity center, except the El Paso and Eagle Pass sectors, which were subcontracted to WSA to take advantage of their previously calibrated models for the El Paso sector. The Eagle Pass sector was also subcontracted because of its proximity to El Paso, and the possibility (indicated by origin and destination data) that it might have to be included in an overall traffic diversion model.

Both CTR and WSA developed simplified spreadsheet models for the trip assignment, and some of the assumptions are common to both models. However, specific assumptions regarding trip generation, travel behavior, route choice, post-NAFTA truck traffic, and future origin and destination patterns were not disclosed by WSA, and a meaningful comparison of both methodologies is not possible at this point. It is also important to point out that departures from these undisclosed assumptions are subtle, requiring specialized and close monitoring to be noticed. Such departures may invalidate the study results just as much as major macroeconomic changes and national or local emergencies, which are easily noticeable. Nevertheless, demand and revenue analyses results, coupled with the current capacity assessment, can provide valuable guidelines about the border infrastructure needs. These guidelines are preliminary in nature and cannot substitute for project-level analyses of traffic demand, or for a detailed revenue forecast for bond issuance. The analyses and models rely on several assumptions, and departure from these assumptions may substantially change the conclusions.

While post-NAFTA predictions are very difficult to make, it is useful to categorize the possible effects as high impact, moderate impact, or the low impact. The demand forecast for each sector was done under these three scenarios to cover all possibilities. It is impossible at this point to predict the actual NAFTA impacts on each border sector, and it is conceivable that different locations will be differently affected. The combined results of the capacity, demand, and revenue analyses discussed in the next chapters indicate sectors where additional infrastructure is needed, why it is needed, and whether an additional toll bridge is feasible in each sector.

CHAPTER 4. ANALYSIS OF THE EAGLE PASS SECTOR

BACKGROUND

The Eagle Pass Sector stretches between the eastern and western city limits of Eagle Pass, in Maverick County, Texas. On the Mexican side, the sector includes the urban area of Piedras Negras, Coahuila. The sector contains one vehicular bridge and one rail bridge. The rail bridge, owned by Southern Pacific, is located approximately 0.65 mile (1 km) downstream from Eagle Pass Bridge.

Existing Binational Entry Systems

The vehicular bridge is a two-lane facility owned by the City of Eagle Pass in the U.S. On the Mexican side, "Puente Piedras Negras" is owned by the Mexican Government and managed by Caminos y Puentes Federales (CAPUFE). It is located approximately 100 miles (161 km) west of the Colombia Bridge in the Laredo Sector. It is open 24-hours a day, seven days a week, and is a toll facility with three southbound toll booth lanes. This bridge is connected to U.S. Highway 57, which in turn connects to Interstate Highway 35. U.S. Highway 277 provides access to Del Rio, and a connection to US 83 to the east. In Mexico, Highway MEX57 provides access to Monterrey and Highway MEX02 provides access to Nuevo Laredo.

The U.S. border station facility has two commercial primary inspection lanes. As for the other facilities, a recent (1991) expansion and upgrade included:

(1) Increasing the existing 10-truck dock to a 25-truck dock, expandable to 50;

(2) Expanding the automobile inspection to five primary inspection lanes and twenty secondary inspection lanes; and

(3) Upgrading the administration building.

On the Mexican side, the number of Customs' primary inspection lanes for privately owned vehicles (POVs) was recently expanded from 3 to 4, and a primary inspection lane exclusively for trucks was added. There are approximately 10 parking spaces for autos' secondary inspection, which are basically on the streets adjacent to the bridge. About 10 percent of autos go through secondary inspection, which takes an average of 5 minutes. For trucks, there are approximately 12 to 15 parking spaces ("recinto fiscal de entrada") where the documents for random selection are presented. Trucks undergoing detailed inspection go into the import lot, which has capacity for approximately 60 vehicles.

Proposed Binational Entry Systems

City officials from Eagle Pass and Piedras Negras have been proposing a second bridge for several years, and extensive environmental assessment work has been completed (Ref 7).

Their preferred site is approximately 0.5 mile (0.8 km) east of the existing vehicular bridge and approximately 600 feet (183 m) west of the existing Southern Pacific Railroad bridge. According to Eagle Pass city officials, most of the environmental questions have either been officially resolved, or will be in the near future. On the other hand, the General Services Administration (GSA) and U.S. inspection agencies have concluded that a second bridge in Eagle Pass cannot be justified at this time because the traffic volumes are not large enough.

Eagle Pass city officials do not dispute the findings by GSA that the U.S. inspection facilities are adequate for the traffic levels that they are currently experiencing. According to Eagle Pass city officials, the major thrust behind the proposal for a second bridge at the site being advocated by both Eagle Pass and Piedras Negras officials is the traffic congestion problem on the approaches to the existing bridge in Piedras Negras and the lack of right-of-way to expand these approach facilities. On the Mexican side, the concession was granted, the right-of-way acquired, and the design completed. Mexico is awaiting the U.S. decision.

Maverick County officials have recently expressed interest in constructing a bridge at a different site than that being proposed by city officials. The county's preferred site is on the north side of Eagle Pass where Loop 277 intersects with Business 277.

TRAFFIC ANALYSIS

North and southbound traffic histories by vehicle type (including pedestrians) are available from CAPUFE (1975-1992) and from the bridge managers on the U.S. side (1988-1992). Additional 1983-1992 northbound traffic history is also available from GSA. Traffic histories are depicted in Figures 4.1 through 4.4.

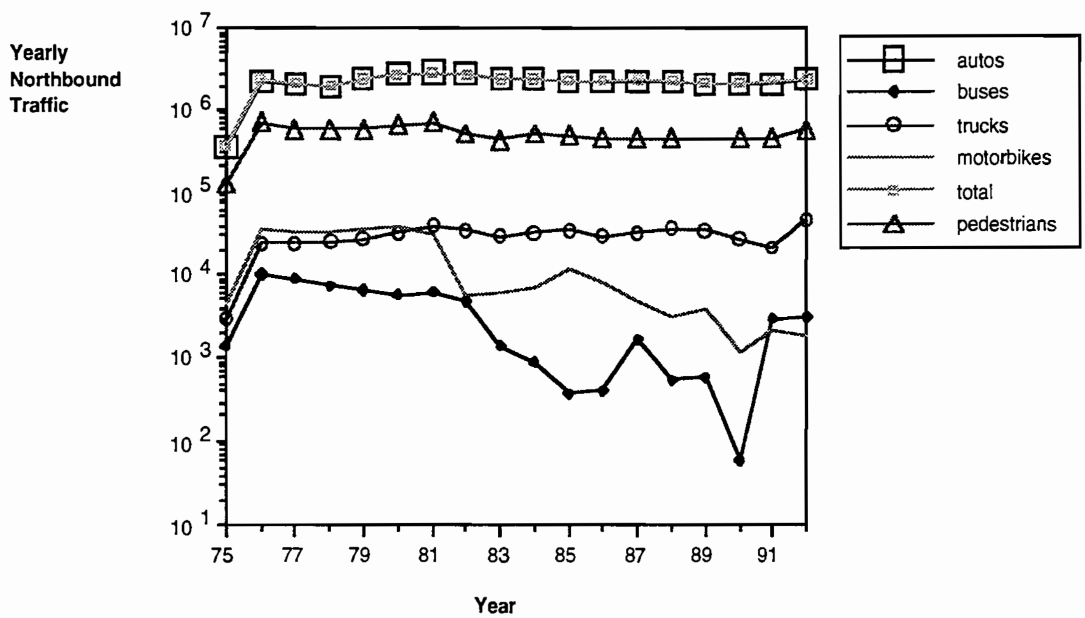

Figure 4.1. Northbound traffic history at Eagle Pass-Piedras Negras Bridge (Source: CAPUFE)

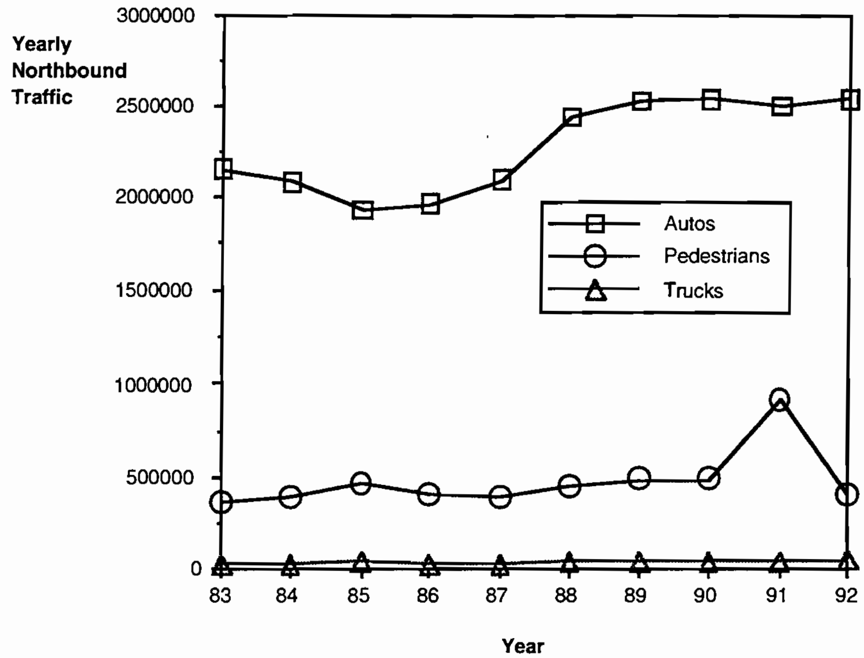

Figure 4.2. Northbound traffic history at Eagle Pass-Piedras Negras Bridge (Source: GSA)

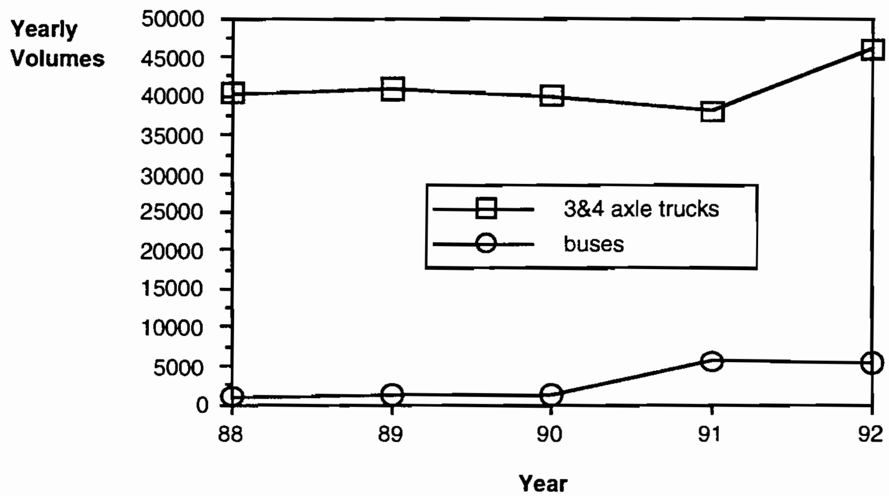

Figure 4.3. Southbound commercial traffic history at Eagle Pass-Piedras Negras Bridge (Source: Laredo State University, according to U.S. bridge owners)

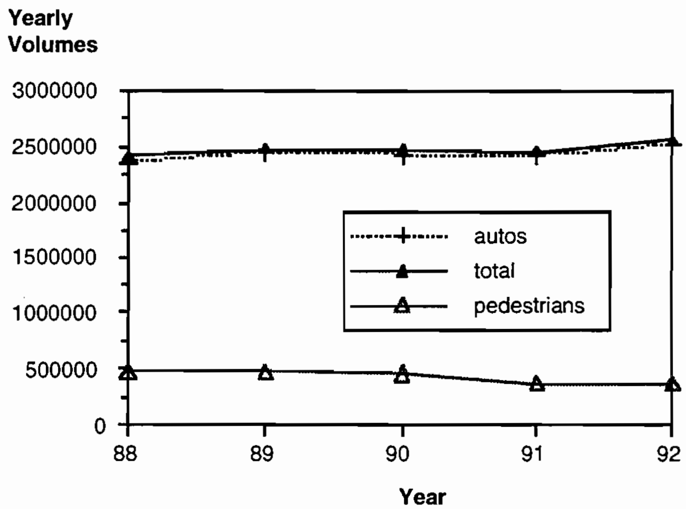

Figure 4.4. Southbound auto, pedestrian and total traffic history at Eagle Pass-Piedras Negras Bridge (Source: Laredo State University, according to U.S. bridge owners)

The average differences between north and southbound traffic are 20.5 percent for autos and 16 percent for trucks. This is consistent with the origin and destination data collected by CTR at this site, which show that over 80 percent of all trips have origin in Eagle Pass and destination in Piedras Negras. This implies over 80 percent round trips on this bridge, and the difference between north and southbound traffic volumes be less than 20 percent.

Figures 4.1 through 4.4 consistently show lack of traffic growth at this bridge for the past 12 years, except for southbound buses, which had a fivefold jump in 1991, after three years of a much lower growth rate. On the average, the yearly growth rates for autos, trucks, and pedestrians are respectively 0.08 percent, 0.01 percent and 4.3 percent for northbound traffic, and 1.57 percent, 3.82 percent and -5.36 percent for southbound traffic. This is consistent with the fact that Eagle Pass population growth was negative (-3.5 percent) from 1980 to 1990. Piedras Negras, on the other hand, had a 72 percent population growth from 1970 to 1980, and a 22.3 percent population growth from 1980 to 1990. According to Mexican Customs officials, population growth in Piedras Negras was triggered by federal investments in the energy and mining sectors, in addition to the maquiladora industry. The number of Maquiladoras in Piedras Negras grew 147 percent between 1982 and 1992, while the number of maquiladora employees grew 280 percent. As a result, a considerable part of the rail traffic on the Eagle Pass and Piedras Negras rail bridge is from automotive Maquiladoras located in the Saltillo area. However, rail traffic also showed little or no increase in the past 10 years.

The observed stagnation in vehicular traffic growth has two possible explanations:

(1) Vehicle ownership in Piedras Negras did not grow in the past 10 years, and/or

(2) This bridge has been operating at saturation levels for the past 10 to 12 years.

The first explanation cannot be verified because vehicle ownership data are available for Mexico only for 1991. Given the economic activity growth in Piedras Negras, this explanation could be indirectly supported by pedestrian, bicycle and bus traffic growth. This, however, does not hold, except for the increase in southbound bus traffic recorded by U.S. bridge owners, which is not matched by an increase in northbound growth.

The second explanation (the bridge cannot process more traffic than the level maintained in the past 10 to 12 years) implies existence of a latent demand, which cannot be verified with existing data. Congestion caused by international traffic in both cities, together with the fact that inspection facilities have recently been expanded, may indicate the possibility of a latent demand, which was considered as a possible future scenario in the demand and revenue analyses.

REVENUE AND DEMAND ANALYSES

The demand and revenue analyses of the Eagle Pass sector were developed by Wilbur-Smith Associates, to take advantage of their previous expertise in Segment 2 (Ref 22). WSA performed the revenue analysis for a hypothetical proposed bridge, located approximately 2.0 miles (3.7 km) east of the present Eagle Pass/Piedras Negras Bridge, and connected to the road system in both Texas and Mexico. This site was chosen as a logical alternative location within that sector for a possible binational entry system.

Background

Information on origin and destination (O/D), vehicle type, trip frequency, and trip type for both sectors was assembled from CTR's O/D survey conducted on April 22, 1993, between the hours of 6:00 and 11:00 a.m. and 1:00 and 2:00 p.m., which obtained information on trip origin and destination, purpose, frequency, and number of vehicle occupants, as well as vehicle type and license plates. Information on origin and destination was then coded into a geographical network developed by WSA for this project. Traffic data for the years 1983 to 1992, supplied by CTR, were also analyzed to develop traffic growth factors to be used in the model. These traffic data were discussed in the previous section.

The current toll rates for both sectors at each potential binational entry system were assumed to be the same as the present bridge locations. In this case, they are $1.00 for autos and $14.00 for commercial vehicles.

Potential Revenue and Demand Estimates

The traffic considerations discussed in the previous section suggest analyzing this bridge under two basic scenarios. The first assumes that lack of traffic growth actually reflects no demand increase, and that this situation will continue in the near future. The other assumes a latent demand currently unable to cross the border as often as desired because of time spent in queues. A scenario with no growth rate for 10 years and no latent demand (induced growth) was initially studied. This was then expanded to include moderate normal growth rates with a latent demand of 10, 20, and 30 percent. The larger latent demand would reflect the optimistic post-NAFTA scenario.

The results of the analysis for this sector are depicted in Tables 4.1 through 4.4. Table 4.1 shows the baseline condition and assumes no growth and no latent or induced growth demand. Tables 4.2, 4.3, and 4.4 assume moderate growth of 1 percent for the first 5 years and 0.5 percent over the remaining years, with latent demands (induced growth) of 10, 20, and 30 percent, respectively.

Table 4.1. Demand and revenue estimates for Eagle Pass Sector — Low impact scenario

Year	Eagle Pass		Proposed Bridge		Total	Total
	Traffic	Revenue	Traffic	Revenue	Traffic	Revenue
	(THOUSANDS)					
1993	2,784	$3,774	1,948	$2,797	4,732	$6,573
1994	2,784	3,774	1,948	2,797	4,732	6,573
1995	2,784	3,774	1,948	2,797	4,732	6,573
1996	2,784	3,774	1,948	2,797	4,732	6,573
1997	2,784	3,774	1,948	2,797	4,732	6,573
1998	2,784	3,774	1,948	2,797	4,732	6,573
1999	2,784	3,774	1,948	2,797	4,732	6,573
2000	2,784	3,774	1,948	2,797	4,732	6,573
2001	2,784	3,774	1,948	2,797	4,732	6,573
2002	2,784	3,774	1,948	2,797	4,732	6,573
2003	2,784	3,774	1,948	2,797	4,732	6,573
2004	2,784	3,774	1,948	2,797	4,732	6,573

Growth of zero assumed for this scenario.
Assumes following toll rates: passenger car $1.00; commercial vehicle $14.00

Table 4.2. Demand and revenue estimates for Eagle Pass sector — Moderate impact scenario, 10 percent latent demand

Year	Eagle Pass		Proposed Bridge		Total	Total
	Traffic	Revenue	Traffic	Revenue	Traffic	Revenue
	(THOUSANDS)					
1993	2,784	$3,774	1,948	$2,797	4,732	$6,573
1994	2,951	4,000	2,065	2,965	5,016	6,967
1995	3,069	4,160	2,147	3,083	5,217	7,246
1996	3,161	4,285	2,212	3,176	5,373	7,463
1997	3,193	4,328	2,234	3,208	5,427	7,538
1998	3,225	4,371	2,256	3,240	5,481	7,613
1999	3,241	4,393	2,268	3,256	5,508	7,652
2000	3,257	4,415	2,279	3,272	5,536	7,690
2001	3,273	4,437	2,290	3,289	5,564	7,728
2002	3,290	4,459	2,302	3,305	5,591	7,767
2003	3,306	4,482	2,313	3,322	5,619	7,806
2004	3,323	4,504	2,325	3,338	5,648	7,845

Growth of 1 percent per year for the first five years and 0.5 percent per year thereafter; 10 percent latent demand.
Assumes following toll rates: passenger car $1.00; commercial vehicle $14.00.

Table 4.3. Demand and revenue estimates for Eagle Pass Sector — Moderate impact scenario, 20 percent latent demand

Year	Eagle Pass Traffic	Eagle Pass Revenue	Proposed Bridge Traffic	Proposed Bridge Revenue	Total Traffic	Total Revenue
	(THOUSANDS)					
1993	2,784	$3,774	1,948	$2,797	4,732	$6,573
1994	3,090	4,189	2,162	3,105	5,253	7,296
1995	3,307	4,482	2,314	3,322	5,620	7,807
1996	3,472	4,706	2,429	3,488	5,901	8,197
1997	3,507	4,754	2,454	3,523	5,960	8,279
1998	3,542	4,801	2,478	3,558	6,020	8,362
1999	3,559	4,825	2,491	3,576	6,050	8,404
2000	3,577	4,849	2,503	3,594	6,080	8,446
2001	3,595	4,873	2,516	3,612	6,111	8,488
2002	3,613	4,898	2,528	3,630	6,141	8,530
2003	3,631	4,922	2,541	3,648	6,172	8,573
2004	3,649	4,947	2,553	3,666	6,203	8,616

Growth of 1 percent per year for the first five years and 0.5 percent per year thereafter 20 percent latent demand.
Assumes following toll rates: passenger car $1.00; commercial vehicle $14.00.

Table 4.4. Demand and revenue estimates for Eagle Pass Sector — High impact scenario

Year	Eagle Pass Traffic	Eagle Pass Revenue	Proposed Bridge Traffic	Proposed Bridge Revenue	Total Traffic	Total Revenue
	(THOUSANDS)					
1993	2,784	$3,774	1,948	$2,797	4,732	$6,573
1994	3,229	4,378	2,260	3,245	5,489	7,625
1995	3,520	4,772	2,463	3,537	5,983	8,311
1996	3,731	5,058	2,611	3,749	6,342	8,810
1997	3,843	5,210	2,689	3,861	6,532	9,074
1998	3,882	5,262	2,716	3,900	6,598	9,165
1999	3,901	5,288	2,730	3,919	6,631	9,210
2000	3,921	5,315	2,743	3,939	6,664	9,256
2001	3,940	5,341	2,757	3,959	6,697	9,303
2002	3,960	5,368	2,771	3,978	6,731	9,349
2003	3,980	5,395	2,785	3,998	6,764	9,396
2004	4,000	5,422	2,799	4,018	6,798	9,443

Growth of 1 percent per year for the first five years and 0.5 percent per year; 30 percent latent demand.
Assumes following toll rates: passenger car $1.00; commercial vehicle $14.00.

Under baseline conditions, Table 4.4 shows estimated annual traffic for 1993. Assuming that both the Eagle Pass and the new hypothetical were fully operational, traffic totaled 4,732,000 vehicles, generating over $6.5 million in annual revenue. Under the most optimistic scenarios of moderate growth and a 30 percent latent demand, 1993 traffic volumes shown in Table 4.4 and corresponding revenues will increase to 6,798,000 vehicles and over $9.4 million in revenue by the year 2004.

Conclusions

The trip assignment analysis suggests that the traffic patterns to the existing and proposed bridge are based on geographic proximity rather than on other factors such as excess capacity of one crossing relative to the other. In other words, travelers living closer to the existing bridge will use that bridge regardless of whether a new one is constructed. The preliminary analysis suggests that construction of a new toll bridge at Eagle Pass will produce limited benefits to travelers.

CAPACITY ANALYSIS

Capacity utilization estimates of the Eagle Pass sector were developed by CTR using the approach discussed in Chapter 2, for the main components of a binational bridge entry system, namely access/egress facilities, toll facilities, bridge span, and inspection procedures. The capacity utilization estimates for the bridge span and inspection facilities are based on the methodology and assumptions discussed in Chapter 2. The analysis of the access/egress facilities also followed the basic methodology discussed in that chapter, but since it is more complex, it requires additional assumptions on a case-by-case basis.

Access/Egress Component

Figure 4.5 shows the access and egress facilities in Eagle Pass. Garrison Street (U.S. Hwy 277) is the immediate link between the bridge and the rest of the infrastructure. This street is the southbound access to the bridge and the northbound egress from the U.S. inspection facility.

The signalized intersection at Garrison & Adams is assumed to act as the constraint for Eagle Pass bridge access and egress. An actuated signal that provides a minimum green time for the east/west traffic on Adams Street, and a 60 second cycle along with a three-phase signal operation was assumed. Green splits were allocated for the north or south movements by equal degrees of saturation. With a separate phase for northbound left and through movements, the analysis yields the v/c ratios listed below.

(1) Northbound left turn (northbound egress): 26 percent

(2) Northbound through movement (northbound egress): 23 percent

(3) Southbound approach (southbound access): 55 percent

(4) East/West movements (not related to bridge access or egress): 85 percent

The immediate access and egress for the bridge in Piedras Negras is shown in Figure 4.6. Intersection #1 is assumed to constrain southbound egress from the bridge, while intersections #2 and #3 are assumed to constrain northbound access to the bridge in downtown Piedras Negras.

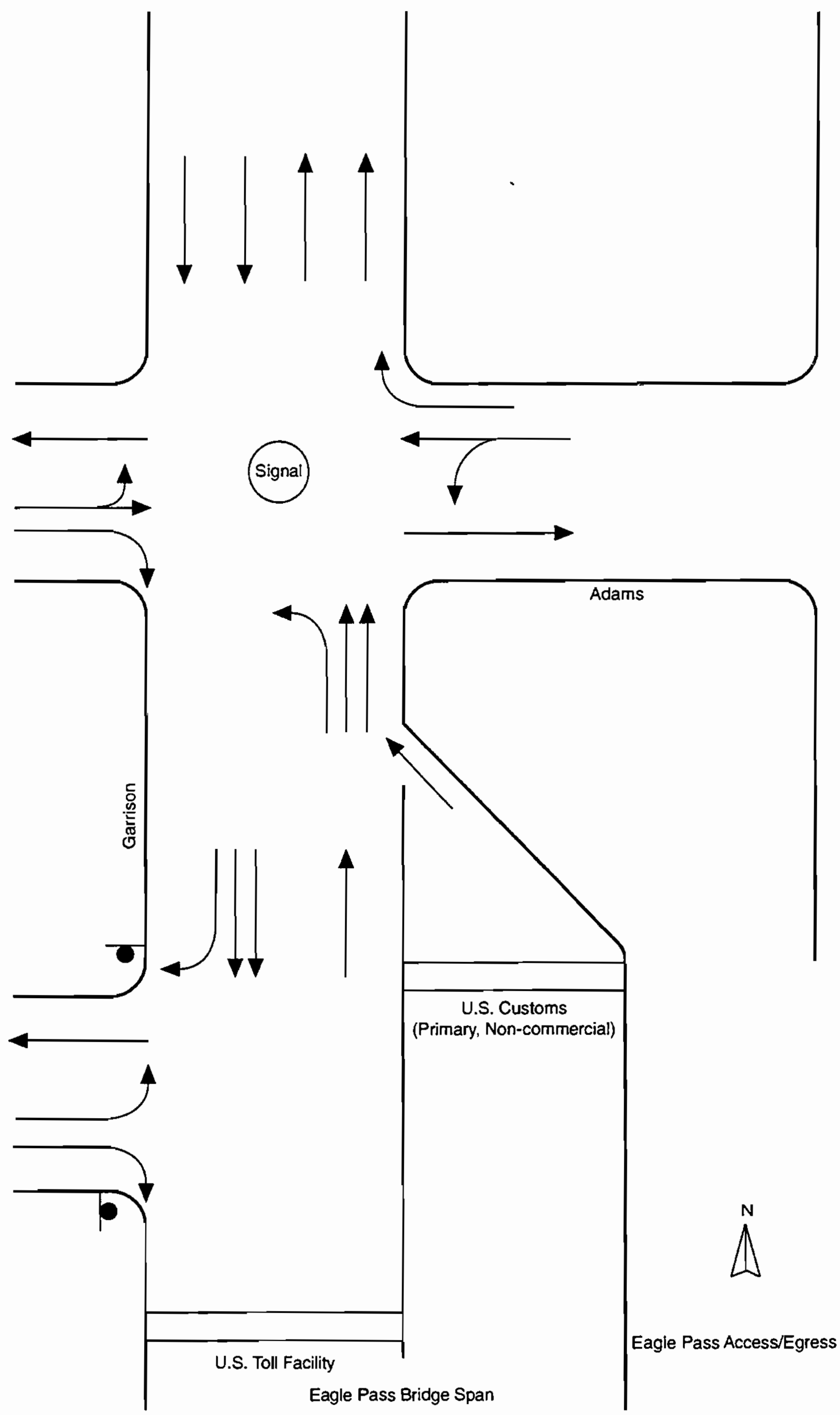

Figure 4.5. Access and egress component in Eagle Pass

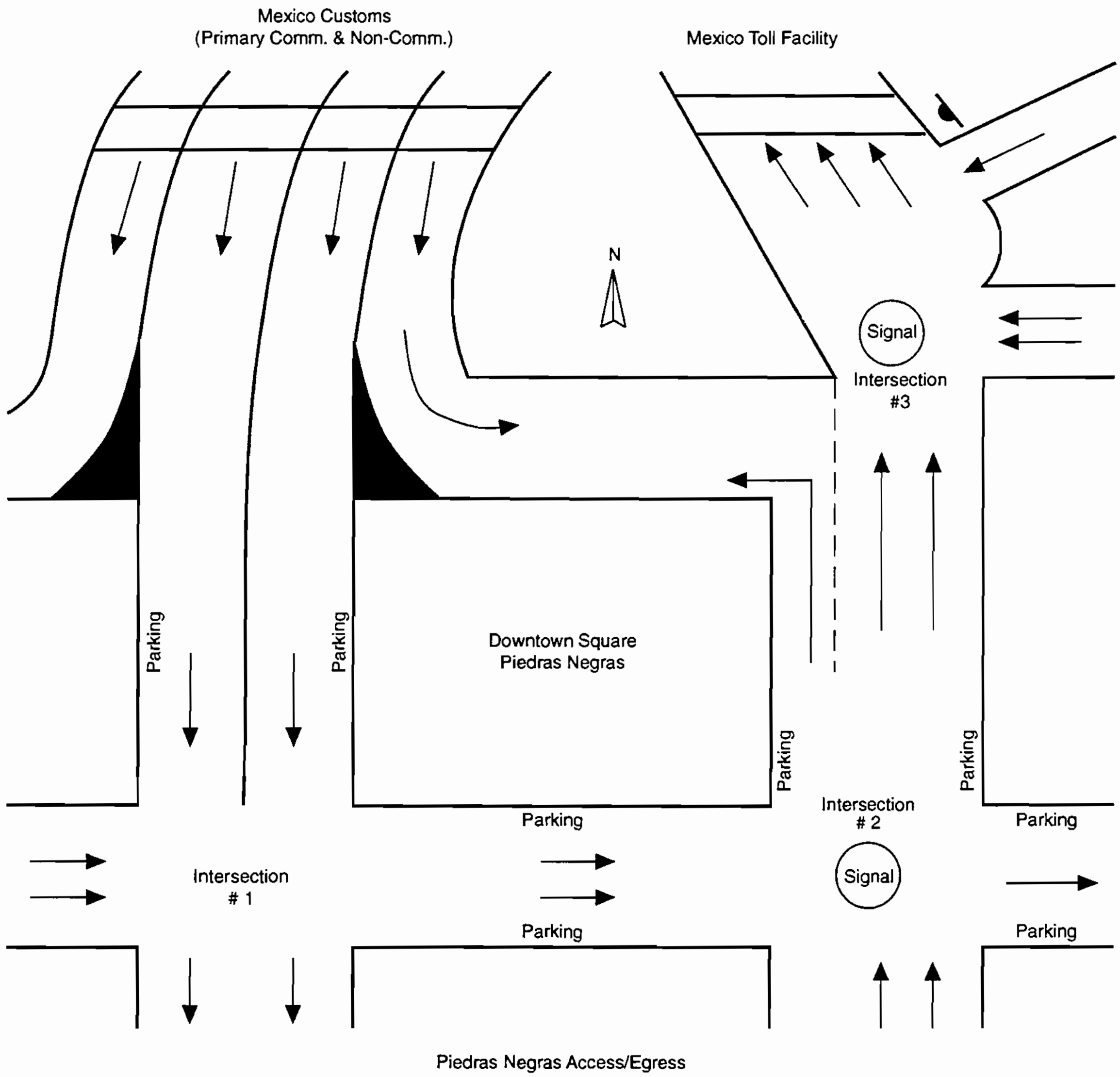

Figure 4.6. Access and egress component in Piedras Negras

Idealizing intersection #1 as a pre-timed signalized intersection with a two-phase sequence that serves all southbound international traffic, the two-lane southbound approach flow rate is estimated at 0.26 v/sec. Given that traffic counts were not collected in downtown Piedras Negras, a flow rate on the eastbound two-lane approach is assumed at 0.40 v/sec, a conservative estimate for this type of one-way street. Allocating green splits based upon equal degrees of saturation, the v/c ratio for both approaches to the intersection is estimated at 73 percent. If, instead of the conservative flow rate estimate, the eastbound traffic volume is assumed to be no greater than the southbound bridge traffic volume (660 vph), the resultant v/c value is 58 percent.

Analysis of the signalized intersection #2 (northbound approach and eastbound approach) yields a capacity utilization of 106 percent assuming an eastbound approach volume of 1,000 vph and a northbound approach volume of 420 vph. Traffic counts were not collected in downtown Piedras Negras, and this peak hour volume is a conservative estimate of the amount of traffic on the eastbound approach. If the eastbound traffic volume is assumed to be no greater than the northbound bridge traffic, the resultant v/c value is 82 percent.

The analysis of intersection #3 requires the following assumptions/estimates:

(1) Only northbound international traffic utilizes this intersection,

(2) Sixty percent of the northbound bridge traffic utilizes the two-lane northbound approach,

(3) Forty percent of the northbound bridge traffic utilizes the two-lane westbound approach,

(4) Flow rate for the northbound approach is estimated at 0.16 v/sec,

(5) Flow rate for the westbound approach is estimated at 0.12 v/sec, and

(6) Signal: 60-second cycle length, two-phase sequence, green splits allocated by equal degrees of saturation.

The analysis of intersection #3 with the above parameters yields a v/c ratio for each approach of 31 percent. This would be the capacity utilization of the northbound access to the bridge in Piedras Negras, if it could be assumed that intersection #3 acts as the only constraint for such access. However, intersection #2 is very close, and the analysis indicates it may be congested. If this is the case, the traffic platoons from intersection #2 sign would interfere with intersection #3, causing congestion at the bridge approach.

It must also be noted that intersection #3 may have excess capacity and still appear congested to an outside observer if the toll booths are causing queues that back up traffic in this intersection and beyond. The analysis of the remaining components clarifies this point.

Capacity Analysis Results

The current capacity utilization of the Eagle Pass/Piedras Negras Bridge is summarized in Figure 4.7. In the southbound direction, the U.S. toll facility for autos is estimated to operate at 123 percent capacity during peak periods, with one of the three toll lanes dedicated to trucks only. Field observations verify both the over-capacity condition and the dedicated truck lane at the toll collection facility.

Also in the southbound direction, the Mexican primary inspection facility for commercial trucks is estimated to operate at 100 percent capacity. However, trucks subject to inspections were observed to park off to either side of the Mexican inspection facility, rather than queue onto the bridge span. As for the northbound traffic, the U.S. primary inspection facility for autos is operating over-capacity, even assuming all lanes staffed (v/c=116 percent). In addition, the access to the bridge in Piedras Negras is congested (v/c ranging from 82 percent to 106 percent).

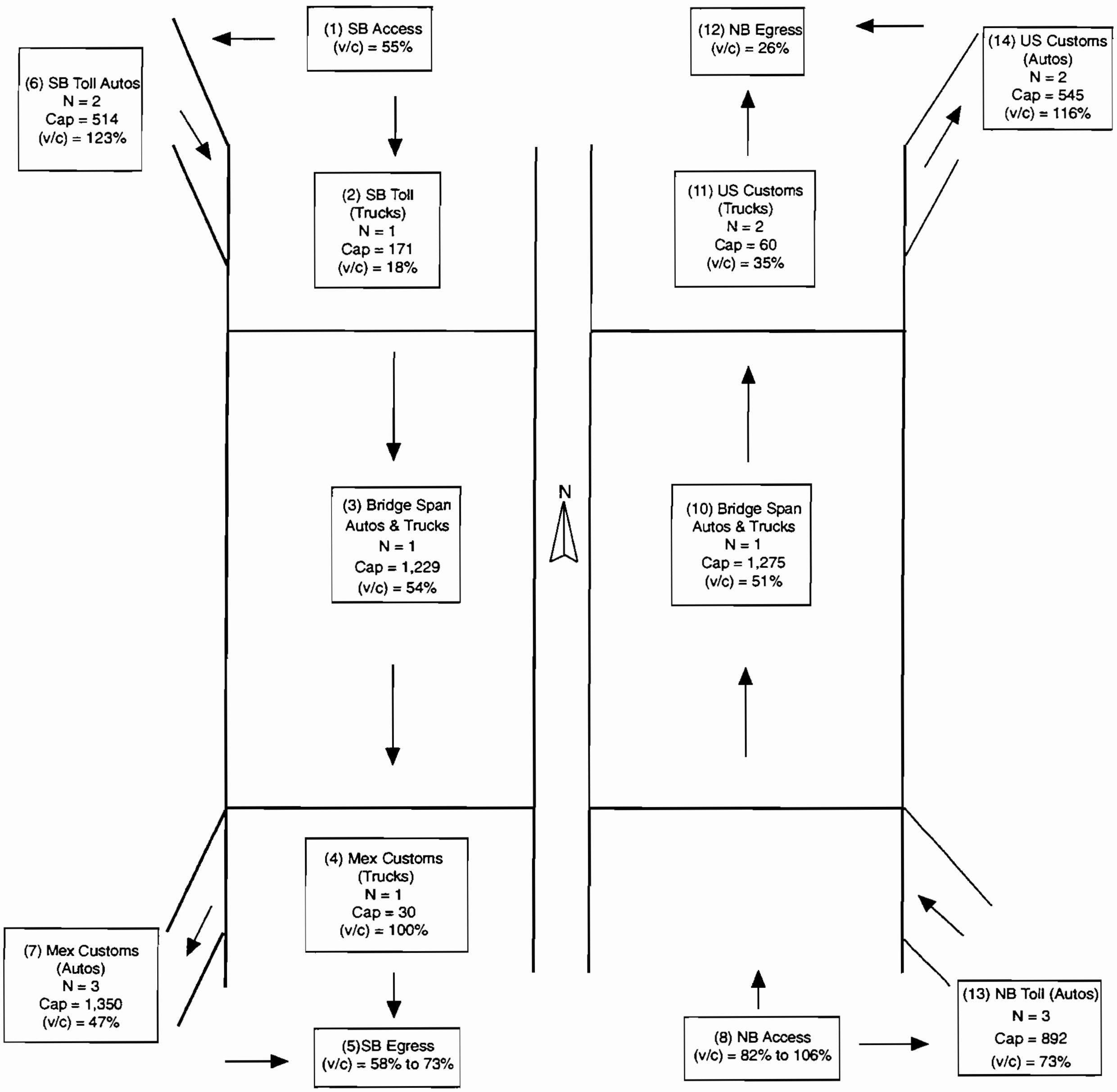

Figure 4.7. Capacity utilization of the Eagle Pass binational entry system

CONCLUSIONS AND RECOMMENDATIONS

The capacity analysis results identify the causes for poor traffic circulation in Eagle Pass and Piedras Negras. When combined with the revenue and demand estimates, these results provide guidelines to plan for transportation infrastructure at this sector of the Texas-Mexico border.

Capacity Utilization

In the southbound direction, the analysis indicates that the main source of congestion for auto traffic is the U.S. toll facility, which is operating at 123 percent of the capacity with all booths open. The other binational entry system components, namely the access facility in Eagle Pass, the egress facility in Piedras Negras; the Mexican primary inspection for autos; and the bridge span, are estimated to operate at volume-to-capacity ratios of less than 100 percent with the southbound egress facility in Piedras Negras estimated to operate at 73 percent capacity. Field observations corroborate the over-capacity operation of the southbound toll booth, and they also indicate that the toll booths are not fully staffed at all times. The southbound access to the bridge should not be congested at a v/c of 55 percent; however, traffic back-up at the southbound toll may interfere with traffic circulation in this access, causing additional delays and making the intersections appear to be operating over capacity.

In the northbound direction, the analysis suggests that the components that constrain traffic flow are the U.S. primary inspection facility for autos with a v/c ratio of 116 percent and, to a lesser degree, the Mexican northbound access facility to the bridge, with capacity utilization ranging from 82 percent to 106 percent, depending on the actual amount of non-bridge traffic near the bridge in downtown Piedras Negras. The analysis examines each component separately, but they are actually interrelated in their effects to traffic circulation in the binational entry system. Congestion at U.S. primary inspection may cause traffic to back-up into the bridge span, and even southward into Piedras Negras, which is already operating near or over capacity by even without any other interferences.

Feasibility of a New Binational Entry System

The gross revenues estimated by WSA, which were discussed in a previous section of this chapter, were subject to the financial analysis methodology developed by CTR (Chapter 3), to provide an indication of the feasibility of a new binational entry system in this sector.

For the most pessimistic demand estimates (those given in Table 4.1), and under the assumptions discussed in Chapter 3, the financial analysis indicates an average yearly coverage ratio for the bonds of 1.3, or 30 percent over the net revenue. While a good bond rating requires a coverage ratio of at least 1.5, a ratio of 1.3 was obtained with a very pessimistic scenario that assumes no traffic growth for the next twenty years, due to a combination of pessimistic NAFTA impacts, and a low impact local scenario independent of NAFTA. For the second worst scenario, the average yearly coverage ratio increases to 1.65, even under the conservative assumption that there will be no traffic growth in the period not covered by WSA's analysis (2004 through 2014), which comprises the last ten years of the assumed twenty-year bond liability period.

Recommendations

The results of the capacity analysis indicate that traffic circulation is poor in this binational entry system, due to inappropriate facilities at the southbound toll, the northbound inspection, and the northbound access in Piedras Negras. The capacity analysis methodology developed by CTR treats each binational entry system component separately, in order to diagnose the causes of poor traffic circulation. It should be noted, however, that congestion at one component causes traffic back-ups that may affect other components of the binational entry system, which would otherwise operate efficiently. The southbound access to Eagle Pass-Piedras Negras Bridge may appear congested, while the delays may be entirely due to traffic back-ups at the congested toll facility. Overall, the analysis indicates that Piedras Negras is suffering more traffic congestion problems than Eagle Pass, a conclusion corroborated by the fact that the proposal for a new bridge in this sector is supported primarily in Piedras Negras (Ref 8). Coordinated binational planning indicates that expansion of U.S. inspection facilities, coupled with assignment of additional inspectors and expansion of the northbound toll facility, has a good potential to reduce the traffic back-ups through the bridge into downtown Piedras Negras, at least partly fulfilling the objective sought by the Mexicans with the new bridge, and saving a considerable amount of additional investment in the implementation of a new binational entry system in this sector.

The brief financial analysis made using the gross revenues estimates suggests that a new bridge in the Eagle Pass sector is financially feasible, except perhaps under the worst possible forecast scenario, which would yield a poorer bond rating and, consequently, higher interest rates that might make the project unfeasible. On the other hand, the capacity analysis results indicate that, rather than the bridge span itself, the main constraints to traffic circulation are toll and inspection facilities and, to a lesser extent, the Piedras Negras northbound access. U.S. inspection facilities have recently been upgraded, but the analysis indicates that further upgrading is necessary to accommodate all traffic. In Piedras Negras, the situation could theoretically be improved by upgrading the northbound access, a solution that Piedras Negras city officials deem unfeasible due to price of right-of-way. Although the bridge span is not the problem, another bridge may be the only solution if the traffic congestion in Piedras Negras becomes intolerable.

While the controversy over a new bridge is not resolved, one remedy would be the expansion and improvement of the toll collection on both sides, combined with an effort from Piedras Negras to improve the traffic circulation with simple measures, such as relocation of parking spaces away from the streets that provide access/egress to the Eagle Pass/Piedras Negras Bridge.

CHAPTER 5. ANALYSIS OF THE DEL RIO SECTOR

BACKGROUND

The Del Rio Sector comprises the city limits of Del Rio in Val Verde County, Texas, and the urban area of Ciudad Acuña, Coahuila. It includes two binational entry systems for vehicular traffic, Del Rio Bridge and Lake Amistad Dam. The Del Rio Bridge is located approximately 65 miles (105 km) west of Eagle Pass, and Amistad Dam is located approximately 13 miles (21 km) west of the Del Rio Bridge.

Existing Binational Entry Systems

In 1988, the old Del Rio Bridge was replaced with a new four-lane toll bridge, owned by the City of Del Rio (U.S. side) and by the Mexican Government. It is open for non-commercial and pedestrian traffic 24-hours a day, seven days per week. Commercial traffic inspections are done at specific working hours, on both sides of the border. These hours may be subject to change, and currently commercial traffic is usually allowed to cross Monday through Friday, from 9 a.m. to 7 p.m.

On the U.S. side, there are two primary inspection lanes for commercial trucks, including one lane for line release or "quick release," and four primary inspection lanes for autos. There are eight secondary inspection spaces for non-commercial vehicles, and there are ten import docks for secondary inspection of trucks, which cannot be simultaneously utilized due to limited truck maneuvering space. There is multi-phase project to upgrade the inspection facilities, and the expansion of the administration building is already concluded (Ref 8).

On the Mexican side, "Puente Internacional de Ciudad Acuña" has three primary inspection booths, two for autos and one for trucks. There are six secondary inspection lanes for autos, in which eighteen vehicles can be simultaneously inspected. The import lot is open 8 a.m. to 8 p.m., Mondays through Fridays, and 10 a.m. to 1 p.m. on Saturdays, and it has an approximate capacity for about ten trucks at one time. The northbound toll facilities are owned and operated by CAPUFE, and they consist of two toll booths for autos, trucks, and pedestrians.

The U.S. connecting facility into Del Rio Bridge is U.S. Highway 277/State Highway Spur 239. United States Highway 277 connects into U.S. Highway 90, which provides access to San Antonio to the east and to west Texas to the west. MEX 2 provides access to Ciudad Acuña from Piedras Negras and Coahuila State Highway 29 provides a connection from Ciudad Acuña to MEX 57.

The Amistad Dam was built in 1969 and the binational entry system consists of a two-lane road over the dam structure. It is jointly owned by the U.S. and Mexican governments, and it is toll-free. Traffic is restricted to non-commercial, and 1991 southbound traffic data show volumes less than 170 vehicles per day. According to U.S. Customs, an average of approximately 27,000 northbound vehicles crossed the dam in the same fiscal year, which gives an annual average daily traffic (AADT) of less than 75 vehicles per day. Amistad Dam is accessed from Del Rio by U.S. Highway 277 connecting into U.S. Highway 90. On the U.S. side, it has one primary inspection booth and one secondary inspection space that were completed in August 1990. On the Mexican side, "Presa de la Amistad" consists of only one lane for primary and secondary inspections of vehicles.

Before the recent expansion of the import lot at Del Rio, Cd. Acuña's officials suggested the possibility of diverting the commercial traffic to Amistad Dam, given that the maquiladoras are located on the northwest side of Cd. Acuña near Amistad. However, there are no current plans to construct a commercial-only binational entry system in the Del Rio/Cd. Acuña area. Lake Amistad is an international recreational area which is part of the Amistad National Recreation Area in the U.S., and there is an initiative in Mexico to further develop its recreational area around Lake Amistad.

Proposed Binational Entry Systems

City of Del Rio business leaders, city officials, and Val Verde County had expressed some interest in a second bridge at Del Rio, but the presidential permit process has not yet been pursued (Ref 8). One preliminary proposal was to construct a commercial truck-only bridge near Amistad Dam. Opponents of this proposed bridge argue that the existing auto/truck bridge in Del Rio is too recent (1988), and that the new bridge would make it more difficult to pay off the existing bond due to competition. A rail bridge connecting to the existing rail line spurs in Del Rio and Ciudad Acuña was proposed to Southern Pacific Railroad, but Southern Pacific's response to the proposal was that the existing binational rail entry system in Eagle Pass/Piedras Negras has more than adequate capacity.

An environmental impact statement has been completed by GSA for the further expansion of the U.S. border station and import dock. Current plans (phase II) are to expand the import dock to 25 docks by 1996, build an import lot, import office, a new hazardous material inspection area, bulk cargo compound, dog building and kennel, and an impound lot. The GSA's capacity model predicts that this would be adequate to handle all inspections up to the year 2010. Phase III of the GSA's master plan, which is not required until the year 2010, consists of building a new border station facility and requires the relocation of part of Rio Grande Road. In addition, the City of Del Rio is proposing an improvement of the toll plaza and a preliminary study has been completed (Ref 19).

REVENUE AND DEMAND ANALYSIS

The demand and revenue analysis of the Del Rio sector was developed by CTR, based on limited information of origin and destination and land use in Del Rio and Ciudad Acuña. The revenue analysis was performed for a hypothetically proposed bridge in the west side of Del Rio to absorb the maquiladora-related demand. This hypothetical bridge was assumed to be efficiently connected to the rest of the infrastructure, as well as fully staffed and efficiently operated.

Traffic Analysis

Traffic histories in this sector are available for both north and southbound directions. Figures 5.1 and 5.2 show the southbound non-commercial and commercial traffic histories at the Del Rio Bridge. Before 1987, non-commercial traffic consisted of almost 99 percent of the southbound traffic. This percentage dropped to 97 percent after 1987, due primarily to the steep growth rates in truck traffic, which were over four times the average auto growth rate in the same period. Auto traffic displays a significant growth after 1988, when the average growth rate jumped from a negative figure to almost 10 percent a year. In 1991, the slope (growth rate) declined. An analogous situation is observed for trucks. Before 1983, there was a negative growth rate of 28 percent. Between 1983 and 1986, the average growth rate increased to 26 percent, and from 1987 to 1990 it jumped to 40 percent. After 1991, it seems to have stabilized in the neighborhood of 4 percent.

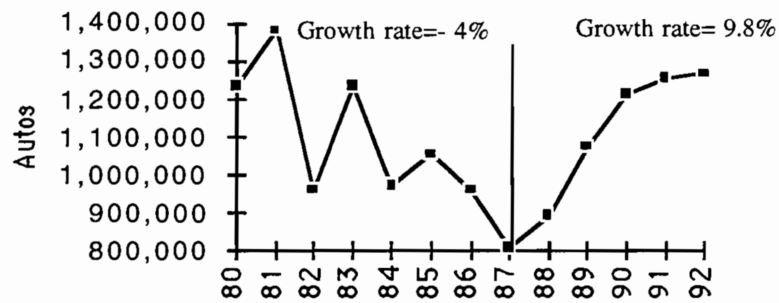

Figure 5.1. Southbound auto traffic history (Source: Bridge Management)

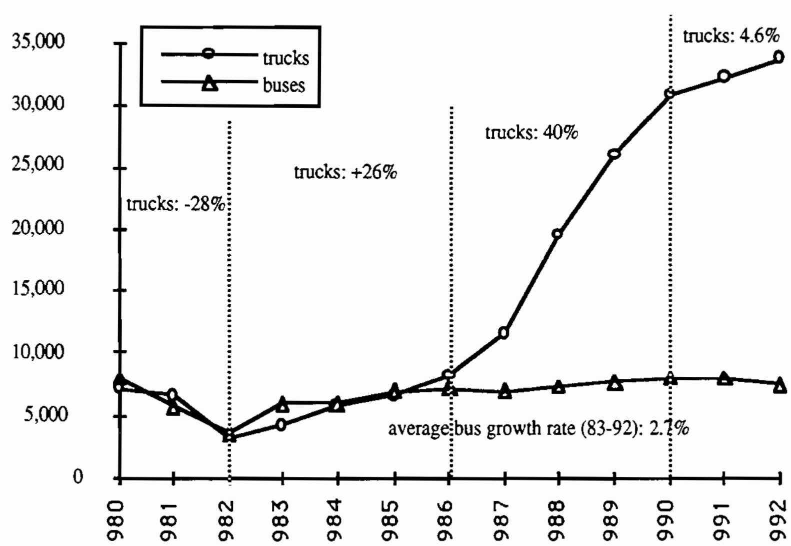

Figure 5.2. Southbound commercial traffic history (Source: Bridge Management)

Figures 5.3 and 5.4 respectively show the northbound non-commercial and commercial traffic histories at the Del Rio Bridge. Throughout the available history, non-commercial northbound traffic has been fluctuating closely around the average value of 97.7 percent of the total traffic. Before 1997, northbound auto traffic had an erratic growth pattern, at an average yearly rate of 2.5 percent. After 1987, a more consistent growth pattern is observed, at a yearly average of 4.2 percent. For commercial truck traffic, these patterns are reversed. Before 1987, traffic growth fluctuated somewhat consistently around 19 percent. After 1987, the growth pattern becomes erratic, but the average rate jumps to 26 percent. Bus traffic has been stagnant throughout the available data period.

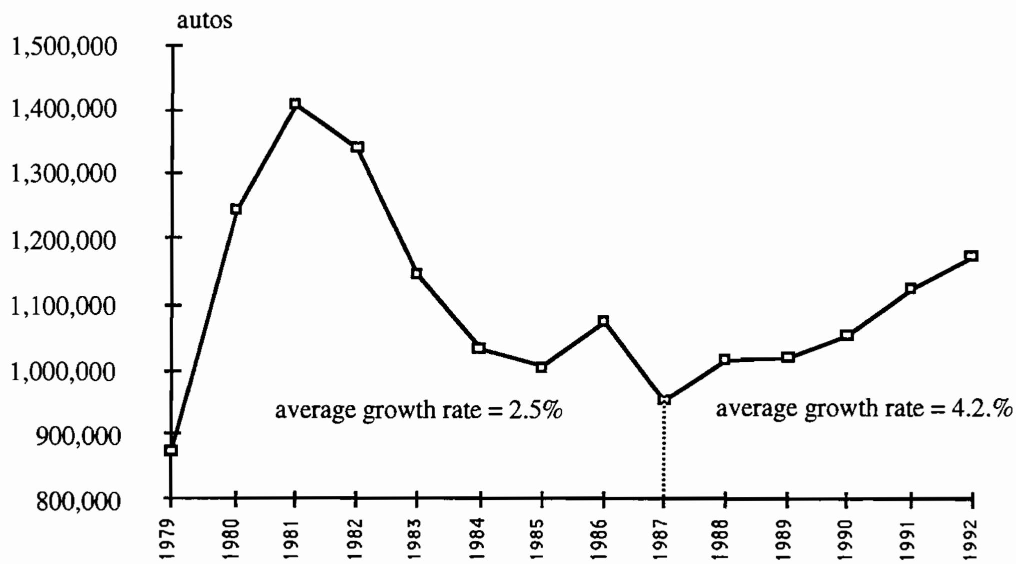

Figure 5.3. Northbound auto traffic history (Source: CAPUFE)

The somewhat sudden traffic increase observed after 1987 in Del Rio is due to a combination of causes. Taking effect in 1986, GATT caused a border-wide increase in economic activity, which resulted in a traffic increase. The number of maquiladoras in Ciudad Acuña increased from 26 in 1986 to 35 in 1988, while the number of maquiladora employees increased almost 40 percent in the same two-year period. Maquiladora activity has been steadily increasing since then, but at slower rates. The growth rates became higher after 1988, the first year of operation of the new four-lane Del Rio Bridge, and this may reflect a latent demand not being met by the old facility.

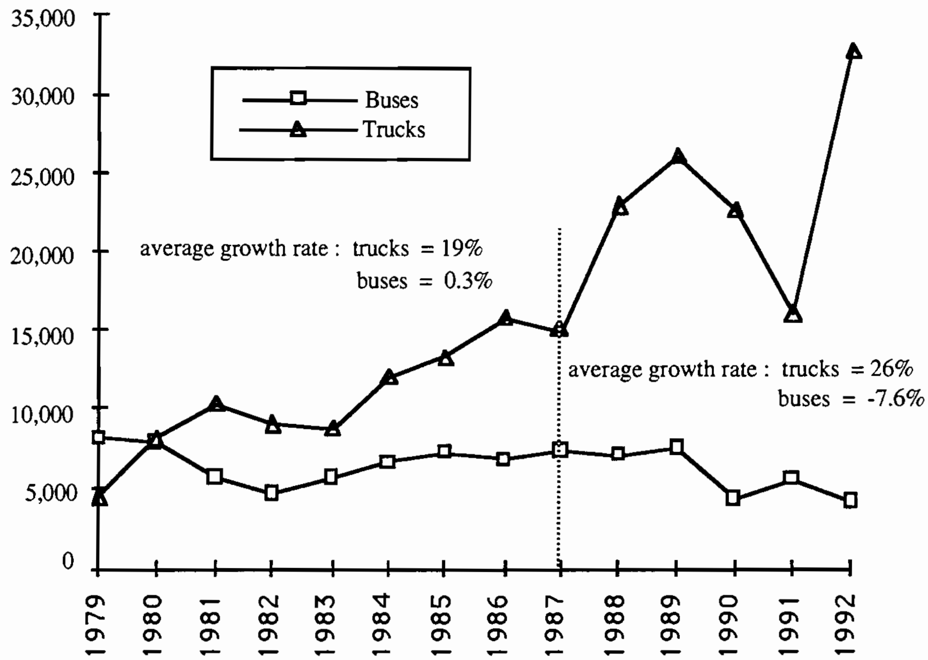

Figure 5.4. Northbound commercial traffic history (Source: CAPUFE)

Attempts to correlate the traffic history to socioeconomic indicators gave poor results in this sector. The erratic growth rates observed for significant parts of this history has an impact on the poor predictive power of a tentative model that correlates traffic to population, maquiladora plants and employees, and other socioeconomic variables. The observed impacts of the years 1987 and 1988 were statistically significant when modeled as a binary variable that takes unit value for the desired year of impact. The low predictive power of a traffic growth model, coupled with the unknown and mathematically unpredictable effects of NAFTA indicate that an ad hoc approach that takes into account possible scenarios is more realistic in this case.

As mentioned in Chapter 3, the traffic forecasts assume three scenarios for NAFTA impact: high impact, moderate impact, and low impact. In the high impact scenario, NAFTA will be assumed to have roughly the same impact on traffic as GATT. The current growth rate trend will be assumed to continue between 1993 and 1996. By 1997, a significant number of trade barriers will be lifted by NAFTA, and in the high impact scenario this will cause the auto traffic growth rate to increase between 1997 and 2006, replicating the trend observed during the years of GATT impact, between 1997 and 2006. The growth rate will then decrease until it stabilizes at a lower level, at an average of 3 percent a year, throughout the rest of the analysis period. The high impact scenario reflects the gradual removal of trade barriers and its positive impact on Del Rio and Ciudad Acuña's economies, characterized by an initial period of little response to NAFTA, then a faster growth rate, and finally a stabilized economic situation occurring after most NAFTA adjustments take place.

The moderate impact scenario will assume no special impacts from NAFTA. Current auto growth rates are assumed to be reflecting the stabilization on a level compatible with normal economic growth, after the GATT boom. The current trend in auto growth rates (2 percent) will be assumed to continue throughout the analysis period.

In the low impact scenario, a negative NAFTA impact will be felt gradually, with a moderate impact scenario for the first four years (1994-1997), and gradual decrease after the NAFTA changes start taking place. This gradual decrease will be represented by an annual average growth rate of 1.5 percent from 1997 to 2006, and 1 percent growth thereafter, a pattern that replicates some pre-GATT growth rates.

Bus traffic has been stagnant throughout the border, and the safest assumption at this point is that this trend will continue regardless of the NAFTA impacts. Customs procedures for international bus passengers can be very cumbersome and time-consuming, and this fact discourages mass transit in the Texas-Mexico border. In all three scenarios, bus traffic was assumed to grow at the average growth rate observed in the available post-GATT traffic history. If this situation changes in the future, the demand and revenue forecasts will be conservative.

Truck traffic demand in this sector is basically from the maquiladoras, and this is assumed to continue for all scenarios. Current growth rates will be assumed to continue between 1994 and 1997 for all three scenarios. From 1998 to 2014, the low impact scenario assumes that maquiladoras will gradually move away from Ciudad Acuña, and truck traffic growth rates will gradually decrease, at an average rate of 2 percent reflecting the fact that some truck traffic will still prefer this binational entry system even after the maquiladoras relocate. In themoderate impact scenario, current growth rates will be assumed to reflect a trend to stabilize at lower levels observed after the GATT boom. This will be represented by a 3 percent rate between 1998 and 2006, and a 2.5 percent rate thereafter. Finally, the high impact scenario assumes that NAFTA impacts will replicate GATT impacts between 1998 and 2002 (25 percent rate), with a gradual decrease thereafter, represented by an average rate of 3 percent throughout the rest of the analysis period. The estimated total annual southbound demand for the Del Rio Sector is shown in Table 5.1 for each of the forecast scenarios.

Potential Demand Estimates

Traffic diversion to a new bridge within the Del Rio/Ciudad Acuña binational urban area depends on current and future land use, and on travel behavior. Although information on future land use is not available, current land use information indicates that maquiladoras are located primarily in northwest Cd. Acuña, while Del Rio retail activities are located mostly downtown.

According to Del Rio city officials, all available bridge origin and destination information was obtained by CTR in a survey (Ref 21). This survey reflected that 94 percent of all trips have origin in Del Rio and destination in Cd. Acuña. The other 6 percent of trips are split among a wide range of origins and destinations, and the only locations that appeared more than twice in the survey were San Antonio and Eagle Pass origins, and Zaragoza and Piedras Negras destinations. The origin and destination matrix can thus be summarized in a four-cell layout that contains Del Rio and external origins, and Cd. Acuña and external destinations. In this case, these are the only cells that have statistically significant data. This result indicates that the transborder traffic at this sector is basically confined to the sister cities, and that origin and destination information relevant to a detailed trip assignment model must be disaggregated by small sub-zones within the Del Rio and Cd. Acuña areas. Nevertheless, trip purpose and trip frequency data, coupled with ad-hoc information obtained from city officials and bridge operators can be used as an indication of a potential percentage of traffic willing to divert to a hypothetical binational entry system more conveniently located with respect to the industrial areas of Del Rio and Cd. Acuña.

Table 5.1. Southbound traffic forecasts for the Del Rio Sector (thousands of vehicles)

		Low Impact		Moderate Impact		High Impact	
Year	Buses	Autos	Trucks	Autos	Trucks	Autos	Trucks
1994	10	1320	37	1320	37	1320	37
1995	12	1346	39	1346	39	1346	39
1996	13	1373	40	1373	40	1373	40
1997	15	1401	42	1401	42	1401	42
1998	18	1422	43	1429	50	1541	53
1999	20	1443	44	1457	52	1695	66
2000	23	1465	45	1487	53	1864	82
2001	27	1487	46	1516	55	2051	103
2002	31	1509	47	1547	57	2256	129
2003	35	1532	47	1578	58	2482	132
2004	41	1555	48	1609	60	2730	136
2005	47	1578	49	1641	62	3003	141
2006	54	1602	50	1674	64	3303	145
2007	62	1618	51	1708	92	3402	149
2008	71	1634	52	1742	95	3504	154
2009	82	1650	53	1777	97	3609	158
2010	94	1667	55	1812	99	3718	163
2011	108	1683	56	1848	102	3829	168
2012	124	1700	57	1885	105	3944	173
2013	143	1717	58	1923	107	4062	178
2014	165	1734	59	1961	110	4184	183

These data were loaded into a spreadsheet model that takes into account hypothetical travel times to and from the main trip purpose such as a maquiladora or shopping, as well as traffic volumes. In addition to the usual assumptions of no catastrophic events, and no significant socioeconomic changes such as peso devaluation, low fuel supplies, economic depression, and the like, the following assumptions were used in this analysis:

(1) Both the hypothetical and the new binational entry systems are fully accessible;

(2) All inspection facilities are fully staffed and efficiently operated;

(3) Future land uses in Del Rio and Ciudad Acuña will approximately follow the current pattern;

(4) Inspection facilities of the new binational entry system are designed in a way that minimizes traffic disruption;

(5) Traffic generation in newly developed areas was taken into account only in terms of route preference of assumed percentages of future traffic;

(6) Both non-commercial and commercial traffic will prefer a bridge that is closer to their origin and/or destination;

(7) Throughout the analysis period, the trip purpose distribution in this sector will be consistent with the origin and destination survey (Ref 21);

(8) Ninety percent of the bus traffic will prefer the downtown location, due to its proximity to shopping and recreational areas; and

(9) Truck traffic destination is always Ciudad Acuña's maquiladoras.

Departures from the assumptions discussed above may cause actual demand and revenues to be considerably different from the results shown in Table 5.2 and 5.3. Assumption 8 implies very little bus traffic, which was considered negligible and as such is not shown in Table 5.2.

The demand analysis indicates that a total of over 11 million autos and almost 800,000 trucks will use the new bridge during the analysis period, for the high impact scenario. These totals increase to over 12.5 million autos and 1.2 million trucks in the moderate impact scenario, and over 21 million autos and 2 million trucks for the low impact scenario.

Potential Revenue Estimates

The revenue and financial analysis for a new binational entry system in the Del Rio sector was prepared with the assumption that the new facility would charge the same toll fees as the existing bridge. These are $1.00 for autos, $6.00 for empty and loaded trucks, and $3.00 for buses.

The financial analysis methodology discussed in Chapter 3 was applied to this sector, and all assumptions on costs, funding financing, and revenue management discussed in that chapter apply to this sector. In addition, the financial model implies the assumption that pedestrian and bus traffic will prefer the downtown bridge, throughout the analysis period, as well as all assumptions needed to arrive at traffic forecasts and to estimate trip diversion to the new bridge. Under these assumptions, the potential net revenues for the hypothetical new binational entry system are shown in Table 5.3.

Table 5.2. Demand estimates — Del Rio Sector

	Low Impact		Moderate Impact		High Impact	
Year	Autos	Trucks	Autos	Trucks	Autos	Trucks
1994	264	11	264	11	264	11
1995	269	12	269	12	269	12
1996	275	12	275	12	275	12
1997	490	13	490	13	490	13
1998	498	34	500	40	539	42
1999	505	35	510	42	593	53
2000	513	36	520	42	652	66
2001	595	37	606	44	820	82
2002	604	38	619	46	902	103
2003	613	42	631	52	993	119
2004	622	43	644	54	1092	122
2005	631	44	656	56	1201	127
2006	641	45	670	58	1321	131
2007	647	46	683	83	1361	134
2008	654	47	697	86	1402	139
2009	660	48	711	87	1444	142
2010	667	50	725	89	1487	147
2011	673	50	739	92	1532	151
2012	680	51	754	95	1578	156
2013	687	52	769	96	1625	160
2014	694	53	784	99	1674	165
Totals	11880	799	12517	1207	21514	2086

Conclusions

A new binational entry system in the Del Rio sector would divert most of the commercial traffic and a considerable portion of the non-commercial traffic of the existing facility. Considering that the existing binational entry system has been only recently remodeled, and that the investment in its remodeling is still a liability, a new facility would result in delinquent liabilities for both the new and the existing binational entry systems.

Traffic in the new facility would have to be twice the most optimistic prediction in order to balance the cash flow, whereas a fourfold increase in the most optimistic demand prediction is needed to obtain a good bond rating (coverage ratio of 1.5 or more). Consequently, a new toll facility in this sector is not feasible at this point.

CAPACITY ANALYSIS

Almost 98 percent of the transborder traffic in the Del Rio sector is carried through the Del Rio Bridge, with Amistad Dam being used only sporadically, mostly by tourists interested in this particular scenic view. The capacity analysis of this sector is thus restricted to the Del Rio binational entry system. The capacity analysis of the toll and inspection components, as well as the bridge span, followed the methodology and assumptions discussed in Chapter 2. The analysis of the access and egress components requires additional assumptions discussed in the next section.

Table 5.3. Revenue estimates — Del Rio Sector

	Net Revenues in Thousands of 1993 Dollars		
Year	Low Impact	Moderate Impact	High Impact
1995	-787	-787	-787
1996	-798	-798	-798
1997	-589	-589	-589
1998	-551	-538	-494
1999	-555	-538	-432
2000	-560	-540	-361
2001	-490	-464	-173
2002	-494	-463	-64
2003	-490	-452	43
2004	-494	-451	135
2005	-498	-450	237
2006	-516	-467	220
2007	-534	-485	202
2008	-553	-504	183
2009	-572	-523	164
2010	-592	-544	143
2011	-613	-564	123
2012	-634	-585	102
2013	-656	-607	80
2014	-679	-630	57
Totals	-12122	-11418	-2092

Access/Egress Component

In Del Rio, southbound access to and northbound egress from the bridge is provided by U.S. Highway 277/239, as shown in Figure 5.5. The four-way stop controlled intersection at Highway 277/239 and Rio Grande Road is assumed to constrain the southbound access to and northbound egress from the bridge, and its capacity was analyzed according to the *Highway Capacity Manual* (Ref 18).

Assuming a 95 percent-5 percent directional split of the traffic volume at this intersection, and assuming a two-by-four intersection type, the *Highway Capacity Manual* indicates that the entire intersection would still operate at a level of service "C" with a volume of 1,440 vph. Since the total volume at the intersection is estimated to be 617 vph, the access/egress facility in Del Rio is estimated to be operating at a level of service better than "C." The total volume at the intersection would have to more than double to reach the level of service "C" (Ref 18).

In Ciudad Acuña, the southbound egress from the bridge is provided by Calle Hidalgo (Hidalgo Street) and is assumed to be constrained by the signalized intersection at Hidalgo and

Allende. Traffic volumes in downtown Cd. Acuña were not collected, but the layout of these streets suggests that applying a 5 percent increase in the southbound bridge traffic on the southbound approach would probably be a conservative estimate of the additional traffic on Calle Hidalgo. Assuming a green time-to-cycle length ratio of 0.35 for the southbound direction, the southbound egress from the bridge in Ciudad Acuña is estimated to be working at a v/c ratio of 77 percent.

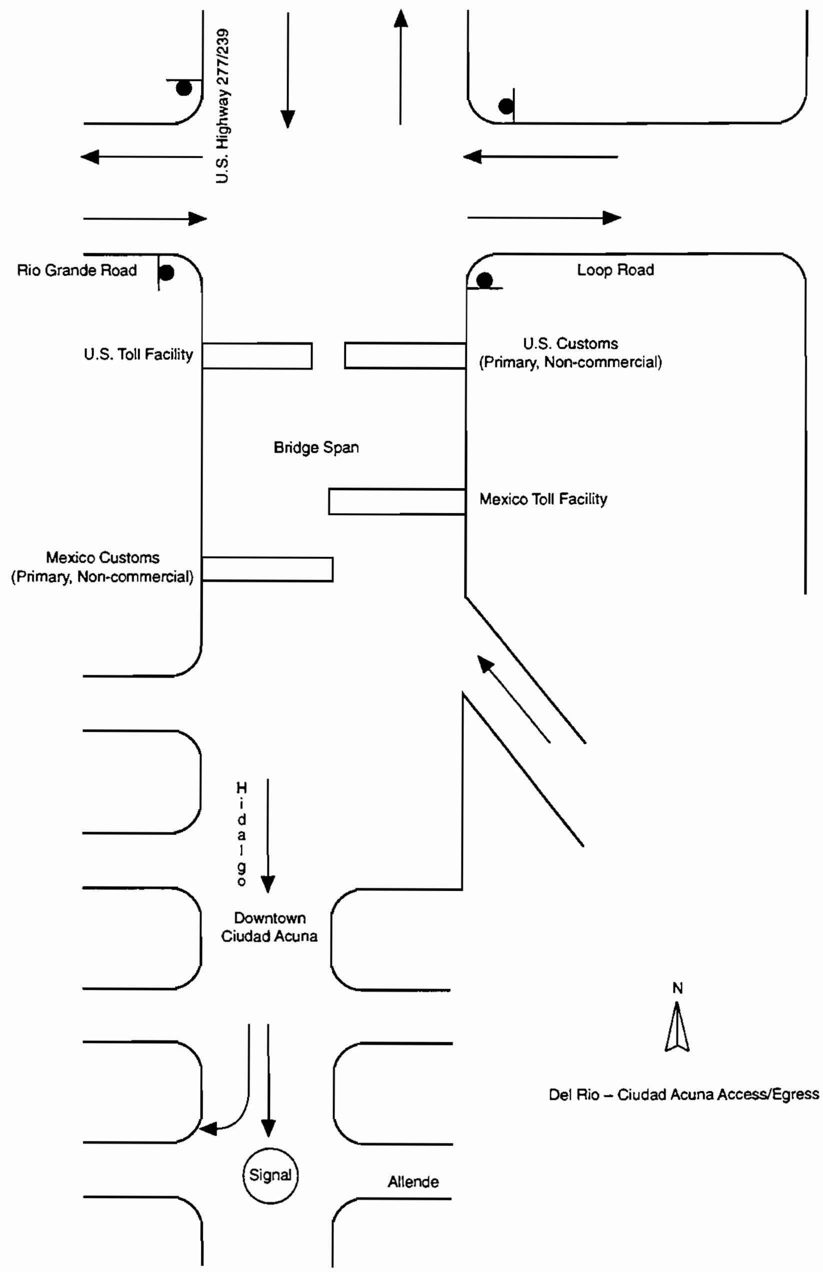

Figure 5.5. Access and egress component — Del Rio

Capacity Analysis Results

Figure 5.6 summarizes the results of the capacity analysis of the Del Rio binational entry system under the assumptions previously discussed. The southbound egress is the most congested facility of the binational entry system, with a v/c value of 77 percent, while the U.S. primary inspection facility for autos is the most congested facility in the northbound direction, with a v/c ratio of 68 percent. With only two toll collection lanes, the U.S. toll collection facility is estimated to be operating at a v/c ratio of 55 percent.

CONCLUSIONS AND RECOMMENDATIONS

The capacity analysis suggests that all components of the Del Rio binational entry system are operating with excess capacity available. In the southbound direction, the highest estimated v/c value is at the southbound egress (v/c=77 percent). In the northbound direction, the highest estimated v/c value is at the U.S. primary inspection facility for autos (v/c=68 percent). Field observations of this bridge substantiate these results, although some queuing was observed at this bridge when only one toll booth was operating on the U.S. side. It is also important to note that the capacity analysis did not include the northbound access to the bridge in Mexico; if this access is working with excess capacity, it will cause traffic congestion in Ciudad Acuña. Field observations indicate that the U.S. access/egress facilities have far more capacity than their Mexican counterpart, which consists of narrow streets of a historical downtown area. The Mexican access/egress component has potential to become the major source of congestion in this binational entry system.

This sector has one vehicular binational entry system that has been recently remodeled, one whose components are operating below capacity, and whose inspection facilities will be gradually upgraded under a project whose first phase is already completed. Field observations on this bridge indicate that queuing is primarily due to vehicles stopping at the toll booth. If a 1992 study to improve the toll plaza is implemented, such delays will be reduced (Ref 19).

A hypothetical new bridge located a convenient position to attract most of the business related trips would still be unfeasible under the most optimistic post-NAFTA scenario. Estimated traffic diversion to the new facility would have to be much greater than the estimates for the entire sector before a good bond rating could be obtained for this project.

The analyses discussed in this chapter are preliminary in nature, and rely on several assumptions regarding land use, traffic patterns, and NAFTA impacts, that may or may not become reality in the future. Still, it provides strong indications that a new binational entry system is neither needed nor financially feasible at this point.

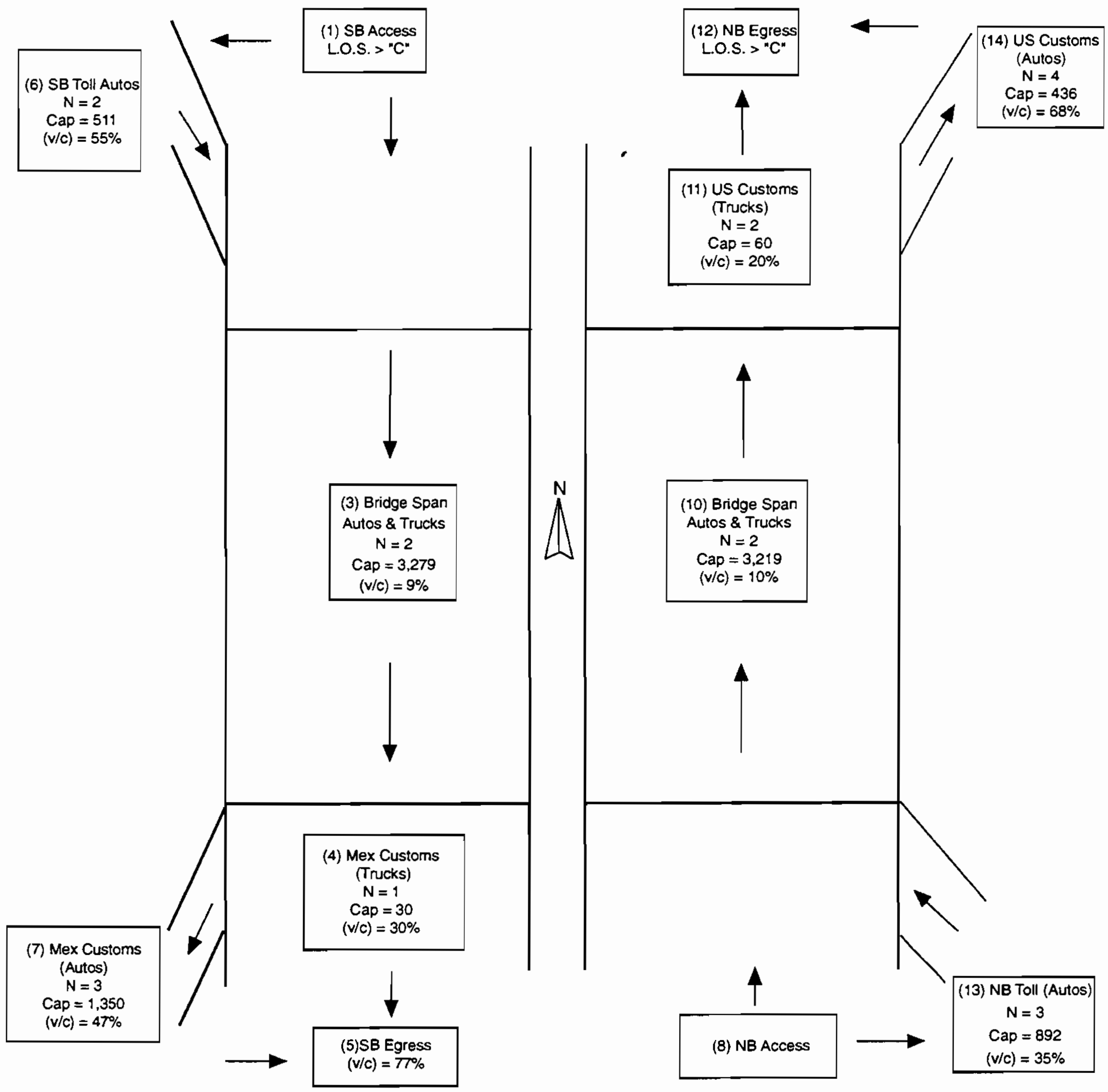

Figure 5.6. Capacity utilization of the Del Rio binational entry system

CHAPTER 6. ANALYSIS OF THE PRESIDIO SECTOR

BACKGROUND

The Presidio Sector comprises the city limits of Presidio, in Presidio County, Texas, and the city limits of Ojinaga, Chihuahua. It contains one binational entry system, the Presidio-Ojinaga Bridge, located approximately 180 miles (290 km) west of La Linda. The existing bridge and border station facility were built in 1986-1987 to replace an older facility. The facility is a two-lane bridge with sidewalks on both sides for pedestrians. On the U.S. side, the bridge is owned by the state of Texas, and is free in the southbound direction. On the Mexican side, the Mexican government owns the bridge, and northbound traffic is required to pay a toll when leaving Mexico. Caminos y Puentes Federales (CAPUFE) operates and manages toll collection. There is only one toll booth for northbound traffic.

There are three U.S. primary inspection lanes for private vehicles, and two additional lanes available for expansion. There are nine secondary inspection spaces for private vehicles, expandable to fifteen. Officially, there are six truck docks in the import lot for commercial truck secondary inspection, but each dock is small and, according to U.S. Customs officials, there is only room to unload three trucks at a time. On the Mexican side, the inspection facility of "Puente Ojinaga" consists of one booth for primary inspection, and 20 parking spaces for secondary inspection of privately owned vehicles. Approximately 4 percent of all autos undergo secondary inspection, which normally requires a maximum of 5 minutes. At the primary inspection booth, it takes about 3 to 4 seconds for each vehicle to pass the red-green light selection. There is also one truck-exclusive lane where clearance documentation is presented. The import lot ("pátio de inspección fiscal") can accommodate about ten trucks.

In the U.S., the Presidio Bridge is served by U.S. Highway 67 and FM 70. To the north, U.S. Highway 67 connects Presidio to U.S. Highway 90 in Marfa, and FM 170 connects Presidio to the Big Bend National Park to the east. In Mexico, the bridge is accessed by MEX 16, which connects Ojinaga to Chihuahua, and by Chihuahua State Highway 49, which connects Ojinaga to Cd. Camargo. The Southern Pacific Railroad enters northern Presidio county, and the Santa Fe Railroad enters the county in the northeast and makes connection with Ferrocarriles Nacionales de Mexico in the City of Presidio.

Although there is no proposal for a second bridge at Presidio, there have been recent proposals by Presidio County and Presidio city officials to transfer ownership of the U.S. side of the existing bridge to the city and/or county. If this transfer is completed, the bridge will become a toll-facility on the U.S. side.

REVENUE AND DEMAND ANALYSIS

The Presidio sector was analyzed using the methodology developed by CTR and discussed in Chapter 3. This methodology includes traffic forecast scenarios that take into account NAFTA effects, as well as a spreadsheet model to estimate traffic diversion to a new binational entry system in the sector. It also includes a financial analysis model to estimate net revenues. All assumptions discussed in Chapter 3 regarding the development of these models are applicable to this sector.

Traffic Analysis

Traffic data for this binational entry system are available in the northbound direction only from two sources: CAPUFE and U.S. Customs. Figure 6.1 shows the auto traffic history according to CAPUFE. This figure shows that before 1985 auto traffic growth was somewhat erratic, but mainly stagnant, and that, one year before GATT, it started to grow at an average post-GATT rate of 16.4 percent. Data for years 1989 and 1990 are not available, and 1991 and 1992 show a trend towards stabilization at a pre-GATT level. These trends are confirmed by U.S. Customs auto data, which are depicted in Figure 6.2. Before GATT, auto traffic was decreasing; it started to increase at an average of 7.5 percent a year after GATT. In 1989, it had a twofold increase, and after that it seems to be stabilizing at a 0.1 percent yearly average.

Customs data are recorded by fiscal year, which starts in September of the same calendar year. An approximate conversion of fiscal year to calendar year can be achieved by using data from a certain fiscal year as data for the same calendar year. Traffic data from U.S. Customs were converted to the calendar year in this chapter.

U.S. Customs and CAPUFE data are not perfectly comparable, since the former are recorded by fiscal year, while the latter are recorded by calendar year, and the conversion used implies a three-month lag. In addition, data disaggregation by vehicle type is done according to different criteria. Nevertheless, both data indicate roughly the same growth patterns, i.e., on the average, periods of "low" and "high" growth rates are matching.

Figures 6.3 and 6.4 show the truck traffic histories according to CAPUFE and U.S. Customs. Figure 6.3 shows that before 1983, truck traffic was mostly decreasing, but the somewhat erratic pattern still yielded a positive growth rate of 2.4 percent. Between 1984 and 1988, truck traffic started to grow at an average rate of 11 percent. Data for years 1989 and 1990 are not available, and 1992 shows a growth rate of 7.5 percent. A three-stage trend is also reflected in the U.S. Customs truck data, which are depicted in Figure 6.4 Between 1984 and 1988, the truck traffic was growing at an average rate of 12 percent in a two-stage pattern, as depicted in Figure 6.4. After 1989, truck traffic has been decreasing at a -5.3 percent yearly average.

Table 6.1 depicts the average growth rates before and after GATT. Pre-GATT CAPUFE averages include data dating back to 1973, while U.S. Customs data are available only back to 1984. On the other hand, CAPUFE data were not available for 1989 and 1990 at this binational entry system, while the U.S. Customs data series are complete. Pre- and post-GATT growth rates were analyzed based on the best history available.

Lands in the flood plain of the Rio Grande near Ojinaga are utilized mainly for agricultural purposes, and harvest is shipped throughout the United States. The largest import/export commodity moving through Presidio is cattle, and the second largest is produce

(Ref 3). Lack of appropriate freight forwarding facilities has encouraged some freighters to use other binational entry systems, regardless of the detour. After NAFTA lifts regulations that require the use of freight forward facilities, truck traffic may increase at Presidio if the issue of harmonization of truck weight limits is satisfactorily resolved. NAFTA provisions regarding agricultural products eliminated taxes on several products going through Presidio, including cattle. In the high impact scenario, this will boost the economies of the sister cities.

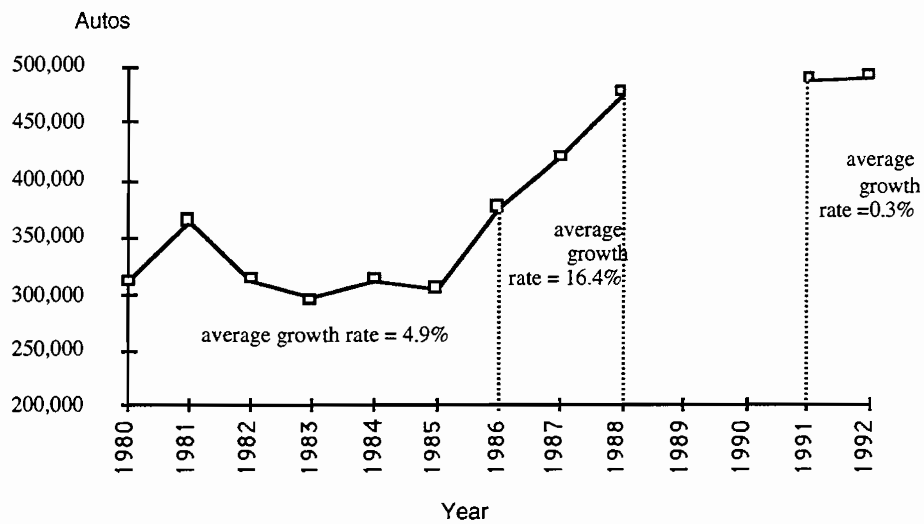

Figure 6.1. Northbound auto traffic history at Presidio (Source: CAPUFE)

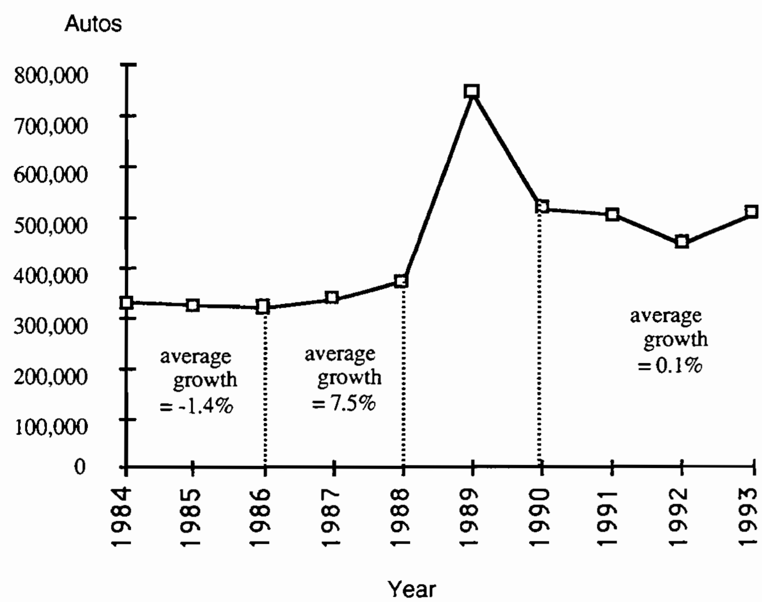

Figure 6.2. Northbound auto traffic history at Presidio (Source: U.S. Customs)

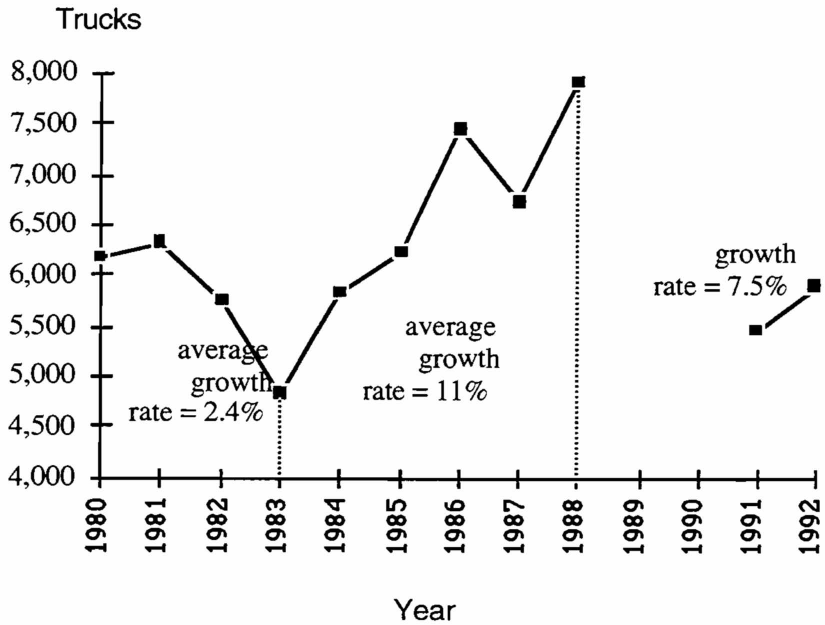

Figure 6.3. Northbound truck traffic history at Presidio (Source: CAPUFE)

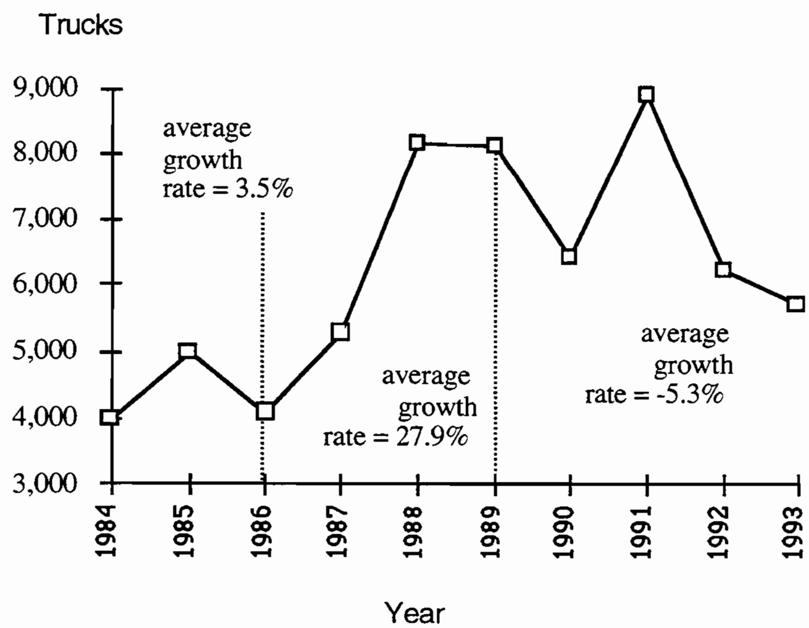

Figure 6.4. Northbound truck traffic history at Presidio (Source: U.S. Customs)

Table 6.1. Average traffic growth rates at Presidio

	U.S. Customs			CAPUFE	
	POV	Freight	Autos	Trucks	Buses
Pre-GATT	1.2%	3.5%	4.9%	5.7%	2.3%
Post-GATT	11.4%	8.9%	8.6%	8.6%	53.7%

Attempts to correlate sector traffic history to available socioeconomic indicators, such as population, employment, and industrial activity, have failed to generate a model that is accurate enough to be extrapolated twenty years into the future. Owing to the predominance of agricultural activity in this area, traffic demand is likely to depend more on fluctuations of produce and cattle harvesting, which are very difficult to predict and introduce a very high magnitude of error when used as explanatory variables in a forecast model.

The high impact post-NAFTA scenario for truck traffic assumes a latent demand and truck traffic growth rates proportional to the agricultural export/import growth (Ref 21). The moderate impact scenario assumes no latent demand, and post-GATT growth rates for the first five years, with less growth thereafter. Since the main commodities going through Presidio are cattle and produce, they are not likely to suffer negative NAFTA impacts; nevertheless, the low impact scenario will assume a steady decrease in traffic growth rate for the entire analysis period.

Presidio's population is less than 10 percent that of Ojinaga, and both cities have a combined population of about 32,000. Maquiladora activity is very limited in Ojinaga, and Presidio is mainly a rural area. For auto traffic, all scenarios assume that the greatest NAFTA impacts will be felt in the first five years. Both the high impact and moderate impact scenarios assume a five-year boom, which is followed by smaller growth rates whose magnitudes depend on the scenario. The low impact scenario assumes a steady decrease in auto traffic growth rates.

Table 6.2 shows estimates of future truck and auto traffic at the Presidio sector for the three scenarios discussed above. Under the high impact scenario, auto traffic would reach almost 1.6 million by the year 2014, while truck traffic would be over 8,700 These totals decrease respectively to 1.5 million and 6,700 for the moderate impact scenario, and about half a million and 5,200 for the low impact scenario. These predictions were made based on the northbound traffic data only, since southbound traffic data are not available.

Potential Demand and Revenue Estimates

Traffic diversion to a new binational entry system in this sector depends on current and future land use and travel behavior, as well as origins and destinations for each trip purpose. Origin and destination data collected by CTR at this binational entry system indicated that almost 90 percent of all trips in this sector have origin in Presidio and destination in Ojinaga, and disaggregated information within sister cities is not available. Assuming a fifty-fifty split of the total sector demand between the existing and the hypothetical binational entry system (an optimistic supposition), and using the assumptions required for the financial analysis discussed in Chapter 2, the potential net revenues for a new toll binational entry system are as shown in Table 6.3.

Conclusions

The revenue analysis indicates that traffic demand in the Presidio sector is not large enough to justify a new toll binational entry system, even in the most optimistic scenario. Toll prices would have to more than double to break-even the cash flow, and a good bond coverage ratio would require a fourfold toll price increase, even under the optimistic assumption of a fifty-fifty traffic split between the old and the new facilities. In terms of replacement of the existing bridge (which means capturing the entire sector demand), toll schedules would have to be 50 percent higher than current prices to break-even the cash flow, and would have to be twice as high than current prices to command a good bond rating based on estimated coverage ratios.

Table 6.2. Traffic predictions for the Presidio Sector

	High Impact		Moderate Impact		Low Impact	
Year	Autos	Trucks	Autos	Trucks	Autos	Trucks
1994	551412	5886	551412	5886	510321	5827
1995	729242	6357	729242	6033	550596	5798
1996	838629	6865	838629	6184	511342	5769
1997	964423	7415	964423	6339	511853	5740
1998	1109086	8008	1109086	6497	512365	5712
1999	1164540	8648	1164540	6659	512878	5683
2000	1222767	8657	1222767	6666	513390	5655
2001	1283906	8665	1283906	6672	513904	5626
2002	1348101	8674	1348101	6679	514418	5598
2003	1415506	8683	1415506	6686	514932	5570
2004	1486281	8691	1486281	6692	515447	5542
2005	1493712	8700	1487767	6699	515962	5515
2006	1501181	8709	1489255	6706	516478	5487
2007	1508687	8717	1490744	6712	516995	5460
2008	1516230	8726	1492235	6719	517512	5432
2009	1523811	8735	1493727	6726	518029	5405
2010	1531431	8744	1495221	6733	518547	5378
2011	1539088	8752	1496716	6739	519066	5351
2012	1546783	8761	1498213	6746	519585	5325
2013	1554517	8770	1499711	6753	520105	5298
2014	1562290	8779	1501211	6760	520625	5271

CAPACITY ANALYSIS

The capacity analysis of the Presidio/Ojinaga binational entry system, the only one in this sector, was developed according to the methodology and assumptions discussed in Chapter 2. No data are available for the access and egress components, and they were not analyzed. Figure 6.5 summarizes the results of the capacity analysis of the Presidio binational entry system. In the southbound direction, the most congested component is the Mexican primary inspection facility for autos, which has only lane, and operates at a v/c ratio of 32 percent. In the northbound direction, the most congested component was estimated to be the Mexican toll collection facility, with a v/c ratio of 49 percent, followed by the U.S. primary inspection facility for autos, at 44 percent capacity utilization.

Table 6.3. Demand and revenue estimates for Presidio Sector

	Low Impact		Moderate Impact		High Impact	
Year	Total Demand	Net Revenues	Total Demand	Net Revenues	Total Demand	Net Revenues
1995	556	-793	735	-704	736	-703
1996	517	-830	845	-666	845	-664
1997	518	-839	971	-611	972	-608
1998	518	-853	1116	-552	1117	-549
1999	519	-866	1171	-538	1173	-533
2000	519	-881	1229	-524	1231	-519
2001	520	-895	1291	-508	1293	-503
2002	520	-911	1355	-491	1357	-486
2003	521	-927	1422	-474	1424	-469
2004	521	-943	1493	-455	1495	-450
2005	521	-960	1494	-471	1502	-463
2006	522	-978	1496	-489	1510	-481
2007	522	-996	1497	-507	1517	-499
2008	523	-1014	1499	-525	1525	-517
2009	523	-1034	1500	-545	1533	-537
2010	524	-1054	1502	-565	1540	-557
2011	524	-1074	1503	-585	1548	-577
2012	525	-1096	1505	-607	1556	-599
2013	525	-1118	1506	-629	1563	-621
2014	526	-1141	1508	-652	1571	-644
Total		-19970		-11540		-11417

Demand in thousands of vehicles
Toll prices: $1.00 for autos, and $5.00 for trucks.
Net revenues in thousands of 1992 dollars

CONCLUSIONS AND RECOMMENDATIONS

The Presidio Sector encompasses a small rural town on the U.S. side, and a larger town on the Mexican side. The main economic activity in this binational area is agricultural, and truck traffic in the existing binational entry system hauls primarily cattle and produce. NAFTA provisions include immediate elimination of taxes for Mexican cattle and some Mexican produce entering the U.S., as well as for U.S. and Canadian agricultural equipment entering Mexico. This may make Mexican cattle more competitive in the near future, and in turn increase truck demand in Presidio, as well as boost the economies of both sister cities. On the other hand, elimination of Mexican taxes on U.S. produce will be gradually implemented during a fifteen-year period, and the long-term effect of these measures on traffic demand of one specific agricultural area is very uncertain at this point.

Under pre-NAFTA regulations (valid until 1997), international truck traffic is prohibited beyond the commercial zones of both countries. As a consequence, commercial traffic relies on freight forwarding to switch cargo from Mexican to U.S. trucks and vice-versa. Larger businesses, such as Presidio Valley Farms, have their own refrigerated storage facilities, but lack of more appropriate freight forwarding facilities causes a considerable percentage of potential truck demand for Presidio to use other binational entry systems. This may be causing a latent truck demand for this sector, which may switch to Presidio when freight forwarding is no longer required. However, even in the most optimistic post-NAFTA scenario, a fourfold increase in total demand is necessary to make a bond-financed international bridge feasible.

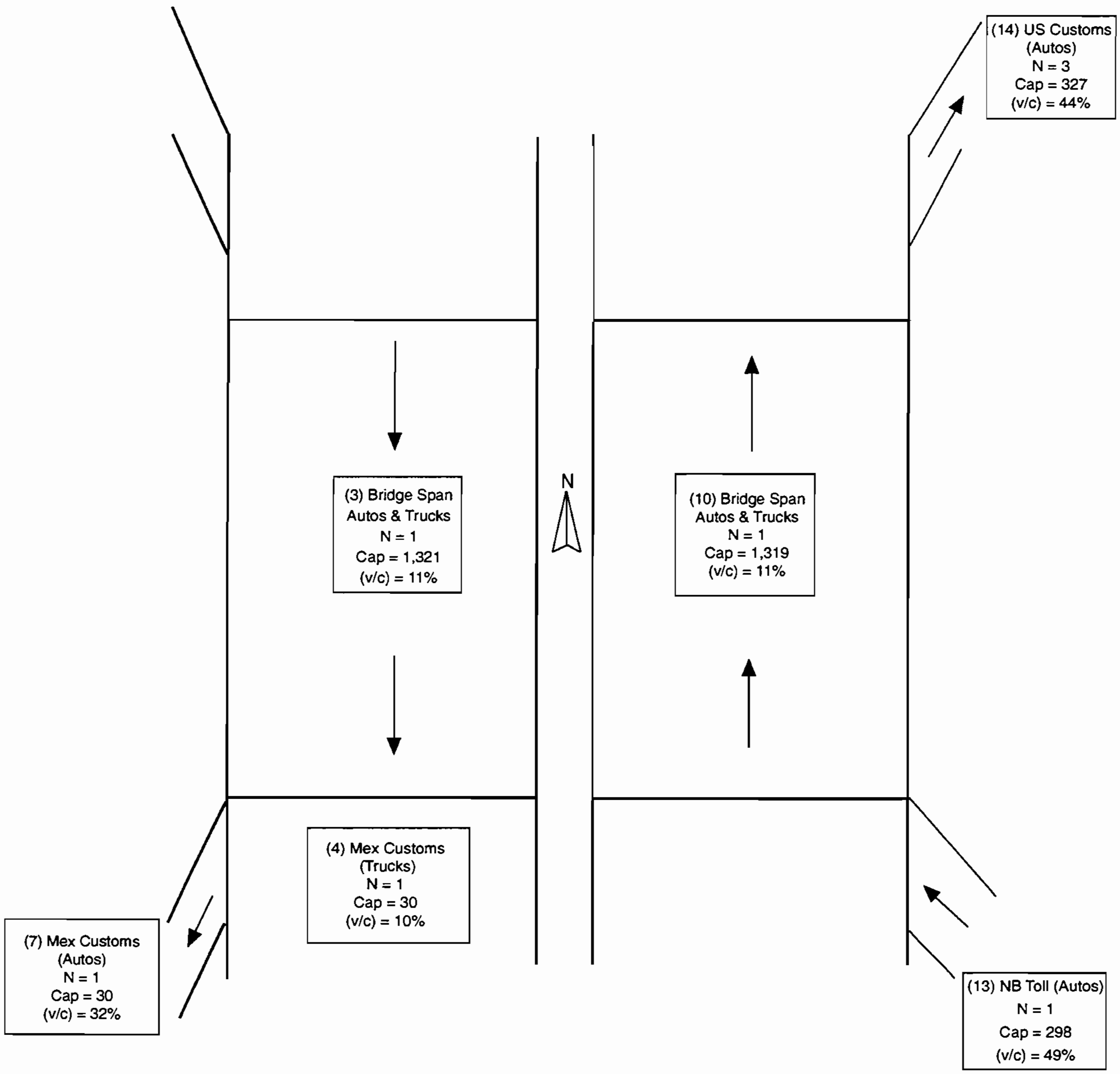

Figure 6.5. Capacity utilization of the Presidio binational entry system

The analysis of current capacity utilization in the Presidio binational entry system indicates that its busiest component (the Mexican toll collection) is operating at less than 50 percent capacity. As for the access/egress facilities, a Department of Commerce study (Ref 3) and field trips to the site suggest that congestion in Presidio is caused by trucks going through the freight forwarding procedures on public roads, parking lots, and other inconvenient locations that cause disruptions to traffic circulation. This problem will probably be eased after NAFTA's liberalization of foreign truck traffic is implemented. On the other hand, freight forwarding may continue for as long as the truck weight limits are not harmonized (an issue of controversy between the NAFTA countries). In addition, the practice may still continue for some time even after the truck weight issue is resolved, while the trucking companies adapt to the new rules. All these facts make the Presidio sector a very interesting case study for NAFTA impacts on agriculture-related traffic demand. Close monitoring of this sector, coupled with agricultural activity monitoring, is recommended for the next fifteen years.

CHAPTER 7. ANALYSIS OF THE EL PASO SECTOR

BACKGROUND

The El Paso Sector begins immediately east of the Fabens Bridge and ends at the Texas/New Mexico/Chihuahua border. It includes the cities of Tornillo, Fabens, Ysleta, and El Paso, in El Paso County, Texas, and the cities of Caseta, Zaragoza, and Cd. Juarez, in Chihuahua, Mexico. This sector has five vehicular binational entry systems: Fabens, Ysleta-Zaragoza, Bridge of the Americas (BOTA), Good Neighbor Bridge (GNB), and Paso del Norte (PDN). The Fabens Bridge was included in the El Paso sector because origin and destination data showed that over 10 percent of the demand for this bridge had origins in El Paso.

Fabens

The Fabens Bridge is a narrow two-lane bridge with one sidewalk, located approximately 23 miles (37 km) west of Fort Hancock. It was built in 1955, and is a toll-free facility on both sides, since it is owned by the International Boundary and Water Commission (IBWC).

The approach facility on the U.S. side is FM 1109, which leads to State Hwy 20 (Alameda Avenue). From there, IH-10 can be accessed through the town of Tornillo. There is a proposal for extending the border highway to Fabens, but the feasibility study has not yet started. On the Mexican side, Highway MEX 02 is accessible from "Puente La Caseta" through the town of Caseta. In the U.S., this bridge has one primary inspection lane, and a one-vehicle secondary inspection space that serves all traffic. Analogous facilities exist on the Mexican side. The bridge is posted at 21,000 lb (9.5t), and is open from 6 a.m. to 10 p.m., seven days a week.

El Paso

The El Paso Port of Entry comprises four vehicular/pedestrian binational bridge entry systems, and two binational rail entry systems. The four vehicular bridges are:

(1) Ysleta or Zaragoza Bridge,

(2) Bridge of the Americas, or Cordova Bridge,

(3) Good Neighbor Bridge, or Stanton Street Bridge, and

(4) Paso Del Norte Bridge, or Santa Fe Street Bridge.

Paso Del Norte (PDN), Good Neighbor (GNB), and Ysleta Bridges are owned by the city of El Paso. The Bridge of the Americas (BOTA) is currently owned by IBWC. The two rail bridges are owned by Southern Pacific Railroad and Union Pacific Railroad.

The Ysleta Bridge is located approximately 21 miles (34 km) west of the Fabens Bridge. It has been recently reconstructed, reopening in December of 1990. The new toll bridge is owned by the City of El Paso, while the older one was owned by IBWC. Open 24 hours a day, this facility consists of two four-lane bridge structures — the west structure for private vehicles and pedestrians, and the east structure for commercial traffic.

On the U.S. side, Ysleta has eight primary inspection booths for private vehicles, with four additional lanes available for future expansion, and 26 secondary inspection spaces for private vehicles, expandable to 36 spaces. For trucks, there are six primary inspection lanes and 55 secondary inspection docks (expandable to 110 docks). In addition, Ysleta has a 10-dock export lot, expandable to 20 docks. On the Mexican side, the inspection facilities of "Puente Zaragoza" consist of three primary inspection lanes and 30 secondary inspection spaces for autos, 5 lanes for truck primary inspection, and an import lot for 40 trucks.

Ysleta Bridge can be accessed on the Mexican side from MEX 2, and the U.S. connecting facility at Ysleta is the Border Highway/Loop 375/Americas Avenue. A new interchange has been completed that links Ysleta to Loop 375. Traffic circulation was good around the U.S. side of this binational entry system, but in January 1994 a gas truck turned over and burned a bridge in Loop 375 in El Paso. TxDOT is already working on a replacement, but traffic circulation will be impaired in that area in this meantime.

Bridge of the Americas (BOTA) is located approximately 8.3 miles (13.4 km) west of the Ysleta Bridge. BOTA is an eight-lane bridge with two truck-only lanes and sidewalks on both sides for pedestrians. Structural damage to the bridge due to excessive trucks loads has caused BOTA to be posted at 20 tons (18.5t). BOTA is owned by the U.S. IBWC and by the Government of Mexico, and it is a toll-free facility, according to the terms of 1963 Chamizal Treaty (Ref 8). El Paso and Cd. Juarez city and customs officials believe that large traffic volumes will continue to prefer BOTA regardless of congestion, since it is a free facility.

BOTA was opened around 1967, and in 1992 the U.S. border station facility was expanded and upgraded. On the U.S. side, there are ten primary inspection lanes and 24 secondary inspection spaces for private vehicles, in addition to six primary inspection booths, and 75 secondary inspection spaces for commercial traffic. The truck inspection facilities are operational from 6 a.m. to 6 p.m. Monday through Friday, and from 6 a.m. to 2 p.m. on Saturdays; they are closed on Sundays. BOTA is open to private vehicles and pedestrians 24-hours per day. On the Mexican side, "Puente Cordova" or "Puente Libre" has six auto primary inspection lanes, about 45 parking spaces for autos secondary inspection, four lanes for commercial vehicles primary inspection, and a 50-truck import lot. It has also approximately 500 parking spaces for southbound tourists.

The U.S. approach facilities to BOTA are Interstate 110 and Paisano Drive (U.S. 62). Interstate 110 provides direct access to IH-10. The Border Highway (Loop 375) passes underneath the bridge and can be accessed from BOTA. On the Mexican side, the bridge can be accessed from MEX 2 and MEX5 through Calzada de las Americas and Paseo Triunfo de la República.

Good Neighbor Bridge (GNB) is located approximately 3.3 miles (5.3 km) west of BOTA. It was originally opened by IBWC in 1967 as a result of the 1963 Chamizal Treaty, and later transferred to the City of El Paso. GNB is a four-lane binational bridge entry system restricted to southbound and pedestrian non-commercial traffic. It is open 24-hours a day, and it is a toll facility with four southbound toll booths.

On the Mexican side, "Puente Reforma" has two primary inspection lanes for privately owned vehicles, and 30 parking spaces for secondary inspection. Puente Reforma can be accessed on the Mexican side from MEX 2, through Avenida 16 de Septiembre. In the U.S., the main access is Stanton Street (U.S. Hwy 62/85) in downtown El Paso, and the bridge is also known as Stanton Street Bridge. Border Highway (Loop 375) passes underneath GNB, and provides additional access to this bridge.

Paso Del Norte Bridge (PDN), the western-most vehicular binational bridge in Texas, is located approximately 0.25 mile (0.4 km) west of GNB, and 3.7 miles (6 km) east of the Texas/New Mexico/Chihuahua border monument. PDN was built as a result of the 1963 Chamizal Treaty and was originally opened in 1967 by the IBWC. Later, ownership was transferred to the City of El Paso.

PDN is a four-lane toll bridge restricted to northbound non-commercial traffic and two-way pedestrian traffic, and it is open 24-hours a day. The bridge and border facilities were remodeled in 1991, and they consist of primary inspection booths and 26 secondary inspection spaces for the northbound traffic, as well as four Mexican toll booths, including one booth utilized for turnarounds as necessary.

PDN connects into El Paso Street (U.S. Hwy 62/85) in downtown El Paso in the north/south directions. The Border Highway (Loop 375) passes underneath the bridge and currently feeds into Santa Fe Street west of PDN bridge, which is also called "Puente Santa Fé" in Mexico. A feasibility study for an extension of Loop 375 to U.S. 85 will start soon. The Border Highway can be accessed after crossing PDN and extends east to Ysleta Bridge and then north to Montana Avenue (U.S. Hwy 180/62). PDN can be accessed on the Mexican side from MEX 2, through Avenida 16 de Septiembre in Cd. Juarez.

Proposed Binational Entry Systems and Infrastructure Upgrades

A proposal to replace the existing Fabens Bridge was being favored by GSA, U.S. inspection agencies, and the City of El Paso. The city is interested in negotiations to make this a replacement toll facility, and the Presidential permit process is about to start. The City of Socorro is also proposing a bridge, located approximately 5 miles (8 km) east of Ysleta Bridge, inside Socorro city limits. So far, there have not been feasibility or environmental studies, nor has a Presidential permit been submitted.

The Bridge of the Americas (BOTA) is currently posted at 20 tons (18.5t) due to structural deterioration, and a new binational entry system consisting of three separate bridges was proposed to replace old BOTA. Commercial traffic will have two one-way dedicated bridges, one leading directly into Mexican customs, the other leading into U.S. Customs. Auto and pedestrian traffic will use the third bridge. IBWC will own the new binational entry system, and it will remain free on the U.S. side. On the Mexican side, trucking companies are negotiating an agreement to finance the northbound commercial bridge and charge toll to repay the initial investment. The design has not started, and it has been suggested that TxDOT be responsible for designing all three bridges, on both sides of the border. Two meetings with IBWC have already taken place to discuss details of the implementation (the aerophotogrametry has also been completed).

Cd. Juárez city officials want to upgrade these three bridges, so a loop can be built underneath to alleviate congestion in downtown Cd. Juárez. However, Cd. Juárez officials feel that the congestion is primarily due to traffic back-ups caused by understaffed and lengthy U.S. inspections, and a number of proposals to expedite border inspection procedures are being discussed among Cd. Juárez, U.S. Customs, and INS officials.

The city of Sunland Park, New Mexico, is proposing the Sunland Park or Santa Teresa binational entry system, located approximately 3 miles (4.8 km) west of El Paso. A New Mexico-Chihuahua binational commission is already working on this project, and New Mexico state will fund a feasibility study. Santa Teresa will include an intermodal yard for rail/heavy trucks, and the preliminary design is done. This new binational entry system will compete with any other in the El Paso sector, but it may also help relieve congestion at El Paso's and Cd. Juárez's downtown bridges (Refs 23, 8). Cd. Juárez is proposing the relocation of the downtown railroad tracks either to Santa Teresa or the Ysleta Bridge, and negotiations are about to start on this subject. Cd. Juárez is also proposing to use the old downtown tracks as light rail for transborder mass transit.

TRAFFIC HISTORY

North and Southbound traffic histories by vehicle type (including pedestrians) are available for toll facilities from CAPUFE and from the Bridge Managers on the U.S. side. In the case of free bridges, however, traffic histories are consistently recorded only by U.S. Customs, limiting the scope of the data to northbound traffic.

Fabens

The Fabens Bridge is a free facility that belongs to the Fabens Port of Entry, which includes Fort Hancock and Fabens Bridges. Northbound traffic data aggregated for the entire port of entry are shown in Figure 7.1. Disaggregated data for fiscal years 1991 and 1992 obtained from U.S. Customs indicate that traffic volumes at Fort Hancock are, on the average, one-fifth of the volumes at Fabens (Ref 20).

The Fabens Bridge is close to the El Paso/Juarez area, and as such 10 percent of its traffic is diverted from the El Paso area (Refs 20, 21). However, traffic at the four El Paso Bridges has been, on the average, about 14 times the traffic at the Fabens and Fort Hancock Bridges together (the entire Fabens Port of Entry), and the impact of Fabens diversion on the other four bridges is very small.

El Paso

For the El Paso bridges, the most comprehensive traffic history available is from U.S. customs. Figures 7.2 and 7.3 show the northbound traffic history of the four El Paso bridges, respectively, for autos and trucks. The average growth rate for northbound autos was 0.014 percent in the past ten years, while for trucks it was 25.7 percent.

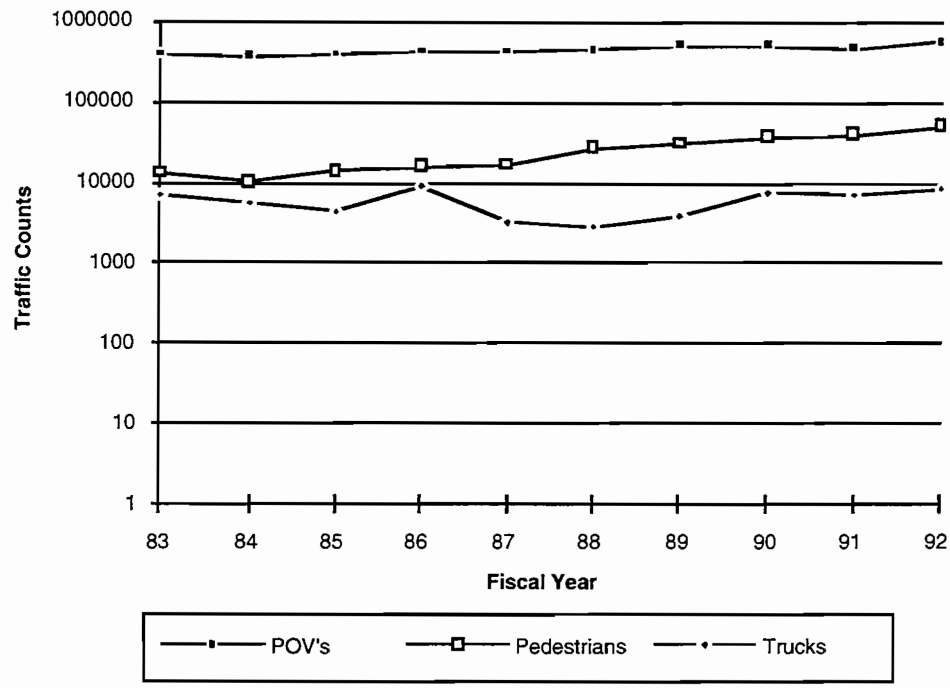

Figure 7.1. Northbound traffic history at Fabens Port of Entry (Source: U.S. Customs Service)

Southbound and CAPUFE traffic data are limited to the toll bridges, but the growth rates are similar to those discussed before (Ref 20). Truck traffic growth has been very impressive in El Paso, especially in 1991 and 1992 (1993 data were not available when this document was being written). During fiscal years of 1991 and 1992, El Paso was the busiest port of entry on the entire Texas-Mexico border, with about twice the total traffic and 1.5 times the truck traffic of the second busiest (Laredo).

REVENUE AND DEMAND ANALYSES

The revenue and demand analyses for the El Paso sector were performed by Wilbur-Smith Associates (WSA), a specialist in revenue forecasts for bond issuance that developed the revenue analysis for the replacement of the Ysleta Bridge in this sector (Ref 22). This section contains material prepared by WSA.

Background

The hypothetical bridge analyzed by WSA was located halfway between BOTA and Ysleta, an area chosen for the possible connections to the local highway system in both countries.

This bridge would serve as the alternative between the two four-lane bridges currently operating at Ysleta and BOTA. The current toll rates at the hypothetical binational entry system were assumed to be $1.00 for cars, $1.50 for light trucks, and $9.95 for heavy trucks.

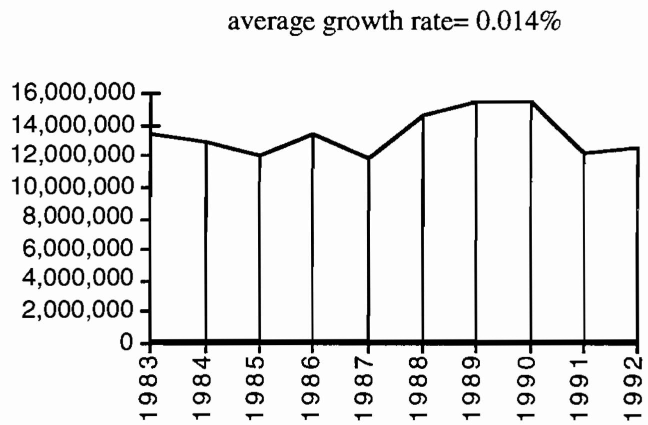

Figure 7.2. Northbound auto traffic history at El Paso bridges (Source: U.S. Customs)

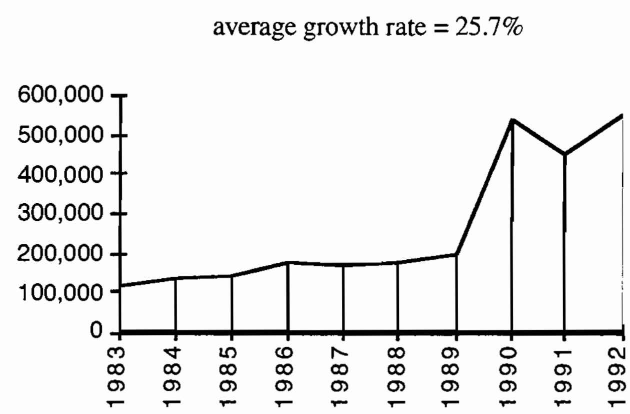

Figure 7.3. Northbound freight traffic history at El Paso bridges (Source: U.S. Customs)

Methodology For Revenue Projections

WSA developed a spreadsheet-based traffic assignment model using data supplied by the Center for Transportation Research (CTR) and route reconnaissance field studies conducted by WSA and CTR. Origin and destination data were obtained from the earlier study conducted by WSA for the replacement of Ysleta (Ref 22). These data were reviewed and re-factored into the overall trip tables used by WSA in this analysis. Data on trip purpose, frequency, vehicle type, and number of passengers were reviewed. Traffic growth schedules developed from traffic data for the years 1978 to 1988 were re-analyzed and used as the baseline scenario for this study. Baseline traffic growth rates used for BOTA were 3 percent for the years 1992 to 1994, 2 percent for 1994 to 1999, and 1.5 percent for 1999 to 2004. Growth rates used for Ysleta were 4 percent for the years 1992 to 1995, 3.5 percent for 1996 to 1999, and 3 percent for 2000 to 2004. In addition, induced growth was assumed at 4 percent in 1993, and 2 percent for 1994 and 1995. These growth rates were used as a baseline for two directions of study: high impact and low impact post-NAFTA scenarios, which assumed a 50 and 75 percent increase/decrease in the baseline growth rate for the same four-year period.

Potential Gross Revenue and Demand Estimates

Tables 7.1 through 7.5 present the results of the analysis for the El Paso Sector. The analysis included all bridges within the El Paso area. However, Fabens Bridge, located about 20 miles (32 km) south of the sector core, did not affect the hypothetical bridge traffic. Similarly, the area bridges located in the immediate downtown area of El Paso remain virtually unaffected by the hypothetical bridge's location.

Table 7.1 shows the results under the baseline growth scenario, which assumes the base growth factors developed by WSA (Ref 22). For the three affected bridges, the annual traffic for 1993 was estimated at 25,934,000 vehicles, and the revenue at $20,142,000. By the year 2004, traffic is anticipated to be 37,191,000 vehicles, producing $31,566,000 in revenue on the two toll facilities, the Ysleta Bridge and the new bridge.

Under a moderately optimistic post-NAFTA growth scenario traffic, revenues are anticipated to grow to $33,939,000 by the year 2004, as shown in Table 7.2. This scenario assumes that NAFTA implementation would result in a 50 percent increase in the baseline growth, due to increased trading between the two countries. Table 7.3 shows a more optimistic post-NAFTA experience causing a 75 percent increase in the baseline traffic growth rates. Resultant revenues under this condition total $35,175,000 by the year 2004.

An analysis of a possible negative NAFTA impact associated with corridor growth was also developed in an attempt to reflect the conflicting opinions of experts who indicate that NAFTA could actually cause a decrease in economic activity along the Texas-Mexico border. As shown in Table 7.4, revenues on the bridges in Sector 18 decrease to $29,319,000 by the year 2004 when the assumed growth reflects a 50 percent reduction due to the anticipated negative NAFTA impact on economic conditions. A further reduction is shown in Table 7.5, where a 75 percent reduction in the demand component of growth was assumed to represent a more adverse NAFTA impact.

Conclusions

The demand and revenue estimates for this sector indicate that a new binational entry system in the El Paso Sector could be justified. The analysis suggests that the hypothetical bridge would draw heavily from BOTA and less so from Ysleta, as travelers seek a more efficient and cost-effective travel route. The diversion analysis takes into account the fact that BOTA is significantly older than the new Ysleta bridges, and is in need of repairs. Motorists continue to experience significant delays because of the burden on the present facilities. It is strongly recommended that the potential shift in traffic to any new binational entry system be verified with the collection of more data in order to demonstrate that the demand for the hypothetical new bridge would in fact result in improved efficiencies in transborder border traffic circulation at this location.

Table 7.1. Demand and revenue estimates (baseline scenario)

	BOTA		Hypothetical Bridge		Ysleta		Total	
Year	Traffic	Revenue	Traffic	Revenue	Traffic	Revenue	Traffic	Revenue
	(THOUSANDS)							
1993	10,661	$0	10,920	$14,439	4,353	$5,701	25,934	$20,140
1994	10,981	0	11,794	15,594	4,701	6,157	27,476	21,752
1995	11,311	0	12,501	16,530	4,983	6,527	28,795	23,057
1996	11,537	0	13,251	17,522	5,282	6,918	30,070	24,440
1997	11,767	0	13,715	18,135	5,467	7,160	30,950	25,296
1998	12,003	0	14,195	18,770	5,659	7,411	31,857	26,181
1999	12,243	0	14,692	19,427	5,857	7,670	32,791	27,097
2000	12,488	0	15,206	20,107	6,062	7,939	33,755	28,046
2001	12,675	0	15,662	20,710	6,243	8,177	34,581	28,887
2002	12,865	0	16,132	21,331	6,431	8,422	35,428	29,754
2003	13,058	0	16,616	21,971	6,624	8,675	36,298	30,646
2004	13,254	0	17,115	22,630	6,822	8,935	37,191	31,566

Assumes no NAFTA impacts.
Assumes the following toll rates: passenger car $1.00; light truck $1.50; heavy truck $9.95.

Table 7.2. Demand and revenue estimates (moderately optimistic scenario)

	BOTA		Hypothetical Bridge		Ysleta		Total	
Year	Traffic	Revenue	Traffic	Revenue	Traffic	Revenue	Traffic	Revenue
	(THOUSANDS)							
1993	10,661	$0	10,920	$14,439	4,353	$5,701	25,934	$20,140
1994	11,141	0	12,012	15,883	4,788	6,271	27,941	22,154
1995	11,642	0	12,973	17,154	5,171	6,773	29,787	23,927
1996	11,992	0	14,011	18,526	5,585	7,315	31,588	25,841
1997	12,351	0	14,746	19,499	5,878	7,699	32,976	27,198
1998	12,598	0	15,262	20,181	6,084	7,968	33,945	28,150
1999	12,850	0	15,797	20,888	6,297	8,247	34,944	29,135
2000	13,107	0	16,350	21,619	6,517	8,536	35,974	30,154
2001	13,304	0	16,840	22,267	6,713	8,792	36,857	31,059
2002	13,504	0	17,345	22,935	6,914	9,056	37,763	31,991
2003	13,706	0	17,866	23,623	7,122	9,327	38,693	32,951
2004	13,912	0	18,402	24,332	7,335	9,607	39,649	33,939

Assumes 50 percent optimistic NAFTA impact.
Assumes the following toll rates: passenger car $1.00; light truck $1.50; heavy truck $9.95.

Table 7.3. Demand and revenue estimates (high impact scenario)

Year	BOTA		Hypothetical Bridge		Ysleta		Total	
	Traffic	Revenue	Traffic	Revenue	Traffic	Revenue	Traffic	Revenue
	(THOUSANDS)							
1993	10,661	$0	10,920	$14,439	4,353	$5,701	25,934	$20,140
1994	11,221	0	12,121	16,028	4,832	6,328	28,174	22,356
1995	11,810	0	13,212	17,470	5,267	6,898	30,289	24,368
1996	12,223	0	14,401	19,042	5,741	7,519	32,365	26,561
1997	12,651	0	15,283	20,209	6,092	7,979	34,027	28,188
1998	12,904	0	15,818	20,916	6,306	8,258	35,028	29,174
1999	13,162	0	16,372	21,648	6,526	8,547	36,060	30,196
2000	13,426	0	16,945	22,406	6,755	8,847	37,125	31,252
2001	13,627	0	17,453	23,078	6,957	9,112	38,037	32,190
2002	13,831	0	17,977	23,770	7,166	9,385	38,974	33,156
2003	14,039	0	18,516	24,483	7,381	9,667	39,936	34,150
2004	14,249	0	19,072	25,218	7,602	9,957	40,923	35,175

Assumes 75 percent optimistic NAFTA impact.
Assumes the following toll rates: passenger car $1.00; light truck $1.50; heavy truck $9.95.

Table 7.4. Demand and revenue estimates (moderately pessimistic scenario)

Year	BOTA		Hypothetical Bridge		Ysleta		Total	
	Traffic	Revenue	Traffic	Revenue	Traffic	Revenue	Traffic	Revenue
	(THOUSANDS)							
1993	10,661	$0	10,920	$14,439	4,353	$5,701	25,934	$20,140
1994	10,821	0	11,575	15,306	4,614	6,043	27,011	21,349
1995	10,984	0	12,038	15,918	4,799	6,285	27,820	22,203
1996	11,093	0	12,520	16,555	4,991	6,536	28,604	23,091
1997	11,204	0	13,739	16,844	5,078	6,651	29,021	23,495
1998	11,428	0	13,185	17,434	5,256	6,883	29,869	24,317
1999	11,657	0	13,646	18,044	5,440	7,124	30,743	25,168
2000	11,890	0	14,124	18,676	5,630	7,374	31,644	26,049
2001	12,068	0	14,547	19,236	5,799	7,595	32,415	26,831
2002	12,249	0	14,984	19,813	5,973	7,823	33,206	27,636
2003	12,433	0	15,433	20,407	6,152	8,057	34,019	28,465
2004	12,620	0	15,896	21,020	6,337	8,299	34,853	29,319

Assumes 50 percent pessimistic NAFTA impact.
Assumes the following toll rates: passenger car $1.00; light truck $1.50; heavy truck $9.95.

Table 7.5. Demand and revenue estimates (low impact scenario)

Year	BOTA		Hypothetical Bridge		Ysleta		Total	
	Traffic	Revenue	Traffic	Revenue	Traffic	Revenue	Traffic	Revenue
	(THOUSANDS)							
1993	10,661	$0	10,920	$14,439	4,353	$5,701	25,934	$20,140
1994	10,741	0	11,466	15,161	4,571	5,986	26,778	21,147
1995	10,822	0	11,810	15,616	4,708	6,166	27,340	21,782
1996	10,876	0	12,164	16,085	4,849	6,351	27,889	22,435
1997	10,930	0	12,271	16,225	4,891	6,406	28,092	22,632
1998	11,149	0	12,700	16,793	5,063	6,631	28,912	23,424
1999	11,372	0	13,145	17,381	5,240	6,863	29,756	24,244
2000	11,599	0	13,605	17,989	5,423	7,103	30,627	25,092
2001	11,773	0	14,013	18,529	5,586	7,316	31,372	25,845
2002	11,950	0	14,433	19,085	5,753	7,535	32,137	26,620
2003	12,129	0	14,866	19,657	5,926	7,761	32,922	27,419
2004	12,311	0	15,312	20,247	6,104	7,994	33,727	28,241

Assumes 75 percent pessimistic NAFTA impact.
Assumes the following toll rates: passenger car $1.00; light truck $1.50; heavy truck $9.95.

CAPACITY ANALYSIS

The capacity analysis of the El Paso Sector was done according to the methodology described in Chapter 2, and includes major components of all five binational entry systems in this sector. The analyses of the bridge span and the toll and inspection booths components are based on the assumptions discussed in Chapter 2. The analysis of the access/egress facilities, however, needs additional assumptions on a case-by-case basis. The next sections discuss these additional assumptions, together with the overall capacity analysis results for each binational entry system in the El Paso Sector.

Fabens Binational Entry System

In the U.S., access and egress to Fabens is provided by two two-lane rural highways, with a stop controlled T-intersection. This type of unsignalized T-intersection yields v/c ratios less than 10 percent for the traffic volumes observed in Fabens (Ref 18).

Figure 7.4 summarizes the results of the capacity analysis of the Fabens binational entry system. These results indicate that all components in both directions have excess capacity. The most congested component of this binational entry system is the U.S. primary inspection facility for autos, with a v/c ratio of 77 percent.

Ysleta Binational Entry System

As discussed before, this binational entry system comprises a commercial and a non-commercial bridge. Figure 7.5 summarizes the results of the capacity analysis of the non-commercial bridge. The analysis suggests that all components have excess capacity available. In the southbound direction, the most congested components are the U.S. toll facility and the

Mexican primary inspection facility, with v/c ratios respectively of 41 percent and 39 percent. In the northbound direction, the most congested components are the Mexican toll collection and U.S. primary inspection facilities, with v/c ratios of 51 percent and 53 percent, respectively.

Figure 7.6 summarizes the capacity analysis for the commercial Ysleta Bridge. The analysis suggests that all components have excess capacity available. In the southbound direction, the most congested component is the Mexican primary inspection facility, with a v/c ratio of 65 percent.

Bridge of the Americas Binational Entry System

BOTA's access/egress facilities in El Paso are provided by the U.S. Hwy 62 eastbound ramps and the below-grade IH-10 connection, as shown in Figure 7.7. The access and egress are assumed to be constrained by the signalized intersection between the eastbound U.S. Hwy 62 ramps (Paisano Drive), and the below-grade connection to IH-10.

The total non-commercial traffic volumes at BOTA are 1,710 vph northbound, and 2,079 vph southbound. The v/c ratio was calculated based on the assumption that total BOTA traffic uses the two through lanes of the northbound or southbound approaches to the intersection, and the two-lane, grade separated connection with IH-10. A two-phase, 120 second cycle length, with green times allocated based upon equal degrees of saturation, was assumed for this intersection. Based on these assumptions, flow rates for northbound and southbound approaches are respectively 0.54 v/s and 0.60 v/s. The two lane eastbound approach to the intersection is assumed to have a non-bridge traffic flow of 0.30 v/s.

In the southbound direction, the analysis yields v/c estimates of 95 percent for the southbound approach to the signalized intersection, and 60 percent for the grade-separated IH-10 connection. The 95 percent and 60 percent v/c ratios are based on two assumptions:

(1) All southbound bridge traffic utilize either one of the two-lane southbound approaches, and

(2) Additional non-bridge traffic utilizes the two-lane eastbound approach at a 0.30 v/s flow rate.

According to the *Highway Capacity Manual* (Ref 18), the total capacity of these three access facilities is about 7,220 vph, which leads to an overall southbound bridge access v/c ratio of 35 percent. This is a conservative estimate, because in reality the southbound bridge traffic is more likely to access the bridge by distributing itself among the two southbound approaches and the right-turn lane.

In the northbound direction, analogous assumptions and calculations yield v/c estimates of 88 percent for the northbound approach to the signalized intersection and 49 percent for the grade-separated IH-10 connection. Again, it should be emphasized that the 88 percent and 49 percent v/c ratios are based on the assumptions that all northbound bridge traffic utilizes either one of the two-lane northbound approaches, and that non-bridge traffic utilizes the two-lane eastbound approach at a flow rate of 0.30v/s. In reality, the northbound bridge traffic exiting from the bridge is more likely to distribute itself amongst the two northbound through facilities and the one northbound exclusive right turn lane, so this capacity estimate is conservative. The total capacity of the three egress facilities can be estimated at 6,820 vph, which implies a total northbound bridge egress v/c ratio of 25 percent.

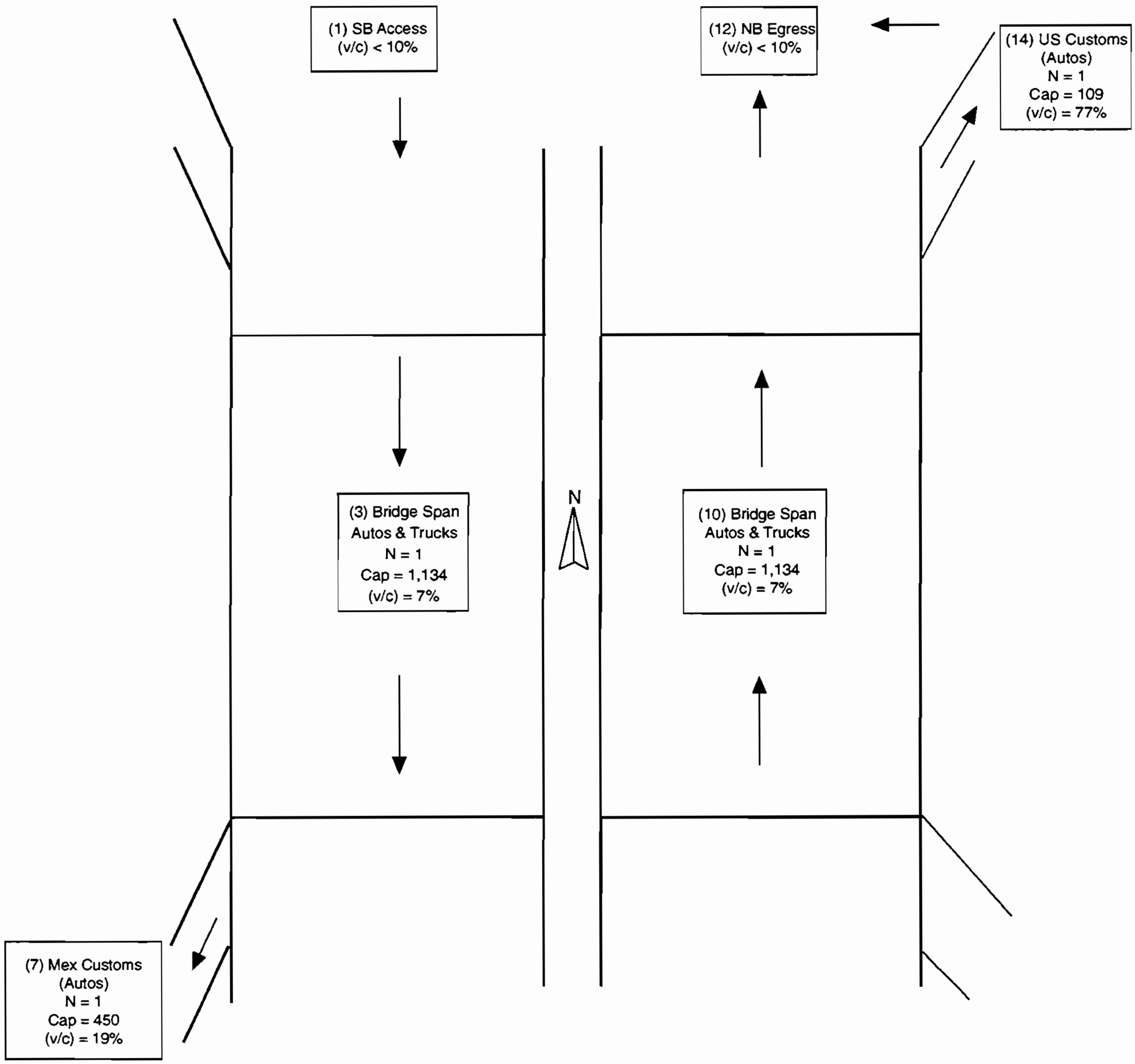

Figure 7.4. Capacity utilization of the Fabens binational entry system

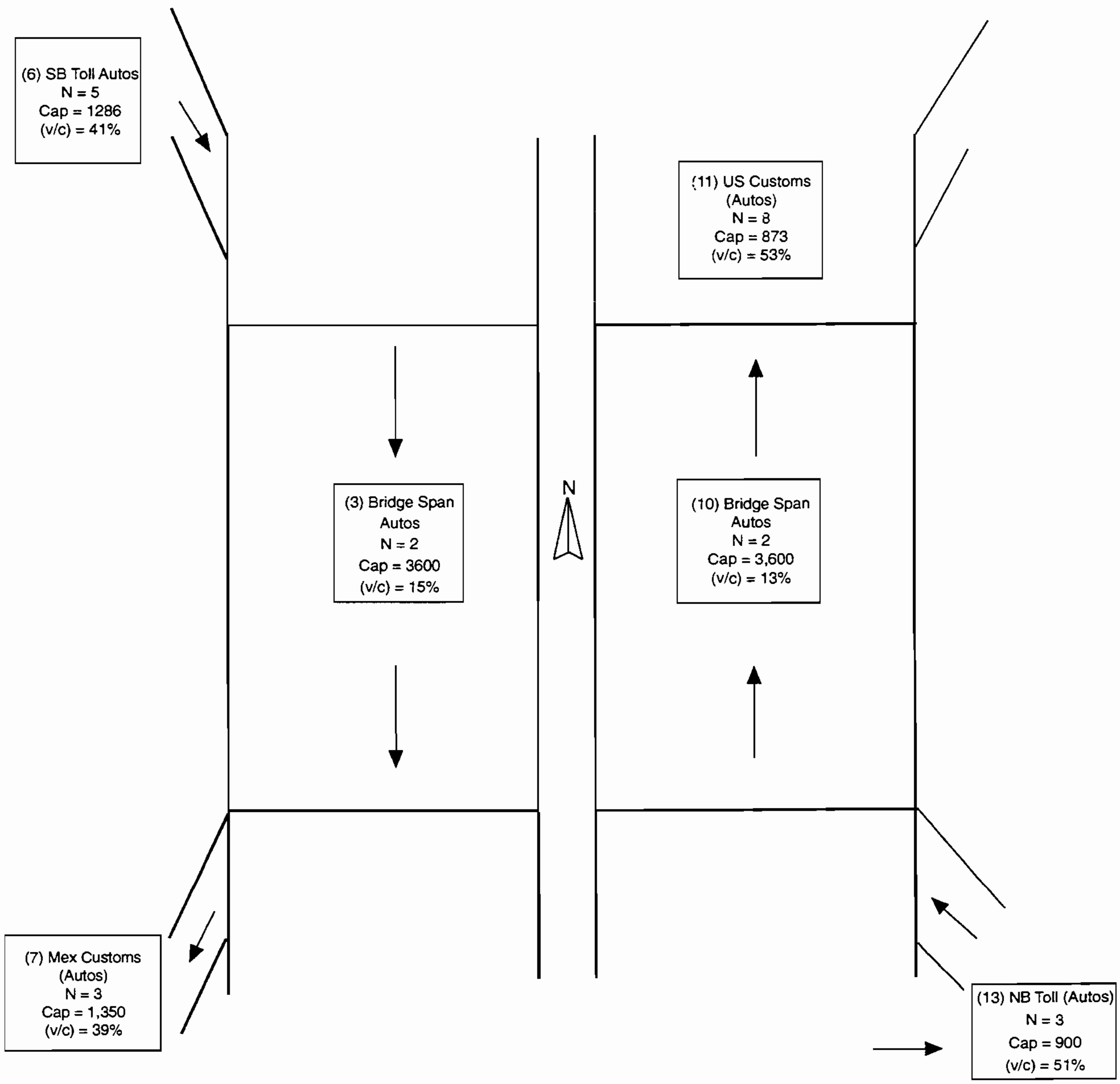

Figure 7.5. Capacity utilization of Ysleta binational entry system (autos)

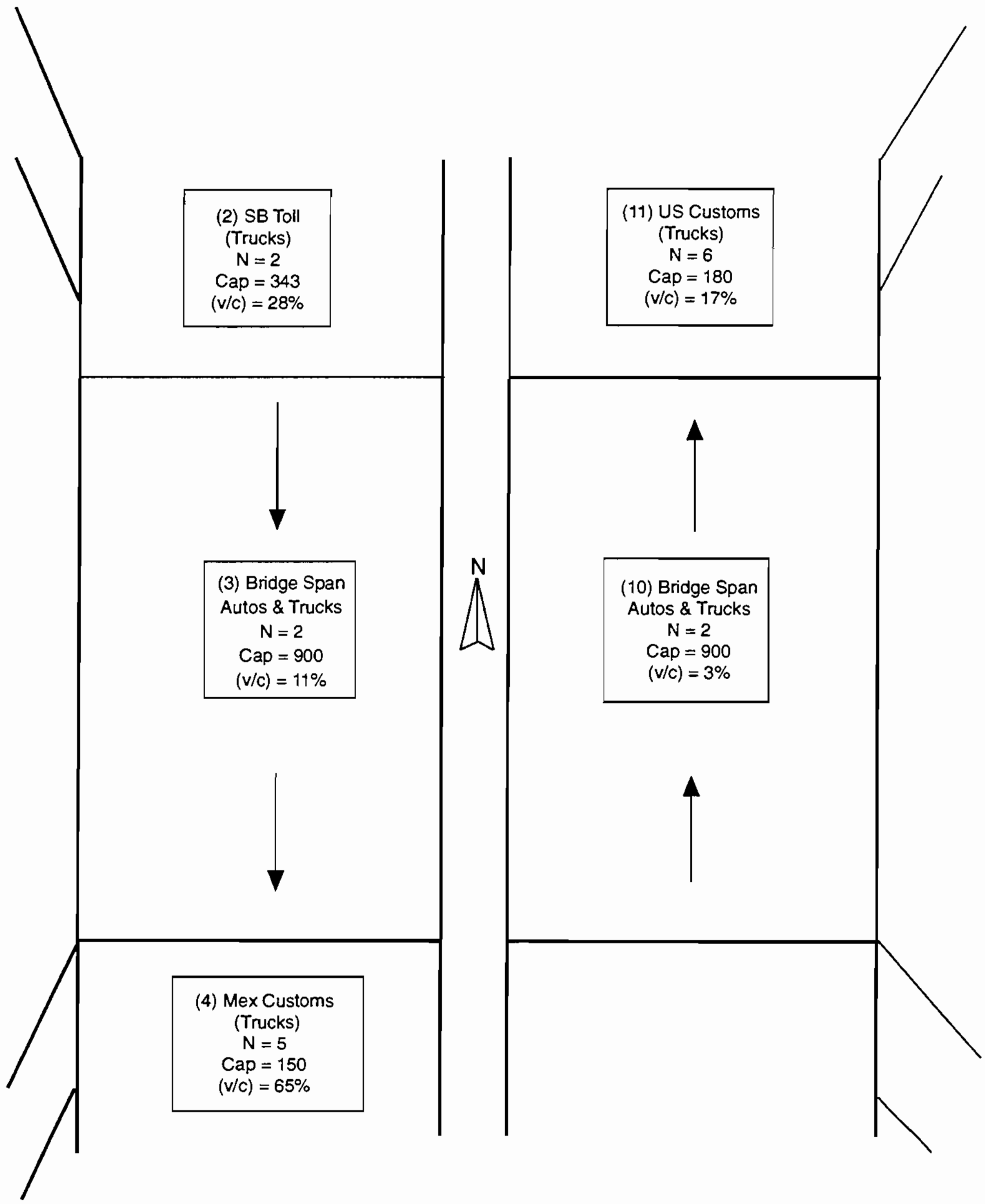

Figure 7.6. Capacity utilization of Ysleta binational entry system (commercial)

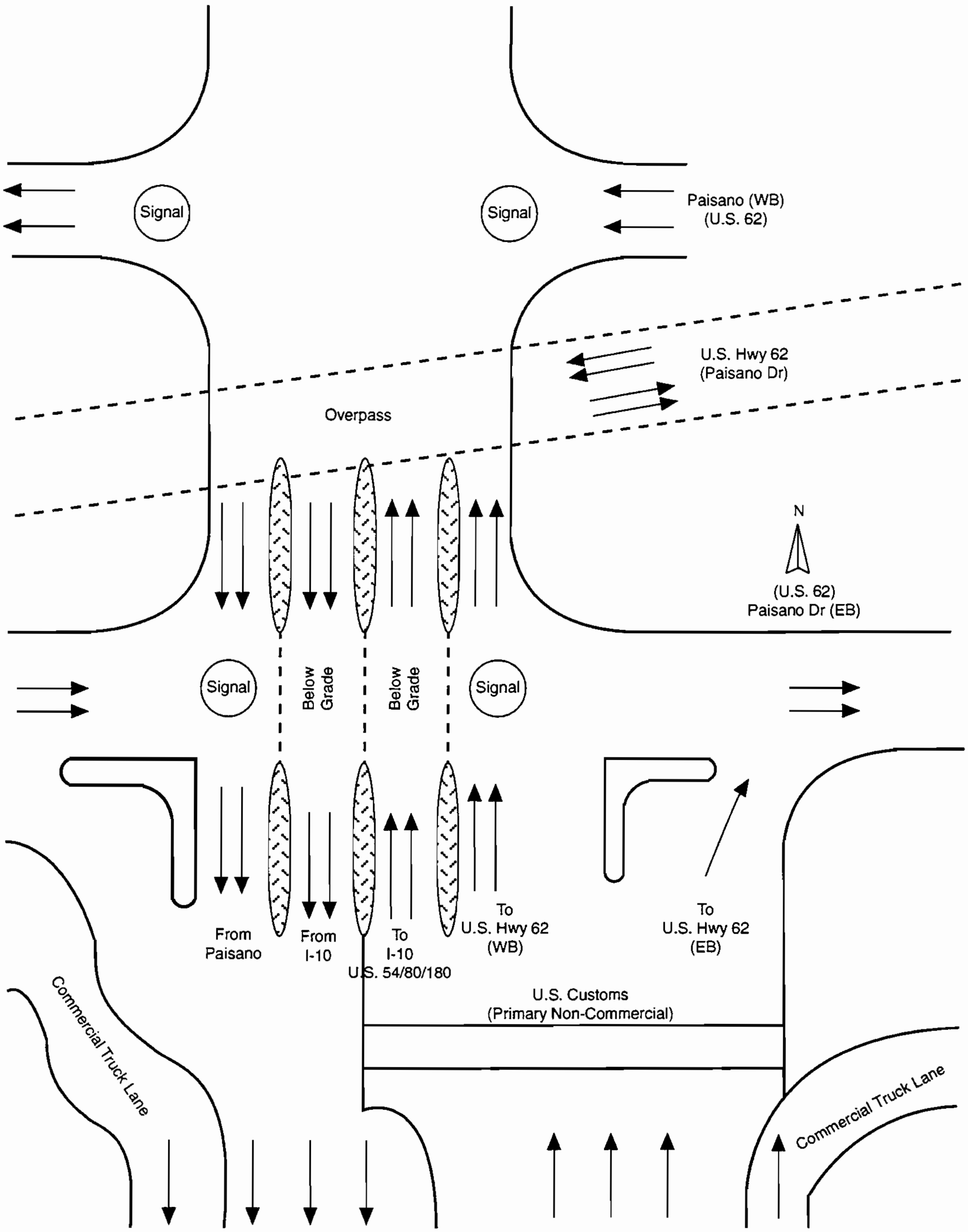

Figure 7.7. BOTA access and egress component

Figure 7.8 summarizes the results of the capacity analysis of the BOTA. The analysis suggests that, in the southbound direction, the most congested component is the Mexican primary inspection for trucks, with a v/c estimate of 156 percent. The Mexican primary inspection facility for autos is estimated to operate with a v/c of 77 percent. In the northbound direction, the U.S. primary inspection facilities for autos and trucks are estimated to operate at 157 percent and 142 percent capacity, respectively. Congestion at inspection facilities cause traffic back-ups into both sister cities, which in turn impairs traffic circulation in downtown areas.

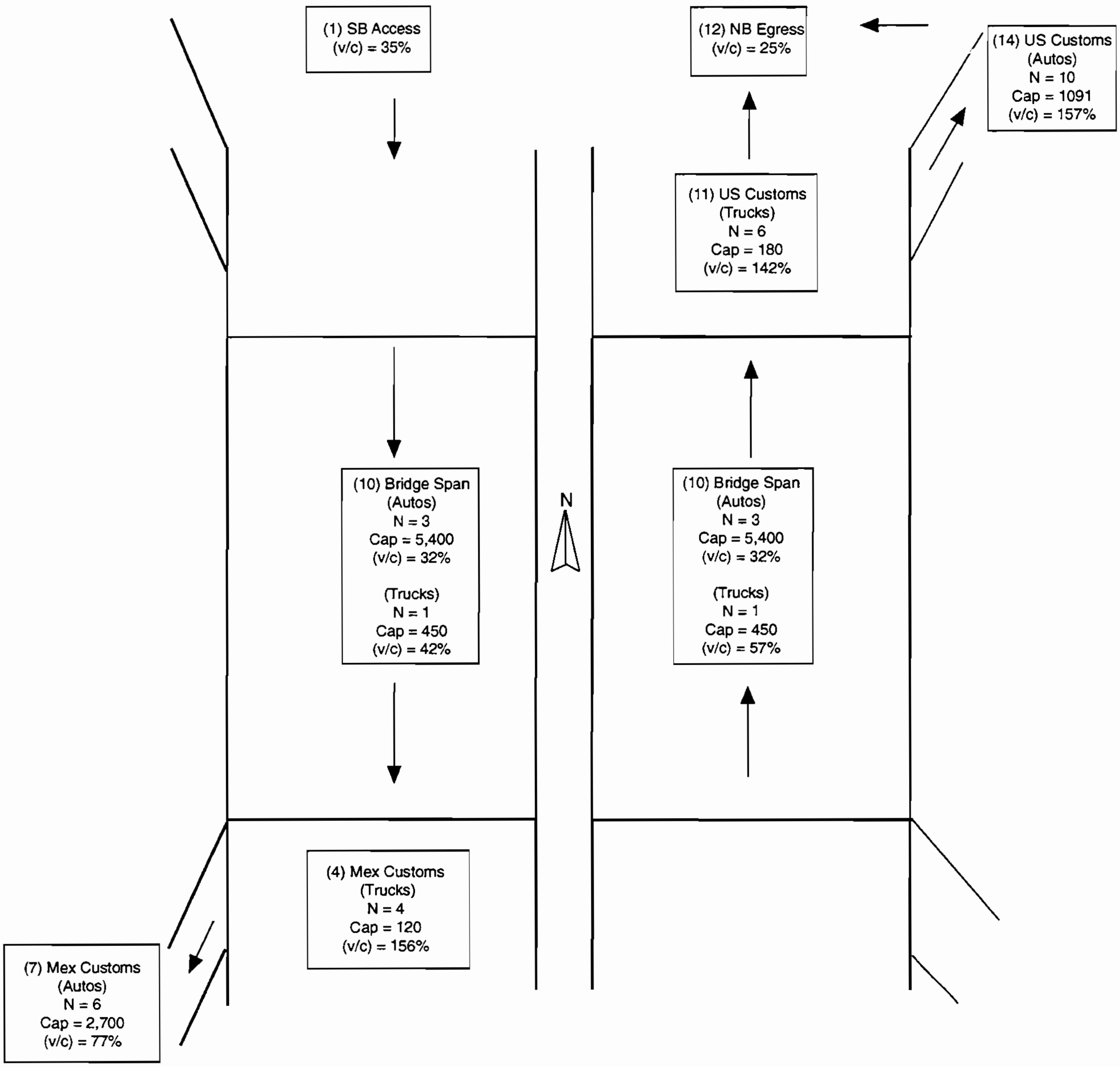

Figure 7.8. Capacity utilization of BOTA binational entry system

Good Neighbor Binational Entry System

In El Paso, the access and egress facility for the Good Neighbor Bridge (GNB) consists of the all-way stop controlled intersection of Stanton Street, as shown in Figure 7.9. A two-by-four intersection type can carry a volume of 1,208 vph, at a level of service "C" (Ref 18). Assuming a 70 percent/30 percent directional traffic split, reducing the four-way service volume by 25 percent to take into account a three-way intersection, and assuming an additional 30 percent non-bridge traffic on the east/west street, the unsignalized intersection analysis yields a service volume of 893 vph for the entire intersection, which implies that this intersection should operate at a level of service better than "C."

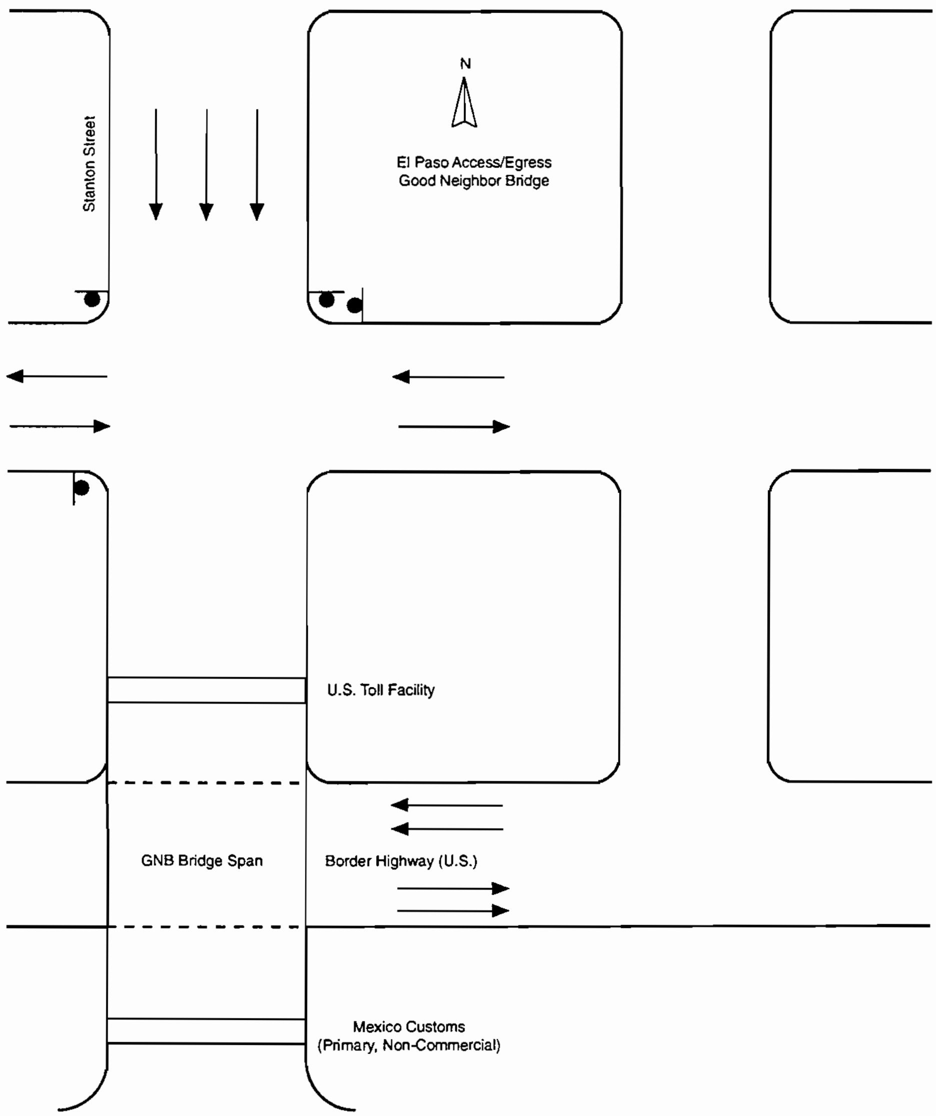

Figure 7.9. GNB access and egress component

Figure 7.10 summarizes the results of the capacity analysis of the binational entry system components. The analysis suggests that there is currently excess capacity available at the U.S. toll and Mexican primary inspection facilities, which operate respectively at 67 percent and 77 percent of total capacity.

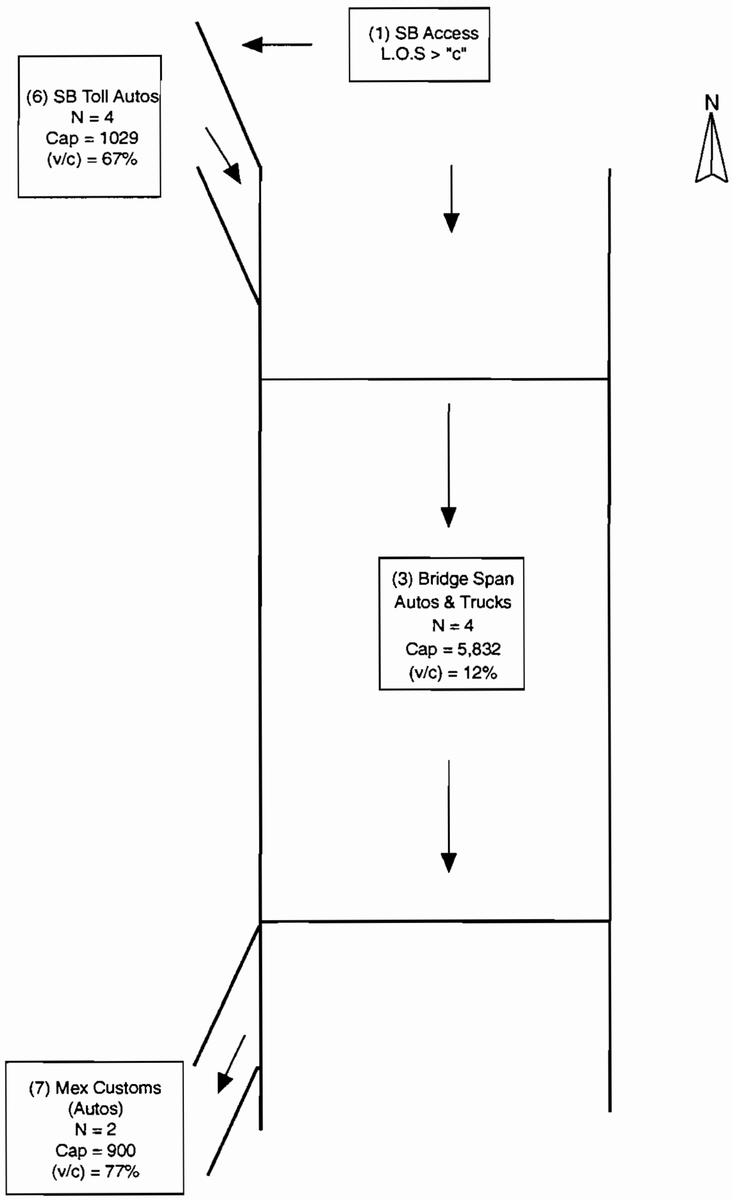

Figure 7.10. Capacity utilization of GNB binational entry system

Paso Del Norte Binational Entry System

The access and egress component in El Paso for PDN consists of a three-way stop controlled intersection, which requires a volume of 1,208 vph to operate at level of service "C" (Ref 18). Applying a 30 percent factor over the international traffic to take into account non-bridge traffic, total intersection volume is estimated at 1,474 vph. This intersection has capacity to handle all the traffic at a level of service slightly worse than "C," and far better than "D."

Figure 7.11 summarizes the results of the capacity analysis of PDN. The analysis indicates the U.S. primary inspection facility as the most congested component, operating over-capacity with a v/c ratio of 116 percent. The Mexican toll facility is also congested, operating near-capacity with a v/c ratio of 95 percent.

Summary of Results

The capacity utilization of the main components of all five binational entry systems in this sector was analyzed according to the methodology described in Chapter 2. The resulting volume to capacity ratios (v/c) are summarized in Table 7.6.

According to the capacity analysis results, BOTA is the most congested binational entry system in this sector, followed by GNB in the southbound direction, and PDN in the northbound direction. The Fabens Bridge carries a small amount of traffic, and operates under capacity, with the Mexican inspection facilities as the main source of potential congestion. Ysleta is a new binational entry system, and its modern design prevents some of the traffic back-up observed in older bridges. Accordingly, the capacity analysis indicated that primary inspections have the highest v/c ratios, followed by U.S. and Mexican toll booths. This reflects the fact that a well-designed binational entry system should have queues only where traffic must stop.

All bridges are operating considerably under theoretical capacity, with BOTA being the only binational entry system in the entire Segment 2 that has a capacity utilization of the bridge span over 20 percent. Nevertheless, field observations indicate queues in most bridge spans, which are due to traffic back-ups caused by actual congestions at other components.

BOTA is a conveniently located free facility, and it is widely preferred to all other bridges in this sector. However, the main causes of congestion are the inspection procedures, which are currently operating over capacity even under the assumption of full staffing, which is not always the case. Recognition of this problem by El Paso and Cd. Juarez officials prompted the proposed BOTA replacement to include better facilities for primary and secondary inspections, with more space for the expected queues that will form on both sides of the border. However, it should be noted that efficient operation of an inspection facility depends on two factors: appropriate facilities and sufficient staff. If the latter is beyond practical possibility, there is potential for congestion.

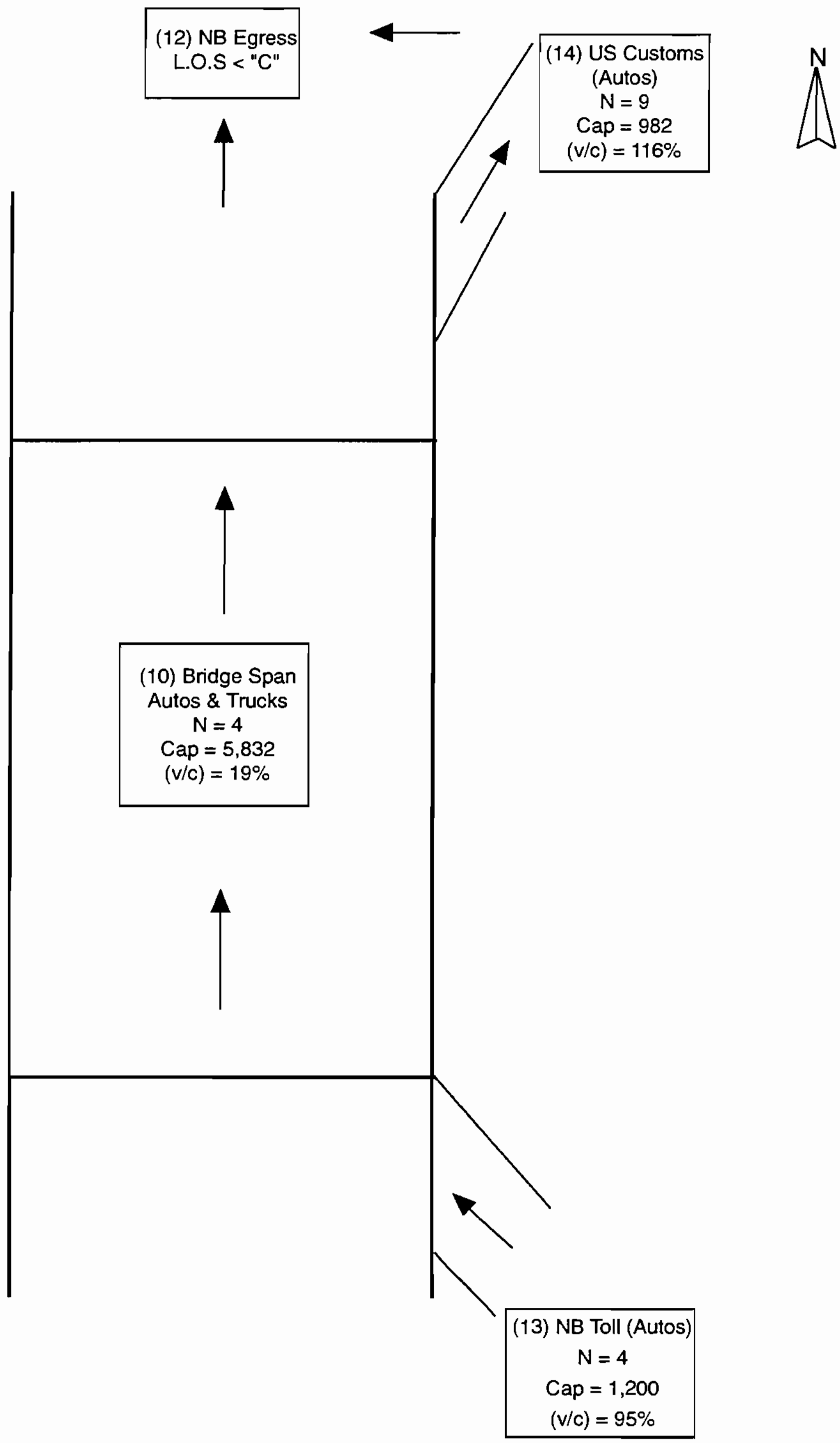

Figure 7.11. Capacity utilization of PDN binational entry system

Table 7.6. Summary of capacity utilization at El Paso Sector

Direction	Facility	Binational Entry System: Fabens	Ysleta (autos)	Ysleta (trucks)	BOTA	GNB	PDN
South-bound	Access	10%	n/d	n/d	35%	">C"	n/a
	Toll (autos)	n/a	41%	n/a	n/a	67%	n/a
	Bridge Span	7%	15%	11%	39%	12%	n/a
	Mexican Primary Inspection (autos)	19%	39%	n/a	156%	77%	n/a
	Egress	n/d	n/d	n/a	n/d	n/d	n/a
	Toll (trucks)	n/a	n/a	28%	n/a	n/a	n/a
	Mexican Primary Inspection (trucks)	n/a	n/a	65%	77%	n/a	n/a
North-bound	Access	n/d	n/d	n/d	n/d	n/a	n/d
	Toll (autos)	n/a	51%	n/a	n/a	n/a	95%
	Bridge Span	7%	13%	13%	32%	n/a	19%
	U.S. Primary Inspection (autos)	77%	53%	n/a	157%	n/a	116%
	Egress	10%	n/d	n/d	25%	n/a	"<C"
	Toll (trucks)	n/a	n/a	n/d	n/a	n/a	n/a
	U.S. Primary Inspection (trucks)	n/a	n/a	17%	142%	n/a	n/a

n/a: not applicable
n/d: no data

The toll facilities of both GNB and PDN are the most congested components of these binational entry systems. The access to GNB and egress from PDN in El Paso are both near level of service "C," which means some restrictions to the traffic flow, and a greater potential for additional congestion due to queues at the toll and inspection facilities. According to Cd. Juárez officials, PDN is causing a serious traffic circulation problem in the city, owing to a combination of queues in the northbound toll booth and in the U.S. inspections. This observation is corroborated by the analysis results.

Since queues in one binational entry system component cause traffic back-ups in most other components, the capacity analysis indicates the need for additional infrastructure in this sector, which theoretically should not consist of additional bridge lanes, since these are all operating well under capacity. Additional bridges may be needed, however, due to the practical impossibility of expanding the binational entry system components that are causing the congestion. The analysis also indicates the need for more coordination between transportation planning and inspection agencies on both sides of the border, since no facility can operate efficiently when understaffed.

CONCLUSIONS AND RECOMMENDATIONS

El Paso is the busiest sector of the entire Texas-Mexico border, carrying about twice the traffic of the second busiest (Laredo), and 15 percent of the tonnage exported by surface in

Texas. In addition, the international bridges serve a very important social purpose, since most auto demand is local and trip purposes include shopping, business and social visits. Clearly, improvements are needed both in the transportation infrastructure and in the inspection procedures staffing and operation.

The capacity analysis objective is mainly to identify which binational entry system components are congested or have a potential to be congested, while the revenue analysis indicates the potential feasibility of a new binational entry system, regardless of whether or not it is the best solution to improve traffic circulation. The combined results of the revenue and capacity analyses provide indications of the need for and feasibility of additional infrastructure in this sector.

Capacity Utilization

The analysis shows that the existing bridge lanes are operating considerably under capacity, and pose no restrictions to free traffic circulation. Queues on bridges are due to traffic back-ups at other binational entry system components. Theoretically, additional bridge lanes are not the best solution to improve traffic circulation; however, a new binational entry system may be required in order solve traffic circulation problems created by toll and inspection facilities.

Field observations indicate considerable congestion at all access/egress components on both sides of the border, while the analysis indicates that, in the worst case (PDN), they should be operating at a level slightly worse than "C." This apparent contradiction can be explained by the capacity utilization of the toll and inspection facilities, which are operating near or over capacity at all binational entry systems but Ysleta and Fabens, and causing congestion on the access and egress facilities, as well as on the bridge lanes. More efficient operation of toll and inspection facilities would alleviate some of the congestion caused by international traffic, and some proposals are discussed later in this section. Nevertheless, regardless of how efficiently a binational entry system is operated, traffic must stop for toll and inspections, and some queue will always form. This problem can be minimized in future binational entry systems with an appropriate design that provides enough queuing area for autos and trucks. For old binational entry systems, the only possible solutions are either expansion of some components, or relocation of the entire binational entry system if partial expansions are not practical or possible.

Feasibility of a New Binational Entry System

The revenue analysis developed by WSA indicates very high gross revenues from a new bridge in the El Paso sector, but some comparison with costs is needed to evaluate its feasibility as a bond-financed facility. Using the financial analysis methodology and assumptions discussed in Chapter 3 to estimate net revenues, even the most pessimistic traffic growth scenario gives a bond coverage ratio about seven times higher than the 1.5 ratio usually required for a good bond rating. It must be pointed out, however, that WSA's analysis assumes that the hypothetical new bridge would divert a very significant amount of traffic from BOTA, due to BOTA's poor condition. Actually, the replacement of BOTA has been approved, and the new BOTA should be open in the beginning of the analysis period (in about two years). In addition, WSA's traffic diversion algorithm assumes that route choice in this sector is based primarily on travel times and avoidance of delays, while customs inspectors, city officials, and field observations on both sides of the border observe a very strong preference for a free bridge over a toll bridge, regardless of the amount of congestion. Before load posting, BOTA cleared 66 percent of the loaded trucks in the sector, and Ysleta cleared 34 percent. Load posting of BOTA reversed these percentages, but most empty trucks still clear at BOTA regardless of the congestion, since it is free. These discrepancies between model assumptions and field observations indicate that WSA's gross revenues may be overestimated for this sector. Nevertheless, actual revenues had to be more than seven times lower than WSA's most pessimistic estimate to make a new bridge in this sector get a poor bond rating, and it is concluded that a new toll bridge in this sector is feasible.

Recommendations

The importance of the El Paso Sector for transborder traffic cannot be overemphasized, since it is the busiest sector along the border. El Paso and Cd. Juárez were growing even before GATT, an indication that even a pessimistic NAFTA impact on this part of the border may not completely hinder traffic growth. Further increase in truck traffic is possible after NAFTA's provisions to lift truck traffic restrictions take effect, and issues about harmonization of truck loads are resolved. Border inspections are already a main source of congestion, and this situation will get worse as traffic grows and post-NAFTA inspections get more complicated due to the need to verify origin of product components.

Changes in transborder infrastructure and in their access/egress facilities, such as BOTA replacement, are about to take place, but their ability to improve traffic circulation depends upon the staffing capabilities of U.S. and Mexican inspection agencies. According to El Paso and Cd. Juárez sources, the design of the new BOTA will minimize interference of primary inspection queues with the rest of the binational entry system, but the success of these measures will be only temporary if traffic continues to grow, and/or if inspection agencies are not able to provide adequate staff.

Multimodalism and intermodalism seem a better solution to meet an increasing demand for transborder commodity flow. In Cd. Juárez, there is a strong feeling that traffic circulation at the border cannot be improved unless mass transit and multimodal options are available, high occupancy lanes are encouraged, and inspection procedures are expedited. Cd. Juárez city officials are now discussing with U.S. customs and immigration officials the possibility of implementing the following suggestions:

(1) Create a pre-clearance system for frequent auto travelers with known (previously checked) backgrounds, and reserve the primary inspection for general traffic.

(2) Encourage transborder mass transit, and implement a park-and-ride system to link Cd. Juárez to El Paso. The transborder mass transit vehicles would park on a special parking lot, and inspection procedures would target pedestrians, rather than cars waiting in queues.

(3) Create high occupancy lanes at as many bridges as possible.

(4) During peak hours, relocate to BOTA some of the inspectors assigned to Ysleta, since BOTA has considerably more traffic.

While the mass transit options have enormous potential to improve traffic circulation, its efficient implementation requires harmonization of U.S. and Mexican standards for vehicles, while simultaneously obeying Mexican laws about circulation of imported vehicles. A recent example illustrates this point. There was a U.S. company providing transborder mass transit, commonly referred to as "red buses (camiones rojos)." This company used old vehicles (1960) which no longer met the standards of either country. Service has stopped because Secretaría de Comunicaciones y Transportes (SCT) enforced the requirement of newer vehicles, and the difficulties in reconciling U.S. and Mexican standards for mass transit vehicles with Mexican laws about circulation of imported vehicles could not be resolved. NAFTA will remove the latter barrier, and make mass transit services more attractive to investors and service providers as soon as standards are harmonized. It is strongly recommended that mass transit options be seriously considered by city officials on both sides of the border. A feasibility study of mass transit services would provide interesting insights on profitability of a city-owned service.

The City of El Paso obtained federal support to conduct an origin and destination study that includes transborder traffic. Origin and destination surveys are expensive, especially in a binational environment requiring bilingual staff. After the city releases the results, it would be advisable to verify their applicability in updating the demand and revenue analyses discussed in this chapter, as well as the resultant recommendations for infrastructure improvements at this sector.

CHAPTER 8. CONCLUSIONS AND RECOMMENDATIONS

This study investigated the Texas-Mexico border area from a binational perspective. It is defined as a planning-level needs study, and its main objective is to help TxDOT and TTA achieve a better understanding of transportation demand and infrastructure needs at the Texas-Mexico border. This report documents the results of the capacity, demand, and revenue analyses developed for border Segment 2, which begins immediately west of the Colombia Bridge and ends at the Texas-New Mexico-Chihuahua border monument. The combined results of the capacity, demand, and revenue analyses help identify where along the border additional infrastructure is needed, why it is needed, and whether a new toll bridge is feasible.

The complexity of this study reflects the challenges of binational planning within a region whose already dynamic character will become even more so through the impacts of NAFTA. Rapid changes are already happening in the border region. Indeed, during the course of this study, several binational entry systems were proposed, some of which became a reality in a short time, others of which are still under consideration or have been rejected or abandoned. Such rapid change suggests that the findings of any study dealing with current border issues are subject to change, based on the ever-shifting circumstances.

CAPACITY ANALYSIS APPROACH

Proper identification of transportation infrastructure needs starts with an evaluation of the current capacity utilization of the facilities, which identifies existing and potential congestion. Traditional methods of evaluating capacity utilization, developed for facilities that do not incorporate the characteristics of an international trip, can be directly applied to only some components of a binational entry system.

The capacity analysis approach developed in this project started with proper disaggregation of a Texas-Mexico binational entry system into fourteen major components. These components are:

(1) Southbound Access,
(2) Southbound Toll (trucks),
(3) Southbound Bridge Span,
(4) Southbound Mexican Primary Inspection (trucks),
(5) Southbound Egress,
(6) Southbound Toll (autos),
(7) Southbound Mexican Primary Inspection (autos),
(8) Northbound Access,
(9) Northbound Toll (trucks),
(10) Northbound Bridge Span,

(11) Northbound U.S. Primary Inspection (trucks),
(12) Northbound Egress,
(13) Northbound Toll (autos), and
(14) Northbound U.S. Primary Inspection (autos).

Each component was evaluated separately, and the results estimate the percent utilization of the total theoretical capacity of each component. Since these components reflect a sequential traffic processing, the overall binational entry system capacity is given by the lowest of its components' capacity. The capacity analysis results are based on the following assumptions:

(1) All existing toll and primary inspection lanes are fully staffed.
(2) AADT estimates discussed in Chapter 2 represent the actual annual average daily traffic for 1992.
(3) The peak hour volumes are 9 percent of the auto AADT (k_a=0.09), and 15 percent of the truck AADT (k_t=0.15), for the entire border (based on the analysis discussed in Chapter 2).
(4) The average processing rates collected for the toll booths, northbound inspections, and southbound inspections are representative of all binational entry systems along the Texas-Mexico border.
(5) The analysis of the access and egress components on both sides of the border is based on limited data, and all additional assumptions concerning signal timing and turning movements at intersections are either valid or conservative.
(6) Signal timing phases are estimated for signalized intersections, and green time proportions are estimated based upon the critical flow rates for each assumed phase. Whenever appropriate, minor cross streets were assumed to be actuated, and a minimum green time was allocated to the minor street movements. Elsewhere, green times were estimated based on equal degrees of saturation per assumed phase.

The capacity analysis approach was developed to provide a diagnosis of the traffic circulation problem, indicating which component of the binational entry system is the weakest link in the traffic flow chain. In practical words, an eight-lane bridge cannot be fully used if it ends in a narrow downtown street, or if the inspection facility is congested. These results also indicate which sectors are in immediate need of additional infrastructure. The demand and revenue analyses provide insight as to whether or not a new toll bridge is profitable.

APPROACHES FOR DEMAND AND REVENUE ANALYSES

In the U.S., a new binational entry system is usually proposed locally, and proponents must repay the initial investment using toll revenues. Financially unfeasible binational entry systems have little chance of being built; and although revenues are a direct function of the demand, an unfeasible binational entry system is not necessarily dispensable. Conversely, a feasible binational entry system may not be the best solution to improve traffic circulation in a particular sector. The feasibility analysis provides an indication of the potential feasibility of a new binational entry system in the sectors and, when coupled with the capacity analysis, provides an overall evaluation of border transportation needs. The feasibility analysis includes four steps:

(1) Traffic analysis, which provides an estimate of future traffic for the entire sector;

(2) Demand analysis, which provides an estimate of traffic demand for the new (hypothetical) facility;

(3) Estimate of potential gross revenues; and

(4) Financial analysis, which provides an estimate of potential net revenues of the new facility, an indication of its feasibility.

CTR developed approaches to analyze all four steps listed above; CTR's approaches were applied to the Del Rio and Presidio sectors. For the Eagle Pass and El Paso sectors, CTR subcontracted the demand and gross revenues estimates to Wilbur-Smith Associates (WSA), a Wall Street accredited specialist in revenue forecasts for bond rating. WSA was responsible for the revenue forecasts for the replacement of the Ysleta-Zaragoza Bridge in El Paso.

Discussion

The feasibility analysis methodology developed by CTR includes four sequential steps, which are:

(1) Traffic analysis, which provides an estimate of future traffic for the entire sector;

(2) Demand analysis, which provides an estimate of traffic demand for the new (hypothetical) facility;

(3) Estimate of potential gross revenues; and

(4) Financial analysis, which provides an estimate of potential net revenues of the new facility, an indication of its feasibility.

The major assumptions used by CTR when developing this four-step approach for the 20-year feasibility analysis period are:

(1) Depreciation costs are included in operations and maintenance (O&M) costs;

(2) The O&M costs discussed in chapter 3 represent the expected values of these costs over the entire analysis period;

(3) The revenues from the hypothetical binational entry system do not need to be shared with other expenses, such as compensating for revenues diverted from other binational entry systems in the same sector;

(4) Funding for implementing the project will come from revenue bond sales;

(5) Revenue bonds are sold at an 8 percent effective interest rate, with a 20-year maturity period;

(6) Throughout the analysis period, the existing toll structure in the sector will remain in effect for all facilities, keeping up with inflation so that its present value at any time is exactly the same as the base year value;

(7) The majority of pedestrian traffic in every sector will always prefer the old bridges because of their convenient downtown location;

(8) All bridges were considered as open and operating in 1995;

(9) Only one additional facility will be constructed in the sector during the analysis period;

(10) New bridges are effectively designed, efficiently operated, fully staffed, and clearly identified along all the access routes in order to promote maximum utilization of the new facilities;

(11) Motor fuel will remain in adequate supply and future price increases will not substantially exceed the overall rate of inflation; and

(12) There will be no national, regional, or local emergency that will abnormally restrict the use of motor vehicles in either country.

In addition, each sector requires specific assumptions on a case-by-case basis. Departures from any of these assumptions may substantially change the conclusions about the feasibility of a new binational entry system in the sector. Assumption (3) is especially important. All the conclusions regarding feasibility, break-even points, and bond coverage rations assume that the revenues generated by the hypothetical facility will be used exclusively to repay the debt, meet bond obligations, and pay O&M expenses. Actual use of revenues to pay for other expenses, such O&M of other binational entry systems in the sector, would invalidate the conclusions.

For the El Paso and Eagle Pass sectors, WSA provided demand and gross revenue estimates for a ten-year analysis period, based on the following assumptions:

(1) All bridges were considered as open and operating at the base year of 1993;

(2) Toll rate schedules for the new bridges are the same as those established for the existing bridges in the respective sectors;

(3) No new competing limited-access facilities, toll or toll-free, will be constructed in any sector;

(4) Any new bridges would be effectively signed and efficiently operated in order to promote maximum utilization of the new facilities;

(5) Motor fuel will remain in adequate supply and future price increases will not substantially exceed the overall rate of inflation;

(6) There will be no national, regional or local emergency that will abnormally restrict the use of motor vehicles; and

(7) The existing toll rate structure now in effect on the present bridges will remain in effect over the projection period.

Both CTR and WSA developed simplified spreadsheet models for the demand and gross revenues analyses, and some of the assumptions are common to both approaches. However, specific assumptions regarding trip generation, travel behavior, route choice, post-NAFTA truck traffic, and future origin and destination patterns were not disclosed by WSA. Departures from these undisclosed assumptions may invalidate the study results just as the assumptions listed by WSA. Nevertheless, demand and revenue analyses results, coupled with the current capacity assessment, can provide valuable guidelines about the border infrastructure needs. These guidelines are preliminary in nature and cannot substitute for project-level analyses of traffic demand or for a detailed revenue forecast for bond issuance.

EAGLE PASS SECTOR

The Eagle Pass Sector stretches between the eastern and western city limits of Eagle Pass, in Maverick County, Texas. On the Mexican side, the sector includes the urban area of Piedras Negras, Coahuila. The sector contains one vehicular bridge and one rail bridge. The rail bridge, owned by Southern Pacific, is located approximately 0.65 mile (1 km) downstream from the Eagle Pass Bridge. City officials from Eagle Pass and Piedras Negras have been proposing a second bridge for several years, and extensive environmental assessment work has been completed (Ref 7). On the other hand, the General Services Administration (GSA) and U.S. inspection agencies have concluded that a second bridge in Eagle Pass is not justified at this time because the traffic volumes are not large enough. On the Mexican side, the concession was granted, the right-of-way acquired, and the design completed. Mexico is awaiting the U.S. decision.

Revenue and Demand Analyses

Analysis of the traffic history in this sector consistently indicates no traffic growth for the past 12 years, except for southbound buses, which had a fivefold jump in 1991, after three years of a much lower growth rate. On the average, the yearly growth rates for autos, trucks, and pedestrians are respectively 0.08 percent, 0.01 percent and 4.3 percent for northbound traffic, and 1.57 percent, 3.82 percent, and -5.36 percent for southbound traffic. This is consistent with the fact that the Eagle Pass population growth was negative (-3.5 percent) from 1980 to 1990. Piedras Negras, on the other hand, had a 72 percent population growth from 1970 to 1980, and a 22.3 percent population growth from 1980 to 1990. The number of maquiladoras in Piedras Negras grew 147 percent between 1982 and 1992, while the number of maquiladora employees grew 280 percent. As a result, a considerable part of the rail traffic on the Eagle Pass rail bridge is from automotive maquiladoras located in the Saltillo area. However, rail traffic has increased slightly in the past 10 years.

Under the moderate impact scenario, traffic remains stationary during the analysis period, and estimated annual traffic for 2004 totaled 4,732,000 vehicles, generating $6,573,000 in annual revenue. Under the high impact scenario, which includes moderate growth and a 30 percent latent demand, 1993 traffic volumes and corresponding revenues will increase to 6,798,000 vehicles and $9,443,000 in revenue by the year 2004. The gross revenues were subject to the financial analysis methodology, to provide an indication of the feasibility of a new binational entry system in this sector. For demand estimates under the low impact scenario, the financial analysis indicates an average yearly coverage ratio for the bonds of 1.3, or 30 percent over the net revenue. While a good bond rating requires a coverage ratio of at least 1.5, a ratio of 1.3 was obtained with a very low demand scenario that assumes no traffic growth for the next twenty years, due to a combination of low NAFTA impact and local economic growth (independent of NAFTA). For the second lowest scenario, the average yearly coverage ratio increases to 1.65, even under the conservative assumption that there will be no traffic growth in the period not covered by WSA's analysis (2004 through 2014), which comprises the last ten years of the assumed twenty year bond liability period.

The demand analysis suggests that traffic diversion to the existing and hypothetical bridge are based on geographic proximity rather than on other factors such as excess capacity of one crossing relative to the other. In other words, travelers living closer to the existing bridge will continue to use that bridge even if a new one is constructed. The preliminary analysis suggests that construction of a new toll bridge at Eagle Pass would produce limited benefits to travelers, but could be feasible if the revenues from the new bridge do not have to be shared with other expenses, such as those related to the existing binational entry system.

Capacity Utilization

The current capacity utilization of the Eagle Pass/Piedras Negras Bridge indicates that, in the southbound direction, the U.S. toll facility for autos is the main source of congestion, operating at 123 percent capacity during peak periods. Field observations verify both the over-capacity condition. They also indicate that the toll booths are not fully staffed at all times, which means that, on the average, the situation is even worse.

The Mexican primary inspection facility for commercial trucks is also congested, operating at 100 percent capacity. However, trucks subject to inspections were observed to park off to either side of the Mexican inspection facility, instead of queuing onto the bridge span. As for the northbound traffic, the U.S. primary inspection facility for autos is operating over-capacity (v/c=116 percent), even assuming all lanes staffed. In addition, the access to the bridge in Piedras Negras is congested (v/c ranging from 82 percent to 106 percent, depending on the actual amount of non-bridge traffic near the bridge in downtown Piedras Negras). This congestion has prompted Mexican approval to a new bridge in this sector.

The results of the capacity analysis indicate that traffic circulation is poor in this binational entry system, due to inappropriate facilities at the southbound toll, the northbound inspection, and the northbound access in Piedras Negras. While the analysis examines each component separately, they are actually interrelated in their effects on traffic circulation in the binational entry system. The southbound access to the bridge should not be congested at a v/c of 55 percent; however, traffic back-up at the congested southbound toll interferes with traffic circulation in this access, causing additional delays and making the nearby streets appear to be operating over capacity. Congestion at U.S. primary inspection facilities may cause traffic to back-up into the bridge span, and southward into Piedras Negras, and this access is already operating near or over capacity even without traffic back-ups from other congested components.

Recommendations

The capacity analysis methodology developed by CTR treats each binational entry system component separately to diagnose the causes of poor traffic circulation. It should be noted, however, that congestion at one component such as a toll booth causes congestion at other components, such as the bridge access. The southbound access to Eagle Pass-Piedras Negras Bridge may appear congested, while the delays may be entirely due to traffic back-ups at the congested toll facility. The northbound access to the bridge in Piedras Negras is working over capacity anyway, but the situation appears even worse due to the queues at the northbound toll and primary inspection lanes. Overall, the analysis indicates that Piedras Negras is suffering from more traffic congestion problems than Eagle Pass, a conclusion supported by the fact that the proposal for a new bridge in this sector is supported primarily in Piedras Negras. Coordinated binational planning indicates that expansion of northbound toll and inspection facilities, coupled with assignment of additional staff, has a good potential to reduce the traffic back-ups through the bridge into downtown Piedras Negras, at least partially fulfilling the objective sought by the Mexicans with the new bridge, and saving a considerable amount of additional investment in the implementation of a new binational entry system in this sector.

DEL RIO SECTOR

The Del Rio Sector comprises the city limits of Del Rio in Val Verde County, and the urban area of Ciudad Acuña, Coahuila. It includes two binational entry systems for vehicular traffic, Del Rio Bridge and Lake Amistad Dam. The Del Rio Bridge is located approximately 65 miles (105 km) west of Eagle Pass, and Amistad Dam is located approximately 13 miles (21 km) west of the Del Rio Bridge. This dam crossing is scarcely used, and the analysis concentrates primarily on the Del Rio Bridge, which serves over 98 percent of the traffic in this sector. Del Rio city business leaders, city officials, and Val Verde County have expressed some interest in a second bridge at Del Rio, but the Presidential permit process has not yet been initiated (Ref 8).

Revenue and Demand Analyses

The revenue analysis was performed for a hypothetical bridge on the west side of Del Rio to absorb the maquiladora-related demand. This hypothetical bridge was assumed to be well connected to the rest of the infrastructure, as well as fully staffed and efficiently operated. Under these assumptions, a total of over 11 million autos and almost 800,000 trucks would use the hypothetical bridge during the analysis period, for the low impact scenario. These totals increase to over 12.5 million autos and 1.2 million trucks in the moderate impact scenario, and over 21 million autos and 2 million trucks for the high impact scenario. Still, the financial analysis indicated that a fourfold increase in this demand would be necessary to obtain a good bond rating.

Capacity Utilization

The capacity analysis suggests that all components of the Del Rio binational entry system are operating with excess capacity available. In the southbound direction, the highest estimated volume to capacity ratio (v/c) is 77 percent at the southbound egress. In the northbound direction, the highest v/c value is 68 percent at the U.S. primary inspection facility for autos. Field observations of this bridge substantiate these results. However, some queuing was observed at this bridge when only one of the two toll booths was open on the U.S. side.

The capacity analysis did not include the northbound access to the bridge in Mexico; if this access is working with excess capacity, it will cause traffic congestion in Ciudad Acuña. The U.S. access/egress facilities have far more capacity than their Mexican counterparts, which consist of narrow streets in a historical downtown area with the potential to become a major source of congestion in this binational entry system.

Recommendations

This sector has one vehicular binational entry system that has been recently remodeled, whose components are operating below capacity, and whose inspection facilities will be gradually upgraded under a project whose first phase is already completed. Field observations on this bridge indicate that queuing is primarily due to vehicles stopping at the toll booth, which is both an unavoidable and (under current delays) tolerable situation. If a 1992 study to improve the toll plaza is implemented, such delays will be reduced even further (Ref 16).

A hypothetical new bridge located in a position that attracts most of the business trips would still be unfeasible under the highest NAFTA impact. Considering that the existing binational entry system has been recently remodeled, and that this investment is still a liability, a new facility in this sector would result in delinquent liabilities for both the new and the existing binational entry systems, and as such it is not recommended at this point.

PRESIDIO SECTOR

The Presidio Sector comprises the city limits of Presidio, in Presidio County, and Ojinaga, Chihuahua. It contains one binational entry system, the two-lane Presidio-Ojinaga vehicular bridge, located approximately 180 miles (290 km) west of La Linda. While there is no proposal for a second bridge at Presidio, there have been recent proposals by Presidio County and Presidio city officials to transfer ownership of the U.S. side of the existing bridge to the city and/or county. If this transfer is made, the bridge will become a toll-facility on the U.S. side.

Revenue and Demand Analyses

The revenue analysis indicates that traffic demand in the Presidio sector is not large enough to justify a new toll binational entry system, even under the high impact scenario. Toll prices would have to more than double to break-even, and a good bond coverage ratio would require a fourfold increase, even under the optimistic assumption of a fifty-fifty traffic split between the old and the new facilities. In terms of replacement of the existing bridge (which means capturing the entire sector demand), toll schedules would have to be 50 percent higher than those assumed to break-even, and would have to be twice as high to yield a good bond rating based on estimated coverage ratios.

Capacity Utilization

In the southbound direction, the most congested component of the Presidio binational entry system is the Mexican primary inspection facility for autos, which has only one lane and which operates at a v/c ratio of 32 percent. In the northbound direction, the most congested component was estimated to be the Mexican toll collection facility, with a v/c ratio of 49 percent, followed by the U.S. primary inspection facility for autos, at 44 percent capacity utilization.

Under pre-NAFTA regulations (valid until 1997), international truck traffic is banned beyond the commercial zones of both countries, and relies on freight forwarding facilities to switch cargo from Mexican to U.S. trucks and vice-versa. The Department of Commerce (Ref 3) and field observations indicate that the main cause of congestion in Presidio are trucks going through the freight forwarding procedures on public roads, parking lots, and other inconvenient locations that cause disruptions to traffic circulation. A freight forwarding facility was proposed but was not built (Ref 3).

Recommendations

The Presidio sector encompasses a small rural town on the U.S. side, and a larger town on the Mexican side. The main economic activity in this binational area is agricultural, and truck traffic in the existing binational entry system hauls primarily cattle and produce. NAFTA provisions include immediate elimination of taxes for Mexican cattle and some Mexican produce entering the U.S., as well as for U.S. and Canadian agricultural equipment entering Mexico. This may make Mexican cattle more competitive in the near future, and in turn increase truck demand in Presidio, as well as boost the economies of both sister cities. Elimination of Mexican taxes on U.S. produce will be implemented during a fifteen-year period, and the long-term effect of these measures on traffic demand of one specific agricultural area is very uncertain at this point.

Lack of appropriate freight forwarding facilities causes a considerable percentage of potential truck demand for Presidio to use other binational entry systems, and larger businesses such as Presidio Valley Farms have their own refrigerated storage facilities. This indicates a latent truck demand for this sector, which could switch to Presidio if freight forwarding is no longer required. On the other hand, freight forwarding may continue as long as the truck weight limits are not harmonized (an issue of controversy among the NAFTA countries), and the practice may still continue for some time even after the truck weight issue is resolved, while the trucking companies adapt to the new rules. All these facts make the Presidio sector a very interesting case study for NAFTA impacts on agriculture-related traffic demand. Close monitoring of this sector, coupled with agricultural activity monitoring is recommended. At this point, a new bond-financed international bridge is not recommended, since a fourfold increase in the highest predicted demand would be necessary to justify its construction.

EL PASO SECTOR

The El Paso Sector begins immediately east of the Fabens Bridge and ends at the Texas/New Mexico/Chihuahua border. It includes the cities of Tornillo, Fabens, Ysleta, and El Paso, in El Paso County, and the cities of Caseta, Zaragoza, and Cd. Juarez, in Chihuahua, Mexico. This sector has five vehicular binational entry systems:

(1) Fabens Bridge,
(2) Ysleta or Zaragoza Bridge,
(3) Bridge of the Americas (BOTA), or Cordova Bridge,
(4) Good Neighbor Bridge (GNB), or Stanton Street Bridge, and
(5) Paso Del Norte Bridge (PDN), or Santa Fe Street Bridge.

The Fabens Bridge was included in the El Paso Sector because origin and destination data showed that over 10 percent of the demand for this bridge had origins in El Paso. The sector is thus wide, and is the busiest sector on the entire Texas-Mexico border, carrying about twice the traffic of the second busiest (Laredo). An effort to provide additional infrastructure to cross the Rio Grande has been under way, including the recent replacement of the Ysleta Bridge and the replacement of BOTA, which is about to start. The city of Sunland Park, in New Mexico, is proposing the Sunland Park or Santa Teresa binational entry system, located approximately 3 miles (4.8 km) west of El Paso. The Santa Teresa binational entry system will include an intermodal yard for rail/heavy trucks, and it may draw some traffic from other binational entry systems in the El Paso Sector, but it may also help relieve congestion at El Paso's and Cd. Juárez downtown bridges (Refs 8, 23).

Revenue and Demand Analyses

The analysis developed by WSA indicates very high gross revenues from a new bridge in the El Paso Sector, but some comparison with costs is needed to evaluate its feasibility as a bond-financed facility. Using the financial analysis methodology and assumptions discussed in Chapter 3 to estimate net revenues, even the lowest traffic growth scenario gives a bond coverage ratio about seven times higher than the 1.5 ratio usually required for a good bond rating.

WSA's analysis assumes that the hypothetical new bridge would draw heavily from BOTA, due to BOTA's poor condition, its congestion, and its delays. Actually, the replacement of BOTA has been approved, and the new BOTA should be open in the beginning of the analysis period (in about two years). In addition, WSA's traffic diversion algorithm assumes that route choice in this sector is based primarily on travel times and avoidance of delays, while city officials, customs inspectors, and field observations on both sides of the border observe a strong preference for a free bridge over a toll bridge, regardless of the amount of congestion. According to U.S. Customs, BOTA used to clear 66 percent of the loaded trucks in the sector. Load posting of BOTA caused this percentage to fall to 34 percent, but most empty trucks still clear at BOTA regardless of the congestion, since it is free. These discrepancies between model assumptions and field observations indicate that WSA's gross revenues may be overestimated for this sector. Nevertheless, actual revenues had to be more than seven times lower than WSA's lowest estimate to make a new bridge in this sector earn a poor bond rating, and it is concluded that a new toll bridge in this sector is feasible.

Capacity Utilization

According to the capacity analysis results, BOTA is the most congested binational entry system in this sector, followed by GNB in the southbound direction, and PDN in the northbound direction. The Fabens Bridge serves a low traffic volume and operates under capacity, with the Mexican inspection facilities as the main source of potential congestion. Ysleta is a new binational entry system, and its modern design eliminates some of the traffic back-up observed in older bridges. Accordingly, the capacity analysis indicated that primary inspections have the highest v/c ratios, followed by U.S. and Mexican toll booths. This reflects the fact that a well-designed binational entry system should have queues only where traffic must stop.

The analysis shows that the existing bridge lanes are operating considerably under capacity, and pose no restrictions to free traffic circulation. Queues on bridges are due to traffic back-ups at other binational entry system components. Theoretically, additional bridge lanes are not required to improve traffic circulation; however, additional bridges may be needed, due to the practical impossibility of expanding the binational entry system components that are causing the congestion. The analysis also indicates the need for more coordination between transportation planning and inspection agencies on both sides of the border, since no facility can operate efficiently when understaffed.

Field observations indicate considerable congestion at all access/egress components on both sides of the border, while the analysis indicates that, in the worst case (PDN), they should be operating at a level of service slightly worse than "C." This apparent contradiction can be explained by the capacity utilization of the toll and inspection facilities, which are operating near or over capacity at all binational entry systems but Ysleta and Fabens, and causing congestion on the access and egress facilities, as well as on the bridge lanes. This problem can be minimized in future binational entry systems with an appropriate design that provides enough queuing area for autos and trucks. More efficient operation of toll and inspection facilities would alleviate some of the congestion caused by international traffic, but it must be noted that, regardless of how efficiently a binational entry system is operated, traffic must stop for toll and inspections, and some queue will always form.

Recommendations

The importance of the El Paso Sector for transborder traffic cannot be overemphasized, since it is the busiest sector along the border. El Paso and Cd. Juárez were growing even before GATT, an indication that even a low NAFTA impact on this part of the border may not completely hinder traffic growth. Further increase in truck traffic is possible after NAFTA's provisions to lift truck traffic restrictions take effect, and issues about harmonization of truck loads are resolved. Border inspections are already a main source of congestion, and this situation will get worse as traffic grows and post-NAFTA inspections get more complicated due to the need to verify origin of product components. Upgrades in transborder infrastructure and in their access/egress facilities are constantly taking place, but the success of these measures will be only temporary if traffic continues to grow, and/or if inspection agencies are not able to provide adequate staff.

Multimodalism, intermodalism and mass transit seem a better solution to meet an increasing demand for transborder commodity and passenger flows. In Cd. Juárez, there is a strong feeling that traffic circulation at the border cannot be improved unless these options are available, high occupancy lanes are encouraged, and inspection procedures are expedited. Cd. Juárez city officials are now discussing with U.S. customs and immigration officials the possibility of implementing the following suggestions:

(1) Create a pre-clearance system for frequent auto travelers with known (previously checked) backgrounds, and reserve the primary inspection for general traffic.

(2) Encourage transborder mass transit, and implement a park and ride system in both Cd. Juárez and El Paso. The transborder mass transit vehicles would park in a special parking lot, and inspection procedures would be done on the pedestrians, rather than on the cars waiting in queues.

(3) Create high occupancy lanes in as many bridges as possible.

(4) During peak hours, relocate to BOTA some of the inspectors assigned to Ysleta, since BOTA has considerably more traffic.

The mass transit option has an enormous potential to improve traffic circulation, but its efficient implementation requires harmonization of U.S. and Mexican standards for vehicles with Mexican laws about circulation of imported vehicles. NAFTA will remove the latter barrier, and make mass transit services more attractive to investors and service providers as soon as standards are harmonized. It is strongly recommended that mass transit options be seriously considered by city officials on both sides of the border. A feasibility study of mass transit services would provide interesting insights on profitability of city-owned services.

The City of El Paso obtained federal support to conduct an origin and destination study that includes transborder traffic. After the city releases the results, it would be advisable to verify their applicability in updating the demand and revenue analyses discussed in this chapter, as well as the resultant recommendations for infrastructure improvements at this sector. Even if these surveys results are not applicable to this case, it is strongly recommended that the potential shift in traffic to the new binational entry system be verified with the collection of more data, using updated assumptions, and taking into account that efficient operation of an inspection facility depends on two factors: appropriate facilities and enough staff. If the latter is beyond practical possibility, there is potential for congestion regardless of how many new binational entry systems are implemented. This re-analysis is recommended to demonstrate that the demand for the hypothetical new bridge would in fact result in improved efficiencies in transborder border traffic circulation at this location.

DISCUSSIONS AND RECOMMENDATIONS FOR FUTURE STUDIES

The objective of the capacity, demand, and revenue analyses is the provision of guidelines for border transportation infrastructure planning. The capacity analysis identifies the congested components of a binational entry system, and in general it indicates that toll booths and inspection facilities are the main problems in most binational entry systems, followed by inadequate access to and egress from the bridge. The bridge itself is never the problem. In busy sectors, an additional toll bridge is almost certain to be a good investment, but this does not necessarily mean that it is the best or the only solution to improve traffic circulation. New bridges may be necessary when there is no practical way to relocate or expand inspection or toll facilities, and the congestion is becoming intolerable, but their potential to improve traffic circulation is dependent upon efficient design and full staffing of the new inspection facilities.

A Framework for Coordinated Border Transportation Planning

The provision of a bridge over the Rio Grande involves several inspection procedures, and there is a need to coordinate all agencies involved. At the core of the problem is the fact that additional infrastructure has the potential to disrupt traffic circulation even further if adequate staffing is not provided for inspection procedures. This fact is not intuitive since, in any other situation, additional infrastructure provides at least a marginal improvement in traffic circulation. Interagency cooperation is not the norm, and neither the U.S. nor the Mexican Presidential permit procedures encourage such cooperation during the proposal process (Refs 8, 13, 15).

The need for a new binational entry system along the Texas-Mexico border can be seen from several perspectives, one for each party involved. These various perspectives are correlated and intertwined, but the traditional way of providing binational entry systems implicitly considers these perspectives mainly as sequential and fairly independent of one another. This situation should be replaced by a more coordinated transportation planning framework, one capable of accommodating the different perspectives on the provision of binational entry systems. These perspectives are summarized in Table 8.1.

Coordinated transportation planning is a multi-dimensional perspective, one that considers the problem to its fullest extent, striving to optimize all the different perspectives and objectives into one solution. Attempts to develop coordinated binational transportation planning for the Texas-Mexico border are still very incipient, and this research project is one of those attempts.

One possible way to successfully implement binational transportation planning for the U.S.-Mexico border would be to create a committee composed of both U.S. and Mexican federal, state, and local officials to represent the various interested parties. The committee would also include representatives of research organizations to act as technical consultants. This binational, multi-agency committee would ensure that all responsible parties have their interests represented, and that they cooperate in data collection and/or release, study financing, and harmonization of infrastructure plans and implementation. This would ensure that no public money is wasted in redundant studies and data collection efforts, and that any new proposed infrastructure serves the national interests of both countries and does not create serious burdens to any interested party. Some U.S. border cities are hesitant to agree to mass transit and multimodal options because they fear that consolidation of revenues from several autos into less mass transit vehicles would be financially unfeasible. They also hesitate over the option of rerouting trucks to bridges located on the city outskirts, even when the city also owns this bridge. One possible study sponsored by this international committee should determine if these losses would be compensated by additional revenues from mass transit options, and latent demand that would be encouraged to cross the border more often if the traffic circulation was better.

Table 8.1. Perspectives in providing binational entry systems

Perspective	Objectives	Preferred Action
Local	- Maximize city revenues - Attract visitors to city - Improve traffic circulation	Build new bridges whenever they are profitable or may improve traffic circulation in the city
Environmental	- Minimize Pollution - Maximize biota preservation - Minimize changes in river channel and water level	Avoid new bridges that adversely affect the environment, and encourage them if they relieve "hot spots"
Inspection Agencies	- Minimize staff - Optimize equipment	Consolidate traffic into fewer bridges, preferably multi-modal
Coordinated Transportation Planning	- Maximize level of service of traffic circulation along the entire border - Minimize infrastructure costs along the entire border	Permanent, ongoing binational planning efforts

The International Coordinating Committee Texas-Nuevo León is a pioneer attempt to work as suggested above, but the ideal committee should encompass all border states in both countries, possibly with subcommittees for each pair of neighboring states. In the beginning, the main mission of this binational planning committee would be educating all parties involved to accept the idea of compromising towards an overall benefit for the whole border.

Border Transportation Options

The need for expediting time and staff required for successful inspection procedures suggests that a better long-term solution for border transportation is the implementation of mass transit, multimodal and intermodal options. These measures must always take into account that expeditious inspection procedures would in many cases do more to improve traffic circulation than additional binational entry systems. Cd. Juarez is now seeking the cooperation of U.S. Customs and Immigration Services to expedite border inspections and alleviate the enormous congestion currently experienced in this sector. CTR had the opportunity to interact with border inspection officials on both sides of the border, and they have several ideas to expedite these procedures that should be discussed on a binational and multiagency committee on border transportation matters. Several of their ideas closely match and/or supplement CTR's concepts of sector analysis and super-crossing, two visionary approaches based on the binational transportation planning perspective, rather than on transportation concepts evolved from the 19th century. The third report of this series (Ref 21) discusses these two concepts in detail, and the sector analysis was briefly discussed and implemented in this document. As for the super-crossing concept, it consists of a multi-modal facility designed to accommodate state-of-the-art inspection equipment, including pre-cleared commodities and x-ray inspection equipment. A super-crossing would simultaneously minimize delays and inspection staff, and U.S. Customs and GSA were very enthusiastic about it, as it meets their goals and needs.

The high cost of providing multi-modal facilities with state-of-the-art inspection facilities and equipment means that super-crossings need to be constructed at international trade corridors that generate enough commercial traffic to make a super-crossing financially viable. On the other hand, it has been shown that transportation facilities containing a variety of modes are extremely synergistic in financial terms, and a super-crossing combining different modes would offer economies of scale and generate high net revenues. Experience suggests that a rail-only binational entry system is difficult to justify using conventional cost benefit methodologies. However, where rail is just one element in a multimodal binational entry system, rates of return can become attractive to the investors in revenue bonds.

Environment and Transportation Interaction

Related to the traffic circulation concerns are environmental and air quality perspectives for justifying the need for a new international bridge. United States environmental legislation such as the 1990 Clean Air Act requires cities and regions that exceed the National Ambient Air Quality Standards to develop congestion management plans and transportation control measures in order to alleviate air quality problems. Potential reduction of the overall city-wide level of emissions as well as concentrations or "hot-spots" of emissions could be used to attempt justification and funding for a new binational bridge.

CONCLUSION

The combined results of the capacity, demand, and net revenue analyses indicate that, while there is no need for additional bridge lanes anywhere along border Segment 2, traffic circulation is in fair condition only at sectors with low demand. Even in those, some queues are observed, due to the fact that transborder traffic flow can never be unimpeded, as it must always stop at least for inspections. The solution goes well beyond the problem of designing, building and operating a bridge. The binational environment, the need for several inspection procedures, and the different and sometimes conflicting priorities of all agencies involved make this an extremely complex problem that cannot be efficiently solved solely in the transportation arena. There is a strong need for coordinated binational planning, and a possible solution may be the creation of an international committee with representatives of all agencies involved in border crossing procedures, supplemented by specialists from independent research organizations with no vested interest in the provision of border infrastructure.

The Texas-Mexico border economic development and infrastructure needs are a matter of concern at the local, state, federal and international levels, and a significant number of studies have been and will be conducted on these subjects. Currently, there has been some redundancy and repetition of efforts when different agencies contract studies with overlapping data needs or repetitive objectives. Coordinated inter-agency planning at a binational level would greatly increase the efficiency by providing much needed economies of scale, and by creating awareness that the border transportation needs are complex and require more than traditional transportation planning methods.

The understanding of the border transportation needs would be greatly enhanced if some additional studies are undertaken, and those are recommended in this and in previous reports of this series. While any of the recommended studies could be successfully undertaken by a single organization, considerable optimization of time and funds would be achieved if they were conducted as multi-agency studies, preferably on a binational basis.

NAFTA is expected to foster changes in transborder commercial traffic, and may also encourage changes in auto traffic. In addition, the recently approved Intermodal Surface Transportation Efficiency Act (ISTEA) may foster changes in border transportation modes, especially for commercial traffic. The results of this study are based on data collected before NAFTA ratification, and they reflect a situation that is expected to undergo significant changes which are still subject to academic speculation. This problem was circumvented as much as possible with the use of three NAFTA scenarios, and with the use of the sector analysis concept, a tool for disaggregated analysis of potential demand for new binational entry systems along the border. However, actual NAFTA impacts on border communities may turn out to be some combination of the three basic scenarios investigated in this study. In addition, sectors are defined based on major traffic diversion areas, which are also likely to change as NAFTA is implemented. This dynamic attribute of the border region must be taken into account when implementing the findings of this study, especially its transportation planning guidelines.

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APPENDIX A

GLOSSARY

AADT: Annual Average Daily Traffic

AASHTO: American Association of State Highways and Transportation Officials (Associación Americana de Representantes Estatales de Carreteras y Transportes)

ABI: Automated Broker Interface (Interface Automatizada de Agentes Aduanales)

ACR: Automatic Cumulative Recorders

ADT: Average Daily Traffic

Aduana Fronteriza: Mexican Customs

AFIS: Automated Fingerprint Identification System (Sistema Automatizado de Identificación de Huellas Digitales)

AMS: Automated Manifest System (Sistema Automatizado de Manifestos)

APHIS: Animal and Plant Health Inspection Service (Servicio de Inspección Sanitaria de Animales y Plantas)

ATR: Automatic Traffic Recorders (Estaciones Automatizadas de Aforo de Vehículos)

AVC: Automatic Vehicle Classification (Estaciones Automatizadas de Clasificación de Vehículos)

Binational Entry System: A system comprised by the boundary between two countries, and the border stations and inspection facilities in both countries (Sistema Binacional de Entrada).

Binational Bridge Entry System: A binational entry system where the two countries are linked by a bridge.

Binational Dam Entry System: A binational entry system where the two countries are linked by a dam.

Border Crossing: A binational entry system where the border is only an imaginary line (Cruze Fronterizo, Cruze Internacional).

BOTA: Bridge of the Americas, El Paso, Texas (Puente Cordova, Juarez,)

BRINSAP: Bridge Inventory, Inspection and Appraisal Program (Programa de inspección e Inventario de Puentes)

CAPUFE: Caminos y Puentes Federales de Ingresos y Servicios Conexos (Federal Toll Roads, Bridges and Related Services)

Caseta: Booth

Cd.: Ciudad (city)

CES: Centralized Inspection Station (Estación Centralizada de Inspección)

CET: Contraband Enforcement Team (Agentes de Control de Contrabando)

Chih.: Chihuahua

CILA: Comisión Internacional de Límites y Aguas (International Boundary and Water Commission)

CIS: Central Index System (Sistema Central de Información)

Coah.: Coahuila

CRA: Charles Rivers Associates

CTR: Center for Transportation Research (Centro para la Investigación del Transporte)

DBMS: Data Base Management System

DEA: Drug Enforcement Agency (Agencia de Control de Drogas)

DGF: Dirección General de Fronteras (General Office of Borders)

DOT: Department of Transportation (Departamento del Transporte)

DPF: Departamento de Puertos Fronterizos (Department of Border Ports)

DPS: Department of Public Safety (Departamento de Seguridad Publica)

Economic Activity Center: Areas with the same range of socioeconomic indicators such as population, retail sales, employment by industry, and maquiladora activity (Centros de Actividad Economica).

EOIR: Executive Office for Immigration Review (Oficina Ejecutiva de Inmigración)

EPA: Environmental Protection Agency (Agencia de Protección Ambiental)

ETZ: Extra-territorial Zone (Zona Extraterritorial)

FDA: Food and Drug Administration (Departamento de Alimentos y Drogas)

FHWA: Federal Highway Administration (Dirección General de Carreteras Federales)

FIDENOR: Fideicomiso Para el Desarrollo del Norte del Estado de Nuevo León (The Development Trust of Northern Nuevo Leon)

FNM: Ferrocarriles Nacionales de Mexico (National Railroads of Mexico)

FWS: Fish and Wildlife Service (Departamento de Pesca y Vida Silvestre)

GAO: General Accounting Office (equivalente norteamericano a la Secretaría de Hacienda y Crédito Público)

Garita: Checkpoint

GATT: General Agreement on Tariffs and Trade (Acuerdo General sobre Aranceles y Comercio)

GIPSF: Grupo Intersecretarial de Puertos y Servicios Fronterizos (Inter-Departmental Group of Border Ports and Services)

GNB: Good Neighbor Bridge (Puente Reforma), El Paso, Texas

GSA: General Services Administration (Departamento de Servicios Generales)

IBWC: International Boundary and Water Commission (Comisión Internacional de Límites y Aguas)

I&C: Inspection and Control (Inspección y Control)

ICC: Interstate Commerce Commission (Comisión Interestatal de Comercio)

IM3: Institute for Manufacturing and Materials Management (Instituto de Manufactura y Administración de Materiales).

INEGI: Instituto Nacional de Geografía y Estadistica

Ing.: Ingeniero (Engineer)

INS: Immigration and Naturalization Service (Servicio de Inmigración y Naturalización)

ISTEA: Intermodal Surface Transportation Efficiency Act (Ley para el Eficiente Transporte Intermodal Terrestre)

K9: Trained dogs used at the border (Designación de los perros entrenados utilizados en la frontera)

LDF: Laredo Development Foundation (Fundación para el Desarrollo de Laredo)

Lic.: Licenciado (a college graduate in Law, Business Administration, Marketing, and other related areas)

LLTV: Low Light Level Television, a type of surveillance camera used by U.S. border patrol. (televisión de bajo nivel de luz, un tipo de camera de vigilancia utilizada por la patrulla fronteriza de Estados Unidos)

MEX: Mexican Federal Highway (designación de las carreteras federales mexicanas).

NAFTA: North American Free Trade Agreement (Tratado de Libre Comercio)

NCIC: National Criminal Information Computer (computadora nacional de informacíon criminal).

N.L.: Nuevo León

O/D: Origin and Destination (Orígen y Destino)

PHS: Public Health Service (Servicio Público de Salud)

PDN: Paso Del Norte Bridge, El Paso, Texas

PDP: Project Development Plan (Plan de Desarrollo de Proyetos)

POE: Port of Entry. A place where the entry of people and goods is allowed from one country to the other after going through inspection agencies, such as customs, immigration, etc. A port of entry could be comprised of one or more binational entry systems under the jurisdiction of one port.

POV: Privately Owned Vehicle (vehículo particular)

Port of Entry (POE): A place where the entry of people and goods is allowed from one country to the other after going through inspection agencies, such as customs, immigration, etc. A port of entry could be comprised of one or more binational entry systems under the jurisdiction of one port.

PPQ: Plant Protection and Quarantine (Protección y Quarentena de Plantas)

Presa: Dam

Puerto Fronterizo: The Mexican facilities of a binational entry system. This is not the Spanish equivalent of "port of entry."

SAAI: Sistema de Automatización Aduanero Integral (Integrated System of Customs Automation)

SARH: Secretaría de Agricultura y Recursos Hidráulicos (Department of Agriculture and Water Resources).

SCT: Secretaría de Comunicaciones y Transportes (Department of Communications and Transportation).

SDS: SAS data set

Sector: Sphere of influence of an economic activiy center where the potential demand (and revenue) of any new transportation artery falls within a certain range that has no elasticity with respect to the sector boundaries.

Sectur: Secretaría de Turismo (Department of Tourism)

SED: Shippers Export Declaration (Declaracíon de Exportación)

SEDESOL: Secretaría de Daesarrollo Social (Department of Social Development).

SG: Secretaría de Gobernación (Department of the Interior).

SH: State Highway (designacion de carreteras estatales en Texas)

SHCP: Secretaría de Hacienda y Crédito Público (Department of Treasury and Public Finance).

SP: Southern Pacific Railroad (Ferrocarril del Pacífico Sur)

SRE: Secretaría de Relaciones Exteriores (Department of Foreign Affairs).

Supercrossing: A multimodal binational entry system served by up-to-date equipment designed to efficiently handle commercial traffic, as well as to speed up the border crossing procedures for both commercial and non-commercial traffic (Cruze del futuro)

TAM.: Tamaulipas/Road in Tamaulipas

TAMP: Tamaulipas

TIB: Temporary Importation Under Bond (Importación Temporal con Depósito de Fianza)

TIP: Transportation Improvement Program (Programa de Mejoramiento del Transporte)

TLC: Tratado de Libre Comercio Norteamericano (NAFTA).

Trade Corridor: The area encompassing all possible existing and idealized commercial routes between two major commodity production and/or attraction areas.

Traffic Generating Areas: Economic Activity Center

Transborder: (1) Movement of people and / or goods across the border, as in "transborder traffic," or (2) Database developed by the Center for Transportation Research.

Transborder Activity Center: Activity Center encompassing both sides of the border

Transportation Corridor: The area encompassing existing and idealized routes between a major area of traffic production and a major area of traffic attraction.

TRC: Texas Railroad Commission (Comisión de Ferrocarriles de Texas)

TTA: Texas Turnpike Authority (Departamento de Infrestructura de Cuota de Texas)

TTI: Texas Transportation Institute (Instituto del Transporte de Texas)

TxDOT: Texas Department of Transportation (Departamento del Transporte de Texas)

UP: Union Pacific Railroad ("Union Pacific" Ferrocarril)

USCG: United States Coast Guard

USCS: United States Customs Service (Departamento de Aduanas)

USDA: United Stated Department of Agriculture (Departamento de Agricultura)

UTEP: University of Texas at El Paso

VS: Veterinary Service (Servicio Veterinario)

WIM: Weight in Motion

WSA: Wilbur Smith Associates