# EVALUATION OF MEXICAN TRANSPORTATION INFRASTRUCTURE PROJECTS

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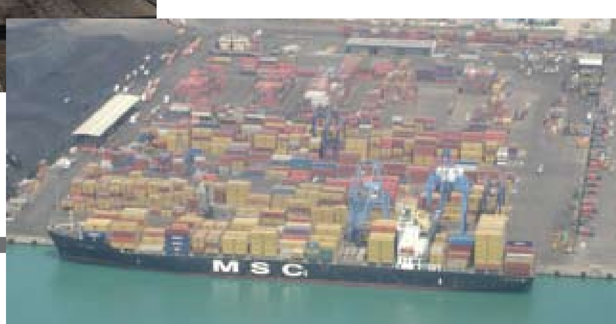


LBJ
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# Foreword

The Lyndon B. Johnson School of Public Affairs has established interdisciplinary research on policy problems as the core of its educational program. A major part of this program is the nine-month policy research projectr (PRP), in the course of which two or more faculty members from different disciplines direct the research of 10 to 30 graduate students of diverse backgrounds on a policy issue of concern to a government or nonprofit agency. This “client orientation” brings the students face to face with administrators, legislators, and other official’s active in the policy process and demonstrates that research in a policy environment demands special talents. It also illuminates the occasional difficulties of relating research findings to the world of political realities.

During the 2008-2009 academic year the Texas Department of Transportation funded, through the Center for Transportation Research (CTR), a policy research project to evaluate through case study analysis how Mexico, plans, finances, develops, and constructs infrastructure projects. This followed upon a first year of research conducted by CTR which examined the legal, institutional and economic underpinnings of transportation planning within Mexico, as well as the National Infrastructure Plan that was announced by President Calderon in early 2007. The fourteen case studies discussed and analyzed in this report (which were drawn from the national infrastructure plan, as well as other public and private led projects), are intended to demonstrate how these institutional factors functioned in real world examples. The case studies were designed to focus on infrastructure projects considered strategically valuable by the Mexican government and assess how various institutions contributed to their development. The scope of the case studies was intentionally broad, focusing on issues such as project prioritization and selection, budgeting and finance, bidding and tendering, right-of-way acquisition, environmental assessment and mitigation, engineering planning and coordination among entities, and citizen involvement. This approach allowed the researchers to develop a complete picture of the planning and implementation process as it applied to different types of projects. The output from this case study analysis, in addition, was also utilized to develop two technical memoranda and a database of contacts for the DOT to utilize. The first technical memorandum highlighted the degree to which Texas and Mexico are coordinating their transportation plans. The second analyzed cross-border coordination and made policy recommendations on cross-border coordination.

The cirrciculum of the LBJ School is intended not only to develop effective public servants but also to produce research that will enlighten and inform those already engaged in the policy process. The project that resulted in this report has helped to accomplish the first task; it is our hope that the report will itself contribute to the second.

Finally, it should be noted that neither the LBJ School nor the University of Texas at Austin necessarily endorses the views or findings of this report.

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# Chapter 1. Executive Summary

In July 2007, Mexican President Felipe Calderon announced the National Infrastructure Program (NIP), a 172-page blueprint for infrastructure development through 2030 that is designed to increase the competitiveness, quality, and coverage of Mexico's infrastructure. This five-year program relies on public-private partnerships (PPPs) to develop over 300 transportation infrastructure projects throughout Mexico.

The NIP constitutes an overall investment of US$196 billion between 2007 and 2012 (Thomson, 2008). According to Thomson, about half the investment associated with the NIP was to come from the private sector; however, recent liquidity problems for companies have put that goal in jeopardy. In February 2009, the Director of *Banco Nacional de Obras* and *Servicios Publicos* (BANOBRAS) was quoted saying that development projects are not ready to begin because of lack of financing and obstacles in the bidding process (Ayala, 2009). However, none of the projects that are included in this report have been abandoned by the lack of available funding and were still underway (or continuing to be developed at the planning stage) at the time of the report's submission.

The NIP endeavors to focus on several key infrastructure areas including the modernization and construction of roadways, the expansion of the railway system including suburban railway projects, the continued development of Pacific and Gulf Coast ports, and the expansion of existing airports (US Commercial Service, 2009).

President Calderon has also set a goal for Mexico to be ranked in the top 25 in World Economic Forum Infrastructure Competitiveness Index and to be the premier example of infrastructure development in Latin America by 2012. The National Infrastructure Program is needed to increase the competitiveness of the Mexican economy vis-à-vis economies worldwide. Mexico's increased attention to its transportation infrastructure is expected to have an impact on trade and transportation flows with the state of Texas. As a result, the Texas Department of Transportation (TxDOT) sponsored a two-year research project with the Center for Transportation Research at The University of Texas at Austin to review how Mexico plans, develops, and implements transportation infrastructure projects.

University of Texas researchers spent one year examining the legal, institutional and economic underpinnings of transportation planning within Mexico. After completing this review a series of case studies were performed in year two of the study intended to demonstrate how these institutional factors functioned in real world examples. The case studies were designed to focus on infrastructure projects considered strategically valuable by the Mexican government and assess how various institutions contributed to these projects' development. The case studies were carried out by a group of graduate student researchers at the LBJ School of Public Affairs through a year-long applied research course called a policy research project. In a policy research project, a group of students selected due to their interest and expertise in key project areas, performs real world analysis on a particular topic for the benefit of a public sector sponsor. The scope of the study was intentionally broad, focusing on issues such as project prioritization and selection, budgeting and finance, bidding and tendering, right-of-way acquisition, environmental assessment and mitigation, engineering/planning coordination among entities, and citizen involvement. This approach allowed the researchers to develop a complete picture of the planning and implementation process as it applied to different types of projects.

In addition to research on the implementation and development of Mexico's infrastructure programs, the project also explored the degree to which Texas and Mexico are coordinating their transportation plans. Through a series of memoranda and this comprehensive final report, the project developed strategies to increase cross-border coordination, create relationships with many important Mexican contacts, assessed discontinuities between Mexico and Texas transportation plans, analyzed the process of project development in Mexico, and recommended policy changes. The project gathered information from literature reviews, telephone interviews, websites, and site visits to twelve projects around Mexico that covered all modes: highways, rail, ports, airports, commuter rail, and inland ports. In addition, personal interviews were conducted with government officials, project directors, and others involved in the development process. This report analyzes several case studies from around Mexico in depth, and comments on the impact of their development on Mexico and Texas's economies.

### 1.1.1 Structure

The research project was conducted in various locations around Mexico and site visits were conducted during the three month period from January to March 2009. Table 1.1 contains a brief description of each of the case studies contained in this report. Figure 1.1 shows the location of these case studies.

**Table 1.1: Transportation Projects in Mexico**

| Project | Type | In NIP | Description |
|---|---|---|---|
| **Manzanillo *Zona Norte* Expansion** | Pacific Port | ✓ | Construction of second specialized container port at the Port of Manzanillo, the largest container port by volume in Mexico. Pacific coast port with direct highway access to Guadalajara. |
| **Lazaro Cardenas Specialized Container Terminal** | Pacific Port | ✓ | Construction of phase two of the specialized container terminal. Eventual construction of a third phase. Pacific coast port south of Manzanillo. |
| **Altamira Expansion** | Gulf Port | ✓ | Gulf port focused on general/bulk cargo. Projects include a galvanized steel plant, a carbon black plant, and a new terminal for the construction of marine platforms. |
| **San Luis Potosi Inland Port** | Inland Port | ✗ | Expansion provides low-cost customs inspections away from maritime ports and border crossings and adds distribution capacity. |
| ***Interpuerto* Monterrey** | Inland Port | ✗ | Construction of new inland port to serve Monterrey's industrial areas. Near main highway that extends to Texas border. |
| **Mazatlan-Durango Highway** | Highway | ✓ | Designed to cross Sierra Madres using tunnels and bridges providing a much needed east-west corridor. One of the cornerstone projects of the NIP. |
| **México City *Arco Norte*** | Highway | ✓ | 146 km of toll roads and 226 km of highways to allow through cargo to bypass Mexico City. |
| **Mexico City *Circuito Exterior Mexiquense*** | Highway | ✗ | Outer loop project. Designed to relieve traffic congestion in Mexico City. Located closer to the city than *Arco Norte* |
| **Mexico City *Commuter Rail*** | Passenger Rail | ✓ | Construction of passenger/commuter railway to reduce length of commute to Mexico City. First of three planned lines. |
| **Monterrey International Airport Expansion** | Airport | ✓ | Construction of an additional passenger terminal. Provides new international destinations and increased capacity for airlines and passengers. |
| **Reynosa-Anzalduas Bridge** | International Bridge for non-commercial vehicles | ✓ | Joint bridge project between Mexico and the U.S. from Reynosa to McAllen. Initially the bridge will serve only non-commercial vehicles, though it's anticipated to eventually open to commercial traffic. |
| **Brownsville-Matamoros West Rail Relocation** | International Railroad Bridge | ✓ | Relocation of rail bridge and switchyards out of the cities of Brownsville and Matamoros. Construction of the new track, switchyards and bridge. |

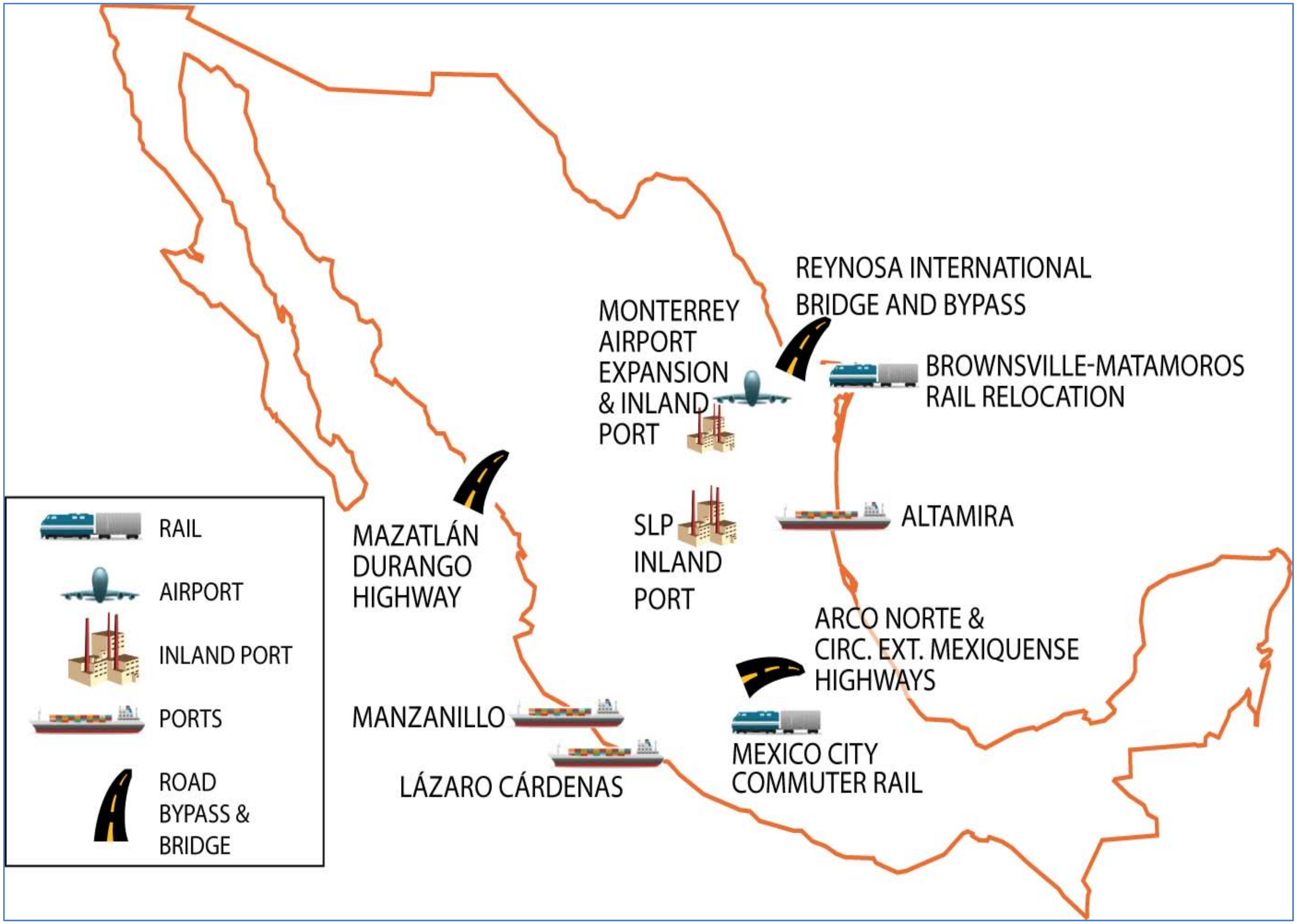



*Figure 1.1: Map of Transportation Projects in Mexico*

### 1.1.2 Case Study Analysis

Currently Manzanillo is the largest container port in Mexico by volume. The designated container terminal is operated by SSA Marine, a private concessionaire. API Manzanillo, the equivalent of the port authority, has developed a series of aggressive expansion plans that include a new container terminal that would double the ports existing capacity, a rail relocation to remove the rail lines from the city, and a highway and bridge project designed to separate port and local traffic. These additional projects will be accomplished with a combination of public and private funds, while the construction of the new container terminal will be completed entirely with private funds. However, there is some disagreement between the public and private sector over the scale of the projects, and a lack of agreement/coordination between the entities involved could slow progress. The port is located in the central part of the city of Manzanillo and therefore its growth is severely constrained due to lack of available land around the existing port area available for expansion. The port suffers from poor public image due to the fact that rail and road connections to the port go through the center of the city. The port is also facing backlash from environmental groups for the destruction of mangrove stands where the new terminal will be located. Notwithstanding API Manzanillo's aggressive development plans, Manzanillo still has some significant challenges, including coordination and environmental concerns that will need to be addressed. There does not seem to be sufficient coordination between the different actors at the port to achieve such a bold expansion plan. While the government may choose to focus on the development of Manzanillo because of its current importance among container terminals, the heavy reliance on concessions and privatization in the Mexican port systems means that such ambitious projects are unlikely to come to fruition without private-sector support and input. Some of the expansion plans at Manzanillo, like rail expansion, do not seem to make much sense financially for the private sector and are therefore not realistically feasible. Additionally, scarce space will continue to remain an issue at the port; there is very little room for expansion. API Manzanillo acts as an individual entity whose best interest is to see the port expand. Given the port's severe challenges, it may be in the national interest to instead focus on the development of container terminals and related infrastructure at another port, such as Lazaro Cardenas. Since privatization, a sense of national coordination is gone from the ports, as ports compete among themselves for container traffic.

Lazaro Cardenas is another Pacific Coast port with an aggressive expansion project. Like Manzanillo, Lazaro Cardenas is overseen by API Lazaro Cardenas with concessionaires funding and operating the various terminals. There are some significant differences between Manzanillo and Lazaro Cardenas. The port of Lazaro Cardenas is located outside of the city, giving the port ample room to expand. Additionally, the town's main source of economic growth is the port and therefore there is a great deal of public support. Lazaro Cardenas' harbor is naturally deep and no dredging is necessary; and rail connections already exist throughout Mexico and to the U.S. The greatest strength of the Lazaro Cardenas project is coordination. Unlike Manzanillo, the various stakeholders at Lazaro Cardenas work together and communicate to facilitate planning and operations. They conduct monthly planning meetings and weekly operations meetings. Communication and coordination is essential with so many stakeholders involved in planning, financing, and operations. There is an obvious difference in the two ports; Lazaro Cardenas is being developed in a logical and coordinated way due to the fact that the various stakeholders are able to work together to develop Lazaro Cardenas into a competitive port. The ultimate goal of Lazaro Cardenas is to be able to compete with the overcrowded ports of Los Angeles and Long Beach thanks to its rail connectivity to the U.S. via Kansas City Southern de Mexico's (KCSM) NAFTA rail line. Currently, there is little demand for cargo from Lazaro Cardenas going to the U.S. However, if Lazaro Cardenas continues to develop in a coordinated and efficient way and proves to be a quality port, it may become competitive with Los Angeles and Long Beach once those ports become too overcrowded.

The port of Altamira is a Gulf Coast port. The port boasts high environmental and safety standards, which are beneficial to public opinion and operations. The Port of Altamira handles multiple cargo types. The port is home to a large Liquid Natural Gas facility, and expansion plans include the construction of a new patio to build deep water oil platforms, the construction of a new carbon plant and the construction of an industrial plant to produce galvanized steel for the automotive industry. The expansion of Altamira is being driven by API Altamira and several private terminal investors. Each of the previously mentioned expansions will be funded by private investment, with API Altamira providing public funds for investment in general port infrastructure. Altamira also does not face the significant land constraints as the port located outside of the town's urban area and has plenty of surrounding land. Recently, however, there was a law suit over the past acquisition of some current port lands from ejido groups. The port suffered a major setback when the Mexican Courts overturned the eminent domain procedure used to acquire the communal land (known as ejido land) 28 years earlier and required SCT to pay compensation in the form of a large fine and, reconvene this process. This case may have major ramifications for other infrastructure projects that take ejido land. Altamira has also experienced some connectivity challenges. Poor road conditions have resulted in connectivity gaps to the far south, central, and far north west regions. Furthermore, unreliable rail service and a lack of double-stack container clearance over parts of the rail route will continue to present challenges in rail transportation. This shows the importance of intermodal coordination and planning, given that a port can be successful only if its cargo can successfully be transported to its destination

San Luis Potosi is an inland port and industrial park ideally situated for a free trade zone due to its location in the center of northern Mexico upon important rail and highway corridors. This project is being privately financed with some government support given through grants and the provision of infrastructure and land. The inland port has been fortunate in having an excellent relationship and coordination with KCSM railroad. San Luis Potosi gained recognition by developing the first Free Trade Zone in Mexico. The purpose of a logistics port is to create cost-effective transportation and provide customs inspection, and storage of international cargo. In the case of the San Luis Potosi Logistics Park and Logistik Industrial Park, there is an additional goal of relieving the burden of incoming international cargo traffic by diverting to the inland ports facilities. Grupo Valoran and San Luis Potosi officials asserted that the vision of the San Luis Potosi Logistics Park began over eight years ago had benefitted from a considerable amount of coordination between the state, city, and private firms developing the project.

Monterrey Inland Port is another inland port project being developed to take advantage of highway and rail corridors that connect Monterrey to both the mega-region of Mexico City-Guadalajara and the U.S. The project is being financed by private funding but has the sponsorship of INVITE, the Regional Integration Program Incentive of Northeastern Mexican State, as well as Secretariat of Communications and Transportation (SCT) and the state of Nuevo Leon. The project has been on the state's planning agenda since the turn of the millennium and was laid out in the State Development Plan of 2004-2009. The inland port is currently in the planning process, although land has already been secured adjacent to KCSMs existing intermodal yard. INVITE and the state have created a private entity - Servicios Interpuertos - to guide its development, perform feasibility studies, and create a business plan. The inland port is fortunate in that it is being planned at the convergence of two of Mexico's Class I railroads -KCSM and Ferromex- as well as Highway 57, which links up to IH 35 at Laredo. INVITE has also been aggressive in developing business agreements between it and other logistics hubs, and signed a Memorandum of Understanding with the Allen Group's Dallas Inland Port in June 2007. However, this inland port still has a long way to go to begin operations, including the development of infrastructure, utilities, and access roads. It will also have to overcome one large hurdle—negotiating with KCSM and Ferromex regarding collaboration between these two privately held rail companies.

The Mazatlan-Durango Highway is an example of a high profile project. It is one of the cornerstones of the NIP, and includes the construction of a massive suspension bridge in the Sierra Madres. The highway is the final part of a larger transversal corridor connecting Mexico's Pacific Coast to the U.S. The corridor is termed the "Mazatlan-Matamoros" corridor and extends from the port of Mazatlan through Torreon, Saltillo, and Monterrey to the border with Texas. The project is very ambitious due to the difficulty of crossing the Sierra Madres. While there is currently a road connecting Mazatlan and Durango, this project will significantly shorten travel time significantly. The project is indicative of the push to develop Mexico's east-west corridors, which have historically been underfunded as infrastructure development focused on roads to and from Mexico City. The national government has been the major driver in this project, with input from the states of Sinaloa and Durango. The project is deemed as so important that it has been placed in front of other transversal corridors across the Northwest, and has diverted funds and attention from road development to and from the port of Topolobampo. This project is sponsored by federal government, with input from the states of Sinaloa and Durango. The project was found not to be suitable for a concession, but the highway was nonetheless funded in part by private money in the form of profits from the re-concession of other roads. Funds from the FARAC I concession package are being used to build the road, and the project financing is an example of how Mexico is seeking to insulate its infrastructure funding from the current dependence of the federal government on PEMEX by leveraging older infrastructure investments into capital for new roads through re-concession packages. The project is also indicative of the push to develop Mexico's east-west corridors, which have historically been underfunded as infrastructure development focused on roads to and from Mexico City. Mexico is in a fundamentally different place in its infrastructure development from the US. While the US is working to maintain its existing system, Mexico is still working to connect the major urban and manufacturing centers in the country. A connection from Monterrey to the West coast, which the Mazatlan-Durango Highway will provide, is a key step in the Mexico's process of building a highway transportation network capable of supporting growing international trade.

Arco Norte is a 223-km highway connecting federal and state highways in the northern half of Mexico City's metropolitan zone. This project intends to significantly reduce congestion and pollution and will decrease travel time from 4 hours to 1.5 hours. This project is a PPP between SCT and Autopista Arco Norte (the concessionaire). Although the need existed in 1990s, the project was not developed until the option of creating a PPP provided an alternative to federally financed projects. The planning and feasibility studies for this project were conducted in a similar fashion to U.S. feasibility and traffic and revenue studies (T&R). The cost-benefit analysis was conducted as an economic analysis, taking into account societal improvements such as time saving and vehicle operations costs savings. The feasibility studies predicted future social benefits, as well as potential financial gains; additionally, Cal y Mayor, who conducted the feasibility study, recommended that 76% of the road be constructed as a 4-lane instead of 2-lane highway. The most notable challenge to Arco Norte was obtaining the right-of-way. The right-of-way acquisition was originally predicted to be $104 million. However, due to the size and nature of the project, SCT didn't get all the acquisitions before the project began, and as a result, the concessionaire was forced to pay additional compensation. Furthermore, sections of the road go through urban areas with many small properties that complicate and delay the right-of-way procedure. Arturo Trejo Ordonez of Cal y Mayor reflected that in most cases, it would have saved SCT time and money to change the route in order to avoid densely populated areas, although doing so would have decreased the benefit of Arco Norte as an economic development engine for some communities. Arco Norte was financed through a PPP, with SCT constructing a portion of the road using public financing and the concessionaire constructing the majority of the road. The concessionaire was chosen through an open-bidding process; SCT looked at the technical and economic aspects of the bidders and chose the bidder that requested the least amount of federal money to finance the project. The concession includes the construction of 146 km of toll road and the operation and maintenance of the entire 226-km highway (including the 77.6 km constructed by SCT).

Circuito Exterior Mexiquense highway is a 95 mile highway east of Mexico City running north/south that will connect four major highways around Mexico City and alleviate the need to enter into the city to travel between these highways (two loops will connect these major highways). Circuito Exterior Mexiquense will provide similar benefits to Arco Norte in terms of time savings and air quality benefits. The project is groundbreaking in that it is not being developed by SCT, but by the state of Mexico and the Federal District utilizing a PPP process. The project is contained in the Economic Development Plan 2005-2011 for the state of Mexico. It is being developed in four stages and the first three of these were estimated at MXP$6,628 million, of which 40% of the financing came from OHL (the concessionaire), and the remaining 60% from a syndicate made up of BANOBRAS, the official Credit Institute of Spain (ICO), and BBVA-Bancomer. In November 2008, the project was refinanced to obtain capital development funding for Phases II and III. Cal y Mayor (the consultant for Arco Norte) produced feasibility and traffic and revenue studies for this project. Of the 140,000 vehicles circulating everyday in the area, 100,408 were estimated to use Phase I in 2006. During the first three years of operations for Phase I, usage surpassed these estimations. Phase IV of this project is currently on hold because the initial traffic and revenue studies were not positive and the concessionaire is waiting to see how other planned projects that are being developed in this area will affect potential users.

Mexico City commuter rail links Mexico City to municipalities in neighboring Mexico states. It is the first commuter rail project to be developed using a PPP process in Mexico. The project is utilizing existing tracks, which were originally built in the late 1800s, fell into disrepair, and were sold-off as part of the privatization process of the Mexican National Railways in 1994. The commuter rail project is in the NIP, and is being developed in three stages. The project is also very unusual because it has had the cooperation of three levels of government (federal, federal district, and state) who signed multiple development and coordination agreements. Line 1 opened in 2008 and was developed by a Spanish concessionaire. The financing of this project was divided into two parts: private and public. The federal government paid for pedestrian crossings and right-of-way separation of the rail tracks. The private concessionaire paid for the rehabilitation of track, signaling, developing the stations, and supplying the trains. Two trust funds were also created for the development of Line 1. The first established by the concessionaire for warranty, administration, and payment also included the publically subsidized railway works. The second trust fund is a contingency fund set up to back up the partial payment of concession debt. There are two more lines to be built and opened for the commuter rail; the tenders for these lines were issued during 2008, but currently they have been suspended. Thus far, Line 1 has been a success with ridership numbers exceeding expectations and the concessionaire already preparing to extend the route within the five-year time frame that the contract outlined. Notably, both the concessionaire and SCT commented that, given another opportunity, they would involve all interested parties earlier, particularly companies such as bus operators and private transit groups. There has been one setback for Line 1: in April 2009, two trains collided, resulting in 109 injuries. This accident was allegedly caused by human error. The impact of this accident on ridership numbers is not yet clear and it will be some time before the findings of two investigations being undertaken by the concessionaire and the Mexican Attorney General are released.

The Terminal B expansion at the General Mariano Escobedo International Airport in Monterrey, Mexico will provide the airport with additional passenger capacity. The project is privately funded by a consortium directed by *Grupo Aeroportuario del Centro Norte.* The airport serves the major metropolitan area of Monterrey, and will facilitate the movement of people to and from the city. The airport is also developing its cargo terminal, Terminal C, which will facilitate the movement of air cargo to the region. One notable feature about the Terminal B project is the terminal's use of environmentally friendly building techniques.

The Reynosa-Anzaldúas Bridge is a joint project between Mexico and the United States as outlined by a Presidential Permit signed by both sides in 1999. On the U.S. side, the bridge is a partnership between McAllen, Hidalgo, Mission, the Texas Department of Transportation, and the federal government. On the Mexican side, it is a partnership between the state of Tamaulipas, the federal government, and the concessionaire Grupo Marhnos. Once construction is complete, the Reynosa-Anzaldúas Bridge will ease congestion of commuter traffic on two neighboring bridges. On the Mexican side of the bridge, the concessionaire, Grupo Marhnos, is responsible for the entire implementation, including access roads, port, and bridge. They have been able to keep the project on schedule and within budget, and as they are responsible for the entire project, they have not had to wait for other contractors to complete their work for them to be able to conduct theirs. One of the key points stressed by SCT was that they would like to coordinate more closely with the American side in the future projects. They also stated that there should be a greater exchange in technology and ideas between both countries. The biggest drawback mentioned for this project was with respect to the Executive Plan conducted by the state of Tamaulipas, which was outdated and contained several errors that increased construction costs.

The Brownsville-Matamoros West Rail Relocation project (BMWRR) will move a heavily trafficked rail line outside of city centers to reduce traffic congestion and noise, as well as improve safety and environmental conditions. The motivation behind this project was almost entirely a response to negative public opinion regarding the railway running through the major cities, and has little economic benefit. This project provides insight into international projects and border coordination. Local, state, and federal governments in the U.S. and Mexico, international commissions, and private entities are all involved in this project and therefore a great deal of coordination is necessary. There are multiple bridge projects along the Texas-Mexico border currently in the planning stage or already under construction. The BMWRR project is nearing completion and can be used as a model and be highly beneficial for planners. The challenge of a project such as the BMWRR is coordination between various stakeholders. Brownsville-Matamoros has been successful in the coordination at the public level. There are two project sponsors, one representing Cameron County and one representing the state of Tamaulipas, as well as an overall project manager coordinating all details. The project sponsors coordinate well with the cities of Brownsville and Matamoros, as well as with the state of Texas and SCT Mexico. There are monthly meetings that are jointly led by the two project managers and include all stakeholders in the project. However, there has been concern that the private stakeholders involved such as the rail KCSM, the current bridge operator (B&M Bridge Company), and the port of Brownsville have been left out of the planning process. The lesson learned from this project is that planning and implementation can be hindered without involvement and coordination of all crucial stakeholders, including both the private and public sector.

### 1.1.3 Key Findings

*Financing & Public Private Partnerships*

Mexico is utilizing public private partnerships to develop its infrastructure. This is because funding for infrastructure comes out of general revenue, which is heavily dependent upon revenues from PEMEX and is therefore subject to the vagaries of market conditions. Private financing in many ways opens the door for efficiency and competition and relieves pressure on the Mexican government to finance project. Several projects in this study are being constructed as Build-Operate-Transfer (BOT) toll projects. Mexico also uses an Asset Utilization model whereby it leverages its assets by leasing routes and then uses this generated capital to finance new infrastructure development. Thus far, it has been successful in raising US$4 billion to infuse a new infrastructure fund, FONADIN.

Mexico's federal transportation policy since the 1990s has generally emphasized the decentralization of the responsibility for infrastructure projects from SCT and other federal entities to the states, private sector companies, and autonomous public sector entities. The Federal government maintains a strong and in many cases dominant role, yet it is clear that infrastructure planning under the Calderon administration is moving in the direction of joint action and joint responsibility. The Mexican government has increased private sector participation in the provision, operation, and maintenance of transportation facilities. The NIP goes much further in solidifying and quantifying the role of private and non-federal participants in advancing broad development goals and providing attempts to develop different transportation modes within the greater concept of a transportation system, integrating port development, highway connectivity, and rail projects into one multimodal plan. This trend toward thinking of the various modes as part of a system was evident in several of the case studies where projects were being constructed with other complementary infrastructure developments in mind. For example, the Lazaro Cardenas container terminal being developed in concert with improvements to the Kansas City Southern de Mexico (KCSM) double stack rail connection to Mexico City and other points north.

*Coordination*

Several projects included in this study exemplify the necessity of coordination among various stakeholders in both the public and private sector; cross-border coordination between the U.S. and Mexico as well as coordination among public entities, private concessionaires, and various modes of transportation such as rail and road. Project success is often directly linked to the openness and coordination between various stakeholders. Projects that maintain open communication and collaboration throughout the planning and implementation process face fewer difficulties and roadblocks. The most complex and in some ways successful coordination project has been the Mexico City Commuter Rail project, which required 11 collaboration agreements between the multiple parties that were involved with the project. These agreements were signed over a period of six years (the first was signed on June 11, 2003) failure in any one of these agreements could have derailed the entire project. This also highlights that public officials are cognizant of the importance of many of these projects and are willing to make the necessary concessions that may be required to bring them to fruition.

*Environment and Right-of-Way (ROW)*

Many of the projects in this study had environmental challenges along the way. However, it seems that the projects were able to pass the environmental review with enough support behind the project, though increasingly international organizations are getting involved in Mexico's environmental process. This may lead to more stringent environmental reviews in the future. The timing of the environmental review before ROW has been acquired may also be problematic for TxDOT and U.S. parties who are collaborating on projects. Because projects in Mexico can be initiated before ROW is acquired, unforeseen costs and change orders can result. In the case of the Reynosa Anzalduas Bridge, this led to unanticipated costs associated with alignment of an access road that was not in the initial design (and connects to Monterrey, the third largest city in Mexico) and also the misalignment of the roadway and a port facility building. Also the environmental and ROW processes in the two countries are reversed. In Mexico ROW is acquired before the environmental process is complete. If there is a difficulty with the environmental review this can force SCT to acquire new right-of-way, as was the case with Arco Norte.

*Public Outreach/Involvement*

Finally, it should be noted that public outreach and involvement can be hit-and-miss. For some projects—for example, Lazaro Cardenas, Mazatlan-Durango Highway, and the Mexico City Commuter Rail—the public has been exceptionally supportive and the projects are proving to be able to generate income for their regions and public good will. However, in some instances, the lack of public support may provide the critical fulcrum point at which the projects may become politically problematic. The port of Manzanillo, for example, will be a problematic project because of both environmental and public distrust issues. Similarly, the news about the *ejido* land that was expropriated for the port of Altamira came back in June 2009—26-years after the expropriation—to haunt the parties involved, especially the SCT.

# Chapter 2. Seaport Projects

## 2.1 Introduction

Prior to 1993, Mexican ports were operated and administered centrally by a national port authority called Puertos Mexicanos. The Mexican port sector failed to prosper under central control for a number of reasons, chief of which was the general failure of Mexico to develop a robust international trading system that necessitated modern and efficient ports. Under centralized planning, significant investments in new ports were made including a substantial modernization effort under the administration of President Carlos Salinas. However, while these investments significantly boosted the ports' nominal capacity, they generally were not sufficient to bring Mexican port infrastructure up to world standards. In 1993, Mexican ports had the technical capacity to move 59 million tons of cargo per year, but in fact moved only 24 million tons. By 1999, nominal capacity had been increased to 90 million tons and utilization was 55 million tons. Therefore, investments under privatization allowed for the physical expansion of ports and a higher utilization ratio of existing capacity (Estache, 2001). Both prior to and post privatization, Mexico has essentially relied on a four-port strategy for non-petroleum cargoes: Manzanillo and Lazaro Cardenas on the West Coast; and Veracruz and Altamira on the Gulf Coast. While the comparative fortunes of these four ports have changed over the past two decades, they remain at the core of the country's bulk and container port strategy.

The container segment of the port sector was particularly underdeveloped prior to privatization. Container volume for all Mexican ports was only 463,706 TEUs in 1993, prior to the implementation of the Law of Ports and the North American Free Trade Agreement (NAFTA) (Lloyd's List, 2002). The centralized port system led to much inefficiency as the system was unable to adjust to the individual needs of the various ports and terminals. Tariffs were centrally set without regard for port location, and funds were dispersed centrally, so the more successful ports ended up subsidizing the less successful ports. There was little incentive to invest in technology or port improvements, and quality of service at the ports was extremely low (Martner, 2002). The Mexican government was cognizant of the deficiencies in its port system long before privatization. The Salinas administration, along with Puertos Mexicanos, hired the Singapore Port Authority (PSA) in 1990 to recommend efficiency improvements in the country's four commercial cargo ports as well in their inland connections (Wong, 1991). Salinas also poured significant resources into a previously undeveloped site, the port of Altamira, which was seen as a way to modernize the port sector from the ground up (Houston Chronicle, 1989). These investments by the Salinas administration in the late 1980s and early 1990s might be regarded as the pre-privatization stage of Mexico's port reform.

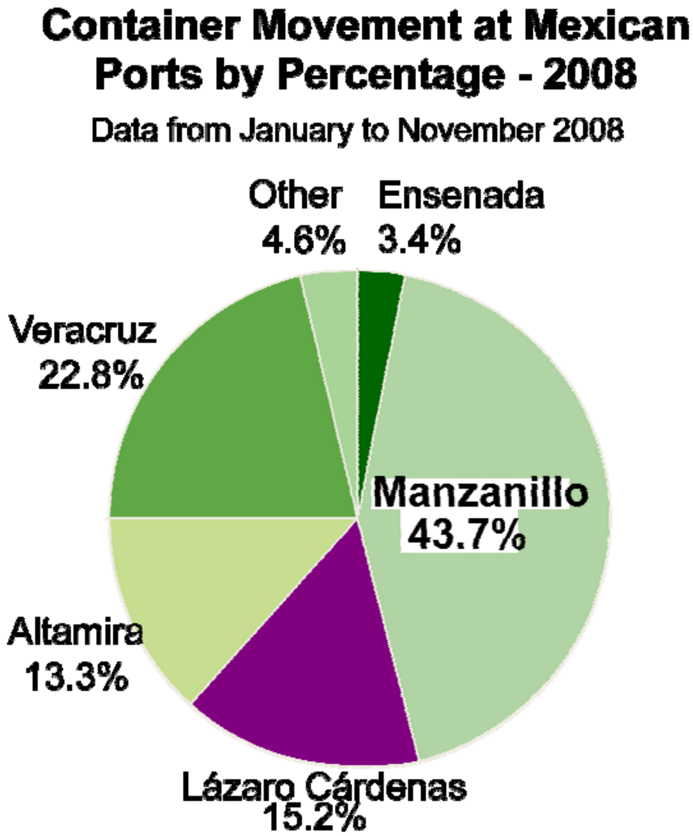
In an effort to overhaul the Mexican port system, in 1993 Mexico passed a new Law of Ports which fundamentally restructured the national port system and granted concessions to Independent Port Administrators (APIs) to manage, operate and run Mexican ports with the aim of increasing competition between ports, and ceased inter-port subsidization (API Manzanillo, 2009.a).

The API is government owned but often has state, local, and private-sector representatives. The APIs control the administrative operations of the ports and are responsible for basic port infrastructure, such as dredging activities. The APIs have the right to grant concessions to private operators for the construction and operation of individual terminals within the ports. The APIs operate like publicly held companies. They are financially independent of one another and rely on concessions to fund their operations (Martner, 2002). APIs are technically not independent port authorities as this role is officially designated to the SCT; yet, in some ways the APIs are more independent than public port authorities in the United States, given the extent to which major Mexican cargo ports are self financing and not beholden to the federal government for dredging costs or other major capital assistance.

The creation of the APIs allowed for private investment in the ports, and led to competition between the ports. The major ports no longer cross subsidize one another, and therefore are in competition for cargo. This competition has succeeded in lowering port tariffs and improving the level of service (Martner, 2002). At the same time, given the fact that ports are in competition with each other, the Mexican government now has diminished ability to craft a binding port strategy for the entire country.

Maritime transportation and international trade have experienced substantial increases over the past ten years. Mexican port planners, given the country's location next to the U.S. and the fact that U.S. ports could become oversaturated, feel that the country's ports could offer an advantage to capitalize on cargo movement, particularly in container shipment (Nelson, 2008).

Particular emphasis has been placed on the development of container terminals in an effort to capture volume from growing trade with Asia. "*Mexico and major shipping interests are bolstering Pacific ports south of the border, hoping to catch future runoff as an increasing tide of Asian cargo sails toward already clogged ports in California*" (Weissert, 2006). Currently the two largest container terminals are Manzanillo on the Pacific Coast and Veracruz on the Gulf Coast. Figure 2.1 shows the percent of containers moved by each of the top container ports from January to November 2008.




Source: SCT, 2009.a

*Figure 2.1: Percent of Containers Moved by Port*

President Calderon reinforced the importance of increased infrastructure investment and development in the previously described NIP. The NIP encompasses a variety of federal infrastructure projects and includes investment of US$6.66 billion in ports alone (Container Management, 2008).

At the heart of Calderon's plan to revamp the Mexican economy through infrastructure improvement is a massive port development plan combined with rail and road connectivity (Nelson, 2008).

According to Thomson, about half the investment associated with the NIP was to come from the private sector; however, the recent downturn in the global economy has made private companies less willing to invest in substantial infrastructure projects in Mexico, which may mean that the government will have to rely more heavily on public investment banks. In February 2009, the Director General of BANOBRAS was quoted saying that development projects are not ready to begin because of lack of financing and obstacles in the bidding process (Ayala, 2009).

Three of the case studies examined the Mexican ports of Lazaro Cardenas and Manzanillo on the Pacific Coast and Altamira on the Gulf Coast. All three are run by APIs with concessions of terminals within the port to various private companies. Though they are structured the same, there are many differences among the three.

## 2.2 Port of Manzanillo

### 2.2.1 Project Description

*Type of Project*

The project examined in this case study is the construction of a second specialized container terminal at the port of Manzanillo and the projects related to that expansion. All of these projects fall under the umbrella name of the Zona Norte Expansion. The related projects include construction of a new road to separate port traffic from local traffic, widening of the highway between Manzanillo and Guadalajara, a rail tunnel and relocation project, and several public works projects.

*Need Addressed*

The Zona Norte expansion is intended to relieve congestion at the port by adding an additional two million TEUs of capacity, and increasing competition within the port by adding a second container terminal to compete with the first container terminal within the port. The project will also increase Manzanillo's competitiveness nationally and internationally. The related projects are intended to construct the infrastructure necessary to support the new container terminal as well as the existing port, improve access to the port, improve port facilities, and pacify local complaints about the port.

*Port History*

The port of Manzanillo dates back to the grand modernization projects of President Porforio Diaz, who promoted development of the country's west coast. The main dock of the port was destroyed in 1914 during the U.S. Naval blockade of Mexican ports and was not rebuilt until 1952. Growth in Manzanillo began to boom in the early 1970s when President Echevarría designated the port as the entry point for sea trade with Asia due to its strategic Pacific Coast location. In 1989, the four-lane highway between Manzanillo and Guadalajara was completed, giving Manzanillo an edge over other ports in the region in terms of ease of cargo movement to and from the port. Due to the highway, Manzanillo began to expand rapidly and became one of the foremost ports in Mexico. The port began operating in its current state in 1994 when the enactment of the Law of the Ports created API Manzanillo, a publicly held company, to manage concession of terminal operations to private companies (Ezquerra de la Colina, 2006).

*Geographical Location*

Manzanillo is located in the Mexican state of Colima on the Pacific Coast. It is the second-largest city in the state, after the city of Colima. The city is 300 km (186 miles) from Guadalajara, Mexico's second-largest city and the closest major city to the port. Manzanillo is connected by highway to Guadalajara, and from there the rest of the country. The port is connected by rail to Guadalajara, Mexico City, Irapuato, Silao, Querétaro, Aguascalientes, Chihuahua, Torreón, Sinaloa, Monterrey, Altamira, and Ciudad Victoria. Cargo can also travel by rail from Manzanillo, through Mexico to the

U.S. via any of the five rail crossings (API Manzanillo, 2009.a). Table 2.1 shows the distances by road and rail from Manzanillo to major Mexican cities.

**Table 2.1: Distance from Manzanillo Port**

| Origin of Cargo | Distance by Rail | Distance by Highway |
|---|---|---|
| Aguascalientes | 522 mi (840 km) | 342 mi (550 km) |
| Guadalajara | 220 mi (353 km) | 186 mi (300 km) |
| D.F. | 590 mi (950 km) | 492 mi (791 km) |
| Monterrey | 858 mi (1,380 km) | 675 mi (1,086 km) |
| Querétaro | 445 mi (715 km) | 410 mi (660 km) |
| Nuevo Laredo | 1,022 mi (1,645 km) | 814 mi (1,310 km) |
| Mexicali | 1,400 mi (2,235 km) | 1,557 mi (2,506 km) |
| Nogales | 1,215 mi (1,955 km) | 1,316 mi (2,118 km) |
| Piedras Negras | 890 mi (1,431 km) | 342 mi (550 km) |
| Ojinaga | 982 mi (1,580 km) | 1,316 mi (2,119 km) |
| Ciudad Juarez | 1,149 mi (1,849 km) | 342 mi (550 km) |

Source: API Manzanillo, 2009.a

*Current Port Infrastructure*

The port of Manzanillo has an area of 437 hectares (1,080 acres). The port has 17 docking stations, 14 hectares of storage area (35 acres), 13.5km (8.4mi) of rail and 5.4km (3.4mi) of road. The port access channel is 500m (1,640 feet) long, and 16m (53 feet) deep. This is roughly the same depth found at the port of Houston, where the access channel depth is between 46 and 50 feet (Port of Call: Houston). The port is equipped with two turning basins: a “north” basin, serving docking positions 13, 14, and 15, with a depth of 16m (53 feet), and a “south” basin serving docking positions 4, 5, and 6 with a depth of 14m (46 feet). The northern turning basin can accommodate ships up to 300m (984 feet) in length and 32m (105 feet) wide, and the southern basin can handle ships up to 300m (984 feet) in length and 28m (92 feet) wide. Dredging announced in January 2009 and completed as of June 2009 provided a consistent width of 150m (492 feet) through the access channel, and increased the draft of the north turning basin by 8m (26 feet) to the current 16m (53 feet) (API Manzanillo, 2009.a).

The port handled 1,871 ships in 2008, down from 1,907 ships in 2007, but saw an increase of TEUs handled to 1,409,782 TEUs in 2008, up from 1,409,614 TEUs in 2007 (API Manzanillo, 2009.a). Of the 1871 ships that the port handled in 2008, 1,257 of those were container ships (SCT, 2008.b). Figure 2.2 shows the principal destinations from Manzanillo.


Source: Delegados Federales Estado de Colima, 8 June 2007

*Figure 2.2: Principal Destinations*

*Project Sponsor*

In 1993, La Administración Portuaria Integral de Manzanillo S.A. de C.V. (API Manzanillo, 2009.a), a publicly held entity that operates similarly to a publicly held corporation, was created to manage port activities at Manzanillo. In 1994, API Manzanillo was granted a 50-year concession to oversee port operations. This concession also granted API Manzanillo the ability to issue concessions for specific terminal operations to various private entities (API Manzanillo, 2009.a).

Currently, API Manzanillo has issued concessions for the operation of 14 terminals, including a terminal for grain, three general cargo terminals, an installation for handling gypsum, and one specialized container terminal (API Manzanillo, 2009.a). API Manzanillo will decide the concession for the Zona Norte second specialized container terminal as well as any construction contracts needed for the related expansion projects.

*Existing Container Terminal Management*

The port of Manzanillo is the largest container port in Mexico by volume, and handled 43.7% of the container movements in the country in 2008 (SCT, 2009.a). The port handled 15% of the country's cargo overall (SCT, 2008.b). In 2008 the port handled more than 20 million metric tons of cargo, up 7.3% from the year before, and the most of any Mexican port (SCT, 2008.b). Cargo flows have been growing steadily since the implementation of the Law of Ports reorganized the Mexican port system, and the Pacific ports have benefited greatly from expanded trade with Asia.

There are currently three terminals at Manzanillo that handle containerized cargo, one specialized container terminal and two general cargo terminals that also handle containers. The general cargo terminals with container operations are run by TIMSA, a subsidiary of Hutchison Port Holdings, which has the concession contract for the container terminal at the port of Lazaro Cardenas, and OCUPA, a privately held Mexican company.

SSA Mexico (SSA) has a 20-year concession to operate the specialized container terminal. SSA, in partnership with Transportacion Maritima Mexicana (TMM), won the bid in 1995, with TMM holding an 80% stake in the venture, and SSA a 20% stake (Lloyds List, 1995). In 2000, SSA and TMM expanded their partnership, creating a joint venture company to manage several ports throughout Mexico, including Manzanillo. Under the new partnership, SSA purchased shares in several ports operated by TMM, gaining a 49% stake in the resulting joint venture. The new partnership was part of a larger restructuring for TMM (PR Newswire, 2000.a). During the third quarter of 2000 the consortium finished the addition of a second birth at the Manzanillo terminal, and effectively doubled their cargo handling capacity with the addition of two cranes, for a total number of four (PR Newswire 2000.b).

In 2003, TMM was looking to sell off some of its port assets to refinance debt, including its 51% stake in the Manzanillo container terminal operations (Dow Jones, 2003). Grupo Carrix, which owns SSA, applied for a loan through the IFC for capital to purchase the 51% of remaining shares from TMM. The group was granted the loan and bought the remaining shares, consolidating its ownership over the companies operating the concession at Manzanillo (IFC, 2003).

At the time of researcher site visits in January 2009, SSA was operating six cranes at Manzanillo (four post-Panamax and two super post-Panamax), and controlled 25 hectares (62 acres) of patio space, 10 hectares (25 acres) of which was not yet in use and will be discussed in the next section. *Patio space* refers to the area granted to the company in the concession for the loading, unloading, storage, and maneuvering of cargo. Since January 2009, SSA has begun operation of three more Panamax cranes. For comparison, Houston's Barbours Cut Container Terminal handles roughly 1 million TEUs per year, slightly more than SSA's terminal at Manzanillo, and has a developed area of 250 acres, compared with 87 acres at Manzanillo, including the Jalipa patio (Port World, 2009).

### *Current Container Patio Difficulties*

Currently, the container platforms at Manzanillo are severely overcrowded. SSA, is therefore, having to stack containers seven high necessitating additional crane movements and reorganization to remove cargo from the patio (see Figure 2.3).

In 2007, Manzanillo underwent a reorganization of the area used for container handling. The reorganization was originally slated to begin in 2002 but legal difficulties with the expansion and disagreements among the container terminal managers kept it from proceeding as planned.


*Figure 2.3: Containers at Port of Manzanillo*

SSA and then-partner TMM faced initial difficulties in procuring the rights for the Jalipa patio expansion because API and SCT refused to cede the water frontage. The project initially gained approval in mid 2002, and SSA planned to invest US$60 million over the second half of 2003 to complete the expansion, but there were additional delays as the other terminal operators objected to the project (Business News Americas, 2003).

Several private groups sought legal means to stop the expansion (Lloyds List, 2004). HPH, OCUPA, and TIMSA (an HPH subsidiary) petitioned SCT, claiming that the cession of the water frontage to TMM was illegal without a bidding process, and that giving SSA so much docking space would destroy competition at the port. According to these operators, the expansion amounted more or less to a new container terminal, and should be conducted through an open bidding process. SCT claimed that the land was in place of property in the Laguna de Tapeixtles that was promised under the initial concession contract but could not be developed due to environmental issues. HPH maintained that SCT was under no obligation to provide the land for SSA (NOTIMEX, 2002.a). After the complaint by HPH and the other companies, SCT mandated that API Manzanillo do an internal investigation to determine if the expansion conformed to federal law (NOTIMEX, 2002.b). The Law of Ports prohibits the expansion of a concession beyond 20% of what was initially awarded without a new bidding process (Lloyds List, 2005.b), and the new patio would add roughly 50% capacity to SSA's operations at the port (Flores-Díaz, 2009).

Ultimately, API Manzanillo decided not to award the expansion directly and the contract was put up for bids. SSA participated in the process (Business News Americas, 2003).

In October 2007, after long negotiations with the SCT, an expansion agreement was signed that would grant additional space to all three terminal operators handling containers at the port (Lloyds List, 2008.d). Under the agreement, API Manzanillo orchestrated several land swaps among concessionaires TIMSA and OCUPA, resulting in each concessionaire having contiguous property. Before the reorganization, the operators had several parcels throughout the port, as is shown in Figure 2.4. In addition to the land swaps, additional space was granted for container handling (Figure 2.5). Timsa and Ocupa were granted an extra 8.3 ha each, and SSA Mexico, was granted the 10 hectares expansion for the Jalipa patio (Lloyds List, 2007.b).


Source: SCT, 2007

*Figure 2.4: Operator Parcels in Manzanillo*


Source: SCT, 2007

*Figure 2.5: Operator Parcels in Manzanillo*

Until they were granted the expansion of the Jalipa container patio, SSA was operating at 95% capacity, whereas an ideal level would be somewhere around 80% to allow for the most efficient use of crane movements. This situation has forced SSA to turn away business. SSA is having to coordinate with the shipping companies on what cargo they can accept, even though they would like to expand to be able to accommodate as much cargo as possible (Flores-Díaz, 2009). Another indication that the productivity of the terminal was being adversely affected by the capacity constraints is the fact that crane productivity per hour dropped from the low 40s to the low 30s between 2006 and early 2008. (Flores-Diaz, 2008)

The new patio was finished in late March of 2009 (El Financero, 2009). SSA purchased 3 additional Panamax cranes, in addition to two other super post-Panamax cranes that began operation in May of 2008 (API Manzanillo, 2008.a). While the reorganization and opening of the Jalipa Patio will alleviate some of the congestion in the short term, the added capacity is only expected to keep pace with growth through 2010 (SCT, 2009.a).

Since the reorganization, TIMSA has invested US$23 million to expand its facilities. The expansion, inaugurated in June 2008, will increase their capacity from 120,000 a 340,000 containers annually (Morales, 2008).

Another problem for Manzanillo is the amount of empty containers going through the port. Of the 1,409,782 TEUs of cargo handled in 2008, 317,420 TEUs were empty containers, a full 22.5% of the total (Informe Estadistico, 2008, 40). SSA does not receive the same fee for empty containers being returned, and would like to see more exports filling those containers (Flores-Díaz, 2009).

### *Additional Related Difficulties*

#### Customs

One of the main reasons for port congestion is the time it takes for containers to clear customs. The problem at the port is not the delay in ships being unloaded, but the time that it takes the container to leave the patio once it arrives. A more traditional Mexican government agency (unlike API, which operates more like a private company), the customs agency has been resistant to change. Customs at Manzanillo is characterized by a reluctance to adopt new technologies, such as scanners and other customs mechanization technologies, to expedite the process (Flores-Díaz, 2009).

Also, customs agents do not have a separate facility to inspect cargo, so they are required to inspect cargo on the patio, further exasperating space constraints. Examining the cargo in a container typically involves unpacking the container in the patio area, as Figure 2.6 demonstrates. SSA and other private companies are pushing for a customs logistics park, so that containers marked for inspection could be taken to another offsite location, thereby freeing up space on the patio (Flores-Díaz, 2009). Part of the reorganization of port areas discussed in the previous section was meant to alleviate some of the customs issues, but as of the researcher visit in January 2009 inspections were still occurring on the patio.

*Figure 2.6: Customs Inspection on Container Patio*

There is also pressure from SSA for customs to adopt a more businesslike approach to the port, including streamlining the customs process, making the container selection process more transparent, and adopting and sticking to a schedule for the release of containers from customs. This would allow SSA to give their customers more accurate predictions of time in port, and would also aid Ferromex in scheduling trains, as they would know exactly how many containers to expect to be released from customs, and could plan rail transport accordingly (Flores-Díaz, 2009, and Pujol de Alba, 2009).

General Cargo Terminal and Containers

Another current argument within the port of Manzanillo concerns the use of general cargo areas for the handling of containers. According to SSA, they were supposed to be the only operator able to process container cargo. However, TIMSA and OCUPA, the operators of the two general cargo terminals, are accepting containers, and currently process around half of the containers coming through the port. These two patios use mobile cranes designed for general cargo to handle containers, which is a less efficient strategy typically employed by small ports that do not have sufficient container volume to justify dedicated gantry cranes. While these other operators do not have the same capabilities as SSA as far as equipment is concerned, they are also not subject to the same fees. SSA has protested the use of general cargo areas for containers; to date API Manzanillo has encouraged this practice in the name of competition (Flores-Díaz, 2009). In fact, API Manzanillo views the general use terminals as useful to alleviate overcrowding at the container terminal until the Zona Norte terminal can be constructed (Business News America's, 2007.a).

Ferromex Crossings

The final serious impediment to the growth of the port is the current tracks that Ferromex operates. The tracks, which are single track, cross the main highway running through Manzanillo multiple times. No crossings have crossing arms, only stop signs, which are rarely obeyed, as Figures 2.7 and 2.8 show (taken by the researchers while on site). The tracks also run directly through the center of the city. This is one of the chief complaints about the port by the city of Manzanillo, and from researcher observations appears to be a serious safety concern.


*Figure 2.7: Rail Crossing Main Highway in Manzanillo*


*Figure 2.8: Rail Crossing Main Road in Downtown Manzanillo*

Ferromex's share of cargo coming into and out of the port has fallen steadily since 2005. Imports leaving the port for other destinations in Mexico by rail have fallen from 35.57% in 2005 to 27.70% in 2008, and exports arriving at the port by rail have fallen from 31.13% in 2005 to 19.45% in 2008. Ferromex attributes much of the decline in volume leaving the port by train to customs inefficiencies. The inability to schedule train service is attributed to not knowing what cargo will be released from customs on which days (Flores-Díaz, 2009, and Pujol de Alba, 2009). This decline is tied to the fact that the absolute volume of containers transiting the port has risen sharply and by maintaining the same number of trains per day, the comparative importance of the rail mode has fallen.

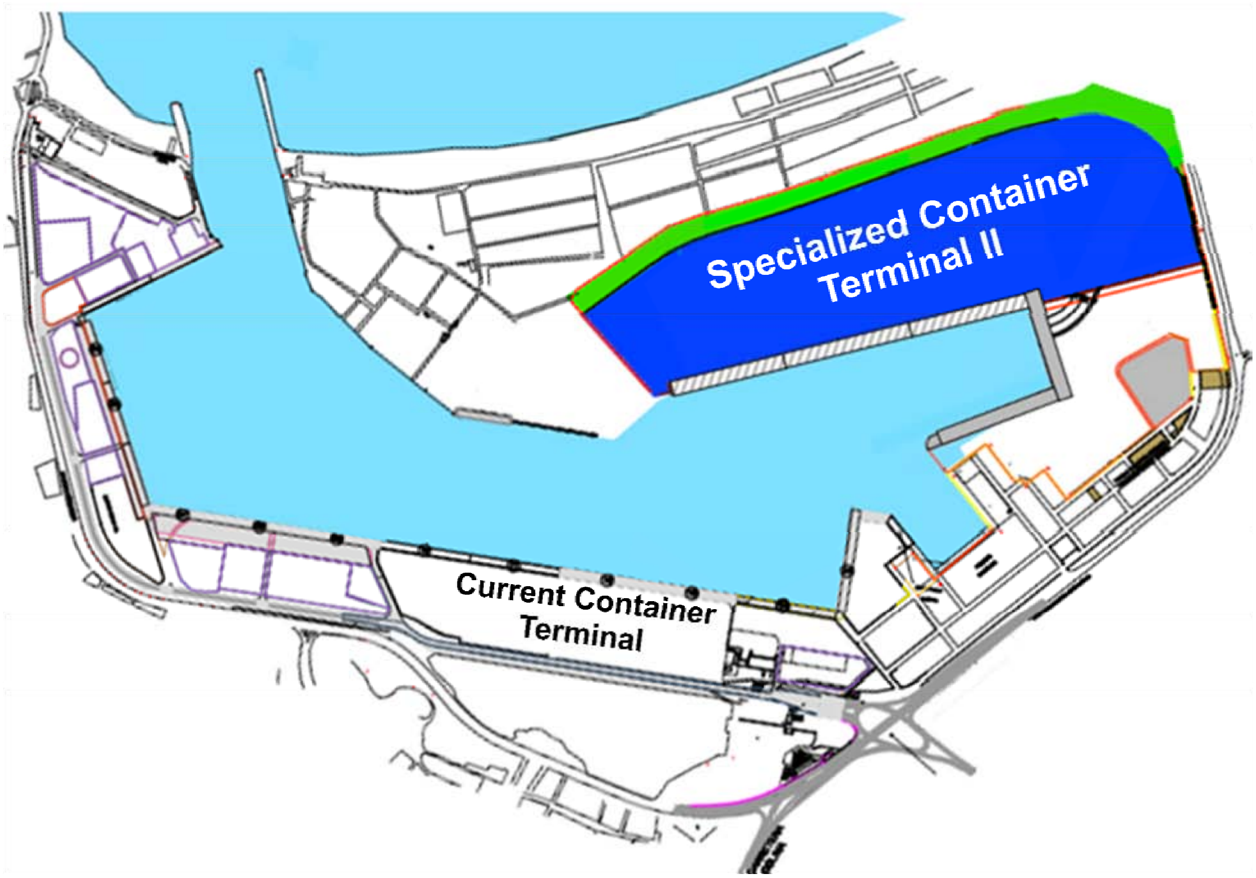
According to Ferromex, the company wants to cooperate with the city and with API to expand operations, but say that they will not move the tracks unless forced to (Pujol de Alba, 2009).

### 2.2.2 History

*Zona Norte Expansion Project Development*

To allow the port to grow, there are currently plans to open a new specialized container terminal and eventually another general cargo terminal. The so-called "Zona Norte" expansion will begin this year. The plan is being developed by API Manzanillo, but the concessionaire for the new terminal will ultimately be responsible for construction and operation of the patio. The tender for the new facility was launched on 14 January 2009 (Business News America's, 2009).

The new specialized container terminal will have three docking positions, 1,080 m (3543 feet) of waterfront, an area of 77.91 hectares (192 acres), and an estimated capacity of 2 million TEUs when completed. This terminal will be larger than the terminal currently operated by SSA, which is 35 hectares (87 acres) including the Jalipa patio. The new terminal will be developed in three phases (SCT, 2009.a). The area for the second specialized container terminal is shown in Figure 2.9.




Source: SCT, 2009.a

*Figure 2.9: Zona Norte Proposed Expansion in Three Phases*

*Zona Norte Related Additional Expansion Plans*

API Manzanillo is planning other projects in conjunction with the second container terminal and expects to invest MXP $5.502 billion in the Zona Norte area. Public expenditures will include miscellaneous port works projects, connectivity projects including bridges and highway, rail relocation, construction of a rail tunnel, and various municipal projects. Total expected investment in Zona Norte, private and public, is MXP$10.617 billion (SCT, 2009.a).

<u>Connectivity</u>

The increase in port traffic likely to result from the Zona Norte expansion has caused some concern in the city of Manzanillo regarding traffic. There are plans to connect the Zona Norte expansion to the highway and circumvent the city through the construction of a new bypass. The bypass would confine port truck and train traffic to an elevated roadway and railway that would separate port traffic from local traffic. Based on researcher observations, this is much needed already, as the principal highway in and out of the port is heavily congested, and is also the principal access to the Hotel Zone of Manzanillo. Figure 2.10 shows a computer generated graphic of the road project.

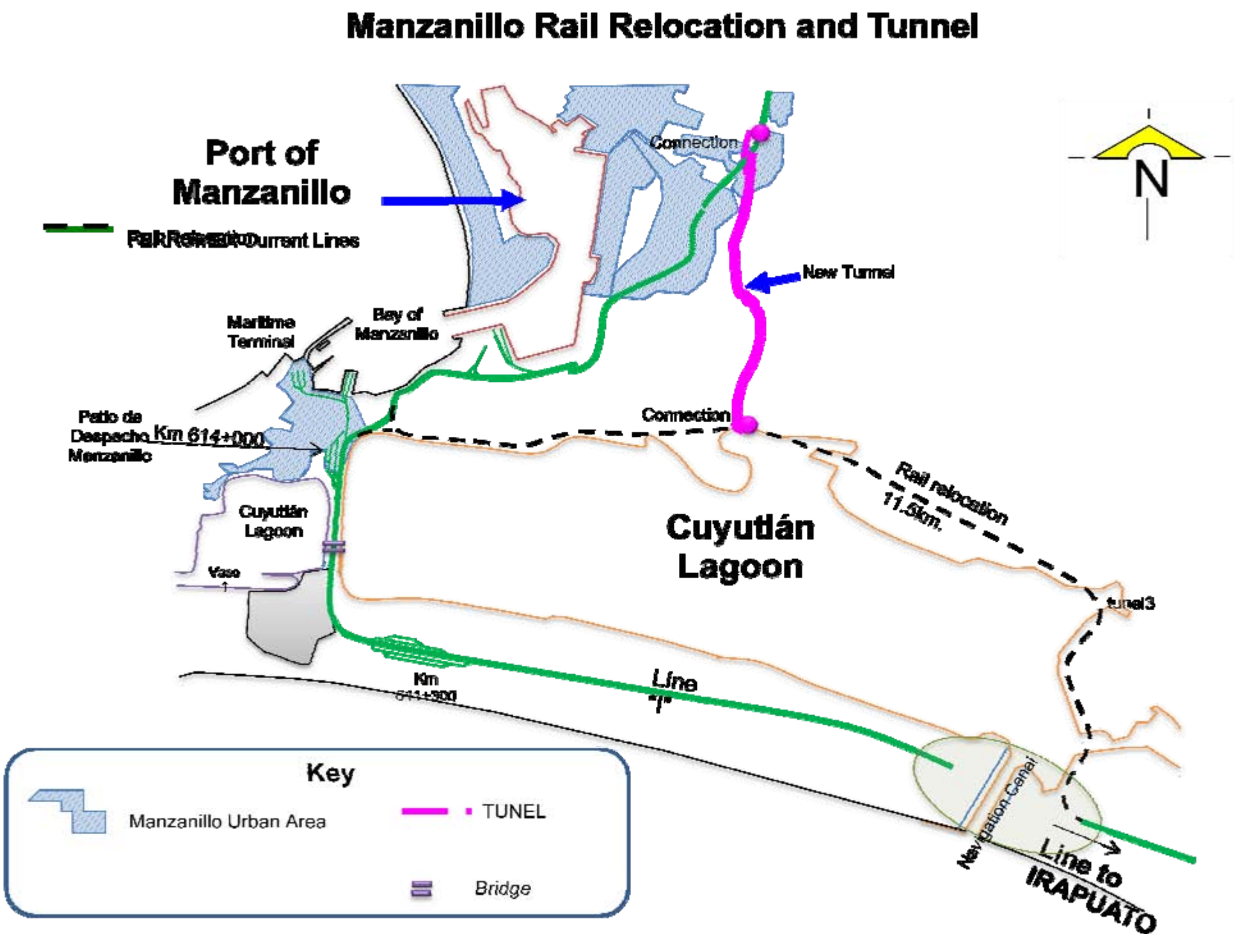

Source: SCT, 2009.a

*Figure 2.10: Planned Roadway Access to the Port*

<u>Rail Relocation</u>

There are two major rail projects planned along with the Zona Norte expansion. The first is the construction of a tunnel to avoid roadway crossings, eliminating the current dangerous situation. API Manzanillo plans to relocate the rail lines so that they do not run though downtown Manzanillo by constructing a tunnel through the mountains behind the city, connecting to existing rail lines by the Cuyutlán lagoon (SCT, 2009.a).

The second project is a planned relocation of several of the rail lines that serve the port away from the town that will connect to the new tunnel, allowing trains access to the port without passing through the urban areas of Manzanillo (SCT, 2009.a). Figure 2.11 shows these projects.




Source: SCT, 2009.a

*Figure 2.11: Manzanillo Rail Relocation*

Ferromex will pay for part of the cost of relocation, and API Manzanillo will fund the rest. Based on researcher conversations with Ferromex and API there seems to be a disconnect between API's enthusiasm for the project and Ferromex's. API views the rail relocation as necessary to growth, whereas Ferromex views the project somewhat grudgingly, reluctant to change current practice. Ferromex would prefer to install crossing arms or other less drastic measures, rather than relocating the rail line (Pujol de Alba, 2009).

Additionally, there are plans to build a short line rail to circumvent Guadalajara as well as plans for a short line to connect El Castillo, outside of Guadalajara, to Encarnación, just south of Aguascalientes, and thereby shorten time by rail to Aguascalientes and Zacatecas. There are also funds being allocated to modernize the rail between Manzanillo and Guadalajara. Like the rail relocation and tunnel construction at Manzanillo, part of these costs will be covered by Ferromex and part by API. All of these projects are aimed at increasing the competitiveness and capacity of the port, and decreasing the time it takes for cargo to reach its final destination (SCT, 2009.a).

Highway Expansion

The widening of the road between Guadalajara is included in the NIP and the expansion is expected to begin during 2009. The highway will be expanded so that it is at least four lanes for its entire length, and repaired to allow for easier passage of trucks. The sections immediately outside of Manzanillo are the most in need of repair based on the researcher visit, as there are many large potholes, slowing down traffic and increasing the travel time between Guadalajara and Manzanillo (API Manzanillo, 2009.a).

This expansion project is seen as necessary to handle the increased volume of containers entering and leaving the port once the Zona Norte expansion is complete. Even if the rail expansion proceeds as planned, and can take container traffic away from trucks, the Zona Norte expansion will double the current installed container capacity at the port, so both rail and road projects will be needed to handle the increased volume.

Cuyutlan

Once the Zona Norte expansion is complete, the port will have little additional room to grow due to land constraints. There are plans to eventually open a second phase of the port utilizing a lagoon to the south of the existing port location, and further removed from the city. API Manzanillo released the tender to dredge the Cuyutlan Lagoon in 2009 in preparation for the eventual opening of this second port area. The Cuyutlan Lagoon will have sufficient space to develop 40 docking positions, with an estimated 1754 hectares (4334 acres) of total space (SCT, 2007.) However, the first terminal at Cuyutlan is not expected to be on-line until after 2020.

*Zona Norte Expansion and the NIP*

The Zona Norte expansion is included in the NIP, but not in significant detail. Funding is allocated for the expansion of Manzanillo but it does not detail what projects the money should go toward. The rail project, including the tunnel, and the expansion of the road to Guadalajara are specifically mentioned. The Manzanillo-Guadalajara-Aguascalientes line updates are also specifically listed in the national plan. These updates will greatly facilitate the movement of cargo in and out of the port of Manzanillo, and will provide Manzanillo with more rapid access to the Mexican hinterland, Mexico City and ultimately the U.S. border.

The expansion projects at Manzanillo are very much in line with the strategies and goals for port expansion set out in the NIP, specifically to "*increase port infrastructure, especially container management capacity, (and) develop ports as part of an integrated multimodal transportation system in order to reduce the cost of logistics for companies*" (NIP, 2007). According to port authorities, though, they do not pay much attention to the NIP when developing expansion strategies for the port. SSA, as a private company, does what is in the best interest of the shareholders, and API Manzanillo, operating like a publicly held company, operates in much the same manner, seeking to expand its operations and be as profitable as possible.

### 2.2.3 Planning

*Forecasting*

API Manzanillo expects container traffic to continue to increase in the future. Projections by API Manzanillo have container volume reaching near the capacity of the Zona Norte expansion and the existing terminal by the end of 2020. As previously stated, the current installed capacity is only slated to keep pace with projected container volume growth until the end of 2010, including the capacity increase provided by the opening of the Jalipa patio.

SSA also looked at the Zona Norte expansion from a forecasting standpoint, but the information is proprietary. The fact that SSA would like to bid on the new terminal, if allowed, suggests that they also expect container volume to continue to grow sufficiently to make the expansion profitable.

*Environmental Review*

The Zona Norte expansion was originally slated to begin several years ago, but environmental difficulties have stalled the project. There is a stand of mangroves in the area of the Zona Norte expansion, and several environmental groups questioned API Manzanillo's compliance with the environmental requirements outlined by Mexico's Environment Agency (SEMARNAT) and their environmental impact study known as an (MIA).

In 2003, SEMARNAT released its review of the project, stating that no dredging activities or other activities that could affect the mangroves may be carried out within 100m (328 feet) of these ecosystems. SEMARNAT later revised its opinion, stating that API Manzanillo could in fact dredge, cut down, or otherwise damage the mangroves provided they paid a fine as compensation. After much legal wrangling, a price was set for compensation for the destruction of the mangroves. Two organizations, Greenpeace and Bios Iguana, contested this change to the original ruling, claiming it to be illegal, and further protesting that damage to the mangroves could not be compensated by a fine (Greenpeace, 2005.a).

The environmental organizations also claimed that the original environmental impact study done by API Manzanillo was severely flawed. According to them, the benefits of the mangroves, including protection of the coastline from hurricanes and other natural disasters, and their impact on fish populations commercially important to the area, were not taken into consideration when the environmental review was done, leading to a lower than actual compensation cost for the mangroves (Greenpeace, 2005.a). SEMARNAT then requested additional information from API Manzanillo regarding the study (Greenpeace, 2005). Ultimately, the project was given the green light with a 10m (38 feet) buffer of mangroves around the expansion, and the requirement that API Manzanillo set aside other lands as environmental preserves to offset damage caused by the expansion.

API Manzanillo has voluntarily increased the 10m buffer around the expansion to 60m (196 feet) as part of its efforts to improve its reputation with the city and citizens of Manzanillo, and has included the wider buffer in the expansion plans (SCT, 2009.a). The wider buffer is the area between the red and yellow lines in Figure 2.12. Also shown is the 15-square-meter (162 square feet) area of mangroves that will be set aside as preserve land, marked in green.


Source: SCT 2009.a

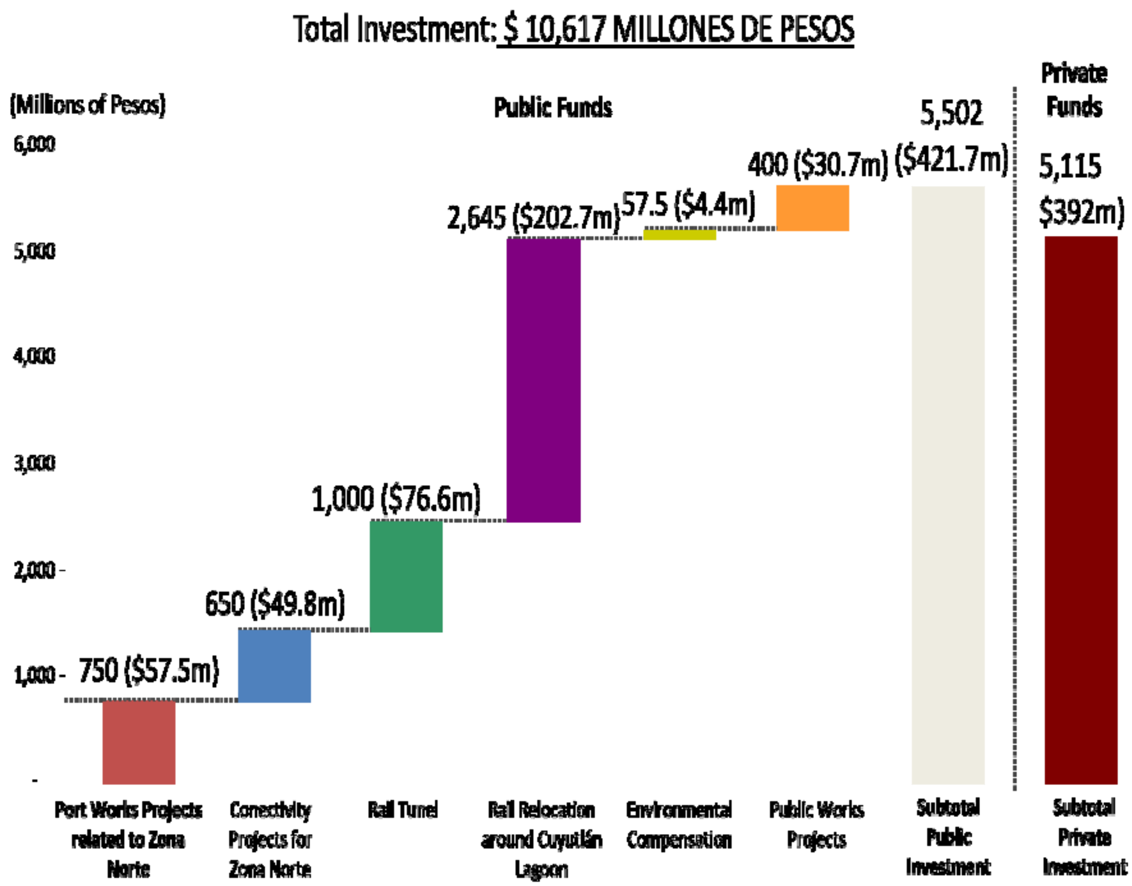
*Figure 2.12: Mangroves/Wetland Area in Laguna San Pedrito*

On February 6, 2009, Bios Iguana, A.C., and Esperanza Zalazar Zenil filed a submission with the Secretariat of the Commission for Environmental Cooperation, the international body responsible for ensuring compliance with the NAFTA. The submission asserts that Mexico is failing to effectively enforce its environmental laws with regard to the Cuyutlán Lagoon, which they say represents 90% of the wetlands in the state of Colima. The group argues that this puts Mexico in violation of its agreements under the North American Agreement on Environmental Cooperation, signed as a partner to the NAFTA (CEC, 2009). Regardless of the outcome of this submission, construction is likely to continue on the Zona Norte project, though this case could delay future terminals at the Laguna Cuyutlan.

*Financing*

The Zona Norte expansion will be financed using both public and private funds. The second specialized container terminal will be funded entirely by private capital. The company that wins the concession will be responsible for the construction and operation of the terminal. The company will also pay fees to API Manzanillo for the concession based on the terms of the concession contract.

Several of the other projects will be publicly funded or publicly and privately funded. The rail relocation project will be funded partially by API Manzanillo and partially by Ferromex. The road construction and the public works projects will be entirely publicly funded. Public funds used for the Zona Norte expansion will outweigh private funds slightly, as the following chart shows. The most significant portion of the public funds will go to the rail relocation and tunnel projects. See Figure 2.13 for a breakdown of total public and private investment in the Zona Norte expansion.




Source: SCT 2009.a

*Figure 2.13: Public and Private Investment for Zona Norte*

*Public Participation*

The port has also faced difficulties from the city of Manzanillo. The expansion of the port has been seen as a threat to the tourism industry. The main complaint was that the addition of the new terminal would be detrimental to the hotels in the Las Brisas area (the portion of the hotel zone that backs up to the land that will be used for the new container terminal) due to increased noise from the port. API has included in the Zona Norte expansion project the construction of a sound barrier between the port zone and the hotel zone, even though they maintain the noise created by the port will be below the maximum level allowed by law (SCT, 2009.a). While the city of Manzanillo certainly benefits from the jobs created by the port, Colima, the state in which Manzanillo is located, is one of the wealthier Mexican states. Also, tourism brings significant jobs to the city. Consequently, the city and state are not as dependent on the economic benefits of the port.

API Manzanillo has eight public works projects that were to begin in May 2009 aimed at alleviating some of the tension over the port and repairing the ports image to the citizens of Manzanillo. The projects include a new residual water treatment plant in the center of the port zone, construction of a new emergency center with equipment (that would also be used by the citizens of Manzanillo), construction of a new landfill that complies with official regulations to be constructed in accordance with the results of an environmental impact study currently underway, and a paving of the open air canal for rain water that drains into the Laguna de Las Garzas to avoid erosion. API also plans to relocate a nursing home currently located near the Manuel Bonilla Auditorium, and construct a new dock for fisherman outside of the port zone. API is planning to continue Lazaro Cardenas Avenue, improving it with asphalt, traffic islands, lights, and drainage. Finally, API is planning to repave the old road to Jalipa. Currently this is the only free road out of Manzanillo, as the other highway to Guadalajara is a toll road, and it is in great disrepair. The intent of these projects is to improve the quality of life for the population of Manzanillo, which they hope will turn public opinion in favor of the port (SCT, 2009.a).

### 2.2.4 Project Implementation

*Concession for Zona Norte*

API Manzanillo published the bid specifications for the new Zona Norte expansion in January 2009, and the bidding process will close in July 2009, with construction expected to begin by February 2010 (API Manzanillo, 2009.a).

Financing for the new terminal will come entirely from private investment, with the concession being overseen by API Manzanillo, in the same manner that the current terminals at Manzanillo are being run. API will provide funds for the related expansion projects discussed above but not directly for the terminal (de la Vega, 2009).

SSA would like to be able to bid for the Zona Norte expansion project, but they may not be able to because they already possess the concession for the other container terminal at the port. Part of the motivation of the Law of Ports was to increase competition, and it is API Manzanillo’s hope to drive growth at the port by having a second concessionaire operate the Zona Norte container terminal to compete with SSA competition (Flores-Díaz, 2009). According to API Manzanillo the decision is up to the Federal Competition Commission (Comisión Federal de Competencia) (de la Vega, 2009).

*Implementation of Zona Norte Related Projects*

So far, no construction has begun for the Zona Norte expansion. The rail relocation and public works projects are slated to begin in May 2009, but given Ferromex's lack of enthusiasm for the project, this seems unlikely.

During a visit from now former Secretary Tellez of SCT in January 2009, the expansion of the highway between Manzanillo and Guadalajara was formally launched but the construction had not yet begun. The public works projects were slated to begin in May of 2009.

### 2.2.5 Conclusions

The project examined in this case study is the construction of a second specialized container terminal at the port of Manzanillo, called the Zona Norte expansion, and the projects related to that expansion. The port of Manzanillo is located on Mexico's Pacific Coast and is the largest container port in Mexico by volume, handling roughly 45% of the container movements in the country. The port has one specialized container terminal and two general cargo terminals that handle containers.

The related projects include the construction of a bridge connecting the new terminal to the existing port, construction of a new road to separate port traffic from local traffic, widening of the highway between Manzanillo and Guadalajara, a rail tunnel and relocation project, and several public works projects.

The Zona Norte expansion is intended to relieve congestion at the port, increase competition among container handling terminals within the port, and increase Manzanillo's competitiveness nationally and internationally. The related projects are intended to support the new container terminal and other future Zona Norte terminals, as well as the existing port, improve access to the port, improve port facilities, and pacify local concerns about the port's expansion.

API Manzanillo has proposed a series of very aggressive expansion plans requiring significant investment, both by the federal government and the private stakeholders at the port. The expansion of Manzanillo is much needed to relieve current congestion at the port and to alleviate current connectivity problems. If the project succeeds, the rail relocation could serve as a model for other Mexican cities struggling with rail lines running through city centers without proper safety precautions. The public works projects could also serve as a model for other ports that are struggling with their public image.

However, there does not seem to be sufficient coordination between the different actors at the port to achieve such a bold expansion plan. This is particularly evident in the discrepancies between Ferromex's preferred plan to expand rail at the port, and what API Manzanillo is proposing. The tunnel and rail relocation project is a very significant investment, and a large undertaking. While Ferromex is adamant that they want to increase rail use at the port and that they are willing to invest funds sufficient to do so, there does not seem to be agreement on API Manzanillo's plan for the tunnel. The API plan for the tunnel and rail relocation is very ambitious, and at the moment Ferromex's share of cargo carried to and from the port is still falling. Given the current situation it seems to make more sense for API Manzanillo to promote investment in an incremental improvement, like crossing arms, which would require significantly less capital investment. Until other problems at the port, such as the customs issues, can be sorted out, Ferromex's percentage of the cargo carried from the port is likely to continue to fall, making investment on such a significant scale undesirable. Until customs is able to stick to a release schedule for containers, Ferromex will not be able to accurately schedule rail service. So, while the tunnel is an impressive project, it might turn out to be overly ambitious if the customs issues cannot be resolved.

In general it seems coordination is lacking at the port, which is especially interesting given the port's national prominence as the largest container port by volume. Unlike Lazaro Cardenas, where expansion projects seems to be driven equally by API and the private concessionaires, API Manzanillo seem to be controlling development of Manzanillo without much regard for other actors. While the government may chose to focus on Manzanillo, the heavy reliance on concessions and privatization in the Mexican port systems means that such lofty projects are unlikely to come to fruition without private sector support and input. API Manzanillo does not seem to be considering the nature of the private sector, which is to increase profits and minimize costs. Some of the expansion plans at Manzanillo, like the rail expansion, do not seem to make much sense for the private sector because of their large upfront costs and unknown returns.

Also, scarce space will continue to remain an issue at the port. The port is boxed in by the city of Manzanillo and the hotel zone. It lacks land to grow beyond the Zona Norte expansion. While the plan is to eventually begin opening terminals in the Cuyutlan Lagoon to the south of the current port area, expansion there will face similar environmental difficulties to what the port faces now. The first terminals in Cuyutlan are planned for post 2020, but already environmental organizations have taken action under NAFTA with regard to activities in the Cuyutlan lagoon. This does not bode well for future expansion projects in the new location, and there is no more space in the port's current location.

Since the enactment of the Law of Ports was enacted, API Manzanillo acts as an individual public entity whose best interest is to see the port expand. This creates a disconnect between what may be best for national infrastructure and what is best for API Manzanillo. Given the port's severe difficulties, it may be in the best interest of the national infrastructure to focus on the development of container terminals and related infrastructure at another port, such as Lazaro Cardenas. Lazaro Cardenas is removed from the city, has space to expand, and does not face the same environmental issues that Manzanillo faces. Since the privatization, though, this sense of national coordination is gone from the ports, as ports compete among themselves for container traffic.

## 2.3 Port of Lazaro Cardenas

Lazaro Cardenas, like the port of Manzanillo, is a Pacific Coast container port. Unlike Manzanillo, Lazaro Cardenas has fewer limitations on expansion. As this case study will discuss, Lazaro Cardenas has recently emerged as a major player in Mexico's container port profile and has promising potential for growth and impressive coordination among parties at the port.

### 2.3.1 Project Description

*Type and geographic location*

The port of Lazaro Cardenas is an ocean port located on the Pacific Coast of Mexico in the state of Michoacan, which is one of the poorer and less developed states in Mexico. Lazaro Cardenas is located where Río Balsas meets the Pacific Ocean. As of the 2005 census, the population of the city was 74,884 people. The municipality of Lázaro Cárdenas, which has an area of 1,160.24 km² (447.97 square miles), had a total population of 162,997 in 2005. The development of the town of Lazaro Cardenas has been closely linked to the port development (Peniche, 2009). The municipality includes extensive territory outside the city, including the communities of Las Guacamayas, La Orilla, and La Mira. Figure 2.14 shows the location of Lazaro Cardenas in relation to Michoacan and the rest of Mexico.


Source: Palos, 2007

*Figure 2.14: Lazaro Cardenas Location*

The port is set apart from the city of Lazaro Cardenas. Both the city and the port are located in an area that has not been substantially developed, and there is significant space between the city and the port. As a result, there is ample space for both the city and the port to expand and there is little risk of either the city or the port being overcrowded or encroaching on each other’s land. Figure 2.15 shows an aerial view of the city and the port. The area west of the city is open space and the city can expand to the west. Likewise, the area northeast and southwest of the port is available for expansion. The region is surrounded by undeveloped areas and there is little risk of overcrowding.


Source: Google Maps

*Figure 2.15: Lazaro Cardenas Layout*

Lazaro Cardenas is centrally located along the Mexican Pacific Coast and is 480 rail miles (773.3 km) from Mexico City, 437 miles (703.1 km) from Toluca, 449 miles (722 km) from San Luis Potosí, and 548 miles (881.6 km) from Guadalajara. Rail connectivity also exists to Monterrey (788 miles /1267.7 km) and Nuevo Laredo (944 miles/1519.7 km) (Port of Lazaro Cardenas Starting a New Era, 2008). Lazaro Cardenas boasts a zone of connectivity hinterland that reaches over 60 million residents (API Lazaro Cardenas, not dated). Figure 2.16 shows Lazaro Cardenas’s zone of influence into Mexico’s hinterland and the Mexico City mega-region.


Source: API Lazaro Cardenas Website

*Figure 2.16: Zone of Influence, Lazaro Cardenas*

*Port Functions*

Historically, the port of Lazaro Cardenas was an industrial port built to handle metals (iron ore and steel) and grains. The rail was built to connect the port to the rest of Mexico and the U.S. in order to transport iron ore, steel, and grains domestically, and export iron ore and steel to the United States. In the 1970s, iron ore production fell and less ore was being exported to the United States; at this time, the rail between Lazaro Cardenas and Laredo Texas became underutilized. Currently, iron ore and steel are still being exported by ship to China, but they are no longer exported to the United States (Peniche, 2009).

Lazaro Cardenas has had a container terminal operated by Lazaro Cardenas Terminal Portuaria de Contenedores. This original container dock could handle approximately 200,000 TEUs per year. This capacity, although minimal, was underutilized because the container dock was small and outdated and Manzanillo's container terminal was newer, larger, and more attractive because of better connectivity to the interior prior to the opening of the Siglo XXI toll road (API Lazaro Cardenas, 2006). In 2003, less than 45,000 TEUs moved through Lazaro Cardenas (Lloyds List, 2007).

*Overview of Terminals and Sponsors*

Lazaro Cardenas has traditionally served a variety of industrial and commercial purposes. Prior to Lazaro Cardenas' development plan, the following concessions existed at Lazaro Cárdenas:

- Metal and Mineral Terminal
  Sponsor: ArcelorMittal, private
  Area: 6 hectares (14 acres)
  Berths: 2
  Capacity: 125,000 tons
  Use: Private
- Fluid Terminal

Sponsor: PEMEX, public
Area: 8.6 hectares (21 acres)
Berths: 2
Capacity: 60,000 tons
Use: Private

- Fertilizer Terminal
  Sponsor: Fertinal, private
  Area: 149 hectares (368 acres)
  Berths: 2
  Capacity: 60,000 tons
  Use: Private
- Coal Terminal
  Sponsor: Carbonser, private
  Area: 125.6 hectares (210 acres)
  Berths: 1
  Capacity: 150,000 tons
  Use: Private
- Grain Terminal
  Sponsor: ALMER, private
  Area: 12.7 hectares (31 acres0
  Berths: 3
  Capacity: 80,000 tons
  Use: Public
- Multipurpose Terminal I and II
  Sponsors: Villacero and ArcelorMittal, private
  Area: 3.6 hectares and 2.6 hectares (8.8 and 6.4 acres)
  Berths: 1 and 1
  Capacity: 20,000 tons
  Use: Public
- Container Terminal(s)
  Area: Island of Enmedio: 15 hectares (37 acres)
  Island of Cayacal: 48 hectares (118 acres)

Source: API Lazaro Cardenas, 2008

The ports area covers 3,634 acres, and has 1,218 navigational acres, 14 berths, and 71 feet of waterfront. The port also has a strategic area for expansion (state-owned land) of approximately 1,690 acres.

### 2.3.2 History

*Administration*

In 1993, API Lazaro Cardenas was granted a concession for the administration and operation of Lazaro Cardenas. API does not hold absolute control over Lazaro Cardenas in that it must answer to SCT and is technically under SCT's control. Yet, API's independent concession for Lazaro Cardenas, which allows the organization to make a profit, results in Lazaro Cardenas being operated more as a private business rather than as a public infrastructure asset. Also, the port requires minimal dredging and can fund its own maintenance requirements, allowing the port to be less reliant on federal involvement.

According to Amaranta Estela Rodríquez Hernández, head of Customer Service at API Lazaro Cardenas, the API's take over of Lazaro Cardenas was a positive change for the port. Lazaro Cardenas ability to operate as a largely independent port entity in competition with other Mexican ports gave Lazaro Cardenas a whole new orientation and business plan. When all the Mexican ports were operated by the same overarching SCT port authority, management and decision making originated from SCT and there was no incentive to develop Lazaro Cardenas because Manzanillo already had a strong-hold on the container business. However, with the creation of independent APIs, now Lazaro Cardenas has incentive to compete with Manzanillo and take market share for containers. According to Rodriquez, API is *"able to use successful business techniques to draw business to Lazaro Cardenas"* (Rodriquez, 2009).

*Background of Lazaro Cardenas Expansion Plan*

Lazaro Cardenas was one of the projects included the NIP as an expansion project. Both President Calderon and the former President Vicente Fox have supported targeting Lazaro Cardenas as a port expansion with the potential to boost the Mexican economy (Lloyds List, 2006).

The port of Manzanillo historically has been the leading container terminal by volume in Mexico and has had a stronghold on Pacific container movement. However, Manzanillo has experienced significant challenges with limited space, coordination problems, and negative public opinion, as was discussed in the case study of the port. Lazaro Cardenas, on the other hand, has some natural advantages over Manzanillo that make it a good place to target for port expansion.

- The city is set apart from the port and there is ample room for port expansion without encroaching on the city of Lazaro Cardenas. This is the opposite of Manzanillo where the port is essentially in the center of the town, there is no room to expand, and the port creates a great deal of congestion in the town. The noise and traffic of the port are in opposition to the tourism industry many are trying to develop in Manzanillo. On the other hand, Lazaro Cardenas is essentially a port city and the citizens gain a great deal economically from the port expansion and are in favor of the port growth. (Peniche, 2009).
- Lazaro Cardenas is a logical place to develop a port because of its natural depth. It is naturally 59 feet deep at the main access canal, and 54 feet deep in the navigation canals. Therefore no dredging had to occur and the port has ability to accommodate Panamax, post-Panamax, and super post-Panamax ships (Puerto Lazaro Cardenas, No date).
- Rail infrastructure already exists and connects Lazaro Cardenas to various locations in Mexico as well as the United States. KCSM owns and operates most of the rail lines connecting to Lazaro Cárdenas and they have expressed desire to cooperate and coordinate with Lazaro Cardenas for port growth and expansion (Smith, 2008).

Nevertheless, prior to the expansion plan, Manzanillo had more capacity and newer facilities and Lazaro Cardenas could not compete with Manzanillo for external markets. Lazaro Cardenas had to build a new facility with greater capacity than its original container terminal and improved intermodal connections in order to compete (API Lazaro Cardenas, 2006).

*Development Details*

As already noted, the current port area covers 1,471 hectares (3,634 acres). The port also has expansion area available as well. For example, the area available for new business is approximately 2,155 hectares (5,325 acres), with capacity for 47 new berths. State-owned land currently held and available for expansion is 684 hectares (1,690 acres), and there is the possibility to obtain an additional 2,000 hectares (4,942 acres) of land.

Lazaro Cardenas' master plan for development and expansion was created in accordance with the NIP. The development plan was written by API Lazaro Cardenas, but had to be approved by SCT. The plans that API developed were consistent with the NIP and were therefore approved. However, API developed its plan in accordance with its own financial priorities, and did not feel bound by the NIP. Yet, because the NIP is aligned with Lazaro Cardenas' strategic goals, there was no conflict between it and Lazaro Cardenas' development plan (Rodriquez, 2009).

### 2.3.3 Planning

*Analysis of Maritime Transportation and Lazaro Cardenas' Role*

Lazaro Cardenas' expansion plan was based on analyzing global maritime trade trends worldwide and looking at how Lazaro Cardenas could become an international cargo hub. To create the best business model and development plan possible, they looked at the trends of the changing market in maritime transportation (API Lazaro Cardenas, 2006).

Asia, the United States, Canada, and Europe are the largest players in maritime transportation. Asia is an export-driven market, North America is an import-driven market, and Europe is a producer with more balanced market trending toward imports. Maritime transportation has become more efficient and better international communication and logistics have paved the way for increased container movement (API Lazaro Cardenas, 2006). Additionally, alliances have formed among container lines, and lines have been consolidated. Ships are larger and carriers are opting for fewer trips with more cargo on each trip. During the past twenty years, ship capacity has almost tripled. However, many ports cannot handle these new, larger ships (API Lazaro Cardenas, 2006).

At the time Lazaro Cardenas engaged in this modernization, ports north of Mexico were believed to have imminent capacity constraints and according to former Mexican president Vicente Fox, *"The diagnosis is clear. By 2010 the global revolution in international trade will saturate the ports of the U.S. and Panama Canal"* (Lloyds List, 2006). These projections now seem to have been premature.

A great deal of the growth potential for Mexico is in container shipment. In the past 18 years, container movement to ports on the Pacific Coast of Mexico has increased an average of 18% per year, for a total growth of over 170% (API Lazaro Cardenas, 2006). The creation of APIs corresponded with an explosion in container movement. This is because API operates in accordance with what is most profitable, and they realized that investing in container shipment was lucrative. Additionally, Mexico is able to offer an economic alternative for ships, and can charge lower labor rates than ports along the U.S. Pacific Coast (API Lazaro Cardenas, 2006).

Officials at Lazaro Cardenas believe they are in a position to become a powerhouse for container movement along the Pacific Coast. As of 2005, the mineral and coal terminals at the port handled 78% of the total cargo going through Lazaro Cardenas. Yet, Lazaro Cardenas made the strategic decision to go beyond grains, metals, minerals, coals, and petroleum and become competitive as a container and auto terminal as well. They believe this is possible due to the natural depth of the port and the availability of land to expand, allowing the port to be an attractive first port of call for Asian importers using post-Panamax vessels.

*Forecasting and Cost-Benefit Analysis*

Throughout the planning process for Lazaro Cardenas' expansion, various feasibility studies were performed in terms of cost-benefit analysis and looking at what type of projects they should invest in. Most of the studies are internal, using current traffic and internal data to predict future growth. Occasionally, the port has contracted out feasibility studies. In both cases, they are looking at what type of investment and what type of cargo will bring in the most revenue. Although they are a public port, API operates in many ways like a private company and Lazaro Cardenas is competing with Manzanillo and other ports for business. The feasibility studies contain confidential information regarding their business plan and what types of changes and investments will give them a competitive edge over Manzanillo (Rodriguez, 2009).

In July 2005, a Mexican consulting company, TyH Economia S.A de C.V, preformed a strategic evaluation of demand and prognosis for Lazaro Cardenas and provided Lazaro Cardenas with information and projections for their development plan This study was one of the most comprehensive feasibility studies Lazaro Cardenas conducted throughout the planning process for the port expansion. This study is confidential, but results are summarized in the master plan. The projections were based on an econometric model looking at the historical cargo trends for Lazaro Cardenas, levels of international trade, and economic performance within the region. The port's performance and plan was examined within the context of available rail capacity and historic rail involvement. A linear regression model was run with 26 observations between 1979 and 2004. The model was trying to predict traffic between 2005 and 2025 and was done based on three scenarios: base, lower than expected, and higher than expected (see Table 2.2). The base scenario predicted a 30 million ton increase by 2025 at a rate of 4-5% each year (Master Development Plan Port of Lazaro Cardenas, 2006–2011). The study predicted that the volume of containers at Lazaro Cardenas will increase 32% between 2004 and 2014. From 2004 to 2025, the growth rate will be an average 17.3% a year (API Lazaro Cardenas, 2006).

**Table 2.2: Prognosis for Different Cargo Types 2007-2025**

*(Thousands of Tons)*

| Type of Cargo | 2007 | 2010 | 2025 | TMCA |
|---|---|---|---|---|
| **General Cargo** | 2,215 | 2,283.1 | 2,966.9 | 1.3% |
| **Container Cargo** | 1,485.5 | 4,163.2 | 9,252.2 | 8.3% |
| **Agriculture Cargo** | 180 | 181.4 | 198.4 | 0.4% |
| **Mineral Cargo** | 13,826.9 | 14,794.7 | 22,280.5 | 2.1% |
| **Liquid Cargo** | 135.3 | 143.5 | 200.7 | 1.7% |
| **Petroleum and Natural Gas** | 539.2 | 972.9 | 3,340.5 | 8.3% |
| **Total** | **18,381.9** | **22,538.8** | **38,239.1** | **3.2%** |
| **TEUs** | 199,769 | 559,871 | 1,244,246 | 8.3% |
| **Vehicles (by unit)** | 64,501 | 99,201 | 206,233 | 5.2% |

Source: API Lazaro Cardenas, 2006

The feasibility study conducted by TyH S.A. de C.V. also looked at Lazaro Cardenas in relation to the port of Long Beach and Los Angeles to analyze Lazaro Cardenas' competitiveness. The study explains how Long Beach and Los Angeles are congested and expensive, due to high labor costs among other issues. In addition, neither was expected to be able to meet growing demand. Some 60% of the cargo that enters Long Beach and Los Angeles is headed towards the center of the United States. Since the beginning of Lazaro Cardenas' planning, a key goal has been promoting Lazaro Cardenas as an entry point for cargo whose destination is the center of the United States in addition to the growing domestic market. The feasibility study examined the reality of Lazaro Cardenas competing with Long Beach and Los Angeles for cargo movement to the center of the United States and found that the advantages of Lazaro Cardenas and the rail connections already in place could put Lazaro Cardenas in a position to begin container movement to the center of the United States (Rodriquez, 2009).

*Environmental Review*

Lazaro Cardenas performed an environmental review, which was contracted out through a bidding process. The environmental review had two requirements: part one was a review of air quality for auto patio A and B (Isla de en medio), auto patio C (Isla de en medio), container terminal, and auto patio (Isla del Cayacal); and part two was a study of environmental impact for everything included in the master plan for development. The most recent environmental review was completed in 2008 and found no environmental issues (API Lazaro Cardenas, 2006).

*Public Participation*

Lazaro Cardenas has a good relationship with the city and state governments. They have a public outreach division and try to be involved in the community. For example, they placed trash cans throughout the city to help clean up litter and have helped with other city projects. However, they do not make their decisions with much consideration of public opinion (Rodriquez, 2009). They operate based on what makes most business sense and do not take public opinion into account as they create their development plans. They believe that they are bettering the community of Lazaro Cardenas and the state of Michoacan by providing economic development, but they make their plans and decisions based on what will generate the most profit and what makes most sense for their business model and not based on public opinion, economic development, or other public participation factors (Rodriguez, 2009).

The port is one of the main employers and the city welcomes the port and encourages expansion. The city has grown significantly in the past few years, much of that due to the port's expansion.

*Lazaro Cardenas Development Plan*

Upon completing feasibility studies and analyzing what business model would be most competitive, Lazaro Cardenas published a master plan for development. This plan includes a three-phase construction of a new container terminal, an auto terminal, logistics patio, new customs patio apart from the port, and a bridge connecting the two islands (API Lazaro Cardenas, 2008). Figure 2.17 shows the layout of the development plan. The new container terminal is the area below the green TEC II; at the bottom left is (Fertinal) the mineral terminal expansion. The auto terminal (TEA) is purple, the future logistics patio (CALT) is red, the blue area in bottom left is the ship dismantling terminal, and the red area beside it is the mineral and grain terminal.


Source: API Lazaro Cardenas, 2008

*Figure 2.17: Port Ground*

Figure 2.18 is a photo of Lazaro Cardenas. On the left side, the cranes are from the new container terminal, and on the right side, the cranes are from the old container terminal.

*Figure 2.18: Port of Lazaro Cardenas*

*Container Terminal*

There is a three-phase expansion plan for the container terminal, plus an additional 20% expansion. When the expansion is complete, it will include 120 hectares (296 acres) of container terminals, 1425 m (4675 feet) of waterfront, and four berths. The final capacity will be 2 million TEUs annually, and the total investment will be MXP$3195 million. The new container terminal will be capable of handling the largest ships in operation including seventh generation, post-Panamax, and super post-Panamax (API Lazaro Cardenas, not dated). Table 2.3 shows the capacity the container expansion will bring to Lazaro Cardenas.

The first phase of the container terminal opened in November 2007. Hutchinson Port Holdings, a private Chinese company, was granted the concession in 2003 for phase one of the container terminal. The first phase is 48.33 hectares and has two berths (API Lazaro Cardenas 2008). HPH invested MXP$200 million in the terminal (Lloyds List, 2008.a).

**Table 2.3: Container Terminal Expansion Capacity**

| Concept | Phase I | Phase II | Phase III | Phase III + 20% |
|---|---|---|---|---|
| **Overall capacity** | 375,000 TEUS/year | 1,100,000 TEUS/year | 1,800,000 TEUs/year | 2,000,000 TEUs/year |
| **Concession Area** | 28.33 acres | 28.33 acres | 28.33 acres | 17 acres |
| **Waterfront** | 600 m | 330 m | 345 m | 210.31 m |
| **TEUs full** | 9,180 | 22,428 | 34,668 | 41,580 |
| **TEUs empty** | 9,065 | 11,365 | 24,640 | 31,000 |
| **Refrigerators** | 720 | 1,740 | 2,640 | 2,640 |
| **Train tracks in the transfer zone** | 2,628 m | 3,234 m | 5,682 m | 5,682 m |
| **Covered storage** | 9,265 $m^2$ | 10,320 $m^2$ | 18,530 $m^2$ | 18,530 $m^2$ |

Source: API Lazaro Cardenas, 2006

Growing trans-shipment volumes and growth in traffic to the U.S. is expected to drive the second phase of construction at the terminal, which is slated to begin in May 2011. Completion of the second phase will take annual capacity to 1.1 million TEUs. It is expected to come online in January 2013. A third phase would raise capacity to 1.8 million TEUs. Demand studies by HPH put development of the third phase in January 2018 with operations beginning in July 2019. Following the completion of the third phase, under Mexican law, the concession will be allowed to add an extra 20%, taking its total capacity to 2 million TEUs (Lloyds List, 2005.a).

*Mineral and Grain Terminal*

The current mineral and grain terminal can be expanded to include 22.4 additional acres and 650 additional waterfront m (2132 feet). There will be two new docking points. This project will be developed in two phases and the total investment will be MXP$394 million. In the end, the mineral and grain capacity will be 5 million tons annually (APILazaro Cardenas, not dated).

*Dismantling Ship Terminal*

This project will be a 20-acre expansion with 1,771 feet of waterfront. There will be one dock and two interior canals. This project will be developed in three phases and will require an investment to MXP$825 million (APIt Lazaro Cardenas not dated).

*Auto/Vehicle Terminal*

This project will include two docks and will be developed in two phases (Figure 2.19 shows the current patio). It will be capable of handling 700,000 vehicles annually and MXP$250 million will be invested (API Lazaro Cardonas, not dated). The auto terminal will be the largest in the country (SCT, 2008.a). Investing in the auto/vehicle terminal gives Lazaro Cardenas a competitive advantage in terms of diversifying cargo (Rodriquez, 2009).

*Figure 2.19: Car patio at Lazaro Cardenas*

*Puente Albatros (Albatros Bridge)*

The Albatros Bridge will connect the two islands, and will allow ease of transportation for trucks and divert traffic from the city of Lazaro Cardenas. The expansions are occurring at the Isla del Cayacal. Currently containers entering the new container terminal do not have any easy way out of the port or city and have to drive on roads that were not constructed for large trucks. This bridge will allow efficient and easy access for trucks into and out of the new terminals (Rodriquez, 2009).

The bridge was originally slated to be finished in December 2006. However, as of January 2009, the bridge was still under construction. At the end of 2007, API said one of their 2008 investment priorities was finishing the bridge and that the bridge would be done in May 2008. However, the bridge is costing US$500 million and has repeatedly been pushed back due to financial problems. This bridge is an example of a public investment that API Lazaro Cardenas is making in order to make the port more attractive for cargo movement and to potential terminal concessionaires. Manzanillo has challenges with train and truck transportation into and out of the port, and Lazaro Cardenas' investment in road and rail shows a desire to ease transportation into and out of Lazaro Cardenas to increase the port's competitiveness.

*Logistics Patio:*

Lazaro Cardenas is planning to invest in a logistics patio for trucks entering and leaving Lazaro Cardenas. The logistics patio will include paved and lit parking, access control boots, communication facilities, restrooms, restaurant, workshops, and more. The project will be 12.7 hectares (31 acres) and will be developed in three stages. It will be capable of holding 620 full trailers. This is a public investment and will cost about

MXP$31.2 billion (API Port Lazaro Cardenas, 2008). The logistics patio is again an example of how API Lazaro Cardenas is making investments in infrastructure to attract business.

### 2.3.4 Project Implementation

*Financing*

There is a mixture of public and private investment in the port. API Lazaro Cardenas operates in many ways like a private entity; however, they are public entity and receive some funding from SCT, though most of API's revenue comes from the private company terminal concessionaires. Aside from PEMEX, the government-owned oil company, all of the concessionaires are private. The company that wins the bid for the concession pays an upfront fee to API and then they must pay a monthly fee (rent) usually either based on revenue or volume.

API invests in the port and is responsible for the basic infrastructure of the port, though not the terminal infrastructure. In the past four years, over MXP$1000 million of API's money has been invested in port infrastructure (API Port Lazaro Cardenas, 2008). Lazaro Cardenas has been relatively successful in increasing its revenue and is able to invest money in expansion. API invests public money in:

- Rail
- Road
- Dredging
- Security
- Communications
- Technology
- Lighting
- Beach protection
- Processes and services

Table 2.4 shows API's investment in Lazaro Cardenas. Table 2.5 shows the private-sector investment in the port, including the container terminal expansion and auto patio, along with possible future investment in container terminal II.

**Table 2.4: API investment in Lazaro Cardenas**

| | |
|---|---|
| Train tracks to Cayacal II, PEMEX and the Isla del Cayacal | Parking space, bathrooms, eating areas and other services in a logistics patio for trucks |
| Parking lot for cars | Acquire new land |
| Sidings that will protect the edges of the beach and the edges of the navigation canals | Build Administrative offices for API, customs offices, and business center in the Isla de Cayacal |
| Lighting for Isla de Cayacal | Reconfigure energy lines to the Isla del Cayacal |
| Roads in Isla de Cayacal and road repairs in the port | Build an emergency control center |
| Protective fencing surrounding the port as well as watch towers | Revitalize three water treatment plants |
| Construct a new control center for marine traffic | Bridge Albatros over the right arm of the Rio Balsas |
| Dredging of canals | Prepare the zone for a sanitary backfill |
| Build a light tower | Build docks |

Source: API Lazaro Cardenas, 2006

**Table 2.5: Private investment in Lazaro Cardenas**

| | |
|---|---|
| Three phase container terminal expansion | Mineral terminal |
| Dismantling Ship terminal | Auto patio |
| Construction of liquid natural gas terminal | Container Terminal II (a future possibility) |

Source: API Lazaro Cardenas, 2006

*Concession Process*

Over the past five years, there have been six successful bidding processes with six concessions granted at Lazaro Cardenas (API Lazaro Cardenas, 2008). The bidding process usually lasts six months; during these six months, various bidders present a detailed proposal that includes their business plan, their plan for infrastructure development, how much they will invest, and what monthly rate they will pay API. API then makes a decision based on who has the best business plan and who presents API with the most competitive financial offer.

After being granted the concession, the concessionaire has 18 months to build the infrastructure for the terminal according to the concession contract. The concession is granted for a specific type of terminal. So, for example, Hutchinson's concession was for a container terminal; therefore, even if they decided that another type of terminal would be more lucrative, they are obligated to build a container terminal in accordance with the concession. The original concession is generally for a period of between 20 and 25 years, usually with an option to extend. The concession's substantial length is due to the fact that the concessionaire must invest a lot of money in building the terminal, and it takes time to recoup the initial investment.

Hutchinson Port Holdings (HPH) was granted the concession for container terminal 1. However, HPH was not the winning bidder API had declared. The concession was originally awarded to Lazaro Cardenas Terminal Portuaria de Contenedores (LCTPC), the operator of the original container terminal at Lazaro Cardenas. They were granted a concession to operate already existing facilities as well as develop the new terminal (Lloyds List, 2007). HPH, which ranked second in the bidding for the terminal, acquired a controlling stake in the company in July 2003 (Lloyds List, 2005.a). This is an important fact because it means that HPH did not necessarily have the development plans or business model that API thought was ideal. Instead, they used their financial power to win the initial concession for the Lazaro Cardenas expansion (Rodriguez, 2009). HPH's concession is a 30-year concession, and it can be renewed for another 20 years. Thus far HPH has invested US$244 million, and has built a 600 meter (2000 foot) dock, a 48 hectare (118 acre) yard area, and a 7000m$^2$ (75,348 square foot) container freight station (Business News Americas, 2008). Hutchinson began operations on November 23, 2007.

*Port Coordination*

One of the biggest advantages Lazaro Cardenas has is excellent coordination among various stakeholders. There is a planning group comprised of the major stakeholders at Lazaro Cardenas that meets monthly to look at big picture planning and coordination. Additionally, there is a logistics and operations subcommittee formed to coordinate the logistics and operations among the major stakeholders of the port; this group meets weekly. Both groups are comprised of representatives from API, the concessionaires that operate the different terminals, and the modes of transportation (train and trucks). These meetings allow for better coordination and execution at Lazaro Cardenas. This is essential to smooth operation and coordinated planning because so many factors go into daily operations at Lazaro Cárdenas. Through interviews with various stakeholders at Lazaro Cardenas, it was obvious that coordination and communication is prevalent at the port. This coordination is in stark contrast to Manzanillo, where there often seems to be miscommunication.

*Coordination with Rail*

A centerpiece to Lazaro Cardenas' plan and their ability to compete with Long Beach and Los Angeles is their rail connectivity to the United States and inland Mexico. Lazaro Cardenas plans to capitalize on the fact that Los Angeles and Long Beach are oversaturated and present itself as an alternative route for cargo to enter the U.S. Lazaro Cardenas has made improvements to the rail system connecting the port to the U.S. (Peralta and Quintero, 2006). KCSM is excited about Lazaro Cardenas' development and is very willing to cooperate and coordinate with the port. The major rail infrastructure is already in place connecting Lazaro Cárdenas to Chicago, Kansas City, Houston, and more. Figure 2.20 shows the rail connectivity from Lazaro Cardenas throughout Mexico and to the U.S. and Table 2.6 shows travel distances. The cooperation of KCSM gives Lazaro Cardenas reason to believe that they can become one of the largest ports on the West Coast. As shown in Figure 2.20, KCSM's tracks pass through San Luis Potosi and

Monterrey, both locations of inland ports that will be discussed in chapter three of this report.


Source: TPP, not dated

*Figure 2.20: Rail Connectivity from Lazaro Cardenas*

**Table 2.6: Transit Distances from Lazaro Cardenas**

| Intermodal Destination | Truck (kms/miles) | Train (kms/miles) | Transit Time (hours) |
|---|---|---|---|
| **Pantaco** | 602/374 | 773.3/480 | 36 |
| **Toluca** | 547.3/340 | 703.1/436 | 40 |
| **Querétaro** | 508.2/315 | 605.6/376 | 42 |
| **San Luis Potosí** | 635.2/394 | 722/448 | 68 |
| **Monterrey** | 1224/760 | 1267.7/787 | 72 |
| **Guadalajara** | 500.8/311 | 881.6/547 | 120 |
| **Altamira** | 1078/670 | 1238.9/770 | 72 |
| **Nuevo Laredo** | 1345.5/836 | 1519.7/945 | 82 |

Source: API Lazaro Cardenas, 2008

Currently, it takes 82 scheduled hours for a train to get from Lazaro Cardenas to the Texas border. According to Marcos Peniche, terminal superintendent at KCSM, the only future rail development that KCSM needs to invest in along their routes throughout Mexico and to the United States is the construction of additional sidings. Sidings will allow trains to pass each other and will prevent backups along the tracks (Peniche, 2009). Gorzalo Ortiz, the previous general manager of API Lazaro Cardenas, expressed concern that KCSM only has a single track over the most of the line to the Texas Border (Lloyds List 2007.a).

KCSM’s current terminal is at Lazaro Cárdenas far from the port and a lot of time is wasted traveling to and from the port (Peniche, 2009). Figure 2.21 shows a train in the current terminal.


*Figure 2.21: KCSM terminal at Lazaro Cardenas*

To meet Lazaro Cardenas port growth, KCSM has plans to build a new patio in Isla Palmas. Isla Palmas is state-owned land just north of the port. The land where the port is located is federally owned land. Using state-owned land for the rail patio is less expensive and it is easier to develop because the federally owned land has more regulations and more bureaucracy to deal with. Currently, there are two tracks at Isla Palmas, but there are plans to expand by an additional seven tracks. Another advantage of Isla Palmas is that it is centrally located between the coal, container, and auto terminals. This allows for easier assembly of cargo and more space for sorting the trains so that trains can leave faster.

KCSM works closely with the various concessionaires to develop the rail connections to the different terminals at the intermodal patios. The concessionaire is responsible for building the rail within their terminal, as they have the concession to develop that terminal, but KCSM also works with the concessionaires to develop the plans for the rail within the terminals. Rail development on the land within the port of Lazaro Cardenas is paid for by API and the rail development on the land at the various terminals is paid for by the concessionaire at that terminal. Rail development outside of the port is the responsibility of KCSM. Because several entities are involved in constructing and financing the rail, KCSM must work closely with API and the concessionaires to plan and guide how and where the rail lines are constructed so that operations remain smooth and coordinated (Peniche, 2009).

At the new container terminal operated by HPH, KCSM first met with HPH to provide advice and guidance regarding how the rail should be built. According to Marcos Peniche, the management of HPH does not have experience with rail. This caused problems because HPH had different ideas than KCSM regarding how the rail should be built in order to use space and move cargo most efficiently. In the end, HPH built the rail how they wanted to because they were the ones investing in the infrastructure. KCSM does not like how Hutchinson built the rail, because it makes the loading and unloading more difficult, and causes KSCM's employees to have to walk the length of the train as they are loading and unloading (Peniche, 2009).

KCSM started a daily service on its NAFTA rail line from the Pacific Coast of Lazaro Cardenas to Laredo, Texas, on June 19, 2006 (Lloyds List, 2006). Currently, three trains a day leave Lazaro Cardenas; one of those trains is a container train, and the other two are for minerals, metals, and general cargo. Some 60% of their trains go to Mexico City, 20% go to Monterrey, and the other 20% go elsewhere in Mexico. Only 2% of their cargo goes to the United States (Peniche, 2009). Despite KCSMs and Lazaro Cardenas' plan that Lazaro Cardenas can become an entry point for U.S. cargo, there has been very little demand for cargo to enter the U.S. via Lazaro Cardenas. In 2005, both Walmart and Home Depot were looking at the possibility of using Lazaro Cardenas instead of congested U.S. West Coast ports, but so far neither company has invested seriously in moving significant amounts of cargo through Mexico (Lloyds List, 2005.c). One issue is speed; when the rail is operating at top efficiency it takes 72 hours for cargo to enter the U.S. and U.S. authorities require that cargo transits the country in a specific time frame to avoid security concerns (Lloyds List, 2007.a). Customs issues are also a serious barrier to transfer of cargo through Mexico to the U.S. According to David Michou, head of SSA's Latin American operations, moving serious volumes of cargo through Mexico to alleviate congestion at the ports of LA and Long Beach was still 10 years away (Lloyds List, 2004).

*Analysis of Development Plan*

*Overview of Current Operations*

Looking at port volume movement at Lazaro Cardenas between 2000 and 2008, overall cargo movement by Lazaro Cardenas remained relatively stable from 2000 to 2007 with a slight increase in 2008. There was a dip in both imports and exports in 2007. One reason for this was due to a significant drop in coal trade between September and December of 2007. There was also a big drop in steel trade (Gutiérrez Santiago, 2008). Exports also fell below expectations in 2007 due to a decrease in metals and General Motors experiencing a downturn (Gutiérrez Santiago, 2008). Between 2007 and 2008, every type of cargo (general cargo, loose freight, mineral, agriculture, fluid, and other fluid) all went down—in fact grain mineral decreased by 47%.

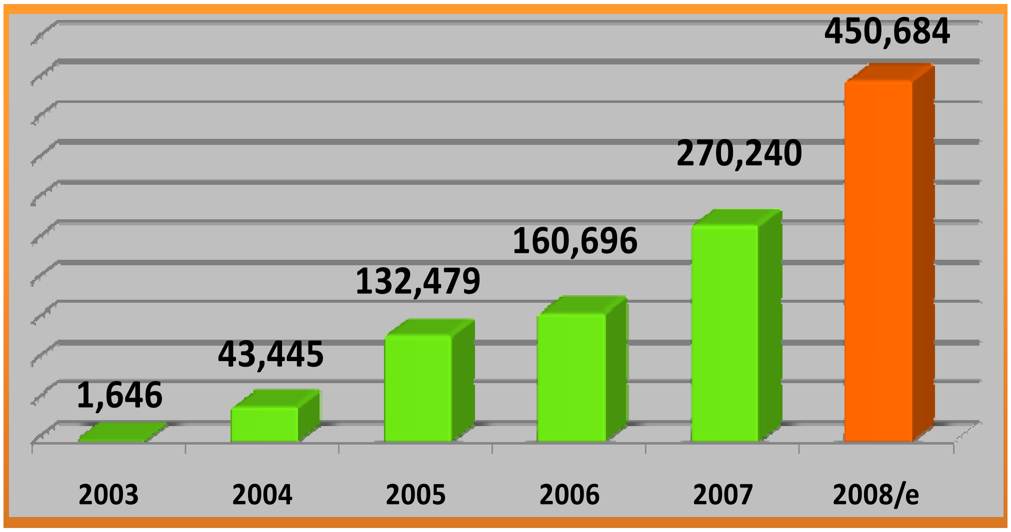
However, container volume at the port increased by 130%, leading to an overall increase for the port. Container movement and vehicle movement experienced huge increases in 2007 and 2008. These are the two areas that Lazaro Cardenas is targeting in the expansion plan, and so far seem to be good investments for the port. Table 2.7 and Figure 2.2 show container movement since 2000.

**Table 2.7: Container Movement**

(all numbers in TEUs)

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| Total TEUS | 752 | 0 | 134 | 1,646 | 43,445 | 132,479 | 160,696 | 270,240 | 524,791 |
| Imports | 198 | - | 134 | 1548 | 18,094 | 62,287 | 76,066 | 128,616 | 263,142 |
| Exports | 554 | - | - | 98 | 25,351 | 70,192 | 84,630 | 141,624 | 261,649 |

Source: API Lazaro Cardenas, 2009




Source: API Lazaro Cardenas, 2008

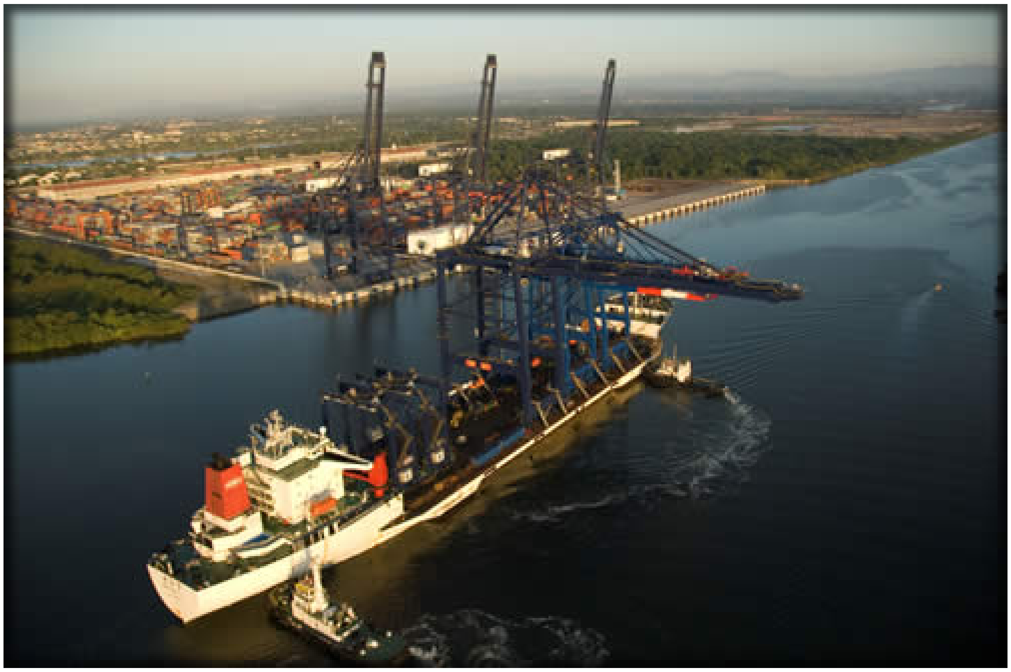
*Figure 2.22: Container Movement (all numbers in TEUs)*

HPH opened in 2007, and 2008 was its first full year of operations. HPH's container terminal experienced substantial growth beyond expectations during this time period. There was a 68% increase in container movement in 2007 and a 94% increase in container movement in 2008. Maersk Sealand, APL, Hapag-lloyd, CP Ship's, Cosco, Evergreen, Compania Sudamericana de Vapores, Hamburg Sud, and ccni regularly do business with Lazaro Cardenas.

HPH, API, and KCSM all view the first two years of operations at the container terminal as a success and stated that cargo movement exceeded expectations. According to HPH's executive director in Mexico, Jorge Lecona,

> "We started a project with nearly zero containers and with an installation that was not perfect, and we have built another one that is in accordance with the needs of the lines….today the whole world is talking about this but four years ago nobody wanted anything to do with Lazaro Cardenas" (Lloyds List, 2007.a).

However, the volume of containers is growing faster than current operations at HPH can handle (Peniche, 2009). They began with three super post-Panamax gantry cranes and they had to order six new cranes (Lloyds List, 2007.a). Figure 2.23 shows the arrival of a new crane to Hutchinson's terminal; Figure 2.24 shows cranes in place. Additionally, at the end of 2008, three new shipping lines began business with HPH which, according to Marcos Peniche, put them over capacity. According to an article in Lloyds List, "*Once the ugly duckling of Mexico's container ports, Lazaro Cardenas has been transformed into an attractive alternative to Manzanillo by Hutchison Port Holdings (HPH), the world's largest container terminal operator*" (Lloyds List, 2007.a).



Source: Port of Lazaro Cardenas

*Figure 2.23: Delivering a Super Post Panamax Crane at Lazaro Cardenas*

*Figure 2.24: Cranes at Lazaro Cardenas*

Container cargo is not Lazaro Cardenas' only plan for expansion and development. Their auto terminal is also a large part of the development plan. In 2007, 114,276 vehicles were imported and exported from the port; this is 20% more than what was predicted and 29% more than in 2006 (Gutiérrez Santiago, 2008). Vehicle imports and exports have expanded exponentially in the past four years. Even so, vehicle movement in 2008 was not as high as was predicted due to the slumping world economy, and the struggling auto industry, especially in the U.S. Many of the vehicles and parts coming in to and out of the port were either made by or destined for American auto companies, so the slump in the American auto industry had a significant impact on the port. Table 2.8 shows vehicle movement at Lazaro Cardenas since 2000.

**Table 2.8: Vehicle Movement**

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| Total Vehicles | 0 | 0 | 0 | 4,500 | 0 | 24,923 | 88,669 | 114,276 | 112,457 |
| Imports | | | | 4,500 | | 17,187 | 62,552 | 110,279 | 111,942 |
| Exports | | | | | | 7,736 | 26,117 | 3,997 | 515 |

Source: API Lazaro Cardenas, 2009

*Future Growth*

Because HPH is operating at capacity and container movement still appears to be growing, there is talk of opening the bidding process on the second container terminal. HPH expected that they would win the concession for the second phase of the container expansion and already have plans for the expansion (Lloyds List, 2007.a). However, API does not want HPH to be allowed to bid on the second container terminal. They want to encourage competition and do not want Hutchinson to have a monopoly, in a similar fashion as to how Manzanillo is trying to discourage SSA from bidding on a second terminal (Rodriguez, 2009). Many industry insiders are also pressing API to create more internal competition at the port (Lloyds List, 2008.e). Yet, HPH is doing everything in their power to delay or stop the bidding process for the second container terminal in order to maintain their monopoly (Peniche, 2009). They want to be allowed to bid on the second container terminal and do not think that it is fair that they invested so much and brought in so much business and now will have competition from another concessionaire operating a specialized container terminal (Peniche, 2009).

Back in September of 2007, when HPH's container terminal was barely operational, Maersk Line expressed interest in bidding on a future concession at Lazaro Cardenas; they want their container line, APM Terminals, to develop its own container facility at Lazaro Cárdenas (Lloyds List, 2007.a). By the end of 2008, there were several companies interested in bidding on the second container terminal. According to API, the bidding process for the second phase of the container terminal was slated to begin in March or April of 2009 but as June 2009 the bid has not been released.

### 2.3.5 Conclusions

The creation of APIs in 1993 led to ports being operated more as independent private entities and Lazaro Cardenas saw that it has several advantages for development of a container terminal. Lazaro Cardenas' port is set apart from the city and there is ample room for port expansion; the port is naturally deep and no dredging is needed to maintain the depth of the docking positions or the access channels, and finally there is already rail and road connectivity in place to most major Mexican cities as well as rail connectivity to the United States. Furthermore, the city supports the port and encourages expansion. Lazaro Cardenas was one of the projects targeted in the NIP and API of Lazaro Cardenas has focused on developing Lazaro Cardenas into a competitive marine port.

Feasibility studies including cost-benefit analysis, forecasting studies for traffic and revenue, and environmental impact studies were all conducted. Because Lazaro Cardenas is operating as a private entity in competition with other ports and these studies help form their business plan, the studies are not made public. The forecasting studies analyzed port activity and maritime transportation at Lazaro Cardenas and worldwide to determine which investments were most lucrative.

As a result of these studies, Lazaro Cardenas decided to invest in the construction of a new container terminal in three phases that, when complete, will include 120 hectares, 1425 m (4675 feet) of waterfront, and 4 berths. The new container terminal will be capable of handling two million TEUs annually. They will also expand the current mineral and grain terminal and invest in a dismantling ship terminal. In addition, they are investing in an auto and vehicle terminal that will be capable of handling 700,000 vehicles annually. API Lazaro Cardenas realized that they must also create the port infrastructure and support that will give the port a competitive edge over Manzanillo and other competing Pacific Coast ports. They are investing in a MXP$500 million bridge connecting two islands of the port in order to provide trucks easy access to the port and prevent congestion in the city of Lazaro Cardenas. They also are investing MXP$31.2 billion in a logistics patio that will include paved and lit parking, access control booths, communication facilities, restrooms, restaurants and more to further ease the process of getting cargo into and out of the port by truck

The port infrastructure is planned through API public investment. All roads, rail, dredging, safety, terminal coordination, and general port support falls under the responsibility of API Lazaro Cardenas. Concessions are granted for the individual terminals and the concessionaire then invests in and develops the infrastructure within that terminal.

Lazaro Cardenas operates through a series of PPPs between API Manzanillo and the concessionaires of the various terminals. Although API is an entity of SCT, they operate much like a private enterprise. API operates under the general authority of SCT; however, they are fairly autonomous and for the most part make their decisions independently. SCT maintains communication and coordination with API Lazaro Cardenas to provide some general oversight. API is then responsible for general port coordination and planning. API provides oversight over the various terminals which are run by concessionaires.

API chooses to grant the concession based on who has the best plan and who offers the most money. One interesting fact is that Hutchinson Port Holdings, who was granted the concession for the first phase of the new container terminal, did not win the bid for the new terminal. LCTPC, the concessionaire for the original container terminal, was granted the concession for the expansion and HPH bought out their concession. This means that perhaps HPH did not have the best business plan but instead was able to buy out the winning bidder.

Public participation does not seem to factor into Lazaro Cardenas' planning. The city is supportive of Lazaro Cardenas and they are naturally located in a place where expansion is relatively easy. Because the port does not encroach on the town there is little friction there. This prevents Lazaro Cardenas from having to deal with public backlash. Lazaro Cardenas performs some public outreach projects and community projects. However, when Lazaro Cardenas makes their plans, they do not really take public opinion into consideration. Instead, they develop and plan based on what makes the most business-sense.

One of the biggest advantages Lazaro Cardenas has is coordination between various stakeholders. The various stakeholders meet for monthly planning meetings and weekly operations meetings. These meetings allow for better coordination among the stakeholders at the port, which was evident during researcher interviews.

Amaranta Rodriguez feels that Lazaro Cardenas has a competitive edge because of the diversity and variety offered at the port. They are not simply a container port; they have also invested in infrastructure for industrial cargo, grains, metals, and petroleum. Furthermore, their development plan is not only for new container terminals; they are also investing in the auto terminal and developing the grain terminal. This diversity means that they will not rely on one source of revenue.

Lazaro Cardenas' connectivity and coordination with the rail is a large benefit. The necessary rail infrastructure is already in place and there is a great deal of communication and coordination between KCSM and API Lazaro Cardenas. This gives Lazaro Cardenas a competitive edge over Manzanillo, where there is little evidence of cooperation between Ferromex and API Manzanillo and rail activity at the port is declining steadily. Lazaro Cardenas advertises that one of its greatest advantages is its rail connectivity to the United States and discusses in its strategic plan how they will bring cargo to the United States. In the past year, however, Lazaro Cardenas has sent only two trains to the United States and there does not appear to be significant demand for this service at the present time. Few outside of Lazaro Cardenas think it is realistic that there will ever be demand for trains to bring cargo from Lazaro Cardenas to the U.S. There are too many problems with corruption, extra time on the ship and in transit, and the border crossing. This is interesting given the fact that a major selling point and focus of Lazaro Cardenas' development plan and their importance in the National Plan has been Lazaro Cardenas' potential to compete with Los Angeles and Long Beach. However, according to Gene Smith, general manager of SSA, *"until there is sufficient congestion on the U.S. west coast I do not think the lines are interested in sailing a vessel 3 days south"* (Lloyds List, 2006).

There is evidence that Lazaro Cardenas could become a major Mexican port. Lazaro Cardenas operates well because they coordinate well. They meet together monthly for a planning meeting, and weekly for an operations meeting. Furthermore, a huge selling point for Lazaro Cardenas is that they have relatively easy customs procedures (Lloyds List, 2006). They are set up to be a competitive port in the future due to their room to expand, natural depth, and positive relationship with the town.

HPH's container terminal is evidence of Lazaro Cardenas' success. The first two years of HPH's operations have experienced incredible growth. Maersk shipping line dropped long-time client Manzanillo for Lazaro Cardenas because they saw better operations and more potential at Lazaro Cardenas (Rainbow, 2004). Other shipping lines have also taken notice of Lazaro Cardenas' success. According Hapag-Lloyd's managing director for the Latin American region, "Recent development at the port which has involved innovative international agreements, infrastructure improvements, and new technology has opened the gateway for U.S. traffic" (Lloyds List, 2006). There has been significant growth in container movement at Lazaro Cardenas over the past two years, and the expectation is for future growth for multiple cargo types.

## 2.4 Port of Altamira

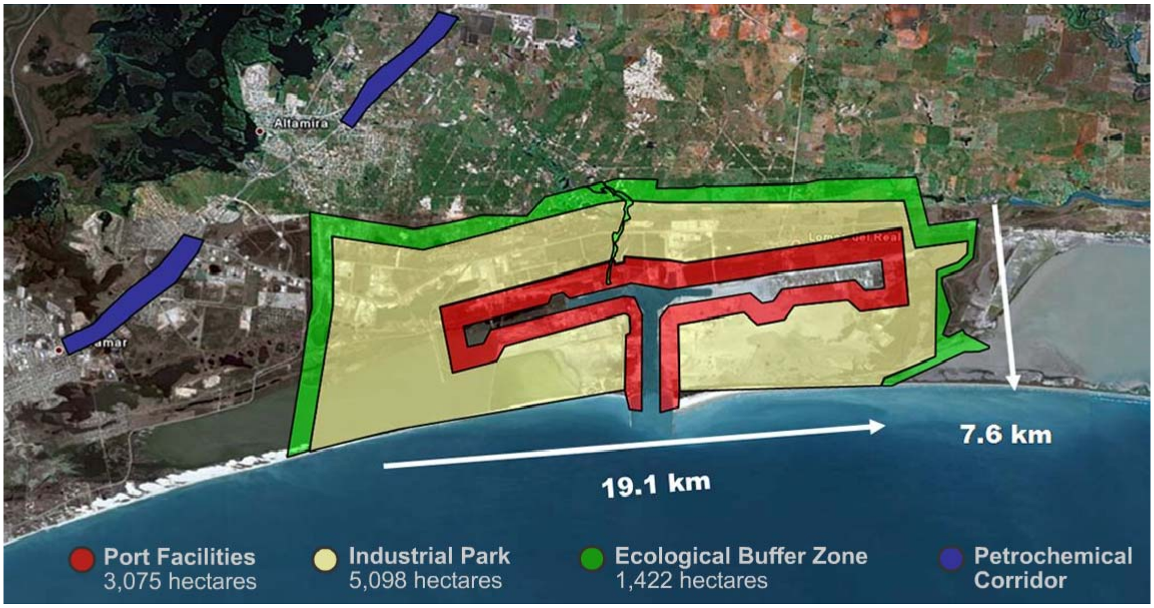
The port of Altamira is located on the Mexican gulf coast. Several bulk and liner services call at both Altamira and a Texas port in the same rotation of ports (known as a string). Altamira's proximity to Texas and Texas ports puts it in direct competition with the Texas ports (Breakbulk, May 2008). Altamira, like both Manzanillo and Lazaro Cardenas, is run by an API, and has similar concession structures. Altamira began operations on June 1, 1985, and was developed as a bulk port to handle expansions that could not be accommodated by Tampico. The port has since expanded to handle diverse cargos. The specific projects focused on in this case study are two projects included in the NIP: the construction of a terminal for manufacturing marine platforms, and the construction of a plant for the manufacture of carbon black. The other significant project that is not included in the NIP is the construction of a galvanized steel plant.

### 2.4.1 Project Description

The port of Altamira is located on the Gulf of Mexico in the northern state of Tamaulipas, and is bordered by the Mexican state of Nuevo Leon to the north and San Luis Potosi and Veracruz to the southwest and south, respectively. The port is located approximately 250 nautical miles from the port of Brownsville and 500 nautical miles from the port of Houston, which means that faster ships can transit between Houston and Altamira within one-day sailing time (Badillo, 2008). Figure 2.25 shows the overall port layout and Figure 2.26 shows the current layout of operations.

Altamira was one of the initial ports to be privatized in 1994 after the Law of Ports went into effect. The port's proximity to the United States allows the port to take part in logistics chains connecting the two countries, and was one of the reasons behind the port's development (API Altamira, 2008). Altamira's location and connectivity network of two-and four-lane highways, allow the port to serve as a hub for domestically distributed goods. Some 65% of the port's goods are distributed to the northern Mexico region, and around 31% are distributed within central and southern Mexico (API Altamira Website, 2008).

The port itself includes a total of approximately 10,000 hectares (24,710 acres), with 5,098 hectares (12,600 acres) reserved for industrial development, 3,075 hectares (7,600 acres) reserved for port facilities/logistics activities, and 1,422 hectares (3,515 acres) reserved for the ecological buffer zones (API Altamira Website).




Source: Port of Altamira Industrial Development

*Figure 2.25: Harbor Enclosure/Industrial Park/Petrochemical Corridor*

The port of Altamira's nine operating terminals include:

- 2 multi-use terminals controlled by ATP (Altamira Terminal Portuaria) and Infraestructura Portuaria Mexican (IPM )
- 5 petrochemical liquid-bulk handling terminals under the direction of BASF, Vopack, Tepeal, Industrias Negromex, and MexPlus/Operadora de Terminales Maritimas (OTM)
- 1 agricultural and mineral bulk terminal controlled by Terminal Maritima Altamira (TMA)
- 1 mineral and break-bulk terminal controlled by Cooper T. Smith of Mexico.
- 1 liquid natural gas terminal controlled by Terminal de LNG de Altamira (TLA),
- 1 facility controlled by Terminal J. Ray McDermott de Mexico, a company that designs and constructs offshore drilling platforms

Additionally, there are seven logistics service companies located at Altamira:

- 1 container maintenance provider controlled by Care Container
- 3 companies that handle minerals including Possehl, Oxbow, and Centrailia.
- 1 auto terminal run by Amports de Mexico
- 1 multimodal terminal controlled by Altamira Terminal Multimodal

- 1 company offering mineral and break-bulk services operated by Servicios Industriales Altamira (Badillo, 2009).

Tables 2.9 and 2.10 give the dimensions of the channels, turning basins and drafts for the port, which are sufficient to accommodate panamax ships. Within the next year, API plans to increase the depth of official draft by approximately 10 feet (Badillo, 2009).

**Table 2.9: Channel Dimensions for Port of Altamira**

| Channel Dimension | Length (miles) | Width (miles) | Official Draft (feet) |
|---|---|---|---|
| Access Channel | 2.2 | 1148 | 45 |
| North Channel | 3.7 | 984 | 45 |
| South Channel | 3.1 | 820 | 38/40 |

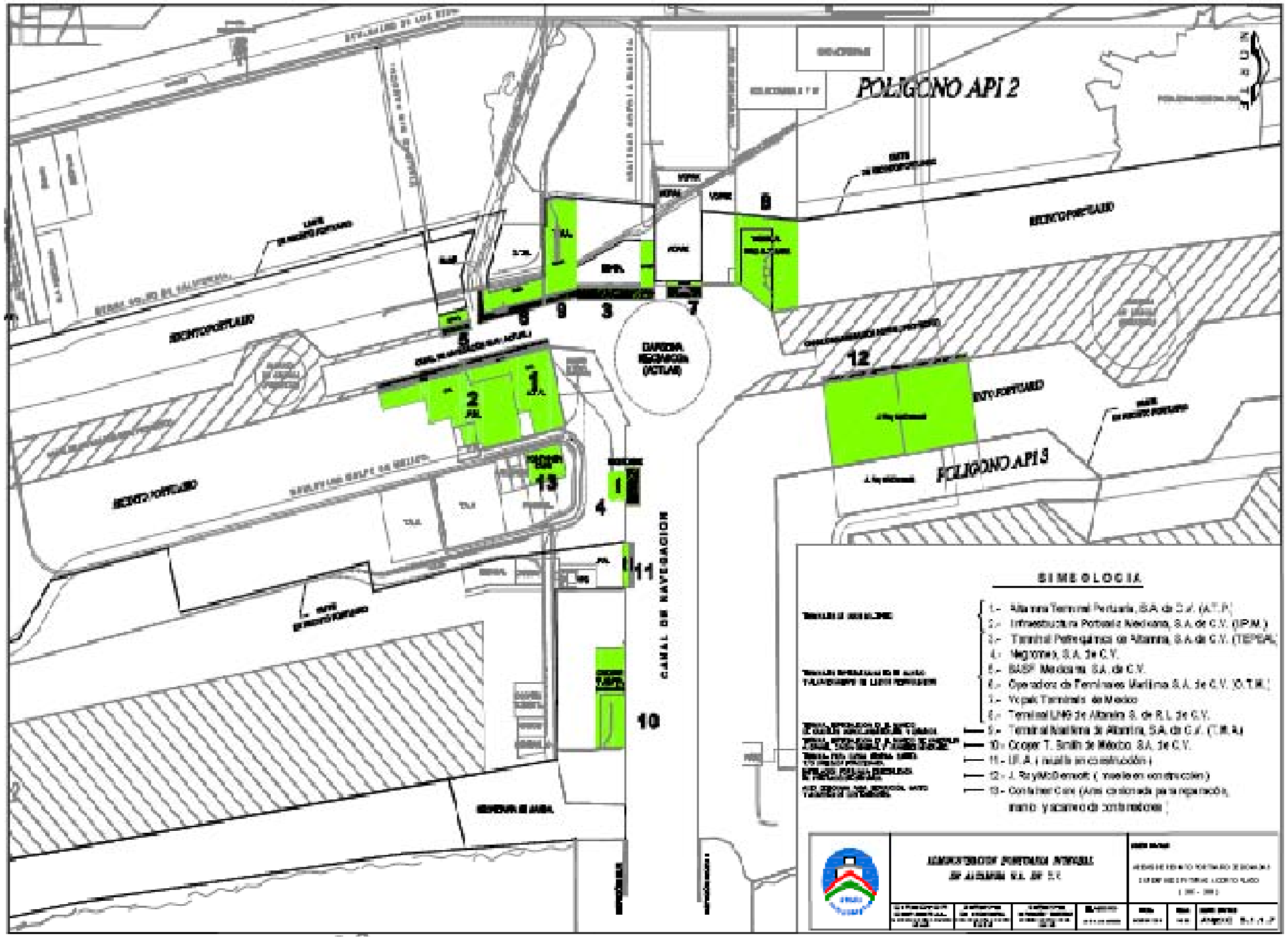
Source: Port Altamira

**Table 2.10: Basin Dimensions for Port of Altamira**

| Basin Dimensions | Diameter (feet) | Official Draft (feet) |
|---|---|---|
| Turning Basin 1 | 2132 | 45 |
| Turning Basin 2 | 1148 | 40 |
| Turning Basin 3 | 1640 | 45 |
| Turning Basin 4 | 1476 | 38 |
| Turning Basin 5 | 1640 | 45 |

Source: API Altamira

The port is equipped to receive and handle general/bulk cargo, containers, and liquid bulk. There are also refrigerated storage areas that accommodate the storage and shipping of perishable goods (Badillo, 2008). Originally created to expand the trading capability northeast Mexico, Altamira has been able to receive spillover from other ports because of its location near the U.S. (Container Management, 2008). By capitalizing on these opportunities, Altamira has emerged as a growth port among Mexico's Gulf Coast ports. Figure 2.26 shows the concessions within the port area.




Source: API Altamira, 2008

*Figure 2.26: Concession Port Enclosures*

### 2.4.2 History

Investment in Altamira began in earnest in the late 1980s. Under President Carlos Salinas, the Mexican federal government chose Altamira as a site of infrastructure investment because of its proximity to highways and rail connections to the interior of the country. The increased investment and attention that Altamira received resulted in a rise in overall Mexican industrial activity (API Altamira, 2008).

During this time, feasibility studies were undertaken to ensure that Altamira would be a viable and productive port despite its close proximity to two nearby ports, Veracruz and Tampico. Unlike the neighboring Mexican port of Tampico, currently facing high dredging costs and lack of room to expand, Altamira has sufficient room to expand with less dredging required.

On June 29, 1994, SCT awarded API Altamira the right to use and manage land that had been previously secured under federal domain (API Altamira, 2008), and whose acquisition has been based on feasibility studies completed years before (Badillo, 27 Feb. 2009). In 1999, 661 hectares (1633 acres) acquired by the Fondo Nacional para los Desarrollos Portuarios (FONDEPORT), a national fund for port development, were added to the port's property holdings, completing the area that would comprise the industrial development zone (API Altamira, 2008).

Unlike Lazaro Cardenas and Manzanillo, development of the port of Altamira has not focused on containers. This is due in part to connectivity problems with central Mexico. Regardless, Altamira moved 13.3% of the containerized cargo in Mexico in 2008, compared with 22.8% at Veracruz, the largest container terminal on the Gulf Coast (SCT, 2009). While containerized cargo is expected to continue to be roughly 20% of the cargo handled by the port (API Altamira Plan del Puerto), the focus of development has been primarily on petrochemicals and other industrial plants. The three most important recent projects have been the development of a plant to produce carbon black, the development of a galvanized steel plant, and the construction of a terminal for marine platforms. Figure 2.27 below shows the ports various development zones.


Source: API Altamira Website

*Figure 2.27: Port of Altamira Infrastructure*

*Connectivity*

The port of Altamira principally serves north-eastern Mexico. The port is connected to north-east Mexico, specifically the states of Tamaulipas, Nuevo Leon, and San Luis Potosi, by highways sufficient for port traffic, but the port experiences some connectivity issues to central Mexico. Roadways connecting the port to the center of the country have been poorly maintained in the past, but are undergoing renovation and modernization, specifically the routes to San Luis Potosi and the DF via Tuxpan. However, there is no date for completion of these upgrades (API Altamira 2006).

In terms of rail connectivity the port is serviced by both Ferromex, which provides rail connection to Monterrey, and KCSM, which provides rail connection to San Luis Potosi. KCSM's route between Altamira and San Luis Potosi faces difficulty for container shipment because several tunnels are of insufficient height to handle double stack rail cars (API Altamira, 2006). The existing railway connections from Altamira are included in Figure 2.28 (API Altamira, 2008).


Source: Badillo, 2009

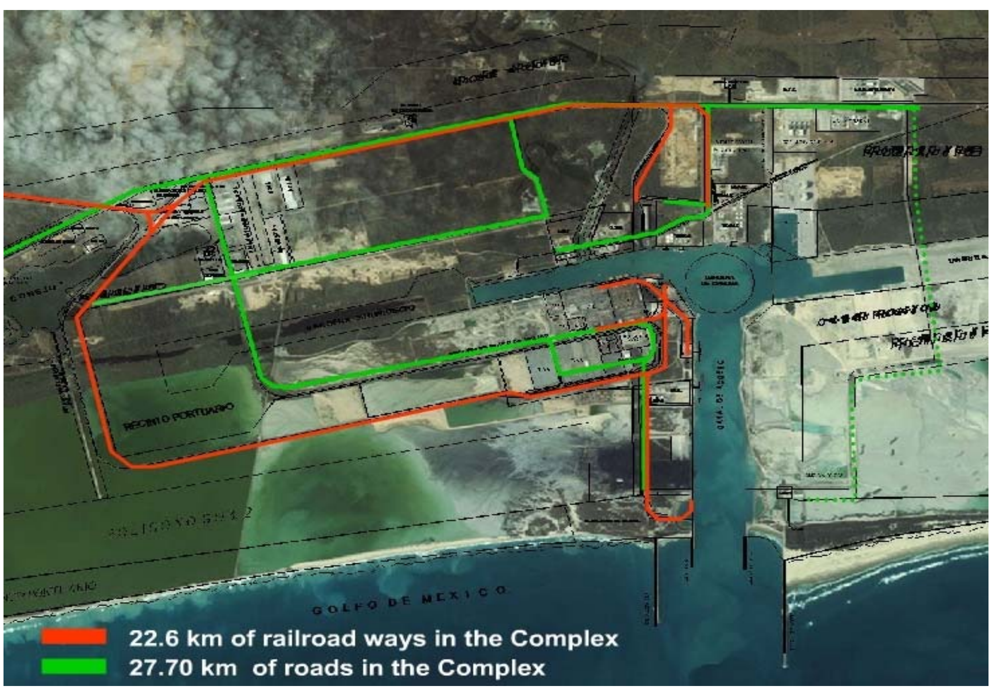
*Figure 2.28: Altamira's Railway Connections*

Transversal travel and shipment has suffered from lack of infrastructure investment. The NIP seeks to address many of these issues. The lack of extensive highway connections can be seen in Figure 2.29 (API Altamira, 2008).


Source: Badillo, 2009

*Figure 2.29: Mexico's Highway System*

The ports internal road and rail infrastructure is shown in Figure 2.30.



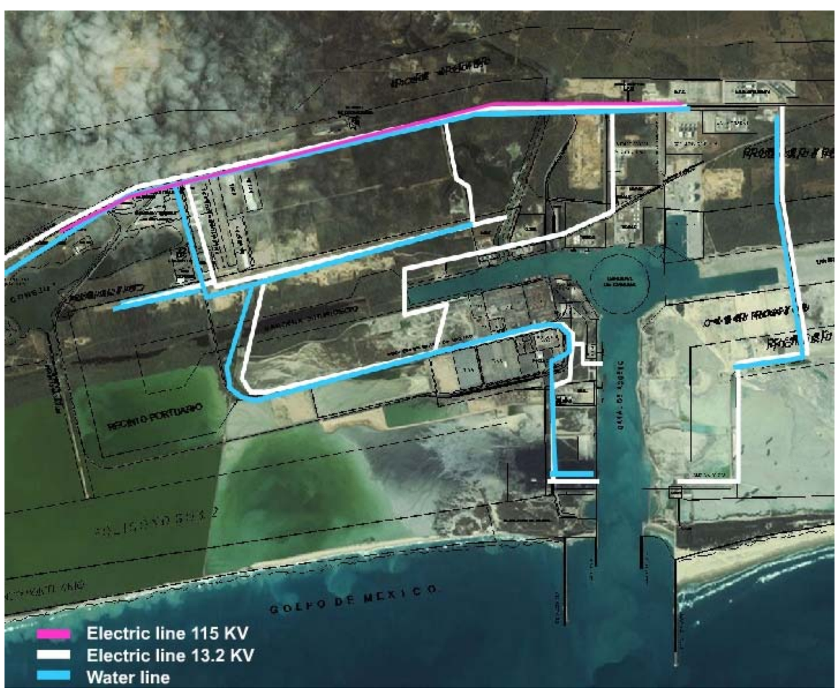

Source: API Altamira Website

*Figure 2.30: Railroad and Paved Roads within Port Complex*

*Overview of current operations*

Altamira accounts for more than 30% of the country's petrochemical processing production. The petrochemical corridor has benefited from more than US$5.5 million of investment from 13 national and international industries currently located in Altamira. Since 1994, significant investments have been made by such businesses as BASF, which selected Altamira as the site of its North American styrenics complex, specializing in the production of acrylonitril butadiene styrene, styrene acrylonitrile, and acrylonitril styrene acrylate. According to an officer of the company, BASF chose the port of Altamira for its ideal location for serving the NAFTA region because the United States is the leader in the styrenics market and Mexico's molding and extrusion market is the fastest growing (Wood, 1996).

In 1999, an investment of US$900 million by a Nuevo Leon-based group upgraded the port's storage capacity, customs procedures, and large-ship passage within the channel. This investment was later followed by a US$20 million investment by BASF to add a colorants unit at the port (Chemical Market Reporter, 1999). With the turn of the century, Altamira experienced more investment from business partners like Altamira Terminal Multimodal (ATM) that invested US$23 million in the port with the hope that it would attract cargo coming from the city of Monterrey, an industrial hub traditionally serviced by U.S. ports. ATM's dealings within the port created railways connections from Altamira to Monterrey that brought Ferrocarril Mexicano (no longer operating) and Transportes Ferroviario Mexicano (now KCSM) to Altamira (Export Today's Global Business, 2000). As of August 2009, there were 11 terminals and seven logistics companies with operations at the port. Services provided by logistics companies include ambient and bonded storage, cargo consolidation, container stacking, customs clearance, forwarding, refrigerated storage, and loading/marshalling of transportation vehicles. Figure 2.31 shows the port's utility infrastructure.




Source: API Altamira Website

*Figure 2.31: Electric & Water Infrastructure at the Port of Altamira*

Closely associated with the increasing number of terminals and service providers within Altamira is the port's economic output, measured by the annual average growth rate (AAGR). Over a seven-year period, from 1994-2001, the port has seen an 18.3% AAGR in total cargo movement and a 10.3% AAGR for "Attended Vessels." The four major types of cargo within Altamira (containers, liquid bulk, general cargo, and automobiles) have average annual growth rates of 16.2%, 11.4%, 2.7%, and 8.6% respectively, from 1994-2002 (Badillo, 2009). In 2007, the port handled 12,332,407 tons of cargo and estimated that 14,371,620 tons would be handled in 2008 (API Altamira, 2008).

Over 25 shipping lines serve the port with most routes having weekly service (see Table 2.11). In 2007, the port hosted 1, 475 ships (API Altamira, 2008).

**Table 2.11: Large Vessel Schedule**

| Large Vessel Schedule | Frequency |
|---|---|
| **U.S. East Coast** | Every 3 days |
| **Northern Europe** | Every 7 days |
| **Mediterranean** | Every 9 days |
| **New Zealand/Australia** | Every 7 days |
| **South America** | Every 3 days |
| **Caribbean** | Every 7 days |
| **Far East** | Every 7 days |
| **South Africa** | |
| **General Cargo** | Every 30 days |
| **Containers** | Every 7 days |

Source: Badillo, 2009

Altamira's channel can accommodate Panamax vessels. The specific maximum vessel dimensions and capacity for Altamira are included in Table 2.12.

**Table 2.12: Maximum Dimensions/Capacity of Vessels**

| Maximum Dimensions/Capacity of Vessels | |
|---|---|
| **Total Length** | **984 feet** |
| **Breadth** | **105 feet** |
| **Draught** | **40 feet** |
| **Cargo** | **65,000 tons** |

Source: Badillo, 2009

*Cargo Terminal Operation*

Altamira Terminal Portuaria (ATP) currently has a 20-year concession with API Altamira for the operation of the general cargo terminal that began in 1993. The terminal handles both general cargo and containerized cargo. ATP has two Panamax cranes with capacity of 40 tons each and two Gottwald cranes with 100 tons capacity (API Altamira, 2008). Containerized cargo currently represents roughly 22% of cargo through Altamira, and the port's forecast expect that percentage to remain roughly the same through 2015 (API Altamira, 2006). ATP did express concern over the possibility of the lack of double stack rail connectivity inhibiting growth of containerized cargo volumes at the port.

*Petrochemical Corridor*

Altamira relies on its proximity to the 'petrochemical corridor', a block of chemical and petrochemical companies located to the south and west of the port, to generate volume for shipment internationally and nationally. The corridor first took shape in the 1960s when DuPont built a petrochemical plant and is now home to more than a dozen companies who produce a wide range of products. Altogether, this complex accounts for more than 80% of Mexico's thermoplastic resins output (API Altamira, 2008).

In the late 1990s, the state of Tamaulipas began promoting the construction of a US$1.5+ billion petrochemical cluster in Altamira whose investors included Lefere of Houston (10%), Serbo of Mexico (30%), and Taipei's Tuntex (20%). The state's interests extended beyond the port and the petrochemical corridor because State officials believed that this cluster would create the development of downstream industries, namely a coveted Pemex-controlled refinery that would bring millions of investment dollars to Tamaulipas (Alperowicz, 1998). Such projects also benefit the port because increasing growth in the petrochemical sector will mean more volume through the port.

*Liquid Natural Gas Operations*

The port has a LNG terminal that has been in operation since 2003 (Mexico, 2008). The port receives regular shipments of LNG from Shell and Total, each company adhering to an alternating schedule. LNG is stored, re-gasified, and converted to electricity by the Mexican Power Company, Comisión Federal de Electricidad (CFE) (API Altamira, 2008). Currently, the port has three electric-power generating plants that produce more than 2,500 MW/hr (API Altamira, 2008). The Altamira LNG project is formed by two companies, Terminal de LNG de Altamira (TLA) and Gad de Litoral (GdL). TLA owns and operates the re-gasification terminal at Altamira LNG. Its parent corporation is comprised of three companies: Shell (50%), Total (25%), and Mitsui (25%). GdL handles and transports the natural gas and is owned by Shell (75%) and Total (25%). Figure 2.32 shows the re-gasification facility.

Source: API Altamira Website

*Figure 2.32: Natural Gas Facilities used in the re-gasification process of LNG*

### 2.4.3 Planning

API Altamira is guided by the Master Development Program, that delineates the port's business plan, including bidding procedures, and is updated at regular intervals. The current

Master Development Program covers the years 2007-2015 (API Altamira Plan del Puerto). Strategically, Altamira is attempting to maintain its specialization in petrochemicals while at the same time diversifying into other cargo types and developing the port's industrial zones (Lloyds List, 2002).

### *Forecasting and Cost Benefit Analysis*

SCT and API Altamira created an extensive development plan that includes forecasts of cargo volumes and expected revenues. API Altamira is responsible for fulfilling their responsibilities under the Master Development Program, which includes the creation and maintenance of infrastructure as well as providing services such as dredging and access to dependable utilities like electricity and water (Badillo, 2009).

SCT also did a comprehensive cost-benefit analysis to determine if the port could attract enough investment partners to offset the costs to the federal government (Badillo, 2009). According to Mr. Badillo of API Altamira, the analysis for the port tends to favor large business plans that are interested in long-term investment. The port is specifically targeting the development of specialized terminals, rather than general or multiuse terminals. One of the major advantages of Altamira is its ability to handle both natural resources and manufactured products, which the port views as an important selling point to many of the port's industries and a major reason behind the port's creation. Included under the title of "Port-Industry Integration," this particular point is explained on Altamira's website as a way for raw materials to be imported on a large-scale while inland connections facilitate the dispersion of finished products (API Altamira, 2008).

### *Environmental Review*

The environmental impact of the port of Altamira has been a major concern for API Altamira since the port's inception, evidenced by the large ecological buffer zone surrounding the harbor industrial complex and in its adherence to environmental standards (Badillo, 2009). By proactively seeking methods of mitigation for the port they have avoided the environmental problems and community push back faced by Manzanillo.

According to Badillo, SCT and API Altamira spent three years negotiating with SEMARNAT concerning environmental issues. Businesses who work with the port are able to receive their environmental approval papers in about four weeks, compared with the months that it could take elsewhere, because of the extensive environmental study that was done during the planning of the port (Badillo, 2009).

The port has a list of proposed environmental goals, many of which are enumerated on their website. Potential projects include harnessing wind energy and evaluating the conservation/degradation of wetlands within the port. Other goals include an effort to test the water quality within the canal. Through frequent testing, they hope to guard against contamination from container ships and service providers and to minimize harm done to wildlife living within the channel (i.e., the dark brown and green turtle common along Altamira's coastline). On June 18, 2008 the port saw a successful mating season for turtles with the hatching of hatchlings emerging as seen in Figure 2.33.

Source: API Altamira Website

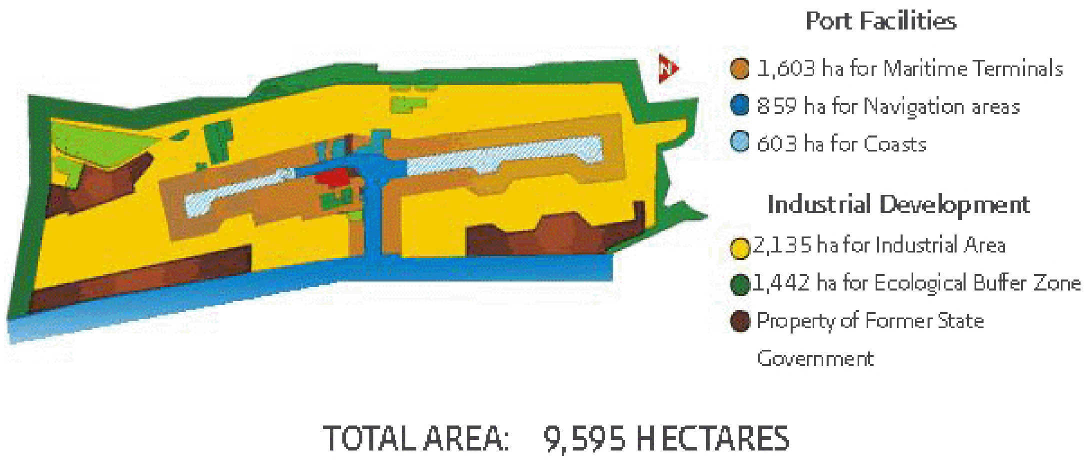
*Figure 2.33: Turtle's Hatching*

More tangible environmental projects include reforestation efforts to plant more than 51,000 plants per year to protect the ecological buffer zone surrounding Altamira (API Altamira, 2008). Since 2005, a total of 114,760 plants in 86.5 hectares (213 acres) have been distributed in the Altamira area. On July 5, 2008, for example, the port planted more than 6,000 trees covering 7.4 hectares (18 acres) with special emphasis on native species. This is also conducted under the auspices of federal legislation; for example, the Pursuit of Vegetation under norm NOM-059-2001.

Through all these efforts, API hopes to develop an environmentally conscious culture within the harbor and reinforce their image as an environmentally responsible entity. Throughout the port, there are environmental signs that alert visitors to prohibited activities in that particular zone. It is also their hope that an increase in port tours will further their efforts to establish their images as an environmentally friendly port. API's goal was to have 2,500 tourists visit the port in 2008.

*Acquisition of Port Lands*

In 1981 and 1982, the federal government expropriated the land east of the city of Altamira. Part of this was ejido land. When the Law of Ports was passed in 1993, the land was privatized and put under the care of API Altamira but the port has never directly been involved in the land acquisition process (Badillo, 2009). Figure 2.34 shows areas that Tamaulipas SCT gave to the port after the expropriation took place.




Source: Park, 2008

*Figure 2.34: Harbor Enclosure/Industrial Park/Petrochemical Corridor*

However, in November 2008, a judge declared as void two of the five expropriation decrees applicable to lands that were given to API Altamira. As noted, these decrees took place in 1981 and 1982 and the expropriation applied to five ejidos. Figure 2.35 shows the area of the disputed land (Gomez, 2009.c).


Source: Gomez, 2009.a and b.

*Figure 2.35: Land in Dispute*

According to Francisco Gomez (Gomez, 2009.b), the grounds for this judgment were based on the following arguments:

- The government did not justify that the taking had a superior benefit to the "public good" vis-a-vis the social objectives of an ejido rural communal land.
- The final legal document was not signed by hand by the Secretary of Transportation.

In a newspaper interview on June 10, 2009, an official of SCT stated that SCT had officially declared the expropriation decree is indeed void, that it is necessary to re-enact the decree, and that the agency will re-value and re-determine the compensations to be awarded (Gomez, 2009.c). This was based on the federal court's judgment where the judge:

- awarded a Writ of Amparo (judicial review with individual effects) to the initial owners
- asked for the return of the lands to the ejidatarios (residents of the ejidos)
- asked the agency to re-determine the payment and compensation to be awarded to the land owners
- asked for the land to be expropriated again but paying the *new value*

The estimated amount that the federal government will have to pay is an additional MXP$1.5 billion (approximately US$120 million) to approximately 85 ejidatarios in the two ejidatario groups. The agency responsible for this *"mishap"* is still to be determined.

It is important to note, however, that ex-PAN presidential candidate and former Senator Diego Fernandez de Cevallos and ex-Attorney General, Antonio Lozano Gracia, are the lawyers acting on behalf of two groups of these ejidatarios. Fernandez de Cevallos and Antonio Lozano Gracia began this action in June 2007, after President Felipe Calderon assumed office. Furthermore, these two lawyers had, in 2002 (also under a PAN president), won a similar judgment for MXP$1.2 billion (approximately. in that period to US$120 million) on behalf of the Santa Ursula's ejidatarios, against the Secretariat of Rural Reform (Gomez, 2009.a).

Now that two groups of ejidatarios have won in federal court, the other three ejidatario groups have announced they will commence suit to obtain a similar judgment (Gomez, 2009.b). According to the Secretary, SCT have no intention of paying again to the ejidatarios as this would amount to "unjust enrichment" (Gomez, 2009.e).

The port has additional problems with land that has yet to be expropriated. According to the Port Master Development Program 2007-2015 there remains about 83.5 hectares of land within the port zone that has not been expropriated and there are people living there. According to API Altamira the problem with these populations is twofold: first, those populations are being exposed to the dangers inherent in being located near a petrochemicals port, while at the same time their existence is impeding port growth. API Altamira continues to try to acquire these parcels of land, and is working with state and municipal authorities to determine suitable alternate urban zones, outside the port zone, where these populations might be relocated (API Altamira, 2006).

### *Public Participation*

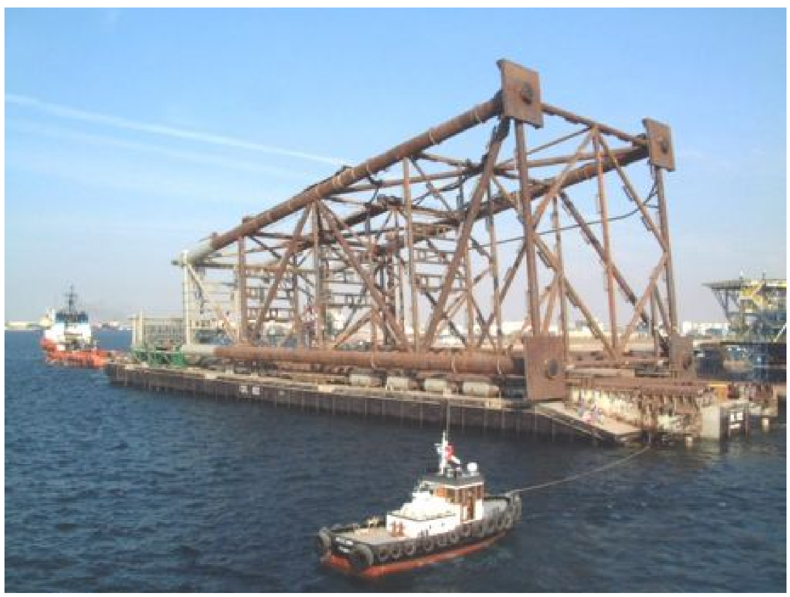
The extent of public participation in the port's planning process has been extremely limited. API Altamira, not withstanding its "public" status, views itself more as a private entity whose sole purpose is to make profit by deftly managing the concession of terminal operations at the port. As noted above, ejidatario conflicts have arisen surrounding the eminent domain proceedings that secured the original land for the port, and it remains to be seen if this will have any effect on public sentiment locally.

API Altamira, like Lazaro Cardenas and Manzanillo, promotes several community projects to further its reputation with the citizens in the area. These include allowing seasonal access to beaches located in the northern side of the port and providing access walkways to said beaches. The port also has a student program that seeks to inform students of activities at the port, and an "adopt a school" program consisting of promoting within the port the adoption and donation of funds for elementary schools in low income areas of the Altamira Municipality. The port also has an emergency center primarily designed to respond to accidents at the port, but that will respond to other emergencies within the community.

### 2.4.4 Project Implementation

*Marine Platform Fabrication Terminal*

In 2008, Altamira set aside land for an offshore fabrication yard and a construction yard for the fabrication of oil platforms (API Altamira, 2008). The initial phases of construction for the J Ray McDermott marine platform construction terminal were completed in 2007, and the company is expected to continue with the second phase of development in the coming months. The next phase of development is expected to include a rolling mill and a deep pit to facilitate the offloading of large structures. The yard recently completed the fabrication of the Maloob-C drilling platform for Pemex. Figure 2.36 shows the delivery of the Maloob-C platform, first platform constructed at Altamira.



Source: La Region Tamaulipas, 2009

*Figure 2.36: Maloob-C platform, Altamira*

Work on the drilling platform began in February 2008. Fabrication of the two-level, 2,535-ton deck and the 3,527-ton jacket, factory testing, onshore pre-commissioning and operational testing, load out and sea fastening were all performed by J. Ray McDermott at the Altamira facility, and 3,300 tons of piles were sourced from a J. Ray facility in Louisiana. At peak production the company had more than 500 craftsmen and professionals working on the project. The project installation is expected to be completed during the third quarter of 2009 (Marine Link, 2009).

The initial target for the new terminal at Altamira was construction contracts with Pemex, but the company also hopes to take advantage of the port's gulf location to serve the American market as well.

The company was awarded the yard space in a 30 year concession contract with the port of Altamira. The concession agreement was signed in lat 2006 (Upstream, 2007). The company has the ability to extend the bulkhead length to 1,000 meters under its lease arrangement (Business News Americas, 2007.b).

*Galvanized Steel Plant*

One of the major projects being developed at Altamira is a galvanized steel plant to manufacture steel sheets for use in the auto industry. POSCO, South Korea's leading steelmaker, announced the completion of the plant in early August 2009, and shortly expects to begin commercial operations.

POSCO broke ground on the plant in September 2007. The company invested roughly US $250 million in the facility in an attempt to capitalize on Mexico's lower labor costs and proximity to the US auto industry (Asia in Focus, 2009). The facility was originally slated for completion in June of 2009 but was delayed by the slump in the US auto industry. The facility will have a capacity of 400,000 tons per year, raising POSCO's output to almost 7 million tons per year. Roughly 150,000 tons of the plant's output will supply the Mexican market, while the rest will be exported to the US for processing by POSCO's facilities there. The POSCO plant is shown in figure 2.37.

Source: Badidllo, 2009.

*Figure 2.37: Korean Galvanized Steel Company, POSCO*

*Carbon Black Plant*

Bridgestone has invested in the construction of a carbon black plant at Altamira. The carbon black plant, located on 42.5 hectares within the port, will produce 35,000 tons per year and was built with a private investment of 81 million dollars. The plant opened in October of 2008 (Chemical Week, 2009). Another company, Carbon Black, a subsidiary of Indian company Aditya Birla is also expected to establish a carbon black plant at the port, and signed initial agreements to that effect in October of 2008 (NOTIMEX, 2008). This plant will require an initial investment of roughly $150 million. The Carbon Black plant is expected to generate 150 engineering and technical jobs, and later 200 additional jobs (Enfasis Logistica, 2009).

*Financing*

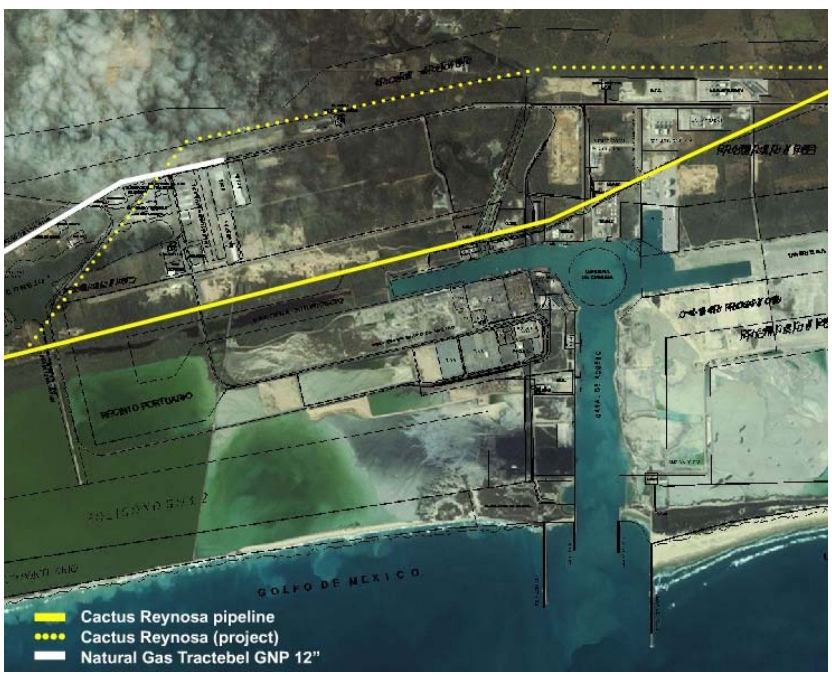
All of the projects examined in this case study were completed with private investment. No public funds are allocated in the NIP projects within the port of Altamira. The port relies heavily on private investment for the development of its industrial zone.

API Altamira is responsible for basic port infrastructure, though individual terminals and industrial installations are the responsibility of the private sector operator. API Altamira finances port services and infrastructure projects by charging harbor fees and soliciting concessions in the same manner that API Manzanillo and API Lazaro Cardenas do (API Altamira Website). Harbor fees and concession proceeds are used to create and maintain infrastructure in the port and provide services such as dredging, electricity, and water. Port tariffs are fees that API charges to ships for the use of common infrastructure areas based on price caps derived from Altamira's long-run marginal costs.

In terms of public investment the port is going ahead with plans to construct an inspections center for perishable goods, the purchase and installations of x-rays to inspect rail cargo, relocation of a pipeline, the construction of a bypass for the port, and the installation of a new berth and patio for a terminal to handle construction aggregates.

There are also plans for an "in-bond" area that will allow customers to store items duty-free for up to two years. This will allow for manufacturing at the port without having to pay tariffs on manufacturing inputs. API Altamira began soliciting Customs for approval of an in-bond area in 2008 and plans to set aside 40 hectares (100 acres) for in-bond activities in this first project. They plan to solicit approval for other duty-free areas as the need arises to assist value-added manufacturing (API Altamira, 2008).

Another current project is the relocation of the Cactus Reynosa pipeline. With an expected completion date of 2010, this project will help workers avoid breaking the pipe during construction projects within the port (see Figure 2.38). The pipeline's current location is a safety concern, necessitating the move.




Source: API Altamira Website

*Figure 2.38: Cactus Reynosa Pipeline Relocation Project*

Finally, SCT announced in late February 2009 its plans for a highway project, *Libramiento Altamira*, which will connect the port of Altamira with Mexico's central and southern regions. It is expected to break ground in March 2009 and be completed in one year. The project will be controlled by a concession process that will bring in an investment of more than MXP$240 million into SCT and will depend on other highway concession projects like the one currently connecting Tampico and Mante. The road is expected to have an average traffic flow of about 2,000 vehicles per day. The project also is expected to create about 120 jobs once functioning (Invertia, 2009.c).

*Impact on U.S. Transportation Systems*

During the planning process and development of the feasibility study for the port, API officials realized that the port's creation would be an attractive alternative for both petrochemical and general cargo that was being shipping into the U.S. ports of Houston, Corpus Christi, and Brownsville (Badillo, 2009). Despite the competition for cargo, the port of Houston has established a relationship with both the port of Altamira and the port of Tampico that has encouraged Mexican-U.S. maritime traffic (Badillo, 2009).

Altamira also is able to play a role in international ground shipping between Mexico and the United States. Trucking time to the U.S. border at Laredo, Texas is about six hours from the port, and because of the focus at the port on streamlining customs clearance processes, cargo shipment by truck is a viable option for bi-national trade (API Altamira, 2008).

In the next two to three years, Altamira is looking to create an Altamira-New Orleans-Mobile shipping route. API has begun the process of a feasibility study and is planning to solicit bids as soon as infrastructure needs and other details have been worked out (Badillo, 2009).

### 2.4.5 Conclusions

Altamira is a modern port that has capitalized on its geographic advantage and specialization in petrochemicals to create a thriving Mexican industrial development complex. API Altamira provides basic port infrastructure while relying heavily on private investment to develop the industrial zones of the port. These strengths, combined with its flexibility and eagerness to accommodate any industry, make this project a good example of a port that was created under centralized planning but has thrived under privatization.

One of the major advantages of the port of Altamira is its geographical location and proximity to the US. Altamira is served by road and rail connections to San Luis Potosi and Monterrey, though there are issues with the lack of double stack container service to San Luis Potosi. API Altamira currently has territorial reserves that include more than 2000 hectares (4942 acres) available for development in the industrial zone and 1,500 hectares (3706 acres) remain undeveloped within the harbor enclosure, an area reserved for marine terminals (API Port Altamira, 2008).

Another of the port's notable features is its long list of environmental goals. Through environmental projects such as frequent testing of the waters in the canal and reforestation projects in the areas around the port, API Altamira hopes to avoid some of the pitfalls Manzanillo is experiencing and reinforce their image as an environmentally responsible entity. It is also their hope that an increase in port tours will further their image as an environmental friendly port.

*Challenges*

On average, Altamira receives investment totaling more than US$30 million per year to provide services and develop harbor infrastructure (API Altamira, 2008). However, the current global economic crisis has adversely affected Mexico's economy. The opening of Posco's steel plant was delayed due to the troubles with the US auto industry (Badillo, 2009). To combat this, SCT is looking to award concessions in the amount of MXP$21 million that would prop up port infrastructure projects within the country. The resulting program is estimated to be of value not only for the money that it would bring to the SCT's shrinking accounts but also for the nearly 30,000 jobs that it would create. Included in this port infrastructure program are plans to increase port tonnage in five major ports including Manzanillo, Tampico, Tuxpan, Veracruz, and Altamira. However, the severity of this economic crisis can be seen in the fact that the planned port at Punta Colonet, regarded as one of the most important and ambitious infrastructure project of the past six years, has been postponed until the economic situation improves, according to former SCT Secretary Luis Tellez (Invertia, 2009.a). Additionally, Badillo pointed out the difficulty in combating public opinion that believes overland shipping is cheaper than using ocean liners to transport freight.

The automobile industry within Mexico has also been affected by the global economic downturn. In February, it was reported that maritime exports of vehicles fell 56% for the entire country, and this was just one part of a 70% constriction of overall exports. Motor vehicle imports also decreased 41% since January 2009. For its part, Altamira experienced a 92.3% decrease in exports with just 44 vehicles leaving its docks for the entire month of January 2009. Veracruz, the leading port by volume in the export of motor vehicles, experienced a decrease of 49.1% for the same month. Altamira is not a huge player in the automobile industry, with a capacity to store only 15,000 vehicles, but this trend is bad news for the port's auto terminal concessionaire (Invertia, 2009).

Although Altamira touts its proximity to the industrial centers of Monterrey and San Luis Potosi, there are challenges associated with product distribution from the port. Altamira's railway and road connections to the Mexican interior are not sufficient to support continued growth at the port. Both KCSM and Ferromex currently connect the port to other large cities, but the port lacks a direct route rail route to Mexico City. Also, the rail between Altamira and San Luis Potosi cannot handle double stacked trains due to clearance restrictions. Roadway infrastructure is also lacking. In general, Mexico lacks highways running east to west, and while the highway infrastructure serving Altamira has been improved somewhat because of the lack of sufficient rail, it will be unable to support continued growth. Currently, Altamira has highway connections to Mexico City, San Luis Potosi, Saltillo, Monterrey, Guadalajara, and Morelia, and to ports such as Manzanillo and Lazaro Cardenas. Noticeably absent are connections to the far south, central, and far northwestern regions of Mexico due to poor road conditions and geographic challenges of building roads over difficult terrain. Addressing this lack of connectivity is one of the principal goals of the Calderon infrastructure plan.

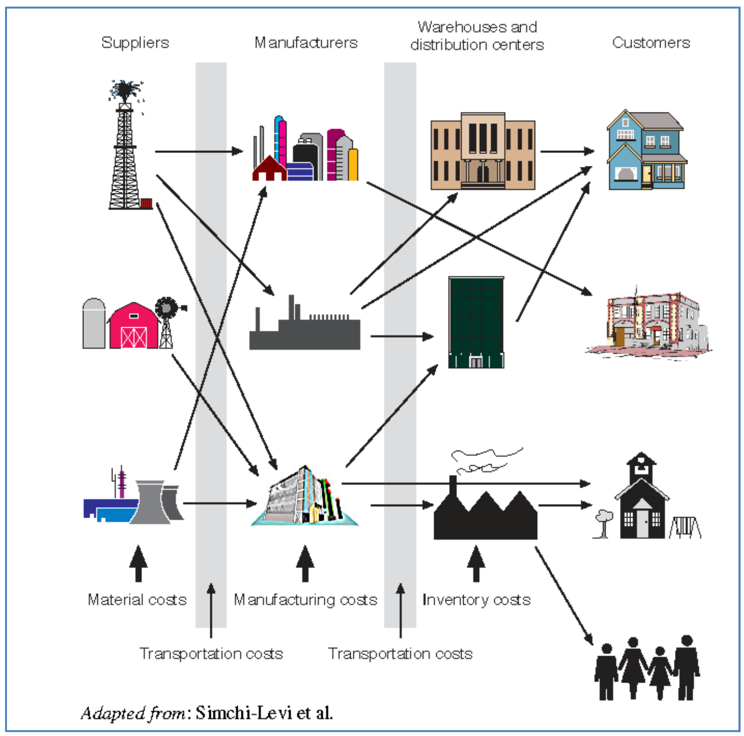
There is hope, however, for increased connectivity to major hubs of industry both nationally and internationally with SCT's announcement of the Libramiento Altamira. Although it is highly unlikely that this project will be completed within one year, its completion will be highly beneficial to the port because it will alleviate some of the connectivity problems. Overall, the port of Altamira is positioned to grow in the future, based on the diversity of its terminals and its proximity to the U.S. Given its progressive environmental stance and the availability of land, the port is poised to be a major Gulf Coast port.

# Chapter 3.  Inland Port Projects

While ports at rivers, and land, air, and coastal borders have been the traditional hubs for trade processing, Leitner and Harrison (Leitner and Harrison, 2001) recognized that larger amounts of trade were being processed at inland sites.  This involved all the transactions and inspections that federal agencies required for goods entering and leaving the country. These sites were named as inland ports and they were defined by Leitner and Harrison as:

> "locations where the processing of trade can be shifted from the national borders and where multiple modes of transportation and a wide variety of services are offered at a common location. International operations are supported at an inland port when customs clearance and Foreign-Trade Zone capabilities are available. Inland ports that provide value-added services in addition to trade processing will support industry efforts to create more efficient supply chains."

Inland ports have grown in popularity globally as the demand for more secure, streamlined commercial shipping routes across international borders increases. Seaport congestion is increasing in Mexico at the ports of Lazaro Cardenas and Manzanillo to the southwest and the ports of Altamira and Veracruz to the east so inland ports will provide an excellent opportunity for shippers, logistics firms, and manufacturers to achieve economies of scale, reduce travel time (in-bond) for goods, and further consolidate manufacturing hubs into regional areas. Figure 3.1 shows the basic supply chain network, which inland ports assist in streamlining by improving supply chain management, including lower inventory levels and costs, and eliminating some of the transportation links.



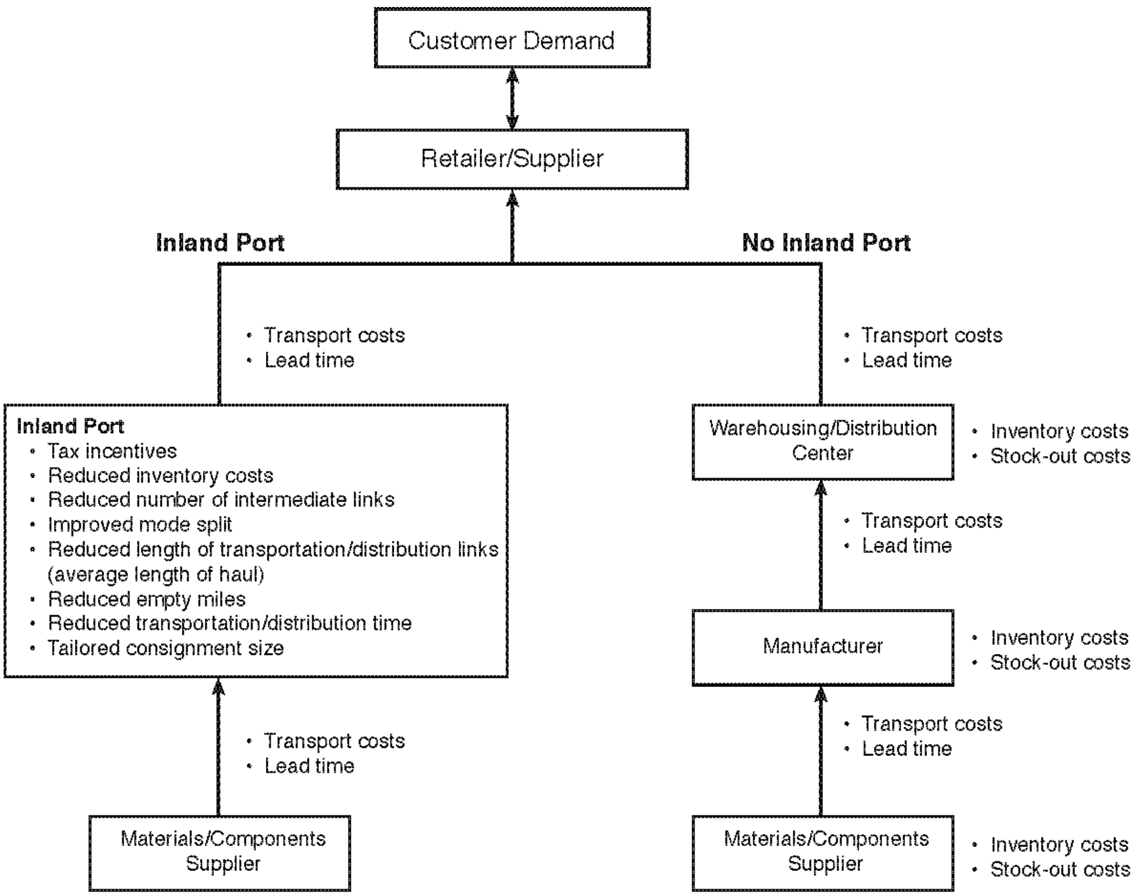

Source: Leitner and Harrison, 2001

*Figure 3.1: The Supply Chain Network*

In Mexico, the researchers have found a number of inland ports in the planning and development stages. These include San Luis Potosi's two inland ports, Logistik and Parque Logistico; Monterrey's proposed inland port Interpuerto Monterrey; Plata Hidalgo in the state of Hidalgo close to Mexico City; Guanajuato Inland port close to the city of Guanajuato; Meridian 100 FTZ in Ciudad Juarez; and the Gomez Palacio Logistics Center in northern Durango along with proposed ports in Toluca and Puebla (north and south of Mexico City) that form p art of the Central Mexico Inland Ports Initiative. While this list is by no means exhaustive, it gives an idea of the intense development of inland ports occurring in Mexico. The Mexican Association of

Industrial Parks (AMPIP), founded in 1986, has been active in the support of development of industrial parks and inland ports (AMPIP, 2006), and counts over 50 corporate members and 150 industrial parks within its membership.

Inland ports offer multiple benefits by improving supply chain management, including lower inventory levels and inventory costs, and by eliminating some of the transportation links between shippers, transportation companies, warehousing, and the end consumer. Figure 3.2 shows the how inland ports assist in streamlining supply chain integral costs components




Source: Prozzi et al., 2002

*Figure 3.2: Inland Ports Streamlined Process*

The inland port case studies in Mexico that are discussed in this section are, in essence, striving to achieve the cost savings that Prozzi outlined through the development of their inland ports, the marketing of multiple services coupled with multi-modal transportation options, and, most notably, by securing Free Trade Zone (FTZ) status.

By 1995, existing legislation had little success in promoting multimodality in the Mexican transportation sector. Multimodal agents providing integrated intermodal services were not regulated, because they were considered to be commissioned traders subject to commercial law. For multimodal terminals, a special permit (ensuring minimal quality) was the sole requirement for entry.

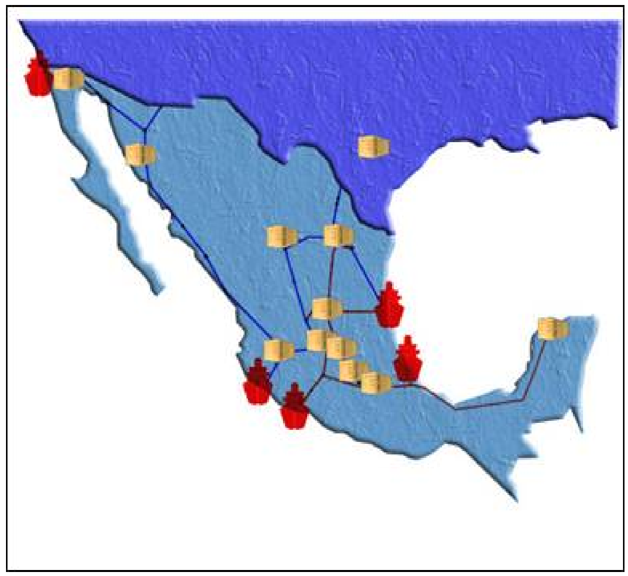
Two initiatives to coordinate the relevant participants and re-work tax administration code were launched in 2004. The first was an effort to spur private-sector logistics and create a process under the auspices of the 2001–2006 National Development Plan (NDP). Under the strategy, public and private entities signed the Multimodal Corridors Development Coordination Agreement (MCDCM) on June 15, 2004[1].

The MCDCM's main objective was to promote the development of multimodal corridors, thus increasing the competitiveness of the Mexican economy. This was to be achieved through the creation and improvement of logistic chains between Mexico and foreign countries, and by the coordination of the parties' respective experience, knowledge, and capabilities.

At the same time, Mexico also began re-working its general standard (norm) for industrial parks (NMX-R-046-SCFI-2005) in 2005. While this standard is not obligatory to run an industrial park, the federal Tax Administration Service requires that industrial parks wanting to operate as Free Trade Zones (FTZ) comply with the standard (AMPIP, not dated). The rules were published in the Diario Oficial (Federal Register) in April 2007.

The MCDCM also created the Inter-institutional Committee for the Development of Multimodal Corridors, a Partnership to design mechanisms and strategies related to the development of multimodal corridors. The committee was tasked with drafting a procedural manual for each corridor; generating data in connection with the productivity of each corridor; and establishing mechanisms to solve the corridor users' requirements, among others. Figure 3.3 illustrates the intermodal terminals that were in existence in 2006, two years after the agreement's inception.

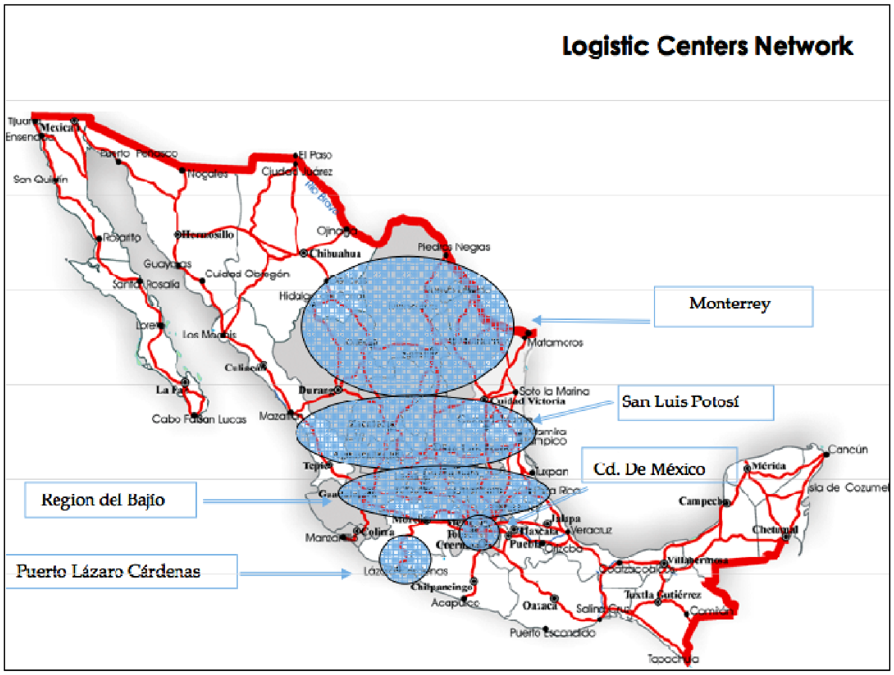
The Regional Integration Program, Initiative of Northeastern Mexican States (INVITE) reviewed logistic centers in Mexico and delineated in Figure 3.4 a network of areas where they expect to see various logistic centers in Mexico.



Source: Asociación Mexicana del Transporte Intermodal A. C Website

*Figure 3.3: Intermodal Terminals in México*

[1] The Multimodal Agreement was signed by public and private entities including SCT, SEMARNAT, Secretariats of Public Safety, Treasury and Public Credit, Economy Agriculture,; the Confederation of Industrial Chambers of the United Mexican States (CONCAMIN), Mexican Association of Multimodal Transportation, Sea Transportation Mexican Association, Sea and Ports Terminals Mexican Association, TFM, FERROSUR, and FERROVALE, among others.




Source: INVITE, No date

*Figure 3.4: Visual Depiction of Logistic Centers Network in Mexico*

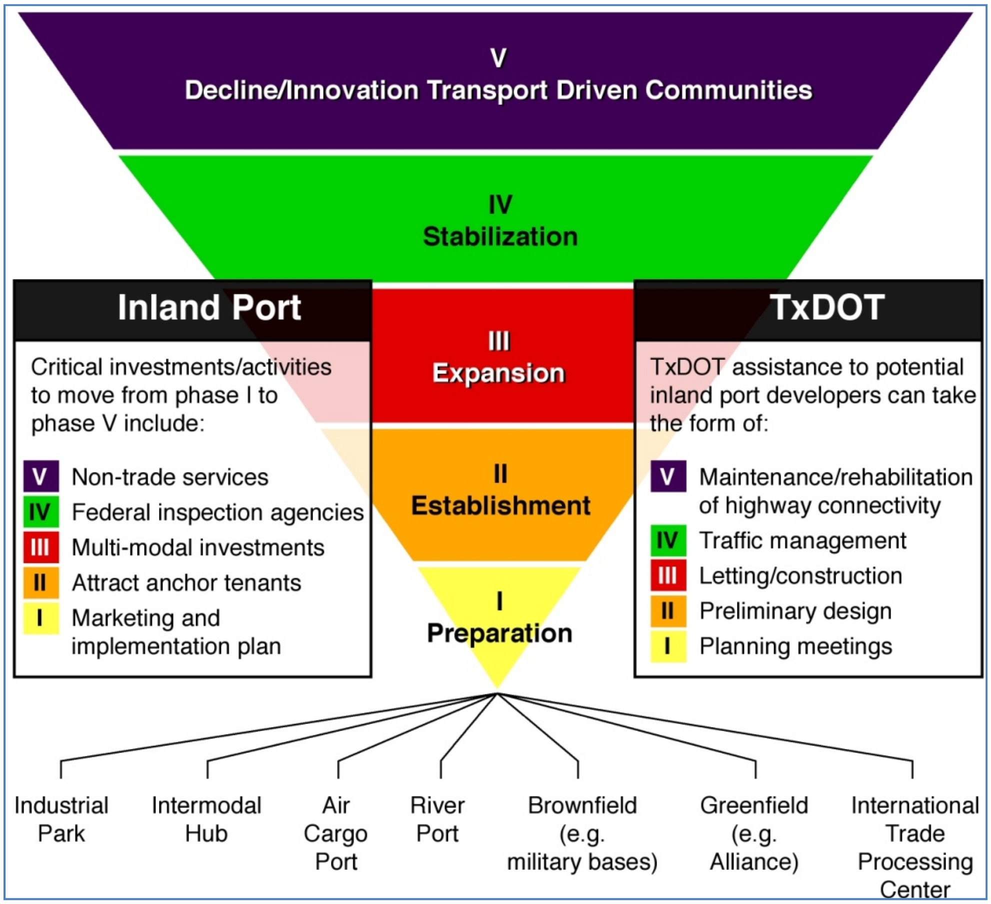
Prozzi, Henk, McCray, and Harrison (Prozzi et al, 2002) noted that well-developed inland ports exhibit the following characteristics:

- tend to be larger regional centers, serving larger markets;
- provide a means for facilitating international trade and expediting shipments ;
- have multi-modal capabilities/opportunities and have good access to the interstate and state highway systems;
- have Foreign Trade Zone status;
- serve certain niche markets, which tend to be higher valued commodities; and
- have access to sufficient labor or skills.

Prozzi et al (Prozzi, et al, 2002), noted that inland ports tend to be labor intensive *"…because of the value-added services provided. Services such as finance, accounting, marketing, legal advice, and customs brokerage will be required from local work forces. This necessitates having access to an educated or trained workforce who can respond to changing logistics demands and new technologies."* Officials at San Luis Potosi and Monterrey inland ports stressed in interviews with the researchers the presence of their skilled labor forces and the educational institutions and proposed education developments that were being created in these regions to support these facilities.

Inland ports tend to vary in physical design, institutional and organization strategies, and ownership, as well as in underlying philosophy and business development plan. As a consequence, there are different phases—critical investments and activities required for an inland port—that inland ports move through five phases which can be seen in Figure 3.5.

The two inland ports reviewed in this section are currently in different stages. San Luis Potosi's two inland ports are up-and-running have achieved a level of critical mass through the securing of FTZ status and could be considered to be in the Expansion/Stabilization Phase depicted in Figure 3.5. Monterrey is still in the first stage of preparation.

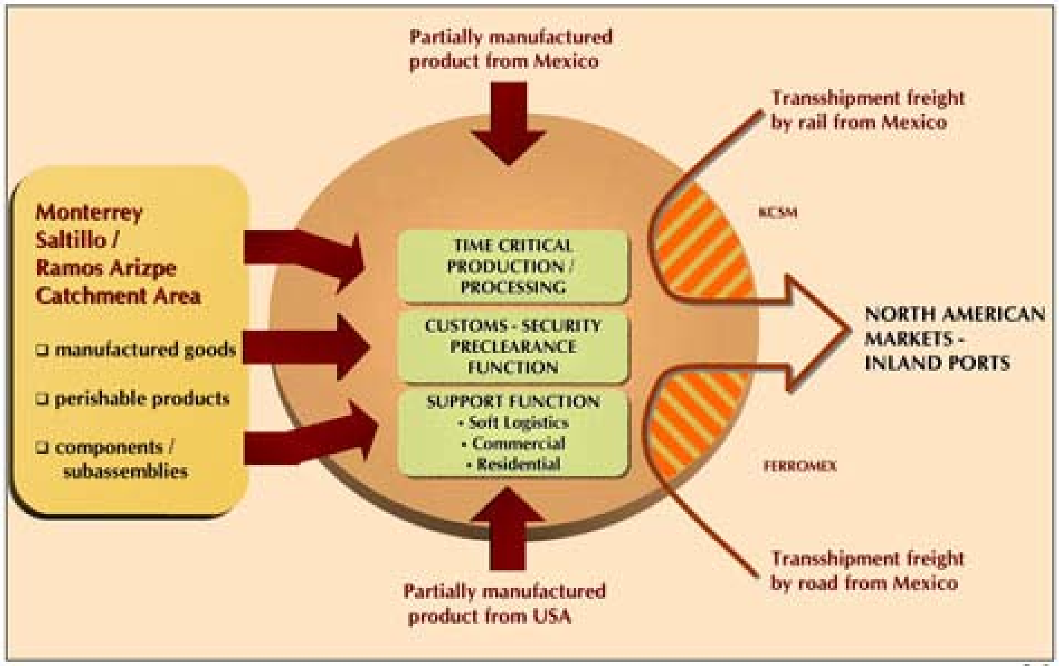



Source: Harrison, Loftus-Otway, and Shakyaver, 2005

*Figure 3.5: Development Life Cycle of Inland Ports*

Free Trade Zone (FTZ) designation is an integral part of an inland port. FTZs are areas designated by the government to which cargo can be transported in bond without being subject to customs duties. This process is especially useful for manufacturing, in that component parts can be transported to the facility for assembly without being subject to import taxes. Items can then be cleared by customs at the inland port for distribution within the domestic market or exportation. As already discussed, Mexico also has a general standard for industrial parks (NMX-R-046-SCFI-2005) that the Tax Administration Service requires new industrial parks wanting to operate as FTZs to comply with.

Figure 3.6 shows how the FTZ designation at Monterrey will be used to facilitate the flow of goods to and from the U.S. through the removal of some components of the supply chain discussed earlier.




Source: Alejo, 2006 and Franco Eluteri & Associates, 2007

*Figure 3.6: Monterrey Inland Port FTZ will facilitate transfer of goods to the U.S. market*

The two case studies that follow are reviews of the inland ports in San Luis Potosi and Monterrey. Figure 3.7 shows the main NAFTA highway in Mexico upon which San Luis Potosi's and Monterrey's inland ports are found and which links to IH-35 here in Texas. Figure 3.8 shows the main NAFTA rail network in North America

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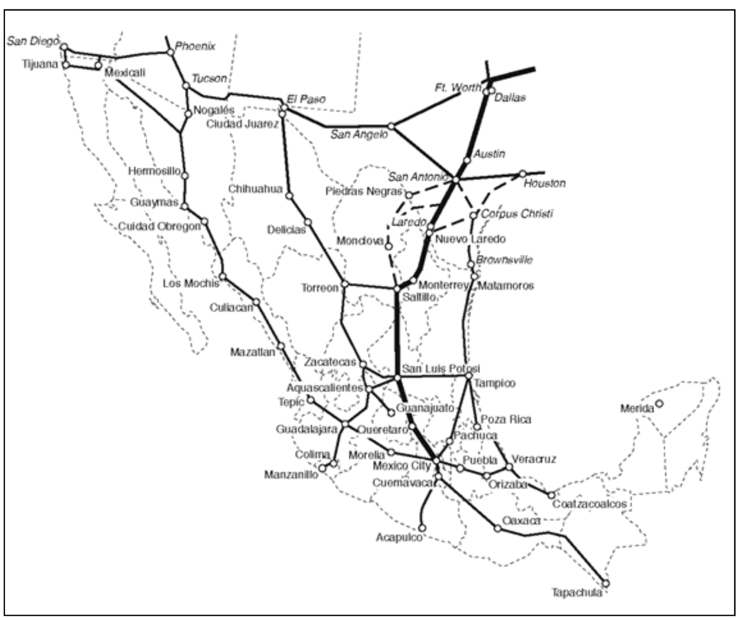
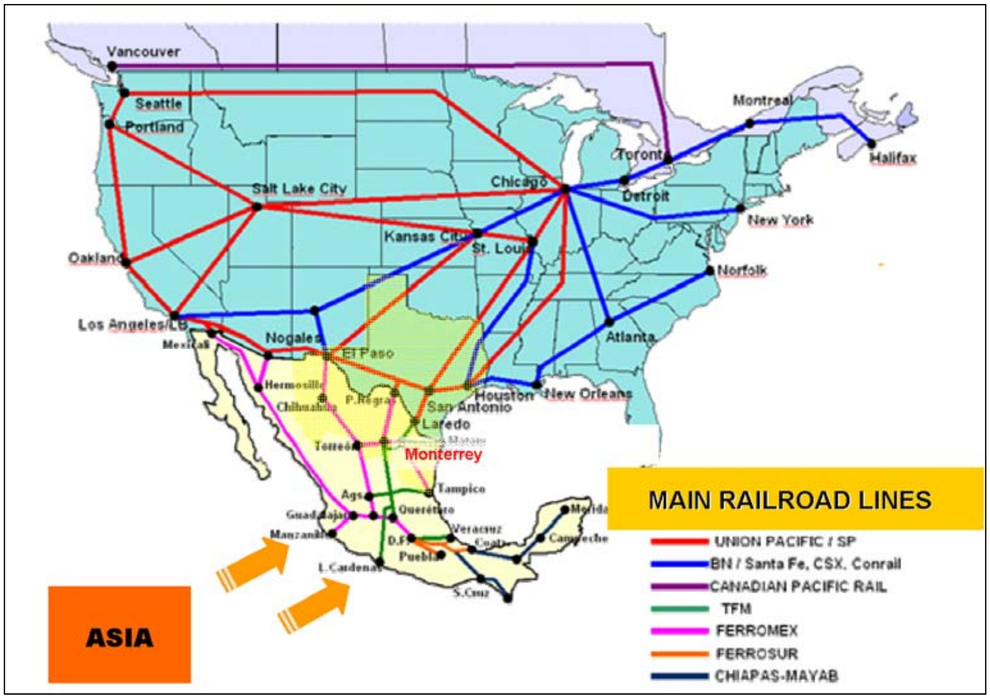



Source: Prozzi et al., 2002.

*Figure 3.7: NAFTA Highway*




Source: Alejo, 2006 and Franco Eluteri & Associates, 2007

*Figure 3.8: Main Rail Connections to San Luis Potosi and Monterrey*

## 3.2 San Luis Potosi Inland Port

The location of the capital of the state of San Luis Potosi, San Luis Potosi City makes it a logical location for concentrated industry coupled with a free trade zone for many reasons. With a population of roughly 700,000 residents, the city has its own market, and is strategically located in the center of northern Mexico, with access to both the U.S. market and major metropolitan areas in Mexico, including Mexico City, Guadalajara, and Monterrey. The city is also located on important rail and highway corridors, including Highway 57, which links to US IH 35 to the north and Mexico City to the south, and KCSM's NAFTA rail line, linking the Pacific Coast of Mexico at the port of Lazaro Cardenas to the U.S. through Laredo. As the federal government of Mexico continues to improve Mexico's overall infrastructure, these projects will benefit from the future development of highway and rail connections. Currently, rail and highway structures allow easy access to local and international sea ports and consumer markets: specifically to Mexico City and Guadalajara in Mexico and the U.S. market through Laredo/Nuevo Laredo.

San Luis Potosi is at the center of an economic triangle, known as the Industrial Triangle, which is between Monterrey, Guadalajara, and Mexico City (Contreras, 2009). This location makes San Luis Potosi an appropriate location for shipping goods domestically (similar to the golden triangle here in Texas) as Mexico City, Guadalajara and Monterrey are the three- largest cities in Mexico. Figure 3.9 shows the industrial triangle.

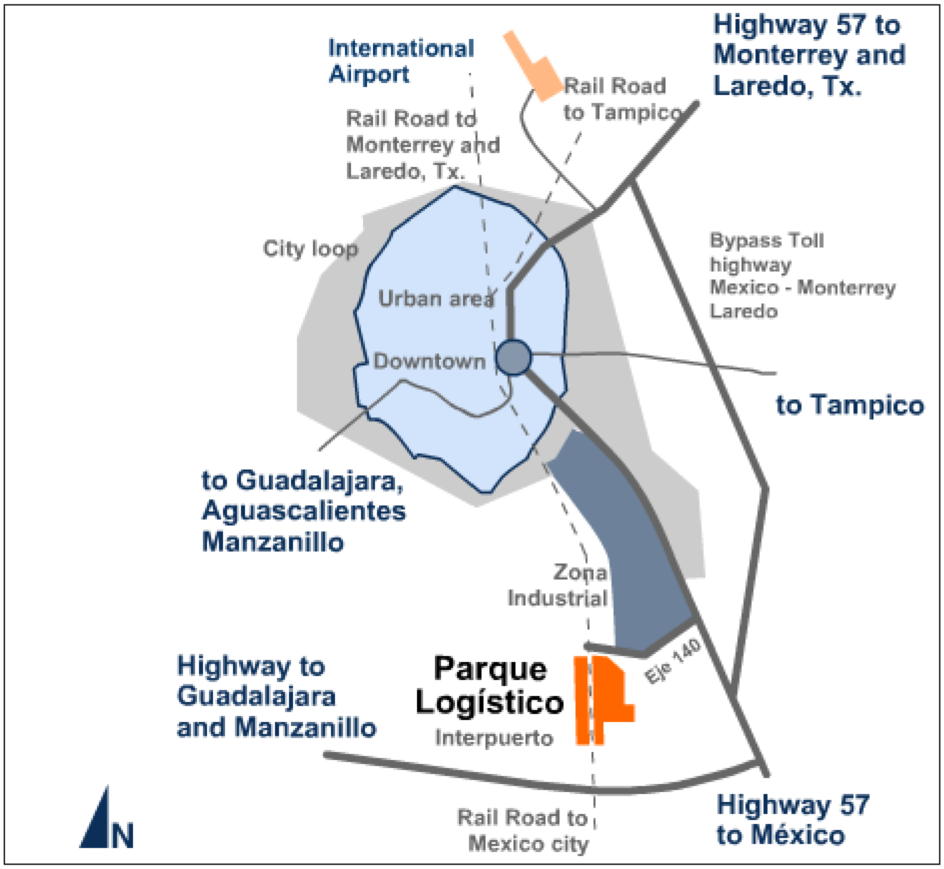

Source: Cardenas, 2009.

*Figure 3.9: Industrial Triangle*

### 3.2.2 Project Description

The two projects examined in this case study are the Logistics Port (SLPLP) and the Logistik Industrial Park (LIP). The two projects were designated FTZs by the federal government in 2003 and initial construction of facilities began in 2004 (Castillo Mireles, 2005). The vision of San Luis Potosi government leaders is aligned closely with the overall vision of transportation infrastructure development enumerated in the NIP as the country seeks to develop integrated logistics systems. San Luis Potosi government officials created infrastructure plans to attract business and leverage San Luis Potosi's geographically strategic location, abundance of skilled and unskilled labor, to develop industries to produce economic growth.

San Luis Potosi Industrial Park is located on the Mid-Continent Trade Corridor. Several highway and railroad lines branch out from the port connecting it to major water and inland shipment hubs in the U.S. and Mexico, such as San Antonio, Laredo, Monterrey, Brownsville, Altamira, Manzanillo, Lazaro Cardenas, Veracruz, and Mexico City. San Luis Potosi Logistics Port is located on the NAFTA highway corridor Highway 57 and the north-south railway just outside of San Luis Potosi City, which can be seen in Figure 3.10.




Source: http://www.parquelogistico.com.mx/ Website (not dated)

*Figure 3.10: Map of Transport Connections from San Luis Potosi*

San Luis Potosi City is surrounded by industrial parks with local and global manufacturing companies. In total, there are seven industrial parks (Mexico Industrial Maps, 2008). These various industrial parks in and around the inland ports were proposed to create a large number of skilled jobs, as well as bringing revenue into the state.

The SLPLP and LIP are distinct from the other industrial parks in San Luis Potosi because of their FTZ designation, which allows for customs clearance to be done at the intermodal facility and cargo to be held in bond. Imports are exempt from import taxes until distribution from the intermodal port site. Exports can be manufactured and go through customs inspection before leaving the intermodal port for their international destination saving time and money because they do not need to be stopped at the border (Contreras, 2009). Figure 3.11 shows the location of the industrial parks within and around San Luis Potosi City. Notice that (LIP) is set apart—located off the map further southeast of the city, near FINSA, another industrial park.

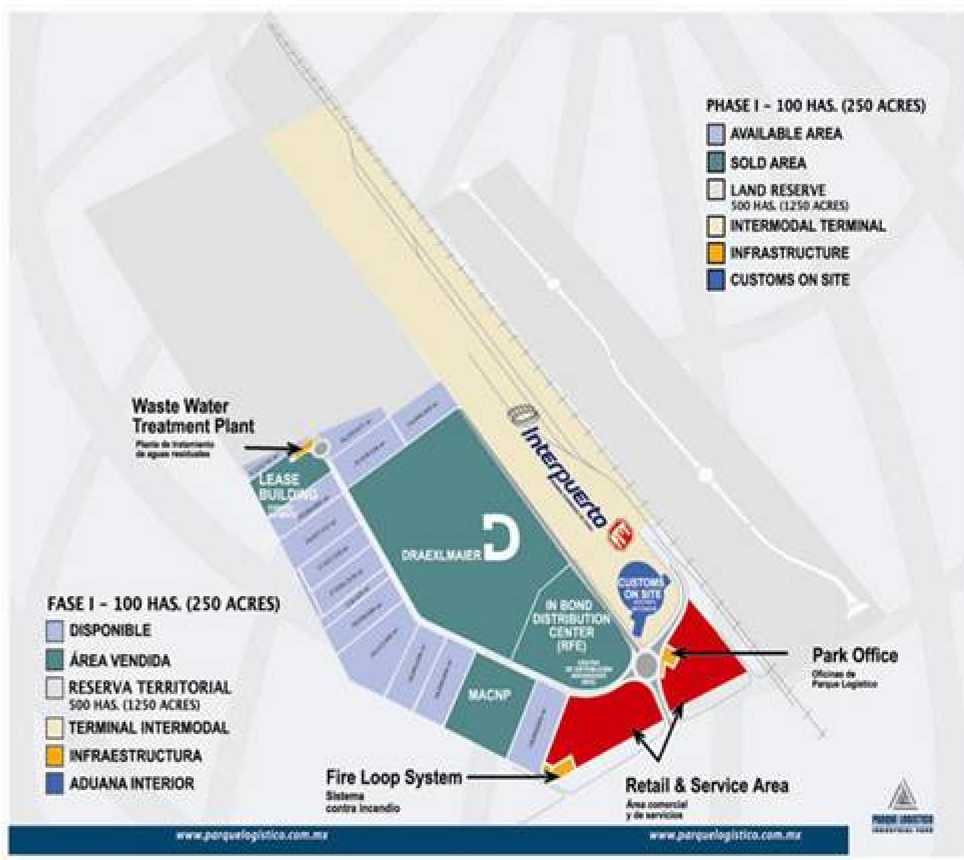

Source: Mexico Industrial Maps, 2008

*Figure 3.11: Industrial Parks Around San Luis Potosi*

### 3.2.3 History

The purpose and original vision of the SLPLP and LIP were to create inland multimodal hubs that manufactured and imported and exported goods locally and internationally (Castillo Mireles, 2005). In an interview with Grupo Valoran and San Luis Potosi officials, Jose Luis Contreras asserted that the vision of the SLPLP began over eight years ago, and there was a considerable amount of coordination between the state, the city, and the private firms in developing the project (Contreras, 2009). The state's economic development division spearheaded promotion of the industrial zone around the inland ports. During researcher interviews in San Luis Potosi, it was difficult to discern who was employed by the private firms and who was a state employee due to the fact that the parties worked closely together.

Critical to the development of these two inland ports was planning for gaining FTZ status. State and inland port officials noted that by attaining FTZ status cost-effective transportation, customs inspection, and storage of international cargo would accrue. FTZs include typically manufacturing facilities, and many of the inputs for these processes enter the FTZ duty free. In the case of the SLPLP and the LIP, there was also an additional "goal" of relieving the burden on customs officials at seaports by diverting the cargo in-bond to the inland ports facilities for clearance. As was discussed in the Manzanillo case study in Chapter Two, this could significantly reduce time in port for cargo. This is also an extremely important issue for shippers, third-party logistics (3PLs), and other logistics firms, especially for those who utilize just-in-time (JIT) manufacturing. The FTZ makes a significant financial and time difference to shippers, logistics companies, 3PLs, and manufacturers making container shipments by reducing paperwork, fees, and taxes, as well as the actual turn-around time to receive goods and components for JIT manufacturing. Figure 3.12 shows a schematic of SLPLP.



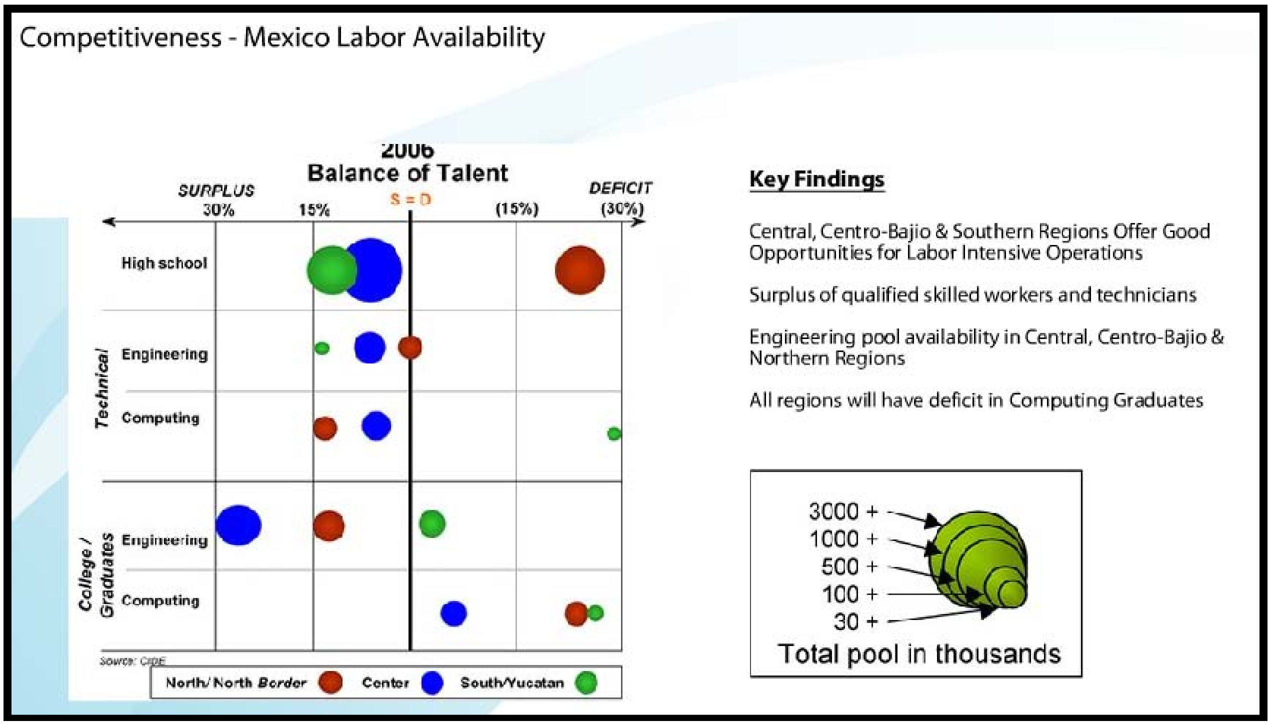

Source: Parque Logistic Website (not dated)

*Figure 3.12: Schematic of Parque Logistico*

San Luis Potosi was also able to leverage its excellent rail connections to population centers within Mexico and the U.S as it developed these inland ports. KCSM expanded into Mexico in 1995 when Mexican National Railways privatized into several segments under concessions (KCS, 2007). The SLPLP and LIP are important hubs of business for KCSM, which manages freight shipments by rail at the intermodal facilities at these two inland ports. In an interview, San Luis Potosi state official Jose Luis Contreras highlighted how pleased they are with KCSM services, noting that turnaround time for unloading goods from the rail line is 20 minutes (Contreras, 2009).

Cost competitiveness for wage rates, land, and utilities was also important in bringing investment capital. San Luis Potosi touts the availability of natural gas and its hydroelectric power plants for adequate transmission of electricity to businesses and lower electricity prices in the state. The average daily wage in San Luis Potosi was MXP180.9 in 2007 (US$13.50 in June 2009) (Understand Mexico, 2007).

San Luis Potosi has multiple technical schools and universities, many of which focus on engineering with the goal of training future employees for the Industrial Zone. As previously discussed, educational institutions are important for developing the skilled labor necessary for value added production at an inland port. A high number of engineers are educated within the state and provide a large labor pool for the industrial facilities (SEDECO, no date). Figure 3.13 shows the availability of skilled laborers in the state of San Luis Potosi.




Source: Cardenas, 2009.

*Figure 3.13: State of San Luis Potosi Labor Availability*

### 3.2.4 Planning

According to a presentation by the state's Secretary of Economic Development, the state of San Luis Potosi geared its development plans to focus on achieving top rankings in levels of education, per capita income, and economic growth. The state has qualified and skilled workers for employment, including engineers, due to the many technical universities and research and development institutes in the area (Cárdenas, 2009).

The state of San Luis Potosi has also introduced the idea that sustainable development for Mexico will rely on improved efficiency in transportation networks, particularly those used for handling international trade. The potential sustainability advantages offered by an inland port facility such as San Luis Potosi would include, for example, improving the probability that a shipper could use rail for a greater percentage of their deliveries, shortening interterminal dray distances, and consuming comparatively less land industrial and distribution activity than would be the case if the facilities were build independently in disparate locations. As stated by Jose Luis Contreras, Secretary of Communications for the state of San Luis Potosi, *"We want to make international trade cheaper by putting shipment, storage, and customs inspection together in one place. We want to be the best at this task. We are located in the perfect place for an intermodal port"* (Contreras, 2009). San Luis Potosi officials highlighted this point throughout researcher interviews (Cárdenas, 2009).

The development of FTZs in Mexico is at the center of San Luis Potosi's industrial vision and in keeping with the branding of San Luis Potosi as a distribution hub in Mexico. Both LIP and the SLPLP have functional FTZs with on-site customs inspection.

Inland ports with FTZs are common in the U.S. In the United States there are Free Trade Zones, called Foreign-Trade Zones (NAZFTZ, 2005). FTZs are located in all 50 states and Puerto Rico, regulated by the Foreign-Trade Zones Board and chaired by the secretary of commerce (Where are zones, Feb. 2009). As San Luis Potosi City was the first location for logistics parks with an FTZ, the city hopes to be a model for the proposed inland ports in Monterrey, Guanajuato, Hidalgo, and other regions.

*Planning Coordination: Government and Private Firms*

In an interview with Grupo Valoran and San Luis Potosi officials, Jose Luis Contreras asserted that the vision of the SLPLP began over eight years ago, and there was a considerable amount of coordination between the state, the city, and the private firms in developing the project (Contreras, 2009). Both state officials and intermodal hub developers have a number of future goals for the San Luis Potosi Industrial Zone. The first priority is to bring in additional business to utilize all available space at the SLPLP and LIP. State officials mentioned bringing goods shipped to Tampico and Lazaro Cardenas through customs inspection and storage at SLPLP to alleviate customs facilities in these locations. Increased collaboration with Asian firms and international firms, in general, is also a priority (Contreras, 2009).

On a local level, state officials are interested in having more direct contact with Texas officials, especially those at San Antonio's inland port and the port of Houston. Currently, San Luis Potosi ships to San Antonio and Houston by utilizing KCSM on the Mexican side. During researcher interviews, state of San Luis Potosi officials expressed a desire to have more contact with Texas government officials and to better understand Texas transportation plans (Contreras, 2009).

In some ways, there is more coordination between the private-sector companies and Texas entities than between the Mexican state entities and Texas. In early 2008, the Port of Houston and Mexican companies Expide and Logistik signed an agreement to work together to promote trade corridor development linking together San Luis Potosi and the port of Lazaro Cardenas. The agreement was to use rail, maritime and roadway connections to promote cargo movement between Houston and Mexico. In particular, Logistik is focusing on cargo movement by rail between the U.S. and Mexico on KCSM's routes (Cepeda, 3 March 2008).

*Regional Coordination*

SLPLP is also collaborating with ports such as Lazaro Cardenas to potentially conduct customs inspection inland, and thus alleviate a potential bottleneck at the rapidly growing port. Logistik FTZ, the private company operating the LIP, and the port of Tampico signed a memorandum of understanding in June of 2007 to provide cargo transportation services to the center of the country at a lower price. The agreement was primarily targeted at lowering rail costs for auto manufacturers between the two cities to increase the attractiveness of the inland port to manufacturers (Hernandez, 20 Jun. 2007). According to San Luis Potosi officials, they have plans to expand shipments from other Mexican seaports, but their main focus is on manufacturing and export (Contreras, 2009).

San Luis Potosi is a member of the North American Inland Ports Network (NAIPN), which is part of North American Super Corridor Organization (NASCO).

*Environmental Review*

The SLPLP received the Certificate of Environmental Compliance in January 2007 from the state government. In an article by Automotive Alliance, the President of Grupo Valoran Vicente Rangel Lozano references the importance of environmental protection to San Luis Potosi to *"…take its place in the new global reality, generating opportunities while protecting the environment"* (Méndez, 2007). In researcher interviews, San Luis Potosi officials stressed that the port strives for national and international compliance on environmental standards as many of the manufacturers located on-site are global firms. No issues with right-of-way were mentioned, as land used for the logistics park was a greenfield site prior to its development as an inland port (Contreras, 2009). Because the project was privately constructed no environmental impact assessment was required.

### 3.2.5 Project Implementation

The initial investment for the development and construction of SLPLP came from HINES, an international real estate firm based in Houston with offices in 16 countries (Parque Logistico, Feb. 2009). HINES also owns property in other Mexican cities, including Guadalajara, Mexico City, and Monterrey and has been operating in the Mexican real estate market since 1975 (National Mortgage News, 2004). The logistics park is currently owned and operated by Grupo Valoran, a Mexican development firm (Contreras, 2009).

The partnership between Hines and Grupo Valoran began in June 2004 when plans for SLPLP were officially announced (Hines, 2004). Hines financed the original purchase of land and contracted Grupo Valoran as its local developer (Contreras, 2009). Hines was also involved in infrastructure construction for the facility. Their initial investment in phase one of the inland port projects included US$7 million for building infrastructure for a natural gas distribution network, communication system, fire loop, and sewage system[i]. The initial development included 100 acres of the 1000 slated to be developed (National Mortgage News, 2004). The SLPLP currently has its own working fire station and officials state that the SLPLP is not reliant on the city's infrastructure for electricity (Business Wire, 2004).

The Logistik Industrial park (LIP) opened on Oct. 24 2007 and was the first "Reciento Fiscalizado Estratégico" (Refie) or consolidated customs facility, in Mexico. Logistik Enterprise

Group, owner of the LIP, was the first to lobby for a FTZ in San Luis Potosi (Logistik FTZ, 2008). LIP was primarily dedicated to the importation, commercialization, and industrialization of grains. The LIP has grown from its early focus on grain production to include manufacturing plants for the automotive, steel, and lumber industries as well as logistics facilities for containerized and general cargo.

Several domestic and international firms, such as POSCO (manufacturing), Maderas y Triplay (wood products), DHL (logistics), PENSKE (logistics), and Ryder (logistics) at the LIP, and ABB (engineering) and Valeo (automotive) at the SLPLP, have taken advantage of the inland port's access to infrastructure by locating their industries in San Luis Potosi. One of the newest additions to the list of foreign investors is FedEx, which recently launched its second domestic service hub in San Luis Potosi (FedEx, 9 February 2009). General Motors, despite the precarious circumstance of the U.S. auto makers, opened a facility in San Luis Potosi that was to produce the Chevrolet Aveo and Pontiac G3 (Guyette, 2009). Though the facility opened in April 2009, it has already been affected by U.S. auto industry struggles. GM announced that it will no longer manufacture new Pontiac model as of 2010. GM is also expected to halt production short-term at several Mexican plants, including San Luis Potosi, which ceased production from June 1-12, 2009, though no permanent closures are planned (Sánchez, 2009).

The City of San Luis Potosi is now second only to Monterrey for volume of freight shipments generated (Cárdenas, 2009). The state of San Luis Potosi is known for its automotive, mechanical, and stamping industries. The inland port of SLPLP services a number of international companies and shipment agencies. KCSM controls the intermodal terminals used for loading and unloading cargo at SLPLP and LIP. Global and regional companies such as DHL, General Motors, ABB Industrial, Draexlmaier, and Valeo have manufacturing and export facilities at the intermodal terminals in the inland ports. SLPLP is located on 444.38 acres on the south end of San Luis Potosí's industrial corridor (as shown in Figure 3.12) and LIP is located on 5,166 acres near the San Luis Potosi Airport. There are a number of spaces for businesses still available at the SLPLP. When asked about sale of available space, Grupo Valoran stated that vacant property at the SLPLP had prospective buyers, including some Asian firms; however, the names of specific companies was not disclosed (Contreras, 2009).

Security is strict at the customs zones. Although visitors with specific business interests are allowed to tour the SLPIP with a Grupo Valoran escort, the general public is kept away from the facility (Cárdenas, 13 Feb. 2009). The site is over ten miles outside of the city in the designated Industrial Zone and it is surrounded by fencing and security guards. The entrance has a checkpoint for visitors and the loading and unloading zone at the KCSM rail line has a guard tower. Watchdogs are also kept on-site for customs inspection and only those with special clearance may enter the restricted foreign trade zone. Following are two pictures of the logistics park foreign trade zone. Figure 3.14 is an aerial view from the Hines website and Figure 3.15 is a ground shot of one FTZ facility.

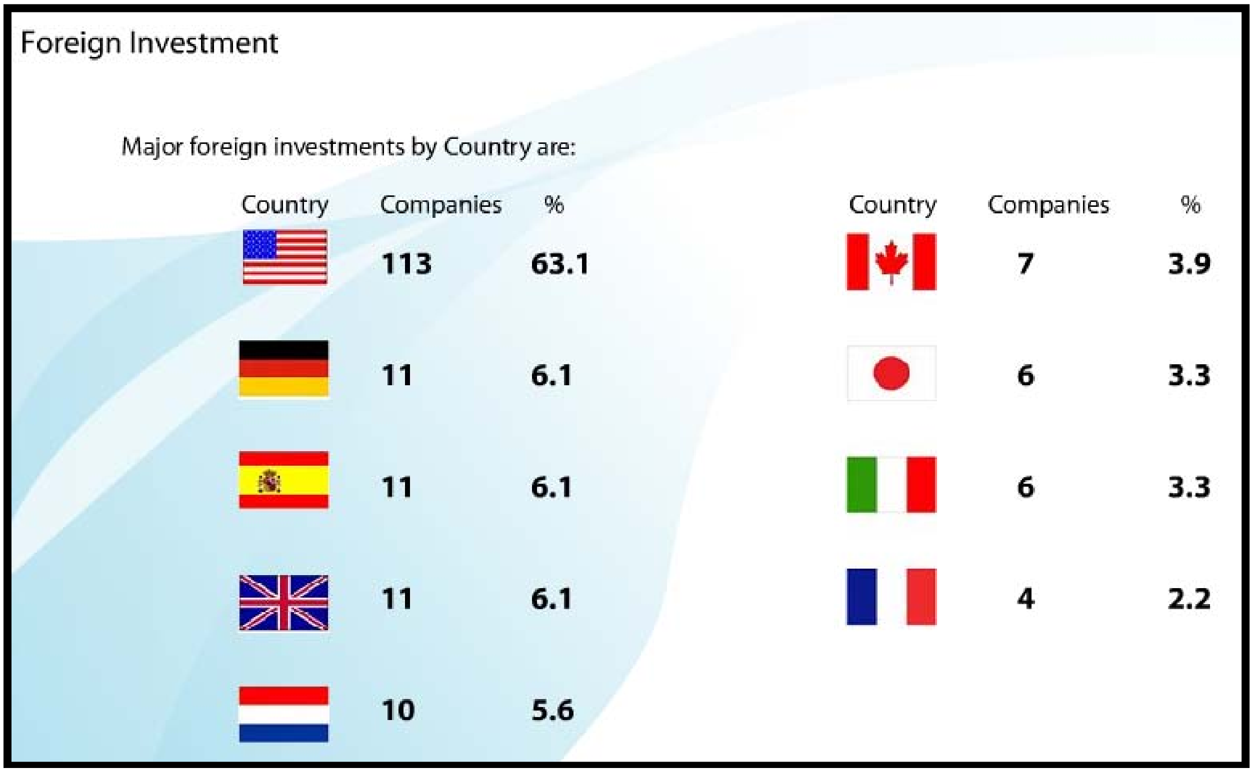
Source: Hines Website.

*Figure 3.14: San Luis Potosí Industrial Park Customs Zone*

*Figure 3.15: San Luis Potosí Industrial Park Customs Zone*

The primary method of export is by truck. Approximately 67% of the shipments for export are performed exclusively by truck, 20.4% percent of exports will eventually move on water. Of the exports destined for a marine port, three fourths are destined for Gulf ports while the remaining one fourth is destined for a pacific port. Air and rail shipments are surprisingly small, despite investment from companies like FedEx and KCSM. The amount of cargo leaving the port by these modes is 8.2% for air and 4.5% for train shipments (SEDECO, 2008).

According to a presentation by the Secretary of Government Development, San Luis Potosi State had US$1.89 billion in exports in 2007, 72.6% of which travel through the U.S. border, and received US$123.5 million in foreign direct investment in 2007. Foreign direct investment in San Luis Potosi State is dominated by the United States, which provides 63.1% of total investment in the state. Other countries with investment in San Luis Potosi State, ranging from 6% to 2% of total foreign investment, include Germany, Spain, Britain, the Netherlands, Canada, Japan, Italy, and France (Cardenas, 2009). Figure 3.16 is a chart of percentage of foreign investment that has developed in San Luis Potosi.




Source: Cardenas, 2009.

*Figure 3.16: Foreign Investment*

*Project-Related Difficulties*

In a meeting with San Luis Potosi government and SLPLP representatives, the officials highlighted the port's success in bringing in foreign investors, cutting costs of customs inspection, and relieving congestion at sea ports (Contreras, 2009). They did not discuss any difficulties in establishing the inland port.

As discussed earlier, the inland ports in San Luis Potosi may face difficulties due to the downturn in the U.S. auto market because of the number of companies focused on auto manufacturing with facilities at the inland ports. However, the full effects of the economic downturn and the outcome of auto manufacturing in NAFTA countries, after GM's June 1, 2009 bankruptcy filing in federal court is still unknown (Vlassic, 2009).

### 3.2.6 Conclusions

San Luis Potosi's inland ports are an example of a private business initiative coupled with state government coordination, in essence a PPP. Construction of the SLPLP and LIP meets the current need to bring low-cost customs inspection and distribution to the center of Mexico to alleviate congestion at ports of entry, and looks to future needs as a mechanism to fuel local development.

*Notable Features*

In the case of San Luis Potosi, a combination of geography, private investment, and public infrastructure planning were essential ingredients for the successful creation of these inland port facilities.

The strategic location of the industrial zones and the customs facilities is undeniable. The city of San Luis Potosi is strategically placed to take advantage of the infrastructure development taking place in Mexico under Calderon's NIP because of its connections to the main population centers of the country, including Mexico City, Guadalajara, and Monterrey. While in Mexico, most projects have some federal funding, the fact that this was led by the private-sector development is evidence of the importance of the location to local business interests.

The involvement of the state of San Luis Potosi is not something to be discounted. Although financing was strictly from private real estate developers, the city has spent a significant amount of time and money supporting education institutions, promoting infrastructure investments in the region at the national level, and planning the layout and promoting the development of the industrial zone. The coordination of the private businesses and the state has helped to make the industrial zone a success.

*Challenges*

Overdependence on foreign firms may hinder regional development in San Luis Potosi if international firms move, downsize, or send offshore operations elsewhere. It will be important that, despite the current economic downturn, the state continues to invest in education and infrastructure to promote continued private-sector interest in the inland ports and San Luis Potosi. It will also be important for SCT to build infrastructure capacity to keep up with cargo growth for the industrial zone to remain cost effective.

*Impact on U.S. Transportation Systems*

San Luis Potosi has built a strong network of inland ports, two successful free trade zones, and a network of international partners. As the U.S. continues to dominate foreign direct investment at 63%, stable and equitable trade policies and cross-border collaboration will be increasingly important as the region develops. The primary method of export is by truck with a significant amount of shipments sent north across the border with Texas. As international business continues to move their facilities to the region, Texas can expect an increase in trade flow. While the financial crisis may have an impact on overall manufacturing output and exports in the short term, businesses will continue to invest in and move operations to the region as long as San Luis Potosi continues to position itself and the inland ports to take advantage of these opportunities. In addition San Luis Potosi has important connections to the inland port in San Antonio and Dallas and to the Port of Houston. Improving contacts with TxDOT will increase regional integration and planning for freight corridors.

## 3.3 Monterrey Inland Port

The city of Monterrey is an essential transport hub between the northeastern border of Mexico and the United States, with frequent interstate commerce with the state of Texas in particular. It also benefits from being in the Industrial Triangle that was discussed in the previous section covering San Luis Potosi's inland ports. The city is home to a major international passenger and cargo airport, 30 industrial parks that accommodate 700 companies, and numerous highways connecting Mexican seaports to the Texas/Mexico border. Because Monterrey is home to many industries and transportation outlets, it has taken the initiative to develop its own inland port to efficiently transfer goods to and from Mexico and the United States. According to the Programa Para la Integracion del Desarrollo Regional del Noroeste y su Vinculacion de Texas (INVITE), translated in English as "Regional Integration Program Incentive of Northeastern Mexican States and linkage with the State of Texas," the development of an inland port is an essential component of the Logistics Development Strategic Program for the Competitiveness of the state of Nuevo Leon (Petterson, 2007). The inland port is part of a greater development plan for the state of Nuevo Leon, and is expected to become an important resource for the northern industrial zone of the metropolitan region of Monterrey.

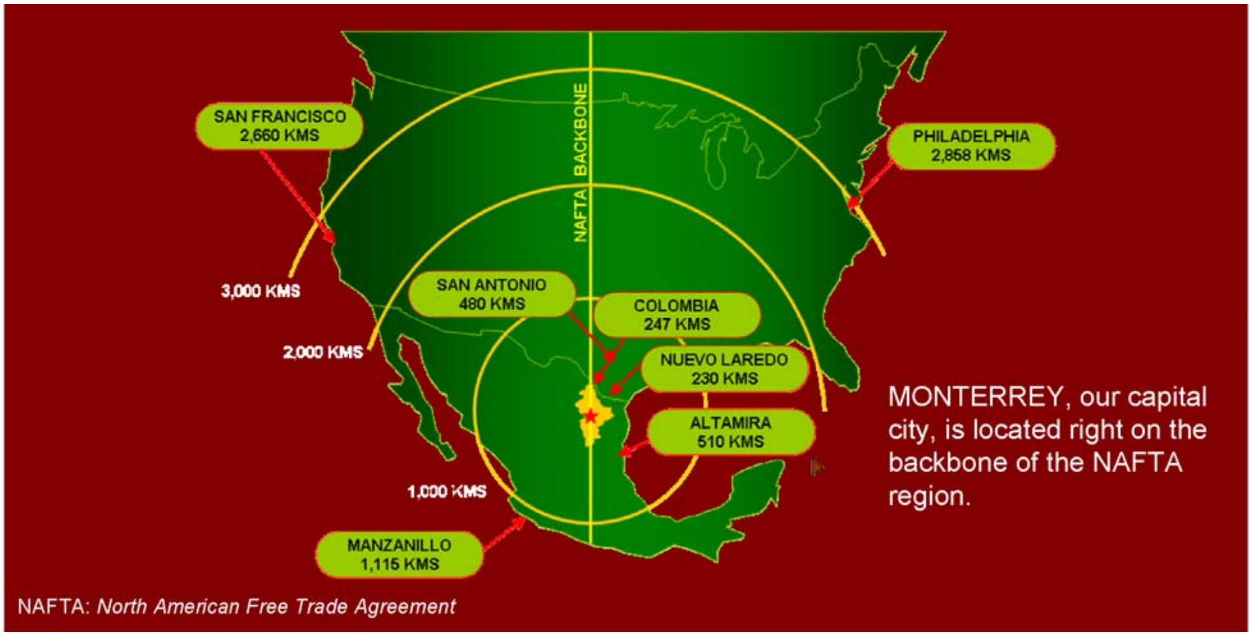
### 3.3.1 Project Description

*Type*

The project examined in this case study is the planned construction of an inland port in Monterrey, Mexico. The port may handle cargo originating from several Mexican seaports, as well as cargo generated from the industrial area of Monterrey. Though the inland port is not part of the NIP, the expansion of the Monterrey-Colombia highway is included and this project is expected to aid development of the port. While many of the projects in the NIP are geared toward finishing the infrastructure network in Mexico, there are several projects, such as this highway expansion, that will have an impact on trade with the U.S. by facilitating the movement of cargo northward.

*Need*

Inland ports are necessary to create more efficient and secure passage for the transport of goods from one place to another—in the case of Monterrey, from country to country. The Monterrey inland port is located near numerous commercial warehouses and industrial parks along Highway 57. Monterrey is strategically positioned on Highway 57 in Mexico, providing access to the U.S. market and the IH 35 corridor. Establishment of an inland port at this location would allow the city to take advantage of increased NAFTA trade and facilitate the movement of goods along the NAFTA corridor. The projected zone of influence of the inland port is shown in Figure 3.18.




Source: Alejo, Francisco. 2006

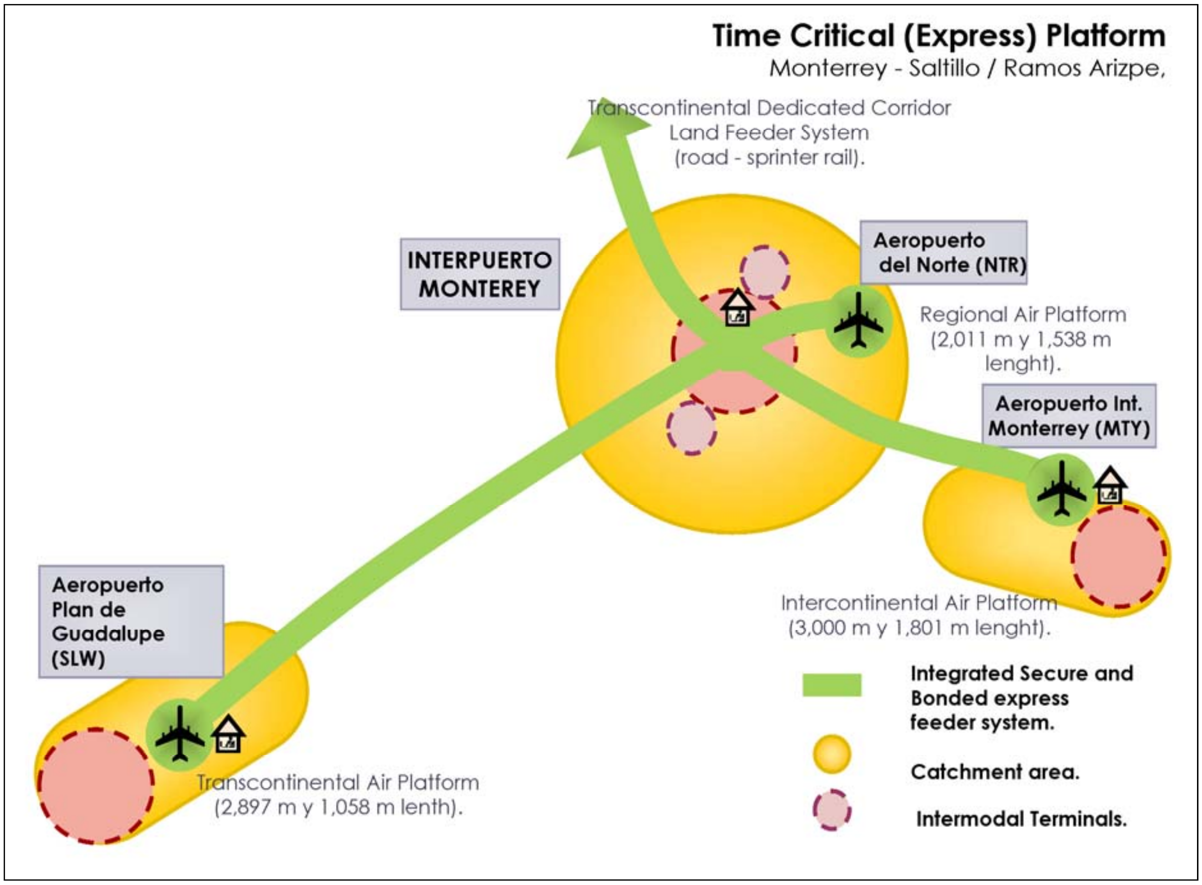
*Figure 3.17: Monterrey and the NAFTA corridor*

The one distinct advantage this inland port may have over others in Mexico is the potential convergence of two major rail lines belonging to Ferromex (FMX) and KCSM. As Monterrey is already a major stopping point for goods coming through Lazaro Cardenas and other seaports, the creation of this inland port will reduce transit time to the border by streamlining the customs process. By addressing this need, Monterrey will become an even more important component in the shipping corridor from southern Mexico to the United States, particularly the state of Texas.

Interpuerto Monterrey, in its projected entirety, will encompass land in the towns of Salinas Victoria and Sabinas Hidalgo, approximately 30 km (18 miles) from the center of Monterrey proper, which is also the current location of the KCSM intermodal yard. The port will initially cover about 10 hectares (25 acres) in size, with an additional ten hectares set aside for growth (González Migoya, 2009). At completion the inland port will span between 1,200 and 3,000 hectares (approximately 3,000 to 7,400 acres), according to the CEO of Servicios Intepuertos, Alfonso González Migoya (González Migoya, 2009). The location of the inland port in Salinas Victoria is strategic, as it will encompass the intermodal yards and rail lines of the two biggest railroads in Mexico, KCSM, and Ferromex. Additionally, this area is adjacent to the Monterrey-Colombia/Highway 57, which connects directly to Federal Interstate 85, which becomes Interstate 35 at Laredo on the Texas border. This project is especially enticing to Nuevo Leon transportation officials, as it could potentially lead to the consolidation of rail lines owned by Kansas City Southern de Mexico and Ferromex, making this an ideal and efficient inland port to ship goods into the United States.

Another attractive feature of this project is the proposed streamlining of the customs process to be conducted at the Inland Port. Ideally, the Monterrey Inland Port will be able to have a consolidated customs facility. According to Hugo González, Logistics Development Director of INVITE, the flexibility of this type of customs facility is due to the inland port's designation as a FTZ—an asset that attracts more investment (González González, 2009).

The FTZ designation will allow the inland port at Monterrey to attract businesses dependent on JIT manufacturing. The inland port can help reduce inventory levels and the cost of inventory by providing a more streamlined logistics process. The FTZ may also help facilitate time critical express distribution by providing access to several airports and facilitating the distribution of cargo in bond, speeding up time in transit as is depicted in Figure 3.19.




Source: Interpuerto Monterrey Logistics Gateway, no date

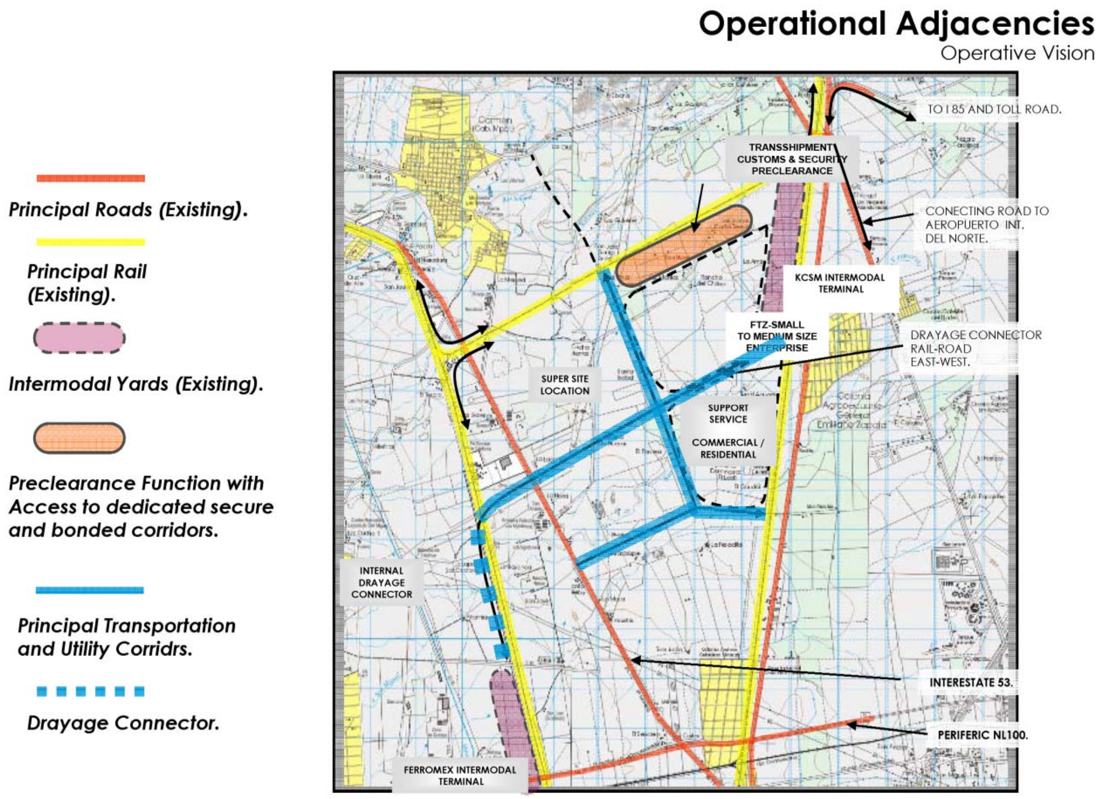
*Figure 3.18: Interpuerto Monterrey Express Network*

There is a lot of work ahead for the inland port to achieve the full vision that the planning officials seek. Currently, the port is only at stage one of the inland port development identified by Leitner and Harrison (Leitner and Harrison, 2001). So far, this project has not required a lot of initial infrastructure overhaul or major planning in terms of the land. The land was ranch land before it was purchased for the development of the inland port, and KCSM already has an intermodal terminal at this site that provides some distribution capability. The combination of a number of factors—the geographic location next to a major highway, the flat terrain, and connectivity to the metropolitan area of Monterrey—provided a logical situation for this project. Figure 3.20 shows an aerial shot with a superimposed computer generated projection of the port's layout.

Source: Petterson, 2007

*Figure 3.19: Computer-generated projection of the future inland port*

Figure 3.20 shows the facilities schematic as well as the major modal connections of existing highways and rail, the proposed FTZ site and the principal transportation and utility corridors in the site.




Source: Interpuerto Monterrey Logistics Gateway, no date

*Figure 3.20: Facility Schematic*

*Geographical Location*

Mexico is quickly becoming a logistics hub for North and South American companies seeking to take advantage of the country's regional integration of supply chains, especially in Monterrey. This regional integration provides a significant cost reduction in transportation, with an inland port completing the path for JIT shipping to connect suppliers to the plant, and then to the customers (AMPIP, 2006).

Monterrey is the capitol city of Nuevo Leon, which borders the state of San Louis Potosi on the South, the states of Tamaulipas to the north along with a small outlet to the United States border, and the state of Coahuila to the West. The city is home to about 1.1 million residents and another 2.7 million are distributed between the surrounding municipalities of San Pedro Garcia, Juarez, Garcia, Santa Catarina, Escobedo, Guadalupe, Apodaca, and San Nicolas de los Garza. The metropolitan population of 3.8 million makes Monterrey the third most populous city in Mexico and the second-largest urban area in Mexico, trailing only Mexico City. Monterrey is known as "la ciudad de las montanas" (the city of the mountains) because it is located within the Sierra Madre Oriental mountain range (Secretary of Economic Development, not dated).

The city contains 85% of Nuevo Leon's population and is home to 54% of the state's industries. Overall, Nuevo Leon is home to roughly 4% of the entire population of Mexico, but generates over 8% of the country's GDP. For this reason, Monterrey is known as the business capitol of Mexico, and has more millionaires per capita than any other Mexican city. Monterrey's major industries (beer, glass, steel, and finance) have pushed the development of the city and created a need for increased infrastructure to handle the products created in Monterrey and also products from around Mexico destined for the United States (Day, 2006).

The population of Monterrey also provides potential industries with a highly skilled workforce in the technology and manufacturing sectors. The work force of the state of Nuevo Leon has an average of 10.1 years of education, and the state is home to 30 higher education institutions and 213 technical schools (Alejo, 2006). In the metropolitan area of Monterrey, there are numerous institutions of higher education, with the Universidad Autonoma de Nuevo Leon (the public university), as well as the PIT (Parque Industrial Tecnologico) that houses several state and private universities, as well as companies developing new technologies in fields such as robotics (González González, 2009). With a heavy emphasis on technology and commercial development, the state is welcoming to any project that can supplement the development of leading industries in Monterrey in order to give their high-skilled workforce ample employment opportunities.

*Sponsorship*

In March 2004, the governor of Nuevo Leon created INVITE (translated in English as Regional Integration Program Incentive of Northeastern Mexican States and linkage with the State of Texas) to promote integration between the Mexican states of Tamaulipas, Coahuila, Chihuahua, and Nuevo Leon, and the U.S. state of Texas.

Most of the initial funding and research to identify a proper parcel of land for the port was conducted by SCT, the state of Nuevo Leon's Urban Development Planning (Desarollo Urbano de Nuevo Leon (DUNL)) office, and INVITE. Currently, the development of the inland port is under the guidance of a private entity created by the state to bring investment into the inland port, Servicios Interpuertos. It is headed by CEO Alfonso González Migoya, a veteran financial consultant who has served as Director of Coca-Cola FEMSA SAB de CV, Director of Maxcom Telecomunicaciones SA de CV, and served on the Board of Directors of Banco Regional de Monterrey S.A. (Forbes.com, 2009). In an interview with Mr. Migoya, he conveyed that the nature of the relationship between his company and governmental entities as a PPP is not entirely accurate citing that the majority of the infrastructure and investment will come from private sources and that the federal or state government has no legal ownership of the land. The federal government's role in this project was limited to MXP$20 million investment to provide water, electricity, and telecommunications for the port, as well as a onetime payment of MXP$50 million. Mr. Migoya did note that the state of Nuevo Leon has been very instrumental in promoting and supporting the project for potential investment and have not presented any barriers to its development. (González Migoya, 2009).

### 3.3.2 History

*Project Development*

Interpuerto Monterrey has been discussed by the state and private sector since the early part of the millennium when Governor Jose Natividad González Paras laid out his State Development Plan 2004-2009. The governor's plan aims to direct resources to strategic projects such as the inland port and continues to play an integral part in planning in the state. There is active involvement in this project from the federal government, the state of Nuevo Leon, and the private sector. Each entity's involvement seems to be linked to the planning stages, as SCT laid out an initial investment that was further enhanced by the state of Nuevo Leon. The state has since commissioned a private company, Servicios Interpuertos, to handle the concession of land to potential investors and finance the physical development of the inland port. Currently, the terms of the agreement are still being negotiated. No decision dates have been stipulated. Interpuerto Monterey will be built, but is still in the beginning stages of planning and development.

*Feasibility Study*

Feasibility studies are currently being conducted (June 2009) and others will be developed, but will not be made available to the public for proprietary reasons (González Migoya, 2009). Mr. Migoya's main objective as the CEO of Servicios is to sell real estate space to prospective companies, dubbing the project a *"real estate project with value-added bonuses,"* alluding to the additional features of the port such as the FTZ designation and warehouse/manufacturing space (González Migoya, 2009). The state of Nuevo Leon completed a regional study of metropolitan Monterrey and the surrounding areas of Nuevo Leon to monitor and project the economic development and population growth of the region, noting that the Inland Port is projected to generate more than 52,000 jobs over a period of ten years (Urban Development Agency of Nuevo Leon, 2007).

The actual physical development of the inland port is not complete; it will build upon the existing intermodal yard occupied by KCSM at Salinas Victoria that was developed in 2001 and services the KCSM operations. Ferromex also has a small intermodal yard in the same vicinity to serve their operations. Other than those two yards, the site is currently undeveloped, as will be discussed in greater detail in the following sections.

According to Vladamir Robles, the North Zone Manager for KCSM, the land had previously served as ranch land owned by a few different families, but has since been sold for the development of the Inland Port. Although the land is still undeveloped, it will not require intensive infrastructure overhaul, as it has access to major utilities, but it will require construction of access roads and other infrastructure to serve the port.

### 3.3.3 Planning

*Forecasting Freight Traffic, Revenue and Cost-Benefit*

Because this project is still in the very first stages of development, many typical planning activities and studies have yet to be conducted or are in progress. In terms of forecasting traffic and revenue, the state of Nuevo Leon conducted a traffic study of the northern region to identify the need for the expansion of the Colombia Highway (González -Migoya, 2009). In terms of a cost-benefit analysis, Servicios Interpuertos has conducted a financial analysis regarding the real estate possibilities of the inland port and Mr. Migoya expects around 15% return on investment from the initial cash-flow studies (González Migoya, 2009).

The other types of planning documents drafted by Servicios Interpuertos at this point are for soliciting potential investment, and are in the early stages. They are also developing master business, and executive plans. The timetable for completion of the inland port has also put the inland port's future development into questions. While news reports from 2007 and early 2008 noted that construction was close to becoming a reality, no construction has occurred. Mr. Migoya affirmed that the project will be completed, but could not pinpoint an exact date (González Migoya, 2009). He noted that it could be fully operational from anywhere between two to twenty years, depending on when companies invest in the port and how many invest.

As initially envisioned, the inland port of Monterrey will contain multimodal services, distribution services and centers, telecommunications services, customs services, and industrial parks. The specific sectors for the industrial parks have not been confirmed but the companies in the park will likely be from the aerospace, automobile, and electronics industries, according to Mr. Migoya. In addition, there will be an International Logistics Center to integrate all business services between companies, universities, and the inland port administration (González Migoya, 2009). The port is estimated to create 7,000 jobs in the initial three years of operation, and at full capacity it is expected to provide 52,000 jobs (Urban Development Agency of Nuevo Leon, 2007).

*Environmental Impact and Right-of-Way Analyses*

The researchers were unable to gain specific details about any environmental analysis done for the project. This might be due to the fact that this project is not near breaking ground and extensive environmental studies have not occurred. The researchers were assured many times that environmental concerns will be taken into consideration and there have yet to be any major issues (González González, 2009). ROW also seems to be a non-issue at this point, as the land that will be developed has been secured by Servicios Interpuertos for the purpose of selling it to companies interested in developing industrial operations at the port.

*Infrastructure Needs*

One infrastructure need that is being addressed by the federal government is the expansion and extension of the Careterra Monterrey-Colombia/Highway 57. This stretch of highway is a vital link for Monterrey, as it connects to the Federal Highway 85-D, which in turn links Monterrey to the border with Texas at Nuevo Laredo/Laredo. Improvements to this highway are vital to the success of the Monterrey Inland Port. Improvement to Highway 57 has been identified by the state and federal governments as a priority, and is included in the NIP. From researcher observations at Salinas Victoria, the current highway would not be sufficient to handle the traffic load that Interpuerto Monterrey would produce. The Mexican Government will invest US$180 million to widen the highway 7 to 12 feet to accommodate freight trucks. The current highway was not designed to accommodate heavy trucks. It is too narrow and is only one lane in each direction. If this road project is not completed, the inland port may not fully develop.

*Public Participation*

In an interview with Hugo González, he noted that there has been a fair amount of public participation in the port development process. He noted that the public has been informed of the project and free to submit any comments or questions. The process, according to Hugo González is very transparent and that his organization, INVITE, is striving to openly promote and inform the public about this project (González González, 2009).

### 3.3.4 Project Implementation

*Financing*

The majority of funds for this project are expected to come from the private sector. The government made a onetime payment of MXP$50 million and will assist with certain utilities (González González, 2009). Billions more will be needed to fully complete the inland port and private sources are expected to finance the remainder. Investors have already shown interest in the inland port, but a list of investors has not been released.

The Monterrey inland port is currently in the process of trying to secure investment from private companies. Servicios Interpuertos is the legal entity that can broker the land purchases for companies interested in setting up facilities at the port. Texas-based engineering, consulting and development firm Halff Associates will develop the project, and has been contracted to begin construction and development of the intermodal port after all of the major financial planning and forecasting has been completed (González Migoya, 2009). Halff Associates worked with Union Pacific Railroad to develop their intermodal terminal in Dallas, as well as the Beechwood Business Park in Fort Worth (Halff Associates, not dated).

### *Coordination with Other Jurisdictions/Private Sector*

Both Ferromex and KCSM's tracks run through the inland port. Ferromex connects the southern and eastern coasts, but it does not have a very direct route from the southern coast of Mexico to the United States (González González, 2009).

Physically, the railways of each of these companies lie a few feet apart at various portions of the inland port property, but are not connected. The development of Interpuerto Monterrey means that these two railways will need to be connected to provide a fluid transport of goods. However, this also calls for collaboration of two competitive companies (González Migoya, 2009). There have been no formal agreements made with either rail line concerning investment into the inland port, and it does not seem like there will be. According to the corporate communications director, the rail lines have no real incentive to invest in the port, other than it might attract potential new clients (Macias, 2009). Additionally, Ms. Macias, the Corporate Communications Coordinator for KCSM noted that there seems to be a discontinuity of information on the progress of the port, noting that "everyone is confused" and "no one knows what is going on" (Macias, 2009).

A bigger hurdle will be negotiating the potential collaboration between the two rail companies because of the disparity between the networks. KCSM owns better routes, and therefore has no incentive to grant Ferromex trackage rights. Ferromex, on the other hand, could potentially gain access to valuable routes upon the completion of Interpuerto Monterrey, but does not seem to be as favored by logistics park developers (Gonzalez Gonzalez, 2009). In order to facilitate cooperation between these two companies and to promote infrastructure investment in Nuevo Leon, INVITE has been brought in to the negotiations.

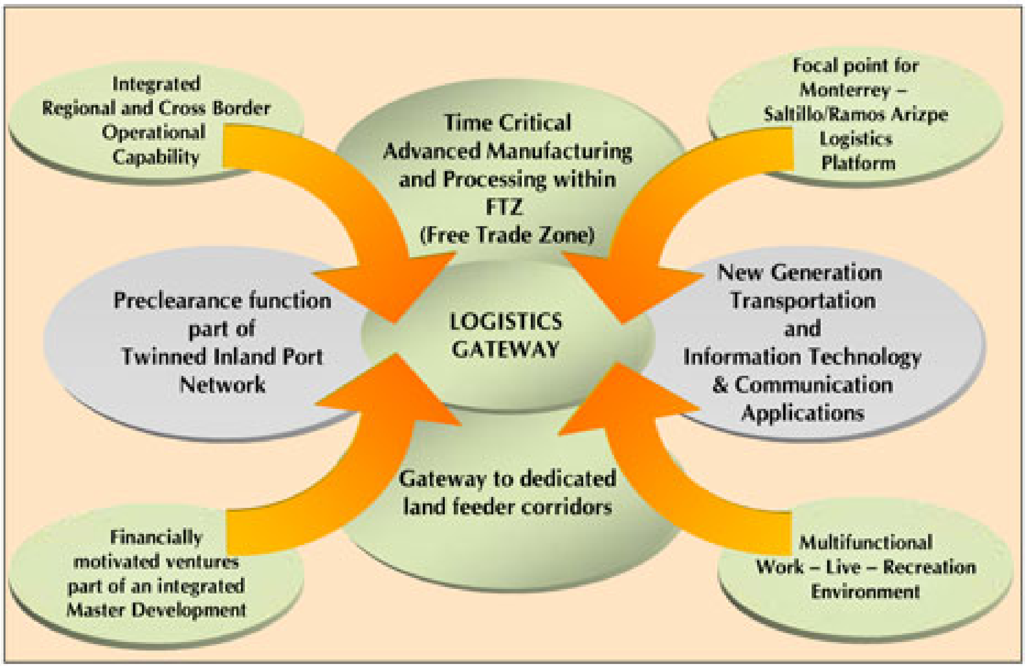
### *Overview of Current Operations*

Interpuerto Monterrey has been under development for some time now, but virtually no physical progress has been made as evidenced by the site visit the researchers conducted with KSCM officials at Salinas Victoria. As pictured in Figure 3.22, the site that will house the port is mainly open, flat land. There are many factors that are delaying the development of this port. Slow planning, uncertainty of funding, delays in infrastructure improvements and arguments over railway use have contributed to the current delay.

*Figure 3.21: Site location of Interpuerto Monterrey, as of 1/14/09 at Salinas Victoria*

At present, Interpuerto Monterrey is not in operation aside from the KCSM intermodal yard. The only discreet action, aside from planning and engineering that has been taken is the land purchase. A cost-benefit analysis has been completed, but has not been released. Environmental and traffic studies were completed by DUNL during their initial research to identify a possible site for the inland port, but no studies specific to this project have been completed (González Migoya, 2009). As of January 2009, Mr. González Migoya noted that he was in the process of developing a Master Plan for the port, which will hopefully get the project moving forward. The Master Plan for the port will seek to integrate regional and cross border operational capability, time critical advanced manufacturing processes, preclearance functions and new generation transportation, communications and IT technologies into one multifunctional logistics gateway, as can be seen in Figure 3.23.

While Miogoya noted that he could not provide the researchers with any additional planning documents, he did note that he had researched and visited similar inland port projects in Dallas (The Allen Group) and Zaragoza, Spain and these projects will inform the planning at Monterrey. With regard to the Zaragoza project, he emphasized that their project was a true PPP, as a significant share of the land is government owned, where in the case of Monterrey the land will be sold to private investors. Dallas and Monterrey have signed an agreement to link their resources and share a similar vision of development.




Source: Alejo, 2006 and Franco Eluteri & Associates, 2007

*Figure 3.22: Monterrey Integration*

*Possible Competition from San Luis Potosi Logistics Park*

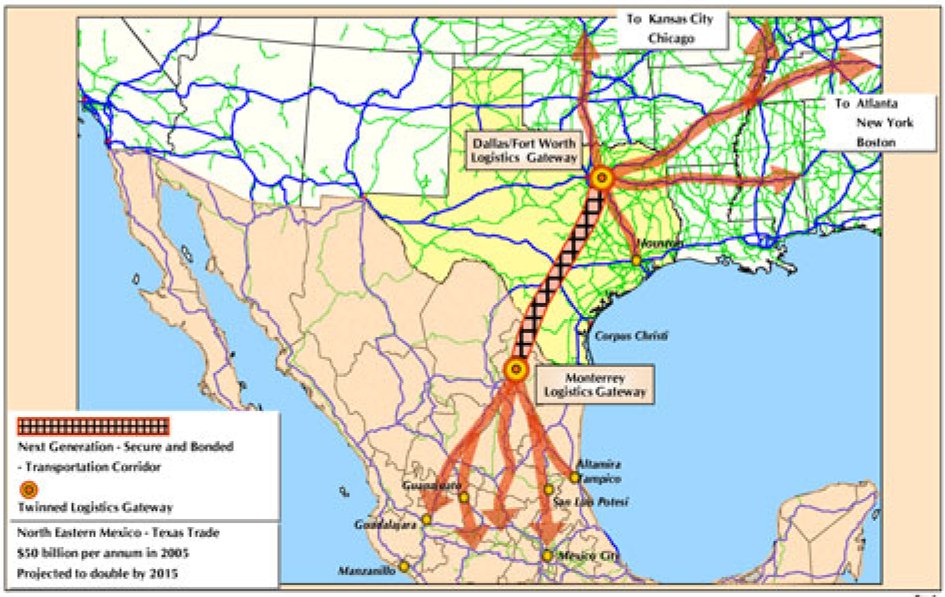
Another logistical issue that may affect the development of Interpuerto Monterrey is its close proximity to SLPLP and LIP in San Luis Potosi. With 240 acres of developed land and 1,200 acres held in reserve, SLPLP contains an intermodal port, but also space for manufacturing and warehousing operations. LIP also has proprietary ownership of the term "Interpuerto," which is the documented name of their intermodal platform (Logistik Park Website).

The SLPLP is an interesting example of what the Monterrey Inland port could look like. The Monterrey Inland Port intends to not only utilize the existing intermodal yards of KCSM and Ferromex, but to also add warehousing facilities where cargo could be repackaged, according to Vladamir Robles of KCSM (Robles, 2009). The one distinction between the two inland ports, though, is that the San Luis Potosi logistics park is serviced only by KCSM rail, while Monterrey could be serviced by both KCSM and Ferromex. Officials with KCSM noted in our interview that Ferromex's operations were "a lot smaller" in comparison to their company (Macias, 2009).

The inland port will be instrumental in attracting new industries to Monterrey, and will solidify and expand existing industries. Presently, the largest industry using KCSM's depot is the auto industry. The most frequent shipments arriving in Monterrey are from Detroit, as there are many American auto assembly plants located in the city. In addition to auto parts manufacturing businesses, Servicios Interpuertos anticipates furniture, plastics, food processing, iron/steel manufacturing, and appliance enterprises to invest in land inside the inland port, due to the manufacturing, warehousing, and freight capabilities that the inland port will be able to provide. Mr. González Migoya characterized the attraction of potential business to the inland port as a "real estate investment with value-added extras" (González Migoya, 2009).

*Coordination with the Dallas Logistics Hub*

In June 2007, a Memorandum of Understanding (MOU) was signed between INVITE and the Dallas Logistics Hub to increase the security, speed, and efficiency of moving goods between the Monterrey-Saltillo region and the southern sector of Dallas County (Allen Group, 2007). This MOU is an important step in not only promoting the development of the inland port, but also linking a vital transportation route that will benefit both U.S. and Mexican industries. The resulting transportation route between Dallas and Monterrey is seen in Figure 3.24.




Source: Alejo, 2006, and Franco Eluteri & Associates, 2007

*Figure 3.23: Dallas-Monterrey Transportation Corridor*

The relationship between Dallas and Monterrey is very cooperative—they are sister cities and actively engage in information sharing. The Dallas Logistics Hub is being developed by U.S. firm The Allen Group. According to its Master Plan, this project will result in a 6,000-acre facility that will accommodate 60 million square feet of distribution, warehouse, retail, and office space (Allen Group, 2008). This memorandum is integral for both parties involved, as it establishes formal collaboration on the designation of a customs zone and the integration of logistical systems to enhance the competitiveness of enterprises in both countries (Business Wire Latin America, 2007).

*Project Difficulties*

One reason for the delay of this project is complexity and informational discontinuities. An inland port of this size requires significant planning, which is partly why it is still in stage one. Servicios Interpuertos has been searching for companies to occupy the space once it is built, and for universities and medical institutions to partner with the inland port. INVITE representatives have heard that Wal-Mart may be interested in investing in the inland port. According to Hugo González González, the Logistical Development Director of INVITE Wal-Mart already has a sizeable warehouse in the city and has been investigating the possibility of investing in the inland port. However, no official commitment has been made by the retailer (González González, 2009).

Another difficulty in trying to promote this project is the lack of open information regarding its progress. As mentioned before, much of the planning process involves proprietary information, so project officials are not at liberty to reveal specific details. This is perhaps the most difficult part of the project, especially because the physical structure has not been erected. When interviewing officials with KCSM about the extent to which they are familiar with the project, they noted that they really had no idea about the progress of the project, other than the formation of Servicios Interpuertos (Macias, 2009).

### 3.3.5 Conclusions

Interpuerto Monterrey will be a major advantage to the state of Nuevo Leon once it comes to fruition because it will attract various companies seeking to more efficiently transport or manufacture merchandise bound for the United States. However, it is currently only at stage one of inland port development. It will also expand the capabilities of companies to utilize on-site manufacturing or packaging functions, which may benefit appliance or furniture manufacturing companies. Additionally, the state has a ready supply of skilled and non-skilled labor to support the port.

The most notable feature of this project is its location. The inland port will border a major highway that connects to the border region, creating a more fluid shipment of goods between Mexican seaports and the border with Texas. This location is ideal to expedite shipments that arrive from the ports of Altamira and Lazaro Cardenas, as the rail lines operated by Ferromex and KCSM will run along the boundaries of the inland port. Another exciting feature of this inland port is the potential cooperation of Ferromex and KCSM's rail lines along a small narrow strip within the boundaries of the inland port. It will take skillful negotiation on the part of both companies, but may help to attract many potential investors to locate their facilities in the inland port because of the potential connection to more locations.

It is too early in the planning process to determine best practices that have been utilized for this project. However, the MOU between the Monterrey Inland Port and Dallas indicates that the inland port planners are consulting with American counterparts to learn from their experience and to strengthen the ties along the NAFTA transportation corridor from Northeastern Mexico into Texas.

As this port becomes more popular, the border region in northern Mexico and the Texas border may see increased vehicular, freight and rail traffic. Monitoring the traffic from the inland ports in San Luis Potosi could serve a good indicator of probable traffic from operations at Monterrey, as this could result in more congestion along the Colombia highway that leads into the border regions and the surrounding areas. The MOU signed by Interpuerto Monterrey and the Dallas Logistics Hub will create a corridor from Monterrey to Dallas once operations begin at the inland port, so it is probable that IH 35 from Laredo to Dallas will be impacted by the inland port.

The next section of this report will turn to look at major highway infrastructure projects, and two commuter projects. These are aimed to reduce congestion, speed up travel time and in the case of the Mexico City projects significantly improve air quality.

# Chapter 4. Commuter Projects (Highway, Rail and Airports)

## 4.1 Introduction

As noted, Mexico is undertaking an ambitious multimodal development plan as outlined in the NIP introduced by President Calderon in 2007. The NIP's main objectives are to connect multiple portions of the Mexican highway network, improve coverage, quality, and competitiveness of infrastructure; make Mexico one of the main international logistic platforms; increase access to public services particularly in areas of greatest need; promote balanced regional development with special emphasis in the south and southeastern regions; encourage sustainable development and employment; and build tourism oriented infrastructure.

The NIP establishes the following strategies related to the construction of highways: complete the modernization of the transversal and longitudinal national corridors (Figure 4.1). One of the main projects (out of the 100 in the NIP) was the completion of the Durango-Mazatlan highway that will be discussed in this section. Another objective is to build inter-regional roads to integrate hitherto neglected regions of the country (especially the southeast) and improve the connectivity of the highway network. There is also special emphasis on the construction of bypasses and access roads as will be seen in the review of Arco Norte, as well as improvement in the physical conditions of all highway infrastructure.


Source: Rubio, 2007

*Figure 4.1: Linking the Mexico Highway Network—NIP Projects*

The NIP is based on three scenarios dependent on the success of tax and other economic reforms. The scenarios are:

- Inertial (if no tax or other reform proposals are approved)
- Base (only tax reforms approved—this was used as the default scenario by SCT)
- Outstanding (tax and other structural reforms approved)

The NIP Inertial scenario considers the construction and modernization of around 6,700 km (4,163 miles) of highway by the end of 2012. The Base scenario considers 12,260 km (7,618 miles) of construction and the Outstanding scenario around 17,598 km (10,934 miles). The Base scenario includes the 100 strategic programs that were outlined in the Highway Program of July 2007 and Outstanding builds over the completion of Base plus new projects.

The Highway Program established a detailed plan for the development of 100 strategic projects chosen by the Calderon administration. Of the US$26 billion projected investment, it gives a little over US$20 billion to the completion and building of roads and the remainder for conservation and right-of-way provisions. The program also details the expected sources of funding for the 100 projects. Almost half of the funding (47%) will come from the federal budget (PEF). Around 28% is projected to come from the Asset Proceeds and the balance through new concessions. Funding for intra-state roads and rural and feeder roads will come exclusively from PEF while the other projects are divided between the sources. Figure 4.2 shows the various road types in the Mexican network as of 2009.


Source: Badillo, 2009

*Figure 4.2: Mexico's Highway System 2009*

Figure 4.3 shows major highways with two, four, and six lanes.


Source: SCT, 2007.a

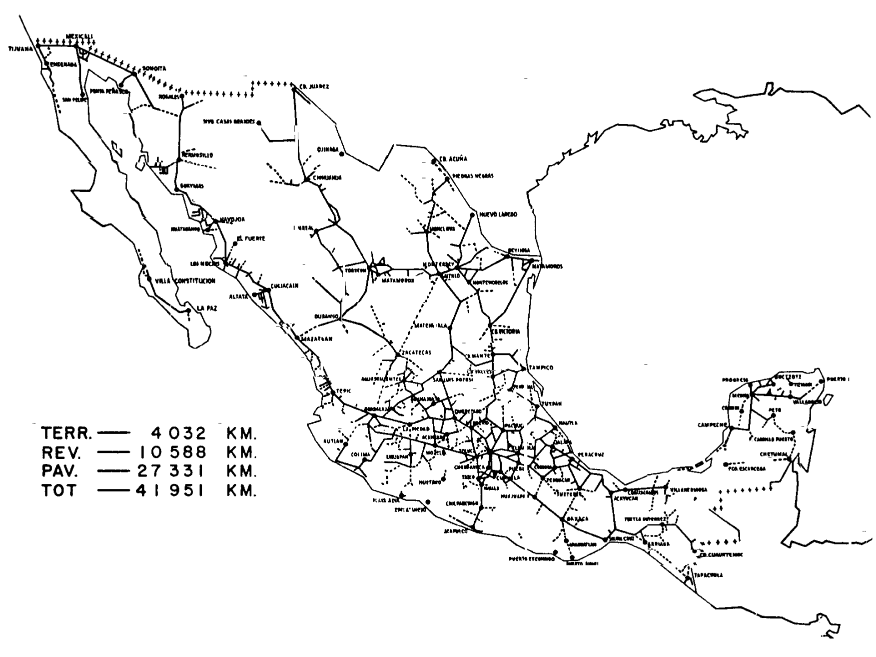
*Figure 4.3: Mexican Highway Network by Number of Lanes*

Before the 1920s, the drivers that used Mexican roads maintained them to a certain degree. Some private companies even had on their payroll workers that were in charge of road maintenance. During Alvaro Obregon's (1920-1924) presidential campaign, he offered to enact laws related to building highways and railroads as well as maintenance (CANACAR, 2006). Once president, Obregon built several roads from Mexico City to Texcoco, Toluca, and Puebla.

Nevertheless, it was not until 1932 that the first General Means of Communication Law (Ley General de Vias de Comunicacion) was enacted. The Mexican transportation regime was highly controlled and monopolistic (Perry & Rehman, 2004). Its anti-foreign based rules and highly restrictive domestic regulations severely constrained growth and competitiveness of the industry and infrastructure. Figures 4.4 and 4.5 show how the Mexican highway network developed between 1940 and 1960, respectively.


Red Vial hacia 1940

*Figure 4.4: Mexican Highway Network 1940*




*Red vial hacia 1960*

*Figure 4.5: Mexican Highway Network 1960*

Source Figures 4.4 & 4.5: SEMARNAT, 2003

In the late 1980s, Mexico began experimenting with PPPs in the form of toll roads. In 1989, President Salinas announced a US$10 billion highway expansion program that promised to construct over 5,000 km (3,086 miles) of BOT concession toll roads. Salinas initiated the toll road program by auctioning off 3,000 km (1,852 miles) of construction work to private-sector concessionaires. The auction was low bid for time and cost and was based around data supplied by the government regarding traffic flows and anticipated toll charges (Levy, 1996). This was focused around a general plan for a network of limited access highways organized around three major north-south axes connecting Mexico City to the Caribbean and Pacific coasts (Yates, 1994). Between 1989 and 1991, the government directed US$4.6 billion towards investment in the road network. Out of this, US$3.4 billion was financed through private concessions (Yates, 1994). According to Yates, between 1989 and 1994 a total of 50 highway concessions were awarded for 5,245 km (3,259 miles) of highway. SCT also had longer-term plans at this stage for an additional 6,000 km (3,728 miles) of highways by the year 2000. According to Levy, part of this highway construction was initiated to upgrade many existing highways with the expectation of entry into force of NAFTA (Levy, 1996). In 1993, in anticipation of NAFTA entering into force, the Communications Law was modified to regulate only Postal Services routes and the Law of Roads was enacted to regulate highway development including the use of a concession regime.

According to Levy, three main companies participated in the concession program: Triturados Basalticos y Derivados S.A. de C.V.; Empress ICA Sociedad Controladora S.A. de C.V (ICA—one of the main construction groups involved in current concessions); and Grupo Mexican de Desarrollo S.A. de C.V.

These first concessions ended up failing miserably because they were given to the winning concessionaire who offered the shortest time periods for the concession in their bids. This led to very high tolls for the roads and because the constitution in Mexico states that there must be a free alternative for toll roads, excessively high tolls led to underuse. In some instances, the short concession periods created tolls that were five to ten times higher than those of many countries, and the concessions had been developed and financed using short-term high-interest loans (Levy, 1996). According to news reports, the trucking community also refused to pay the tolls and continued to use the 'free' roads wherever possible (Transport Topics, 1997), leading to another source of revenue drying up.

Another reason for the failure, according to Persad (Persad et al., 2005), was that often preliminary plans and projections provided by SCT were inaccurate or incomplete. The length of the bid process was very short, and many of the companies did not sufficiently research costs, right-of-way, and environmental issues associated with the roads. The requirement that concessions be offered to the lowest bidder forced bidders to state concession periods that they could not achieve in order to win the project bid. The project award criteria favored local construction companies that were not interested in the long-term financial viability of a project. This led to underestimation of costs and problems with local residents. Because of a lack of proper planning and governmental shortcomings, frequent change orders from SCT resulted in cost and time overruns of projects (Reinhardt, 1994). Another critical misstep was that high-priority segments were not concessioned, creating poor connectivity of the entire road system (Persad, 2005). During the period of 1992 to 1994, the Mexican government began to extend some of the concession periods (up from 5 to 10 years and 10 to 15 years). Unfortunately, this was too little too late and after the devaluation of the peso in December 1994, highway construction firms held total debts of US$2.5 billion.

The government ultimately assumed control over the operation of many of the concessions in 1997 (Engle, 2008). This was achieved through the use of a trust fund established within BANOBRAS called FARAC. As a result of the rescue operation, the trust fund acquired both the assets (the toll roads and the income stream generated by the tolls levied) and the liabilities of the toll road companies. Part of the bank debt of the toll road companies was already restructured into long-term UDI-denominated Notes (Pagares) under the various debtors' support programs in place before August 1997. By 2007, FARAC's debt amounted to MXP$165 billion (Aguilar, No date).

Mexico's government started a new process of privatization in late 2006. The first big package of highway privatization was announced in September 2007 and included several highways in the western region of the country. The concession was awarded to a consortium led by Mexican Construction Company ICA (who were involved in the previous PPP in the late 1980s) and Goldman Sachs. It raised US$4 billion.

In February 2008, the Mexican government unveiled a new US$4 billion Infrastructure Fund that will be used to finance projects of the NIP. The fund's base was FARAC, to which new funds were added. These revenues were directed towards paying off a portion of the debt accumulated by FARAC and to finance some new projects. The process through which the federal government directs the funds received from the new concessions to the construction of new highways or other infrastructure projects' is called the *Asset Proceeds* scheme. This is an important part of the financing of the projects included in the NIP.

Mexico also revisited their plan for PPPs because SCT receives only about half of the necessary funds for construction and maintenance of roads in its budget each year. The government now uses two models for public-private investment in roads: the new concession model and the PPS model. The new concession model for PPPs in Mexico takes into account a company's technical, economic, and legal readiness for the project, and all bids require traffic and revenue studies. Cost overruns are the responsibility of the concessionaire, unless the change is required by SCT, in which case it is reimbursed. To avoid some of the problems with the first round of PPPs, right-of-way is secured by SCT before the bids are awarded. There is also more foreign investment, and companies winning bids are often a consortium of Mexican and international companies (Engel, 2008).

Under the new PPP concession model, the government can grant highway concessions for a maximum of 30 years, typically for a term of 15 to 30 years. The concession is awarded to the company that requests the least amount of public funds (when public funds are to be used) or that best meets the technical requirements of the project and offers the largest monetary amount to SCT (when public funds are not to be used). Most of the contracts issued are design, finance, build, maintain, and operate concessions (DFBO), rather than just the design and build contracts that were offered previously. Typically, even with the former of these arrangements, SCT does provide some specifications for the design of the project, but concessionaires are allowed to offer alternatives during the bidding process.

The PPS model (sometimes also referred to as a type of PPP) is used for toll free roads and usually involves periodic payments from SCT to the concessionaire. These payments are partially fixed and partially based on shadow tolls. The terms of these contracts are usually 15 to 20 years. These projects are typical for roads that are not suitable as toll roads because of low traffic volume or other circumstances (Engel, 2008).

The next segment of this report will turn to look at five multi-modal projects that Mexico is undertaking. The case studies not only highlight elements of this NIP, they also are important projects to improve modal connectivity within Mexico, and, in the case of the three Mexico City case studies being developed, to address the chronic congestion and poor air quality in the Mexico City valley area.

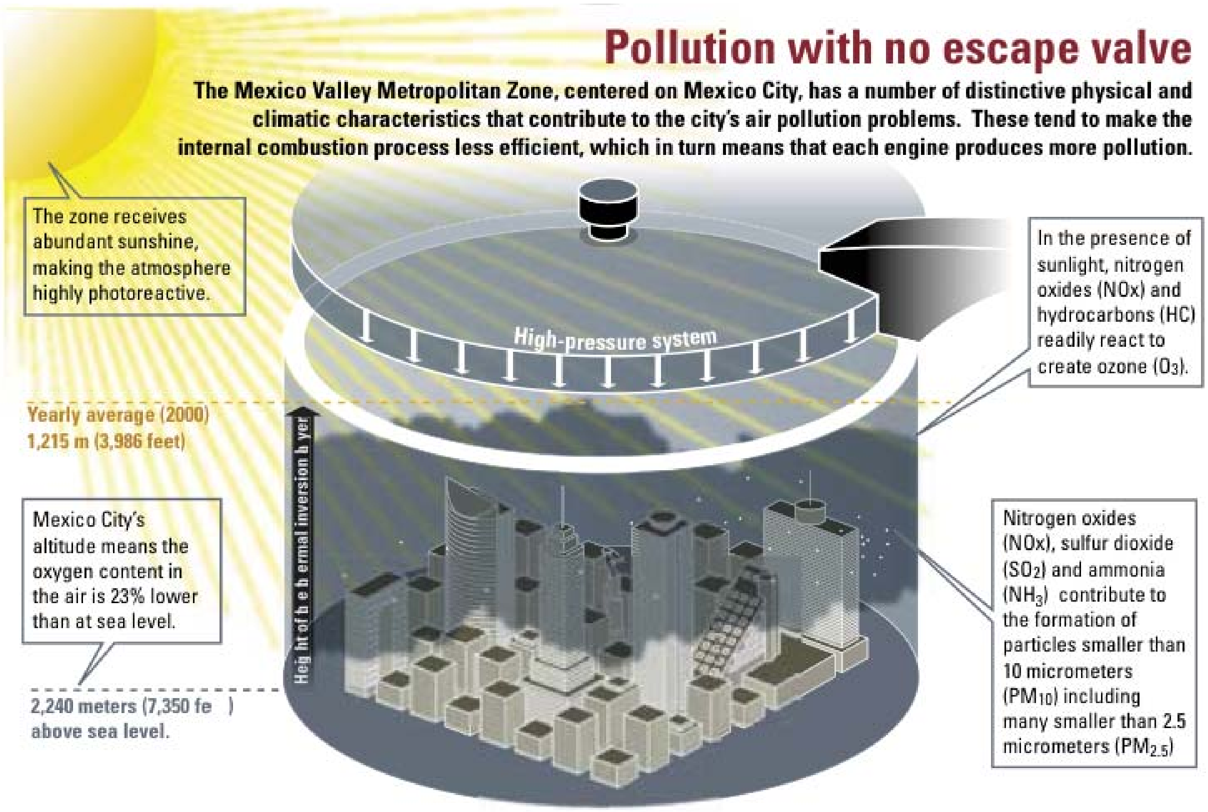
The first study is of the Mazatlan-Durango Highway, a flagship project of the NIP. The Mazatlan-Durango Highway runs through the states of Sinaloa and Durango, connecting the towns of Mazatlan and Durango by a modern and easily traversable highway across the Sierra Madre Mountains. It will significantly reduce travel time between the two locations and facilitate travel between the Pacific and Gulf coasts of Mexico.

The next three case studies are in the Mexico City/Valley of Mexico City area and deal with the chronic congestion and air quality issues that Mexico City faces. These include the Arco Norte Highway, Circuito Exterior Mexiquense Highway, and the Commuter Rail Project in Mexico City. The Arco Norte Highway project in Mexico State—which is part of the Altiplano Corridor that crosses the states of Puebla, Tlaxcala, Hidalgo, and Mexico—will provide a vital outer loop or bypass around the Mexico City area. Circuito Exerior Mexiquense Highway—which will also be a bypass for Mexico City, though closer in than Arco Norte to the Mexico City metroplex—is being developed by the state of Mexico and the Federal District (and not SCT) with the goal of reducing congestion and commute time and improving air quality. The Tren Surbano commuter rail is also being implemented to decrease commute time, reducing a journey of two and a half hours to approximately forty minutes. The final modal case study looks at Monterrey's expansion of its international airport to address passenger congestion and which also included a new freight terminal to handle increased air freight.

Two highway projects have been bid under the new concession process. These are the Mazatlan Durango Highway and Arco Norte Highway, part of the Altiplano corridor around the eastern and northern side of the greater Mexico City area. Circuito Exterior Mexiquense is also a PPP but it is sponsored by Mexico State. The Commuter Rail project is also a PPP sponsored by SCT, the Federal District, and Mexico State.

Mexico City suffers from some of the worst congestion and pollution of any city in the world and was ranked second for air pollution by the World Health Organization in 2002 (WHO, 2002). Mexico City is one of the largest and most congested global cities. Notwithstanding the strides made and policies put in place to improve congestion and air quality, gridlock and air pollution remain serious issues. Auto traffic is responsible for 75% of Mexico City's air pollution (Center for Sustainable Transport, 2006). The Mario Molina Center for Strategic Energy and Environmental Studies estimated that each year, air pollution in Mexico City condemned over 4000 people to a premature death and accounted for over 2.5 million lost workdays (Molina & Molina eds. 2004). In the Greater Mexico City Metropolitan Area (MCMA), health problems mostly associated with pollution are caused by ozone and particulates. The 2002 MCMA Emissions Inventory found that 134,825 of the city's vehicles were diesel powered and generated 70% of the under-10-micron particles (PM10), and 77% of the under-2.5-micron particles (PM 2.5), and 25.3% of the nitrous oxides (NOx) emitted by all automotive sources (Center for Sustainable Transport, 2006). Much of the pollution is also attributable to the age of the fleet, which in MCMA averages 15 years.

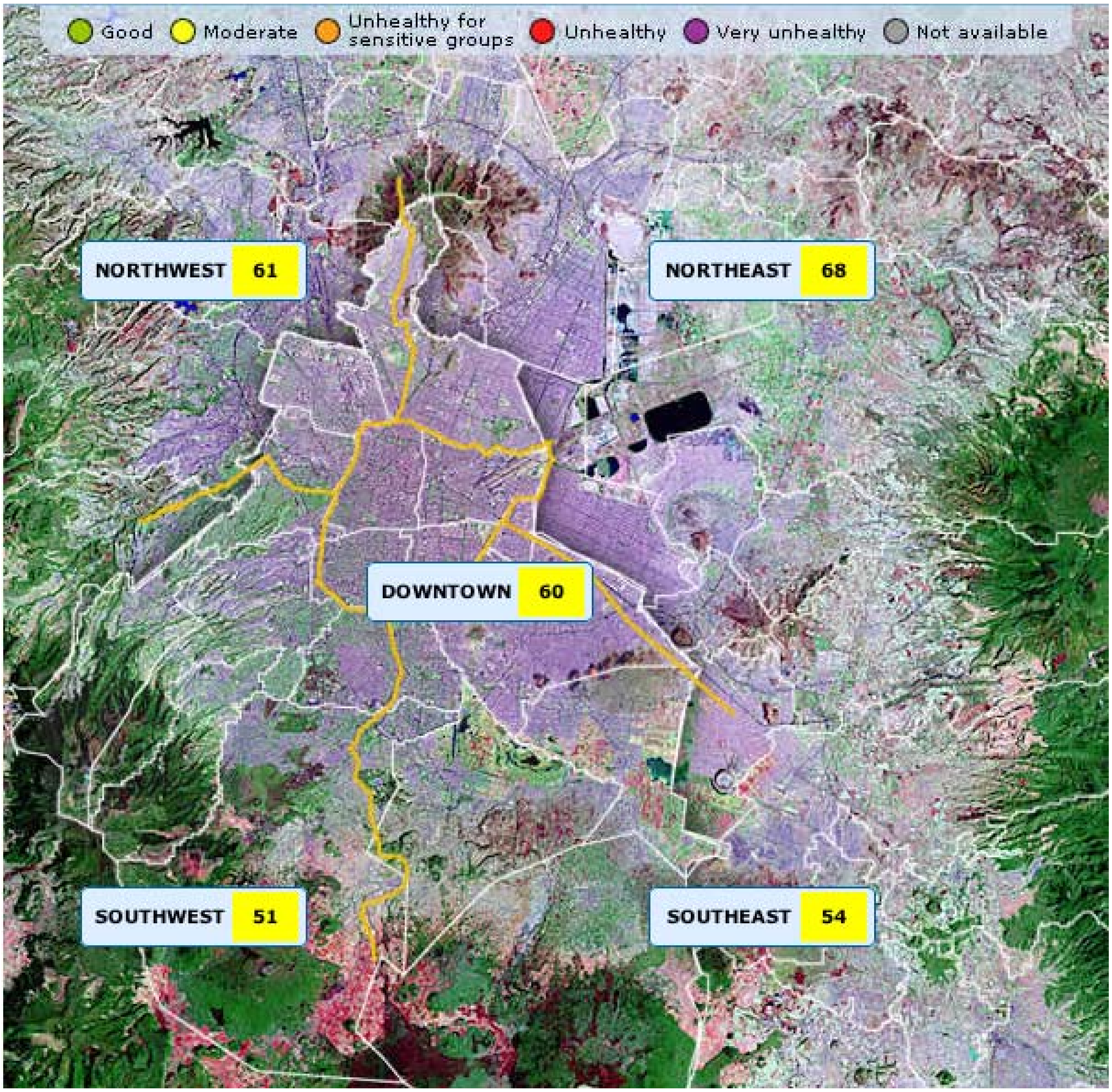
One of the reasons that Mexico City is so affected by pollution is because of the geographic and climatic characteristics of this region, which contribute to making internal combustion less efficient and therefore increase pollution. The Mexico City Valley Metropolitan Zone (MCVMZ) receives an abundance of sunshine so the region is highly photo reactive. The MCVMZ is also at a high altitude, which means that the oxygen content of the air is 23% lower than at sea level. As Figure 4.6 shows, because of the height of the thermal inversion layer and the abundant sunlight, nitrogen oxides NOx and hydrocarbons readily react to create ozone $O_3$. NOx, sulfur dioxide $SO_2$, and ammonia $NH_3$ also contribute to the formation of particulates.




Source: Center for Sustainable Transport, 2006

*Figure 4.6: How Pollution is Formed in Mexico City*

According to Mexico City's Ambient Air Quality Monitoring System (available at http://www.sma.df.gob.mx/simat2/ingles.php), during 2009, 74 days out of 161 were clean for ozone using the Metropolitan Air Quality Index Scale, which calculates for ozone, $PM_{10}$, sulfur dioxide, nitrogen dioxide, and carbon monoxide. This program was initiated by SEMARNAT in December 2000 to unify efforts to measure the polluting agents and is based on the International Standards Organization ISO: 9001:2000 standard. The program has over 78 monitoring stations. As an example, a screen shot of the air quality at 10:30 a.m. on June 12, 2009 can be seen in Figure 4.7.




Source: Mexico City's Ambient Air Quality Monitoring System.
http://www.sma.df.gob.mx/simat2/ingles.php

*Figure 4.7: Screen Shot of Air Quality—10:30 a.m., June 11, 2009.*

Mexico City has implemented a number of policy measures to combat the congestion—a daunting task as it is estimated that over 600 new cars enter the city's streets each day. This has included an U.S. EPA-sponsored retrofit of city buses to use ultra low sulfur diesel to reduce particulate emissions. This has also led to the introduction of ultra-low-sulfur-diesel three years earlier than was planned: 2009 instead of the expected 2012 (Center for Sustainable Transport, 2006). In 1989, the city implemented *Hoy No Circula*, which bans most drivers from using their vehicles one weekday per week based on the last digit of the license plate (Davis, 2008). In July 2008 this was also extended to include Saturday driving restrictions. A new Bus Rapid Transit (BRT) system utilizing newer buses that use low-sulfur fuel came on-line in 2005 and the Center for Sustainable Transport has been monitoring the reduction in emissions as a consequence of the

BRT (Martinez Salgado, 2008). Among the policy initiatives introduced through the NIP has been the development of bypasses around the city. These bypasses link to other highways leading to different regions to reduce the numbers of vehicles that have to currently enter into the city to access these highways. Arco Norte and Circuito Exterior Mexiquense are examples of such bypasses. The NIP also includes transit options, including the commuter rail project that is discussed later in this section. The ultimate goal is to provide a range of solutions, including transit options that are affordable, reliable, and result in people choosing transit over their private vehicles.

Finally, as we move to seeing global mega-regions becoming the driving force of our new world economy (Florida, 2008), the implementation of these projects will allow Mexico to be poised to connect with global mega regions and changing trade routes. Richard Florida has identified 13 mega regions in the U.S. and Mexico, as shown in Figure 4.8. The mega region in Mexico encompasses the area from Mexico City to Guadalajara.


Source: Richard Florida, 2007

*Figure 4.8: The North American Mega Regions*

## 4.2 Mazatlán-Durango Highway

Mazatlán is on Mexico's Pacific Coast at about the same latitude as the tip of the Baja California peninsula. The city lies on a narrow strip of land between the ocean and the Sierra Madre Mountains. With over 400,000 residents, it is the third-largest city in Sinaloa. The largest sector of the Sinaloan economy is agriculture, which includes fishing, followed by commerce, hotels, and restaurants. There is a significant transportation and communication sector in the economy of Sinaloa (INEGI, 2007).

The city's multimodal infrastructure includes an airport, rail infrastructure, and a seaport that supports the fishing industry, tourism (cruise ships) and freight movements, including automobiles, containerized cargo, general cargo, and petroleum products. Mazatlán also has land transportation infrastructure including the Pacific corridor national highway, which connects Mazatlán to Mexico's other Pacific communities and port facilities. Mexican Highway 15 connects Mazatlan to Guayamas in the north and continues to the border with Arizona at Nogales. The highway also connects Mazatlan to Guadalajara in the southeast, and to Mexican Highway 200, the coast road that connects Puerto Vallarta, Manzanillo, Lazaro Cardenas, and Acapulco, in the south.

It is relatively easy to traverse the flat terrain up and down the coast compared to the terrain slightly inland, toward the Sierra Madre Mountains. The extension of the Mazatlan-Durango highway inland from Mazatlán to Villa Union and Concordia is already constructed and operational.

The Sierra Madre Occidental Mountains form the natural boundary between Mazatlán and the elevated regions of central Mexico. There are three sets of Sierra Madre Mountains in Mexico: one set in the south, and another in the east (Orient), and finally the Occidentals in the west. The mountains are densely-wooded and rugged. The pass between Mazatlán and Durango is notoriously craggy and dangerous, and has earned the nickname "Espinazo del Diablo" or "Devil's Spine" for its many canyons and cliffs. The mountains are high, exacerbating weather conditions such as wind, rain, and ice. The official political boundary between the states of Sinaloa and Durango is the Baluarte River, which passes directly through the mountains, carving deep canyons. At the point where the highway crosses, the canyon formed by the Baluarte River is nearly 400 m deep. The size of the many canyons in this region draws comparisons to the Grand Canyon.

Durango represents a very distinct geographical region from the coastal city of Mazatlán. The city of Durango is a gateway to the Mexican *altiplano*, or high planes. At an altitude of 1,880 m (6167 feet) (INEGI, 2005), the city has more than 500,000 habitants (National Census, 2005). The four largest industries in the state are social services, commerce (including hotels and restaurants), manufacturing, and agriculture. The manufacturing sector is mostly food, beverage and tobacco products, but there is also a strong lumber industry and, to a lesser extent, production of heavy machines and mining (INEGI, 2005).

The city of Durango has multimodal facilities including an airport, rail, and modern highway that connects to Monterrey and the U.S. border at McAllen and Laredo, the Gulf of Mexico and into Central Mexico. The city is on an expansive plateau that extends from the U.S. border to Southern Mexico.

### 4.2.1 Project Description

The Mazatlán-Durango highway modernization project is one of a few 'flagship' projects in Mexico's NIP. Mazatlan-Durango's modernization will improve movement between Mazatlán, in the state of Sinaloa, and Durango, in the state of Durango, by modernizing the 232 km of national Highway 40 between the two cities. The existing highway between the two cities is notoriously difficult to travel and thus prohibits economic activity between the two cities. The new highway is, at its widest, four lanes and largely follows the path of the old one. It has been deemed a "superhighway" because of its bold pass across the Sierra Madre Mountains.

Work on the new highway began over a decade ago in the relatively flat expanses outside of the two terminal cities, Mazatlán and Durango. The government deferred the most difficult works, deep in the mountains, until last year when it issued a series of construction contracts for these segments. A competitive bidding process determined who would build the three sections of highway and the impressive Baluarte Bridge between Concordia, Sinaloa, and El Salto, Durango that totals nearly 50 miles in length. The construction of 57 tube tunnels makes up the majority of the work in the contracts and bridge-building is the next largest activity. Paving and signaling make up a relatively small part of the work. The scale of these efforts shows that the Mexican federal government is strongly committed to this highway project.

The Mazatlán-Durango highway is the final link in a route that extends from the Pacific Ocean to the Gulf of Mexico at Matamoros, Tamaulipas. This link will connect Mexico's growing Pacific port and highway infrastructure to the established transportation network that lies beyond Durango: the Texas border to the north, the gulf ports at Matamoros, Altamira, and Tampico; the inland ports in Monterrey and San Luis Potosi; the central Mexican states; and Mexico City.

### 4.2.2 History

*Regional Isolation*

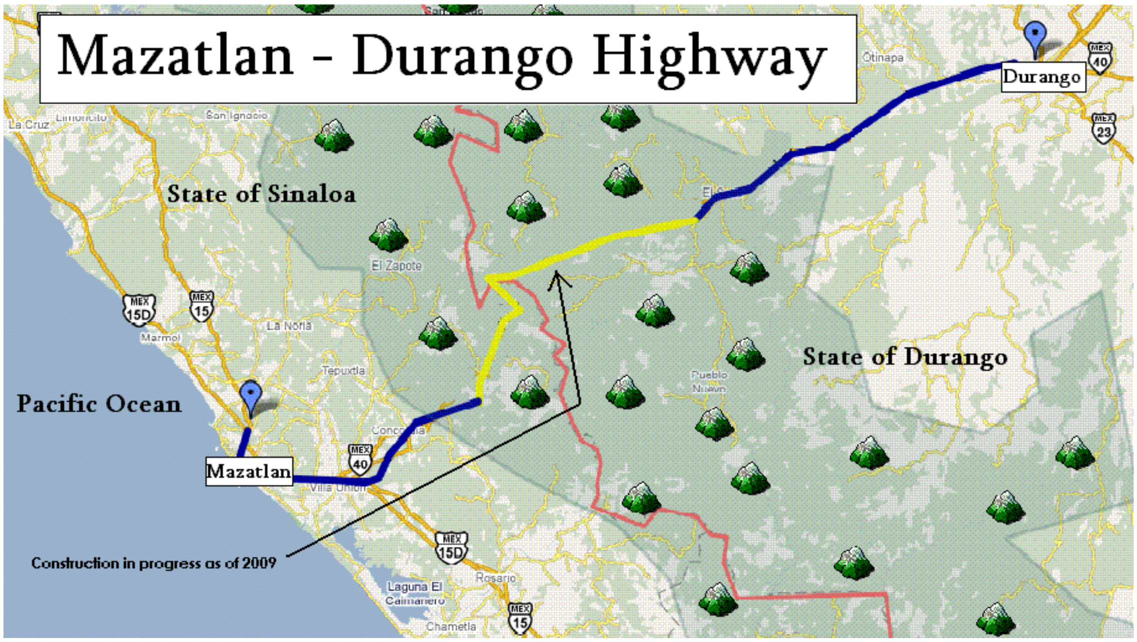
Mexico's physical geography and political history lend themselves to a radial network of highways, with Mexico City functioning as the hub. Figure 4.9 shows the Mexican highway network (federal, federal tolled, and state) as of 2006 (SCT, 2007.a). This infrastructure network has promoted centralized governance, but left neighboring regions and communities isolated from each other.


Source: SCT, 2007.a

*Figure 4.9: Mexico's Highway Network as at 2004*

The term *badlands* describes the expanses of difficult terrain beyond the visible signs of civilization. These regions extend from the U.S. border to central Mexican states such as Durango and Zacatecas. Economic and social growth come slowly in these regions, where the small and scattered populations live in isolation from each other and from the larger national and international exchanges.

The Mexican government is building highway infrastructure that cuts across the radial spokes of the existing highway system, extending from coast to coast and connecting isolated communities to each other. The Mazatlán-Durango highway serves two of these lateral transversals that stretch from the Pacific Coast and reaches the Gulf of Mexico; in the north the highway reaches Matamoros and in the south it arrives at the ports of Altamira and Tampico. Figure 4.10 shows the current progress of the highway's construction. The blue line shows completed construction and the yellow line shows the portion that is in progress today.




Source: Adapted from Google Maps

*Figure 4.10: Mazatlán-Durango Highway*

*The Local Need*

The great challenge in constructing the new Mazatlán-Durango highway is crossing the Sierra Madres Mountains. A straight line between the two cities is only 125 miles long, but travel time between the two cities is over six hours. There is limited economic exchange between the communities scattered in this region, but the new highway will greatly improve transportation between them. The old Highway 40 connecting Mazatlán to Durango is notorious for its many twists and turns and high precipices. Relatively few make the trip, and some travelers report that they suffer from carsickness. Drivers must navigate the many hairpin turns, brake and power through steep gradients on a road that often floods and freezes. The trip is difficult, and it is nearly impossible to navigate at night. The benefits of a new, modern highway are very real for the local population; the new highway will reduce transportation time and costs, and improve safety and highway access for the region (FOA, 2005).

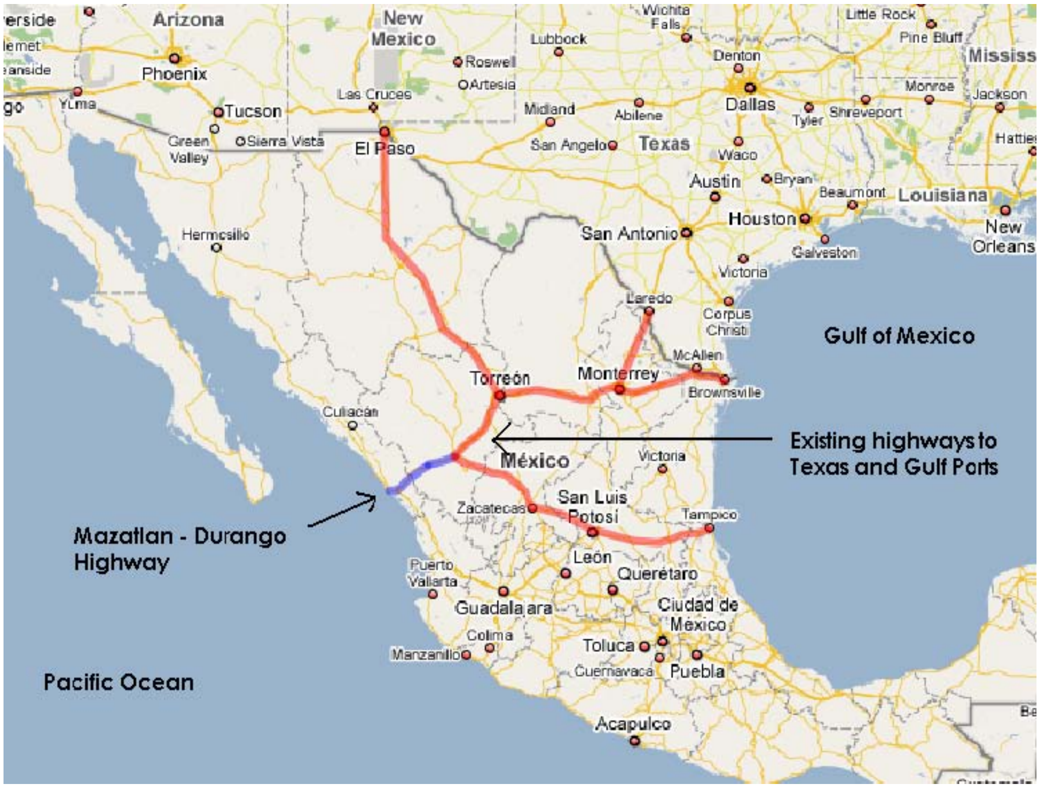
The new highway will cross the mountainous terrain through the Sierra Madre Mountains. Drainage works and extensive leveling will mitigate the dangers of flooding and mudslides. Figure 4.11 shows some of the minor drainage works that have been developed. The new highway will be a safer route, and in the event of natural disasters, it will provide a viable evacuation route where one was not previously available.

Source: SEMARNAT, 2005

*Figure 4.11: "Minor" Drainage Works*

*New Trade Route*

The Mazatlán-Durango highway project is the last link in a transversal inter-oceanic corridor connecting Mexico's Pacific Coast with the Gulf of Mexico. It extends from the Pacific Coast at Mazatlan, across Northern Mexico through Torreon and Monterrey, and reaches the Gulf Coast at Matamoros. Currently, the highway that extends beyond Durango through Torreón and Monterrey is easily traversed by large trucks. The section from Mazatlan to Durango is the final link in the "inter-oceanic" highway that will complete the transversal corridor, and provide the first viable freight route from the port of Mazatlán to the U.S. border. Figure 4.12 shows the Mazatlan-Durango Highway's interconnections to other Mexican highways and the U.S. Durango also connects to the central gulf ports at Tampico and Altamira, which can serve U.S. markets by ship. The transnational movement of goods across Mexico is considered a potential alternative to the Panama Canal and to land transportation originating at California ports. A study by consultant group Felipe Ochoa and Associates (FOA) predicts that the Mazatlán-Matamoros route will provide the cheapest route to parts of the United States (FOA 2005).




Source: Adapted from Google Maps

*Figure 4.12: Mazatlán-Durango Highway and Highways to Texas and Gulf Ports*

The Mazatlán-Durango highway is part of a larger transversal corridor that has various lines of connectivity with Texas border cities. In northern Durango, a logistics center at Gomez Palacio serves as a way station for goods traveling north to Chihuahua and El Paso, Texas. Farther along the route, and closer to the Texas border, is the economic power-house of Monterrey, Nuevo Leon. Monterrey has a strong industrial and manufacturing sector matched with sophisticated infrastructure and the proposed inland port discussed in Chapter Three. The greatest advantage of Monterrey is that it sits directly on the NAFTA corridor that extends to Laredo, Texas and beyond. The inter-oceanic corridor approaches the U.S. border in the Lower Rio Grande River Valley, where there are multiple points of entry, before reaching the port city of Matamoros, Tamaulipas. From the port of Matamoros, goods can easily pass to Houston, New Orleans, and other U.S. markets by ship.

*Increase Economic Opportunity*

The new highway will bolster the manufacturing industries of states beyond Sinaloa and Durango by improving the states' access to exterior markets. Mazatlán is primarily known as a cruise terminal. The port receives 8.6% of the cruise ship stops in the country. It is fifth in Mexico in terms of the number of cruise ships that stop at the port, behind Cozumel with 41.4%, Cabo San Lucas with 13.2%, Ensenada with 10.5%, and Puerto Vallarta with 9.6%. The port was third in the movement of automobiles in 2008, moving 54,028 units. Lazaro Cardenas, a competing Pacific Coast port, was first, moving 112,457 units in 2008. Though the port of Mazatlan is looking to grow container traffic, in 2008 the port had an installed capacity of 52,500

TEUs (Programa Operativa Annual, 2008), but only handled 27,900 TEUs, down 4.9% from 2007 when the port handled 29,363 TEUs (SCT, 2008.b Ports Section). However, greater connectivity to the interior of Mexico via the Mazatlan Durango highway could help port growth, both in terms of containers and automobiles, by providing greater access to the maquiladora industries in the border regions.

The potential labor force in Mexico is great, and many states have strong manufacturing sectors, but in regions with poor transportation connectivity it is hard to mobilize the population. States like Zacatecas and Durango do not link well to neighboring regions, and the manufacturing sectors of these states are underdeveloped. The new highway will bring the people of these regions closer to modern transportation infrastructure and foreign markets. Border states like Chihuahua and Coahuila already have strong manufacturing sectors and will benefit from two new channels to foreign markets: the U.S. border and a Pacific port. The city of Monterrey lies on the corridor to Mazatlán and may take advantage of the new route to export goods to the Asian markets.

Mazatlán is one of Mexico's top-five beach destinations. The coastline is connected to northern ports in the Baja Gulf, and to southern ports at Manzanillo and Lazaro Cardenas. Figure 4.13 shows the current tourist influence origins from 2001.


| Origen | Visitantes (miles) 2001 | % |
|---|---|---|
| ***Nacional*** | | |
| Baja California Sur | 92.4 | 1.2 |
| Guanajuato | 109.7 | 1.5 |
| **Nuevo León** | **20.5** | **1.6** |
| Nayarit | 19.9 | 1.6 |
| Baja California | 45 | 1.7 |
| **Coahuila** | **201.1** | **2.6** |
| Sonora | 31.9 | 3.0 |
| **Chihuahua** | **59.2** | **3.6** |
| **Durango** | **18.2** | **4.8** |
| Distrito Federal | 15 | 7.5 |
| Jalisco | 37.4 | 8.9 |
| Sinaloa | 19.3 | 16.3 |
| ***Receptivo*** | | |
| Estados Unidos | 339.6 | 27.5 |
| Canadá | 69.2 | 5.6 |

Source: FOA, 2005

*Figure 4.13: Tourist Influence of Mazatlan Durango*

In 2001, visitors from the northern states made up a small proportion of Mazatlán tourism compared to tourists that come from the more distant Mexico City (FOA, 2005). Buzz about the new highway is stimulating interest across Mexico and people are eager to see the Baluarte Bridge (see Figure 4.14) and other impressive features of the highway. For many people in northern Mexico, the trip to Mazatlán will be increasingly attractive and affordable. Analysts expect tourism from these states to increase upon completion of the Mazatlán-Durango highway.

As the freight capacity grows along Mexico's Pacific Coast, the highway infrastructure to the U.S. border is also improving. This is likely to become an import trade route bringing commodities such as industrial materials, Asian consumer goods, and fresh seafood from Mazatlán into northern Mexico and the U.S.


Source: SCT, 2008

*Figure 4.14: Artistic Rendition of Baluarte Bridge*

*Social Growth*

For many reasons, this project represents values articulated in Mexico's development strategy. Mexico is a developing country, but as early as 1970, during the presidency of Luis Echeverria, leaders decided to invest resources in transportation and communication infrastructure as a means to address social inequities and to promote social progress (Gonzalez de Cosio, 1971).

Physical infrastructure projects provide lasting social and economic benefits, and Mexico has taken statutory steps to maximize this benefit. Mexico has a codified competitive bidding process for all large public works projects. In order to maximize infrastructure development, the Mexican government enlists private-sector firms to lease highway assets in a form of public-private partnerships. Leveraging public infrastructure like this, Mexico obtains more resources to complete highway projects and connect more distant communities. The established industries capture the benefits of these projects on a large-scale, while individuals benefit in many indirect ways.

As articulated in the Vision 2030 document (Vision 2030), the investments in infrastructure will connect the people of Mexico physically and intellectually, building a more capable and responsible population. The improved transportation and communication between the regions will empower populations that were previously isolated and uninformed and create a safer, more secure, and more democratic society.

*Sponsor*

The Mazatlán-Durango highway is sponsored by the federal government and is a flagship highway project of its NIP. Work on this project began in 1996, at which time the project was funded from the general revenue budget (Athie Rubio, 2009). Since that time, an infrastructure fund was created to finance the project. Contributions to the fund came from the federal government, the states of Sinaloa and Durango, and, indirectly, the private sector. Most of the project financing follows the Assets Utilization model of Mexico's PPP schemes, in which highway assets are leased to the private sector to finance the construction of new transportation infrastructure. In this case, the auction of a highway concession package, commonly known as FARAC I, generated the money to found the infrastructure fund. The fund was formerly known as FINFRA, but it is now called FONADIN (Athie Rubio, 2009). The Mazatlán-Durango highway project is a top priority of the NIP, and its success or failure will reflect on the development strategy elected by Mexico's leaders. The federal government and the Calderón administration are very committed to this project, fast-tracking it ahead of other highway initiatives.

As described earlier, the Sierra Madres prevented significant exchange between the cities of Mazatlán, Sinaloa, and Durango, Durango. In pre-Columbian times, the mountains did not support any unified empire, but rather a multitude of indigenous tribes and languages (Glaxiola-Lopez, 2005). Pasor Rouaix wrote that in 1920 the only transportation between Mazatlán and Durango was by animal (Rouaix, 1980). It is difficult to imagine crossing the "Devil's Spine" on horseback or in a wagon; few could make the difficult journey, and Durango was left isolated from the port city of Mazatlán.

Between 1950 and 1970, Mexico completed a national highway connecting the two cities, parts of which are still used today. This highway connected the two regions, but it left much to be desired. It permits vehicular travel, including trucks and buses, between the two cities, but its steep gradients and hairpin turns prevented significant traffic through the area. For commercial purposes, the highway raises fuel costs and increases the depreciation of vehicles. Since its creation, residents of the region and leaders of commerce have longed for a better Highway 40, but a complete over-haul was not an option due to financial constraints.

In 1996, during the presidency of Ernesto Zedillo, SCT began preliminary works on the Mazatlán-Durango highway modernization project. Progress was slow for about a decade before the creation of a dedicated fund. This project is an experiment in infrastructure finance and the Mexican government has improvised the necessary procedures to move the project forward. Innovations in infrastructure financing for the project include the founding of the infrastructure fund, FINFRA, and its subsequent transformation to FONADIN. These funds provided financing which the general revenue fund could not. In 2008, they financed the complex components of this project in the Sierra Madre Mountains between El Salto, Durango and Concordia, Sinaloa.

### 4.2.3 Planning

*Feasibility Study*

In 2005, FOA published a comprehensive report on the Mazatlán-Durango highway project that drew on previous studies by FOA and other researchers. The first chapter of the report describes the project's technical aspects, enumerates its benefits, and lists relevant regulatory laws. Other chapters discuss the socioeconomic factors, traffic studies, traffic forecasting, and cost-benefit analysis. This section on planning is largely a synthesis and annotation of the feasibility study performed by FOA.

Socioeconomic factors

A combination of sources, including primary research and the national census (INEGI), contributed to the calculations drawn regarding socio-economic benefits, including the following salient information.

- Between 1993 and 2002, most of the states affected by the project, including Sinaloa, Durango, and neighboring Zacatecas, grew at a slower rate than the national average.
- These three states also make below-average contributions to the national GDP
- Industrial, agricultural, and commercial activities powered the economies of Sinaloa and Durango as of 2002.
- Between the years 1980 and 2001, the number of cars in Sinaloa and Durango grew by 7.7 and 5.6 %, respectively.
- Sinaloa, Durango, and Zacatecas have fewer motor vehicles per 1,000 residents than other states affected by this project.
- Northern border states have stronger manufacturing and industrial sectors than do Sinaloa, Durango, and Zacatecas.
- The top origins of Mazatlán visitors not coming from Sinaloa are the following (in order): the United States, Canada, Mexico City, Jalisco, and states in Northern Mexico.

This section of the feasibility study enumerates various other projects in the region; four tourism developments in Sinaloa, a set of dams, and the Gomez Palacio logistic center (inland port) in north Durango will work in concert with the Mazatlán-Durango highway. The new highway will provide a boost to tourism and commerce, while the new dams improve agricultural capacity in the region and provide new recreational and tourist areas.

*Traffic & Revenue Studies*

In 2003, FOA estimated an average daily transit of approximately 3,000 vehicles between Mazatlán and Durango near the two large terminal cities. The numbers dropped to below 2,000 at observation points deeper in the Sierra Madres Mountains.

In 2005, a follow-up survey was conducted, after parts of the project had opened below the city of Durango. At Llano Grande, a town below Durango, traffic increased by more than 800 vehicles, primarily made up of personal vehicles.

In 2002 and 2003, FOA performed surveys in three towns between Mazatlán and Durango to measure the public's opinion and acceptance of tolling the highway (FOA, 2005). FOA found a strong support for tolling in areas associated with long-distance travel, such as those near the terminal cities of the highway. In Los Ebanos, a more central observation point associated with short-distance travel, a slight majority opposed the tolling. The survey also reports on the motive of the trips, and the average number of people traveling in each type of vehicle. Freight data analysis that described the type of cargo and tonnage of the transport trucks was also performed to give insight to the regional industry and development and propensity to use the corridor. Most of the freight was agricultural or industrial material, which the study distinguishes from forest products, animals, minerals, petroleum, and inorganics.

In 2005, FOA determined average travel speeds and times between four points along the existing route. The twisted 174 km (108 miles) of highway between El Salto and Concordia supported only an average personal vehicle speed of 44.7 km (27 miles) per hour, and 32.0 km (19 miles) per hour for heavy trucks.

The Mazatlán-Durango highway is considered to be part of a trade corridor and was compared to other trade routes used to transport goods from East Asia to Central and Eastern United States markets. The study examined other ports and routes that serve these markets, including the port of Long Beach in California, the Panama Canal, and routes that begin at other Mexican Pacific ports such as Manzanillo Lazaro Cardenas and Topolobampo. The study suggests that the Mazatlán to Matamoros route will be able to deliver goods from Asia to the central and eastern United States for a lower cost per kilometer traveled. The study suggests that the Mazatlán-Durango highway will open a corridor that could take volume from the port of Long Beach and the Panama Canal.

Just as the feasibility study draws information from many sources, it also uses a variety of tools to make predictions and projections. The study utilizes a regression analysis employing formula based on Newton's gravity model, where trips are inversely proportional to the square of the distance between two points.

Gravity Model

$$Y = XiXj / DB$$

Where: Y is the number of trips (gravity)
X is population of origin/destination (mass)
D is the distance between origin/destination
B is the difficulty of the distance traveled

FOA measured four versions of this model, most weighted by the GDP of the origin and destination. The $R^2$ - statistics indicate that the fourth model best fits the data, and this model forecasts an 85% increase in vehicle trips taken on the Mazatlán-Durango highway.

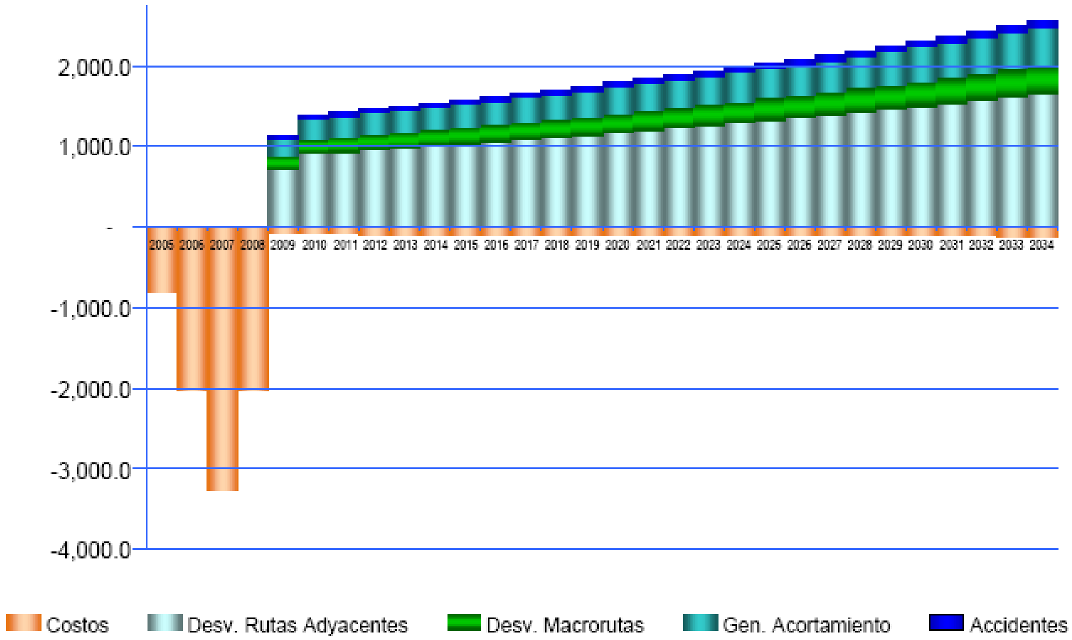
The analysis projected the number of personal vehicles, buses, and trucks that will pass through two observation points, Los Ebanos and La Curva. All three types of vehicles will increase, but personal vehicle trips will increase by more than 50%, according to the FOA projection.

FOA presents models of vehicle trips that grow in stairstep fashion over the short to medium run. To show this, FOA uses the Gompertz Curve, a model frequently used for biological and economic growth.

*Cost-Benefit Analysis*

To evaluate the total benefits of the project, FOA considered the growth of vehicle trips due to savings in time, logistics, safety, pollution, and other factors. Total cost was calculated by determining the value of the investment and estimated maintenance and operational costs of the project. The baseline for prices was 2004, construction was estimated to take four years, and the highway would be operational in year five. The total costs were estimated at MXP$6.3 billion (US$475 million), and total benefits were calculated to be MXP$7.3 billion (US$550 million).

Figure 4.15 shows the cost and benefit projections. The group concluded the project would have a 13.7% internal rate of return on a 30-year time horizon.




Source: FOA, 2005

*Figure 4.15: Cost-Benefit Projections (Millions Pesos)*

*Summary of Feasibility Study by Felipe Ochoa and Associates*

The report by FOA finds the Mazatlán-Durango highway project to be feasible, with a return on investment of over 13%. While the methodology of these conclusions is sophisticated, the feasibility of this project seemed a foregone conclusion from the beginning. The priority national leaders have given this project seemed greater than any findings produced by a consultant analysis of the project. This important piece of the National Development Plan would apparently progress with or without validation by feasibility and environmental studies, and these studies seem to be mere formalities in the bureaucratic process of implementation.

The cost-benefit analysis accounts for intangible benefits that may not be recovered by the government, such as time saved by future travelers. The analysis also underestimated the total cost of the project, as when it was drafted it assumed that the highway would open in 2009 (Business News America's, 2008.c). However, former SCT Secretary Luis Tellez told the media before he resigned in early 2009 that it would open in 2010 or 2011.

Although the study has not been able to predict the future with 100% accuracy, including the global economic downturn, it does provide useful information about the Mazatlán-Durango highway project. It gathered relevant information from many sources, and created metrics from which growth and performance can be measured in the future.

### 4.2.4 Environmental Process

SEMARNAT must approve major public works projects before construction. SEMARNAT received the Environmental Impact report, or MIA as it is known by its Spanish acronym, and began consideration of the Concordia to El Salto construction on June 16, 2005.

On July 26, 2005, the Executive Director of SEMARNAT signed the resolution, certifying the project for construction (SEMARNAT, 2005).

Some perceive SEMARNAT as a powerless, rubber-stamp machine for the large national projects. The Mazatlán-Durango highway is a national priority that trumps other concerns, including environmental issues. In this case, the construction process includes a lot of explosives to clear tunnels through the mountains, creates waste fluids and gas emissions, and debris from tunneling and paving is thrown into nearby canyons. There will certainly be loss of animal life, but there are no quantified estimations of the environmental costs. It is clear that this project has high social and economic benefits, and that the presidential administration supports it fully. The nation expects SEMARNAT to certify projects like this one. The agency could likely do more with more resources, but does produce documents like the MIA.

The MIA is 188 pages in length, and begins with an executive summary that provides information on the types and quantities of materials used in the project, enumerates the environmental regulations, enumerates the environmental impact of construction activities, and establishes other standards such as disposal methods of waste material to mitigate some of the negative environmental impacts of the project. The following is an annotation of information presented in the MIA.

Climatology, Geology and Hydrology

The MIA describes the climate of the region by reporting average monthly rainfall and temperature. The number of cloudy, partly-cloudy, and sunny days, and days with dew are also presented. The hottest months are July, August, and September. August and September also receive the most amount of precipitation. Rainfall is considered with geological features such as the composition of the soils, rocks, and minerals as the region is prone to experience flooding, contamination of natural resources, and soil erosion depending on the amount of rainfall.

Ecology

There is much biodiversity in this the region, as it sits between temperate and tropical climates. The forest is dominated by six species of pine, three species of oak, and other trees, including two species of mandrone, a more tropical tree. Tree survey results are in the MIA.

At least 59 species of mammals inhabit the region, including bats, rodents, armadillo, rabbits, deer, coyotes, wolves, skunk, about six kinds of wild cat, and a multitude of ringtail type creatures not native to Texas. The MIA also lists 59 species of birds known to inhabit the region. Six species of amphibians are listed along with eight species of reptiles. A list of threatened, endangered, or otherwise protected species is 15 long (eight mammals, including cats and wolves, seven birds, and one snake). The MIA does not acknowledge insects, arachnids, or other bugs.

Socioeconomics

The human populations of the region have been stifled by isolation. The MIA gives information on nearby towns, population, growth trends, and percentage of people with and without sewer or septic lines. There are farms, which mainly grow beans and corn, and ranches that raise cows, pigs, horses, and birds. The MIA presents information on the region's agricultural production, including beef, poultry, dairy, and honey. Industries that utilize the abundance of trees are mills, cardboard factories, and furniture workshops. Mineral interests in the region include the mining of gold, silver, lead, sand, and gravel. Finally, tourism and hospitality employs a number of people in the region.

Technical aspects

The project includes 290 drainage works, dozens of bridges, and over 50 tunnels. The greatest amount of work required is by tunneling efforts. The MIA explains the techniques used to build the tunnels, and enumerates the procedures prior to detonation of powerful explosives. The highway between Concordia and El Salto will move about 17 million cubic m (600 million cubic feet) of earth, most of which requires explosives. Sites with little agricultural dependence are preferred so as to discard materials from the leveling and tunneling works, and the mountains' many canyons and gullies become convenient landfills.

The MIA specifies in great detail how to lay pavement: the thickness of tar, time of day of the application, and how to spread other asphalt material. These details seem to come from come a concern that water will damage an improperly laid roadway, as opposed to how the roadway will impact the environment.

Summary of the MIA

The MIA provides a lot of information, but not all of it on the environment. This document is a source of information about the highway construction between El Salto and Concordia, and the region it will affect. It provides details on techniques used in construction and relevant demographic information. The environmental information in the MIA is interesting, but it does not establish a quantifiable way of measuring the environmental impact, with the exception of hydrology. The study does make concrete estimates on the production of black waters and their treatment on an extended time scale. What the MIA lacks is reference to insect, arachnid, and microbial life, and a comprehensive valuation of the environmental impact of the project—especially the hydro geological impact of waste material being put into gullies and canyons that have active streams and may lead to flash flooding in the future. It is a valuable document in many regards, but it gives the impression that the Mazatlán-Durango highway is such an important project that it would move forward regardless of the contents of MIA.

Figure 4.16 shows the impact of activities throughout the construction process on various environmental and socioeconomic aspects of the region. The green represents positive impacts, and the most positive impacts are in employment generation. The yellow are moderate impacts and the red represent severe impacts. Most of the severe impacts on plant and animal life, as well as on human quality of life, fall within the preparation stages. Pale blue squares represent irrelevant impacts and gray squares are where impacts are not applicable.

NATURALEZA DEL IMPACTO / ACTIVIDADES U OBRAS

| Medio | Componente | Factor | PREPARACIÓN: 1.Compra o expropiación del derecho de vía | 2. Caminos de acceso para el desmonte | 3. Desmonte | 4. Despalme | CONSTRUCCIÓN: 5. Caminos de acceso para terracerías | 6. Excavación mecánica en cortes | 7. Excavación con explosivos | 8. Caminos de acceso a obras de drenaje menor | 9. Obras de drenaje menor | 10. Acarreo de Cortes | 11. Acarreo de bancos de préstamo | 12. Formación y compactación de terraplenes | 13. Acarreo de material pétreo de desperdicio | 14.Tendido de bases y carpeta |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MEDIO ABIÓTICO | ATMÓSFERA | 1.Calidad del aire | | 28 | 28 | 28 | 28 | 32 | 35 | 27 | | 24 | 24 | 32 | | 23 |
| | | 2.Microclima | | | 15 | 15 | | 15 | | | | | | 15 | | |
| | | 3.Ruido | | 23 | 20 | 20 | 23 | 20 | 25 | 23 | | 20 | 20 | 25 | | |
| | GEOMORFOLÓGICO | 4.Relieve | | | | | | 41 | | | | | | 41 | | |
| | | 5.Estabilidad de taludes | | | | | | 17 | | | | | | | | |
| | SUELO | 6.Calidad del suelo | | | 41 | 41 | 27 | 41 | | | | | | | | |
| | | 7.Infiltración | | | 37 | | 31 | 29 | 29 | 25 | | | | | | 25 |
| | | 8.Erosión | | | 25 | 25 | 23 | 17 | | 17 | 17 | | | | | |
| | HIDROLOGÍA | 9.Calidad del agua | | 29 | 25 | 25 | 29 | 23 | 23 | 29 | 23 | 23 | 23 | | | |
| | | 10.Cantidad de agua | | | | | | | 31 | | 30 | | | 30 | | |
| | | 11.Afectación de cauces | | 22 | 25 | 25 | | 23 | 23 | | 23 | | | | | |
| MEDIO BIÓTICO | VEGETACIÓN | 12.Bosque o selva | | 26 | 44 | | 26 | | | | | | | | | |
| | | 13.Matorral | | 26 | 44 | | 26 | | | | | | | | | |
| | | 14.Hierba | | 26 | 44 | | 26 | | | | | | | | | |
| | | 15.Diversidad de flora | | 22 | 40 | | 22 | | | | | | | | | |
| | | 16.Especies en peligro | | 20 | 44 | | 20 | | | | | | | | | |
| | FAUNA | 17.Diversidad de fauna | | 38 | 40 | | 38 | | 32 | 26 | | | | | | |
| | | 18.Hábitat, distribución y corredores | | 24 | 44 | | 24 | | 24 | 24 | | | | | | |
| | | 19.Especies en peligro | | 20 | 44 | | 20 | | 20 | 20 | | | | | | |
| SOCIOECONOMÍA | POBLACIÓN | 20.Generación de empleos | | | | | | | | | | | | | | |
| | | 21.Calidad de vida | | | 36 | | | | 31 | | | 31 | 31 | 31 | | |
| | PAISAJE | 22.Modificación del entorno | | 24 | 38 | 25 | 24 | 24 | | 35 | 32 | | | 32 | | |
| | USO DEL SUELO | 23.Uso agrícola | 39 | | | | | | | | | | | | | |
| | | 24.Uso pecuario | 39 | | | | | | | | | | | | | |
| | | 25.Área urbana | 39 | | | | | | | | | | | | | |
| | SERVICIOS | 26.Sector secundario y terciario | | | | | | | | | | | | | | |
| | | 27.Modificación del patrón de transito | | | | | 21 | | | | | | | | | |
| | | 28.Seguridad vial | | | | | 21 | 21 | | | | 32 | 32 | | | |
| | | 29.Servicios municipales | | | | | | | | | | | | | | |
| | | 30.Servicios médicos | | | | | | | | | | | | | | |

| Factor | 15. Construcción de plaza de cobro | 16. Puentes de columnas cortas | 17. Caminos de acceso a puentes altos y túneles | 18. Puentes de columnas largas | 19. Construcción de túneles | 20. Pasos a desnivel | 21. Construcción de entronques a desnivel | ACTIVIDADES ADICION.: 22. Campamentos | 23. Oficinas y Almacenes | 24. Empleados de la construcción | 25. Operación de maquinaria y equipo | 26. Bancos de préstamo y acarreo | 27. Sitios de tiro |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.Calidad del aire | | | 28 | | 35 | 20 | 20 | | | | 33 | 23 | |
| 2.Microclima | | | | | | | | | | | | | |
| 3.Ruido | | | 23 | | 25 | | | | | | 27 | 20 | |
| 4.Relieve | | | | 41 | | 41 | 41 | | | | | 41 | |
| 5.Estabilidad de taludes | | | | | 17 | | | | | | 17 | | |
| 6.Calidad del suelo | 27 | | | | | 27 | 27 | 27 | 25 | 25 | 33 | 25 | |
| 7.Infiltración | 25 | | | | 31 | | | 25 | 25 | | 25 | | |
| 8.Erosión | | | 17 | | | | | | | | | 17 | |
| 9.Calidad del agua | | | 29 | 23 | | | | 17 | | | | | |
| 10.Cantidad de agua | | | 30 | 30 | | | | 30 | | 30 | | | |
| 11.Afectación de cauces | | | 22 | | | | | | | | 23 | | |
| 12.Bosque o selva | | | 26 | | | 30 | 30 | 30 | | | | | 44 |
| 13.Matorral | | | 26 | 26 | | 26 | 26 | 26 | | 26 | | | 44 |
| 14.Hierba | | | 26 | 26 | | 26 | 26 | 26 | | 26 | | | 44 |
| 15.Diversidad de flora | | | 22 | | | | | | | | | | 40 |
| 16.Especies en peligro | | | 20 | | | | | | | | | | 44 |
| 17.Diversidad de fauna | | | 38 | | | | | 26 | | 26 | | | 40 |
| 18.Hábitat, distribución y corredores | | | 24 | 24 | | | | 24 | | | | | 44 |
| 19.Especies en peligro | | | 20 | | | | | | | | | | 44 |
| 20.Generación de empleos | | | | | | | | | | | | | |
| 21.Calidad de vida | | | | | 31 | | | | | | 31 | | |
| 22.Modificación del entorno | 24 | | 24 | 24 | | 24 | 24 | | | | | | |
| 23.Uso agrícola | | | | | | | | | | | | | |
| 24.Uso pecuario | | | | | | | | | | | | | |
| 25.Área urbana | | | | | | | 21 | | | | | | |
| 26.Sector secundario y terciario | | | | | | | | | | | | | |
| 27.Modificación del patrón de transito | | | | | | 21 | 21 | | | | 25 | 21 | |
| 28.Seguridad vial | | | | | | 30 | 30 | | | | 35 | 30 | |
| 29.Servicios municipales | | | | | | | | 25 | | | | | |
| 30.Servicios médicos | | | | | | | | 27 | | 31 | | | |

No aplica | Positivos | Irrelevantes | Moderados | Severos

Source: SEMARNAT, 2005

*Figure 4.16: Impact of Activities on Environment During Construction Period*

### 4.2.5 Right-of-Way Acquisition

The Mazatlán-Durango highway modernization project is largely supported by the public, but in 2004 right-of-way (ROW) acquisition met several challenges. The state branches of the SCT handled the ROW acquisition, and paid more than MXP$20 million to land owners for property needed for parts of the new highway. Parts of Mexico, however, are not owned by single title holders as in the United States. Much of the country is occupied by indigenous tribes that have collective rights to the land. These communal lands are called ejidos and conflicts frequently arise when governmental authorities take land from the ejidos. At least twice in 2004, ejido administrators staged demonstrations that blocked construction workers from the work sites and forced the Durango state branch of the SCT back to the bargaining table (NOTIMEX, 2004). These disputes were settled quickly and by 2005 the SCT had obtained the right-of-way needed to complete the new Mazatlán-Durango highway (Fimbres Castillo, 2009).

### 4.2.6 Project Implementation

The Mazatlán-Durango highway project is a monumental task, especially the middle stretch that crosses the Sierra Madre Mountains between Concordia and El Salto. Anticipating technical difficulties, the federal government sought help from professional engineers and construction contractors. *Proyectistas* (consultants, or design engineers) are contracted to perform preliminary studies that include surveying, modeling, geological and seismic studies, hydraulic studies, and architectural design. The *proyectistas* develop much of the technical designs for the project, and provide a solid base for construction contractors to complete the work. *Proyectistas* are subject to an open bidding process that is independent of the construction contracts.

The Law of Public Works and Related Services of 1994 created a set of procurement protocols for large public works projects and, as the names suggests, related services (Fimbres-Castillo. 2009). The law was created to promote transparency and efficiency in the awarding of government contracts to the private-sector. Contracts are publicly advertised and private firms are encouraged to compete for the contracts. Depending on the type of work solicited, there are requirements for minimum technical experience and financial capacity. Other regulations require partnership with Mexican firms.

The highway concession package FARAC I leased operation rights of other highways, and provided a funding source for the Mazatlán-Durango highway. The winning consortium won the rights to operate the highways of FARAC I for thirty years, during which time it expects to generate profit. The revenue generated from FARAC I helped to fund the Mazatlán-Durango highway project, but the federal government maintains possession of the new highway and the rights to its operation.

A separate bidding is required for particular parts of the project. Design engineers are contracted by a formal bidding process, as are the construction contractors. There have been at least three separate bidding processes for works on the Mazatlán-Durango highway, but in each case the Mexican government paid private firms for services and did not forfeit control of the new highway. It seems likely that Mexico will eventually lease the new highway, like it does with many other highway concessions, but this will be after the highway is completed and operational, and it will require a formal bidding process that follows the protocol of the Law of Public Works and Related Services of 1994.

*Financing*

As noted in the introduction to this case study, the 1990s were tumultuous times for the Mexican federal government; there was a financial crisis, and the private firms operating concessioned highways were losing money and many eventually went bankrupt. The federal government nationalized the failing highway toll operations and created the federal highway rescue program, FARAC, to manage the newly re-acquired highway assets. The government took on significant debt, but rescued the highways. The crisis forced Mexico to reflect on its highway and infrastructure plan, and develop new strategies and goals. In 1996, amidst much uncertainty surrounding Mexico's highway development, SCT began construction on the modernization of the Mazatlán-Durango highway.

Critics were quick to point out the weaknesses and limits of FARAC, but it performed its duty relatively well (Corporate Mexico, 2002). Between 2006 and 2007, it put together a US$4 billion highway concession package. American investment bank Goldman Sachs was part of the winning consortium (Business News Americas, 2008.d). The Mexican government put the US$ 4 billion toward debt services and set up the infrastructure fund FINFRA. The concession moneys made up most of FINFRA, but other contributions were made by the Sinaloa and Durango state governments, and the federal government's liquidation of other financial assets.

FARAC and FINFRA were two separate entities linked together by their mutual involvement in Mexico's highways. FARAC managed the concessioned highways, while FINFRA funded studies and construction work on the new highways. To improve administrative efficiency and promote private-sector involvement, the two agencies were merged into a new organization and fund, FONADIN (Athie Rubio, 2009). With this new entity, Mexico is taking new aim at private-sector investment, hoping to secure even more private-sector investment by leveraging its infrastructure.

Similar to FARAC, some view the financial security of FONADIN with skepticism. FINFRA already invested approximately MXP$6 billion into the project and the project's completion will require even more. Mexico still encourages private-sector participation to maximize the inputs to FONADIN funds, but government officials seem realistic about the possible bankruptcy of FONADIN. In the event of FONADIN bankruptcy, federal and state resources, including toll revenues, would be used to finish the project.

Various other governmental entities have a role in the financing (as well as the management and operation of the financing process) for the Mazatlán-Durango highway. Federal Roads and Bridges, or CAMPUFE by the Spanish acronym, is responsible for collecting tolls on Mexican highways, including two tolling locations on the highway in the state of Durango. BANOBRAS acts as the fiduciary and distributes funds from the infrastructure fund.

The project is officially financed under Mexico's assets utilization scheme of public-private partnership, but it is a part of a continuous movement in the way Mexico treats highway infrastructure planning and financing. A central idea of national plan is matching government investment in infrastructure with funds from the private-sector. To stimulate this participation from the private-sector, the government has invented new agencies and strategies. So far, the strategies have brought in considerable private-sector investment to complete large-scale transportation infrastructure projects. The construction timeline for general construction is expected to take four and a half years. The general timeline for construction of the tunnels in this project is expected to take one year.

El Salto to Concordia

When the SCT designed most of the project and secured right-of-way for construction, it opened a public bidding for the construction of three sections of the highway in the most difficult section of the Sierra Madre Mountains. Interested companies had to form consortiums and demonstrate their firms' technical capability to be considered. In the summer of 2008, the SCT awarded three highway construction contracts to cross the "Devil's Spine." The call to tender on the construction contracts came on February 21, 2008, with an initial start date of June 26 and an expected date of completion in 2012 (SCT, 2009.a). The three phases can be seen in Figure 4.17. Figure 4.18 shows the length of the three sections, the winning consortia, and the approximate construction costs.

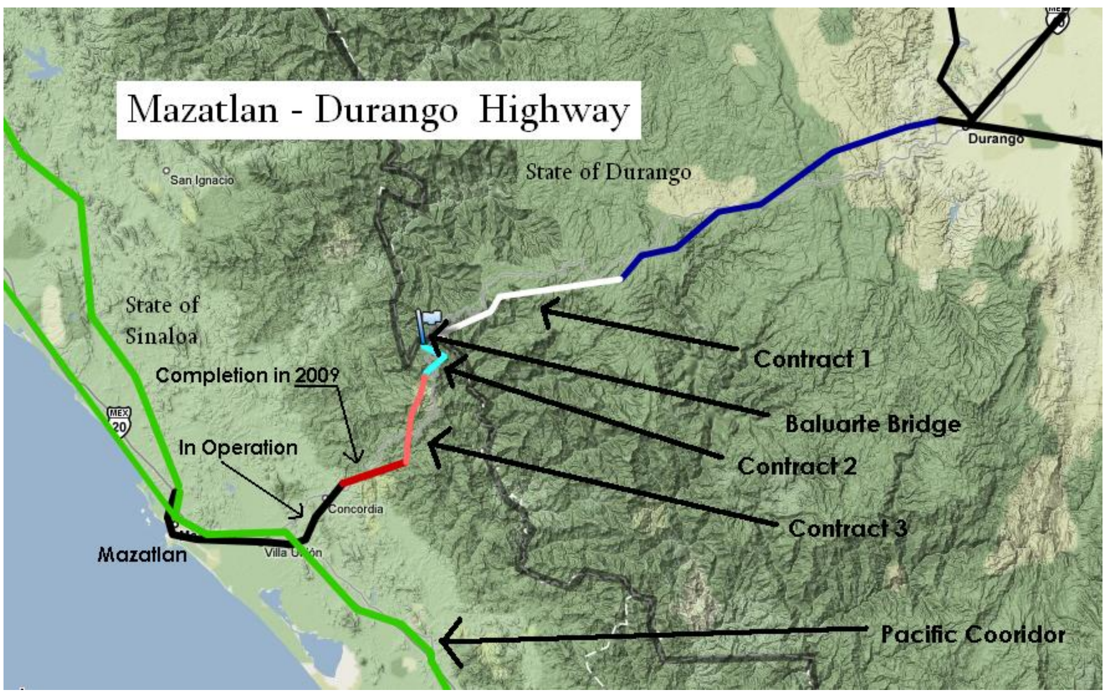



*Figure 4.17: Construction Segments of Mazatlán-Durango Highway*

| Tramo | Empresa adjudicataria | Monto de la oferta con IVA |
|---|---|---|
| km. 111+000 – km. 156+956 (Durango) | OMEGA CORP | $ 3,971'134,894.18 |
| km. 158+080 – km. 168+400 (Sinaloa) | TRADECO INDUSTRIAL | $ 2,056'689,291.02 |
| km. 168+400 – km. 186+300 (Sinaloa) | FCC CONSTRUCCIÓN Y LA PENINSULAR | $ 2,190'727,803.71 |
| | TOTAL | $ 8,218'551,988.91 |

Source: SCT, 2009.a

*Figure 4.18: Length of Contracts, Concessionaires & Costs*

Contract I lies entirely in state of Durango. It approaches the Sinaloan border and the Baluarte Bridge on a southwest trajectory form the city of Durango. The contract specifies that 26 tunnels (8.5 km total, longest is 890 m) and 14 bridges will complete 46 km of highway. The contract was awarded for about MXP$1 billion (US$75 million) to a consortium that included Omega Corp, a Mexican firm, joined with Aldesa, a Spanish firm (Business News Americas, 2008.b). Nine other consortiums participated in the bidding, including Carlos Slim-owned Carso Infraestructura y Construccion (Business News Americas, 2008.a). Figure 4.19 lists the tunnels in Section 1 of this project.

**DURANGO-MAZATLAN HIGHWAY**

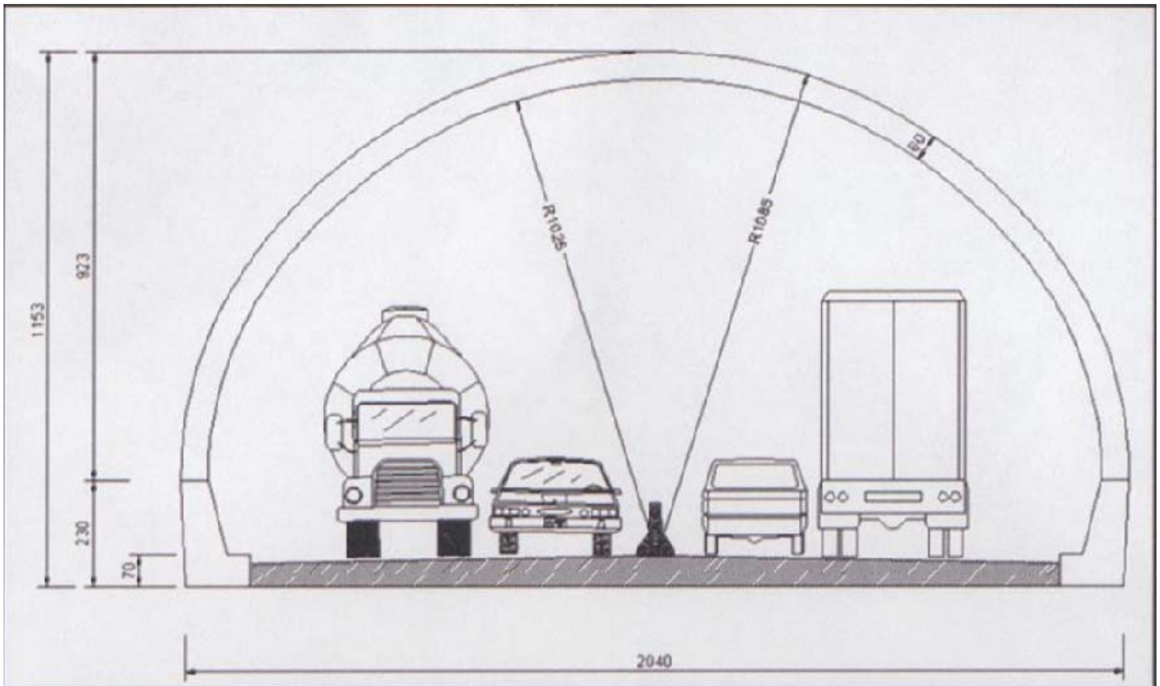
**SECTION 1: KM 111+000 TO 156+956**

| Tunnel | Name | Portal | | Length (m) |
|---|---|---|---|---|
| | | Durango | Mazatlan | |
| 1 | Cerro Lambedero | 115+680 | 115+840 | 160 |
| 2 | Chavarría Nuevo I | 125+785 | 125+880 | 115 |
| 3 | Chavarría Nuevo II | 126+695 | 126+565 | 170 |
| 4 | Leonera I | 127+460 | 127+610 | 150 |
| 5 | Leonera II | 127+830 | 126+000 | 170 |
| 6 | Los Alacranes | 128+891.52 | 129+069.56 | 178.04 |
| 7 | Chavarría Nuevo III | 129+184,02 | 129+387.06 | 203.04 |
| 8 | Chavarría | 129+990 | 130+327 | 337 |
| 9 | El Magueyal | 137+441.32 | 137+669.59 | 228.27 |
| 10 | Pino Gordo | 128+286.32 | 138+444.64 | 158.32 |
| 11 | Los Fresnos | 138+894.32 | 139+054.64 | 160.32 |
| 12 | Piedra Colorada | 139+413.32 | 139+899.59 | 486.27 |
| 13 | El Frijolar | 144+769.33 | 145+207 | 437.67 |
| 14 | La Tortuga | 145+207 | 146+097 | 890.42 |
| 15 | Siete Viboras | 146+313.82 | 146+614.29 | 300.47 |
| 16 | El Venado | 147+003.54 | 147+479.53 | 475.99 |
| 17 | Picachos I | 147+651.32 | 148+079.29 | 427.97 |
| 18 | Picachos II | 148+297.62 | 148+562.43 | 264.81 |
| 19 | Papayito I | 148+986.45 | 149+374.45 | 388 |
| 20 | Papayito II | 149+693.95 | 149+959.22 | 265.27 |
| 21 | Papayito III | 150+195.98 | 151+004.45 | 808.47 |
| 22 | Los Picachos | 151+475 | 151+800 | 325 |
| 23 | Cerro de los Becerros | 152+190 | 152+530 | 340 |
| 24 | Las Mesitas | 152+700 | 153+020 | 320 |
| 25 | La Salitrera | 154+993 | 155+116 | 123 |
| 26 | Baluarte | 156+397.15 | 156+961.77 | 574.62 |
| Total number: 26 | | | Total length: 8,457.95 m | |

Source: Tunnelbuilder.com

*Figure 4.19: Tunnels in Section 1*

Contract II lies entirely in Sinaloa, after the Baluarte Bridge. Eight consortia presented bids (SCT, 2009.a), and a consortium that included the Mexican firm Tradeco Industrial won the MXP$2 billion contract. While the overall length of Contract II is just over 10 km, it is a very difficult terrain and calls for intensive engineering and construction planning. The 15 tunnels of Contract II total to 4.5 km (2.8 miles) in length, and range from 73 m (80 yards) to 792 m long. The average length is 225 m. Seven of the tunnels will be four lanes wide and will accommodate large vehicles easily. Tunneling required the excavation of about 1.5 million cubic m (52.9 million cubic feet) of material and counted for about 55% of construction resources. Over 100,000 cubic m (3.2 million cubic feet) of cement and 11.3 million kilograms of steel were used (SCT, 2009.a). Figure 4.20 shows a diagram of one of the tunnels.




*Source: SCT, 2009.a*

*Figure 4.20: Diagram of Four Lane Tunnels*

Figure 4.21 lists the tunnels in Section 2 of this project

**SECTION 2: KM 158+080 TO 168+400**

| Tunnel | Name | Portal | | Length (m) |
|---|---|---|---|---|
| | | Durango | Mazatlan | |
| 27 | El Guineo | 159+000 | 159+190 | 190 |
| 28 | El Varal | 159+258 | 160+050 | 792 |
| 29 | Otates | 161+076.8 | 161+150 | 73.20 |
| 30 | Guamuchil | 161+220 | 161+500 | 280 |
| 31 | Los Morillos | 161+710 | 162+100 | 390 |
| 32 | Carrizo I | 163+180 | 163+295 | 115 |
| 33 | Carrizo II | 163+473.5 | 163+885 | 411.50 |
| 34 | Carrizo III | 164+150.5 | 164+575 | 424.50 |
| 35 | La Piedra | 164+750 | 165+040 | 290 |
| 36 | La Quemada | 165+194 | 165+320 | 126 |
| 37 | La Quemada II | 165+470 | 165+613 | 143 |
| 38 | La Laguna I | 165+815 | 166+020 | 205 |
| 39 | La Laguna II | 166+200 | 166+455 | 255 |
| 40 | La Laguna III | 166+600 | 166+960 | 360 |
| 41 | Las Labores | 167+355 | 167+674 | 319 |
| Total number: 15 | | | Total length: 4,374,20 m | |

Source: Tunnelbuilder.com

*Figure 4.21: Tunnels in Contract 2*

The 10 bridges of Contract II count for 35% of construction resources and total to 2.4 km (1.5 miles) in length. Bridge construction efforts require nearly 170,000 cubic m (6 million cubic feet) of excavation, 25,000 cubic m (883,000 cubic feet) of concrete, and nearly 9,000 kilograms of steel. The last 10% of resource went to leveling, paving, and drainage works (Enriquez-Garcia, 25 Feb. 2009).

The third and final construction contract (Contract III) to cross the Devil's Spine also lies entirely in Sinaloa and descends from the Sierra Madre Mountains and extends towards the Pacific Coast. It is located between km 168 and 186 of the new highway. Ten consortiums competed for the construction contract, and in the end it was awarded to a group founded by FCC Construccion from Mexico and La Peninsular from Spain for about 2.1 billion Mexican pesos (SCT, 2009.a).

There are 16 tunnels and 12 bridges in the Contract III. The longest tunnel of the entire project lies within this stretch. The Sinaloense Tunnel makes up 2.6 km (1.6 miles) of the total 5.5 km (3.4 miles) of tunnel in the third contract. Figure 4.22 lists the tunnels in Section III of this project.

**SECTION 3: KM 168+400 TO 186+300**

| Tunnel | Name | Portal | | Length (m) |
|---|---|---|---|---|
| | | Durango | Mazatlan | |
| 42 | El Sinaloense | 168+425,45 | 171+219.49 | 2,794.04 |
| 43 | Trópico de Cáncer | 171+430 | 171+616 | 186 |
| 44 | Corte Alto | 172+246.48 | 172+459.56 | 213.08 |
| 45 | La Mina | 173+216.39 | 173+409.38 | 192.99 |
| 46 | Chirimollos | 173+446.42 | 173+674.56 | 228.14 |
| 47 | Santa Lucía I | 179+755 | 180+058 | 303 |
| 48 | Santa Lucía II | 180+310 | 180+445 | 135 |
| 49 | Cerro La Reforma | 180+570 | 180+695 | 125 |
| 50 | Santa Lucía | 181+327 | 181+440 | 113 |
| 51 | Roblar de la Cueva | 181+675 | 181+750 | 75 |
| 52 | Las Mesas | 182+560 | 182+746 | 186 |
| 53 | El Nacaral | 183+253 | 183+470 | 217 |
| 54 | Las Palomas | 183+940 | 184+260 | 320 |
| 55 | Pánuco | 185+240 | 185+400 | 160 |
| 56 | Pánuco II | 185+555 | 185+649 | 94 |
| 57 | Real Pánuco | 185+898.4 | 186+024.33 | 125.93 |
| Total number: 16 | | | Total length: 5,468,18 m | |

Source: Tunnelbuilder.com

*Figure 4.22: Tunnels in Contract 3*

Construction of the more than 50 tunnels in this project requires blasting large quantities of rock in order to clear the tunnel passageways. The project consumes in excess of 750,000 pounds of ammonium nitrate/fuel oil explosives for the tunnels. The tunnels also require more than 2,000 tons of steel, and 12,000 cubic m of cement (SEMARNAT, 2005).

<u>The Baluarte Bridge</u>

The crown jewel of this highway project is the ambitious Baluarte Bridge that is currently under construction and on schedule for completion in 2010 (Business News Americas, 2008.c). The bridge straddles the Baluarte River, the official border between Sinaloa and Durango, and unites the two states. The colossal structure will set records and already draws comparisons to other great bridges of the world.

The cable-stayed design of the Baluarte Bridge is similar to that of a suspension bridge, but cable-stayed bridges are generally shorter. The Baluarte Bridge will have 152 cable stays and will span 1.1 km—longer than the longest cable-stayed in North America, the Cooper River Bridge in South Carolina. The Audubon Bridge in Louisiana, however, is competing for the same title. Scheduled for completion in 2010, it will be slightly longer than the Baluarte Bridge. The Audubon crosses the mile-wide Mississippi River, and Baluarte Bridge will cross a deep canyon in the mountains. The concurrence of these two projects and their similar length will make for interesting comparisons. Please refer to Figure 4.14 earlier in this report for a schematic of this bridge.

The 390-meter height of the deck of the Baluarte Bridge above the canyon floor could accommodate the Eiffel Tower turned up-side down. This height is sufficient to earn the title of highest cable-stayed bridge in Latin America. Figure 4.23 shows the super-imposed Eiffel Tower underneath the bridge and Figure 4.24 shows the main characteristics of the Baluarte Bridge.

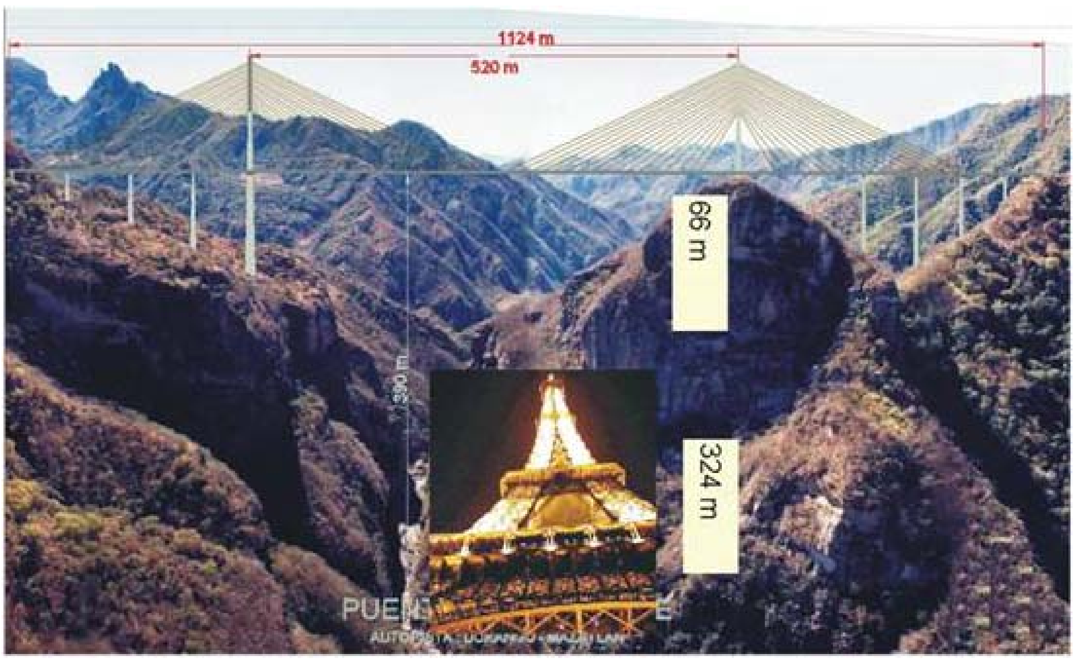



*Figure 4.23: Eiffel Tower Superimposed Under Bularte Bridge*

Figure 4.23 & 4.24 Source: SCT, 2009

**Puente Baluarte**

| No. | CARACTERISTICAS PRINCIPALES | |
|---|---|---|
| 1 | Longitud total | 1124 m. |
| 2 | Profundidad de la barranca | 390 m. |
| 3 | Claro Principal | 520 m. |
| 4 | Ancho total | 20 m. |
| 5 | Longitud de estructura de acero | 432 m. |
| 6 | Longitud de estructura de concreto | 692 m. |
| 7 | Altura de pilones | 101 m. |
| 8 | Máxima altura de pilas | 148 m. |
| 9 | Dimensión máxima de zapata | 18 x 30 m. |
| 10 | Tipo de atirantamiento | Abanico |
| 11 | Número de tirantes | 152 |
| 12 | Longitud máxima de tirantes | 280 m. |
| 13 | Numero de torones por tirante | 20 a 47 |
| 14 | Pendiente longitudinal | 0.05 |

*Figure 4.24: Principal Characteristics of the Baluarte Bridge*

Grupo Triada was the *proyectista* that performed studies and developed the technical design of the bridge. Tradeco Industrial, Aceros Corey, the French company VSL and Impulsora Desarrollo Integral formed the consortium that won the MXP$1.6 billion contract to build the colossal bridge (Business News America, 2009). Construction began August 12, 2008 and is expected to take 3.5 years (Business News America, 2008.b). In 2008, *Business News America* reported that the construction of the bridge could be delayed until 2012, but in February of 2009 the SCT indicated that the bridge was 32% complete and could possibly open in 2010 (Business News America, 2009).

### 4.2.7 Conclusions

*The project in brief*

This case study of the Mazatlán-Durango highway modernization project considers the history of this project, its importance as a transversal corridor and inter-oceanic corridor across northern Mexico and its development in planning and financing. Current activities display incredible feats of engineering that will save transportation costs and time, and promote social and economic growth in the region and beyond.

*Notable features*

This project crosses the Sierra Madre Occidental mountain range by constructing dozens of tunnels and bridges. Among the many impressive bridges is the Baluarte Bridge that straddles the Baluarte River and joins the states of Sinaloa and Durango. The colossal bridge will be the longest cable-stayed bridge in Latin America. There are many tunnels that are more than 100, 200 and 300 m, but the longest is the Sinaloaense Tunnel, which extends over 2.7 km through the mountain.

The method of finance and public involvement is also of interest because this is a model project for the NIP and pilot project for a bold new financing scheme. Funds from the concession of other highways finance this project and project development has been very transparent. Public biddings and competition promote efficiency at many levels of project planning and implementation.

*Lessons learned*

One lesson that Mexican officials have learned over the past fifteen years is that highway infrastructure is expensive. The cost of this route is estimated at MXP$3.5 million per kilometer—double the price of north-south roads (Paper: SCT, 9 Sept. 2008). Progress has been made, but the corridor is still not open. Mexico has taken on a great project, with many associated benefits, but with it has also taken on great responsibility to maintain and operate this highway. Costly delays caused by atypical rains and damaging vehicle accidents have encumbered this project. The project will require more funding before it is complete, and Mexico has passed the point at which the project can be abandoned.

*Impact on Texas*

The project is the last link in the modern highway extending from the Pacific port of Mazatlán, Sinaloa to the gulf port of Matamoros, Tamaulipas. The completion of this lateral transversal corridor opens economic opportunities for many regions. Mexico's North and Northeast regions will have improved access to goods coming from Mazatlán and other Mexican Pacific ports.

This transversal corridor is an important part of Mexico's Development Plan, and it raises hopes that it will create a Pacific Ocean to Gulf of Mexico trade route that will rival the Panama Canal for service to Mexico and North America.

The "inter-oceanic" corridor will undoubtedly have some impact on Texas transportation, but the magnitude of the impact is unknown. Much of the corridor lays in close proximity to the Texas border. Monterrey, Nuevo Leon and Torreón, Coahuila are two large interior cities with close connections to the Texas border. The corridor runs parallel to the border in Lower Rio Grande Valley region, where there are multiple points of entry. Ultimately, the "inter-oceanic" corridor arrives at the port of Matamoros, across from Brownsville, Texas. At this point, commodities can enter the United States by land or water transportation.

## 4.3 Arco Norte

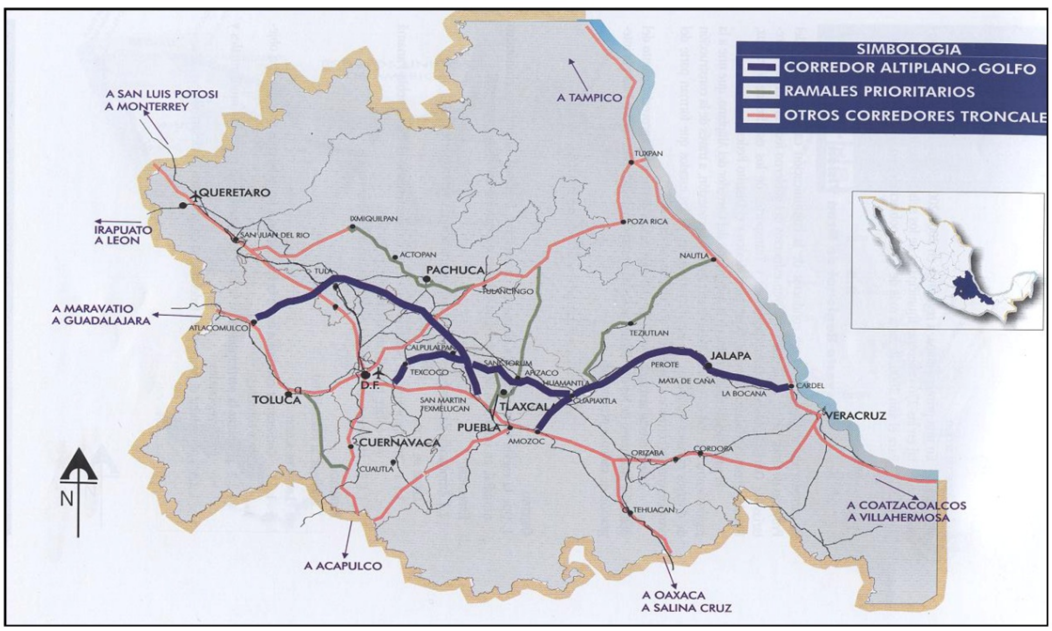
### 4.3.1 Project Description

*Type of Project*

Arco Norte, or Libramiento Norte de la Ciudad de Mexico, is a 223-kilometer highway built to connect federal and state highways in the northern half of Mexico City's metropolitan zone, allowing traffic to circumvent the city. It is the largest PPP project in SCT history.

*Need Addressed*

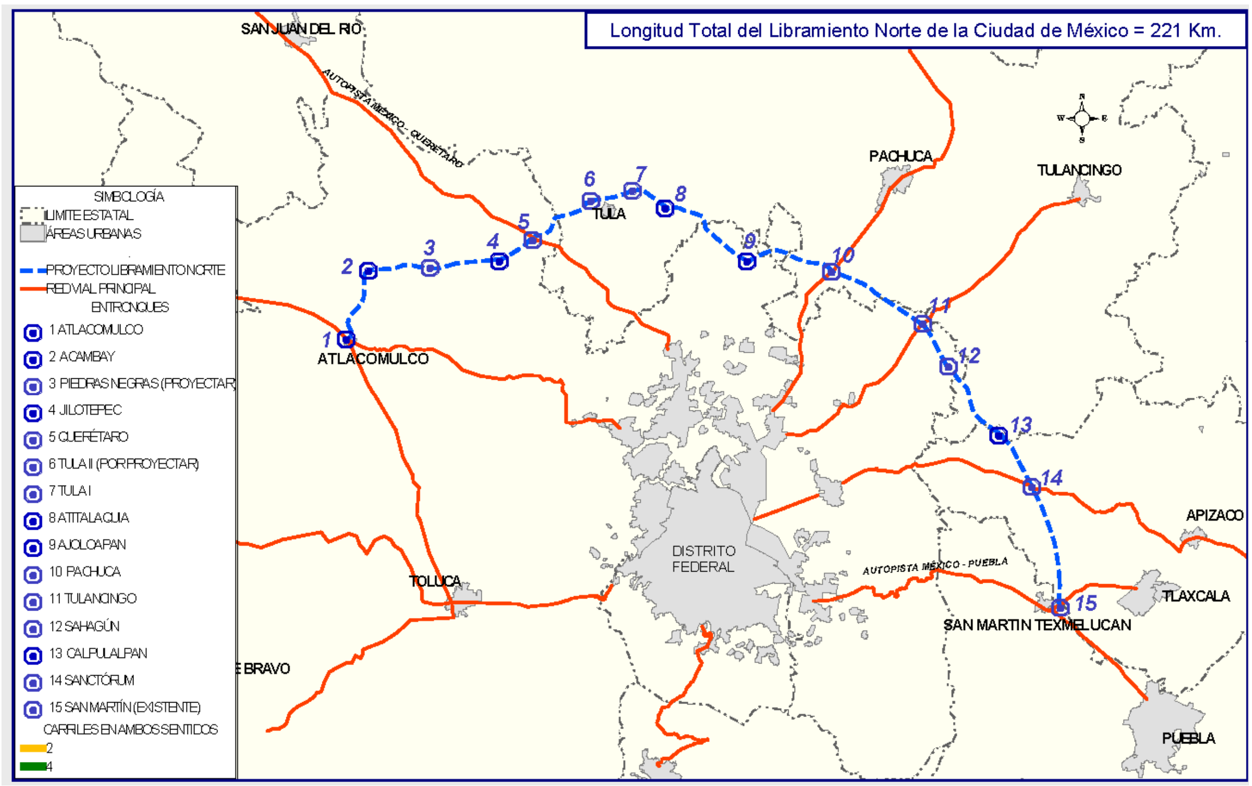
Arco Norte is part of the Altiplano Corridor—a 362-mile highway system that links central Mexico to the Gulf—and forms an important bypass for the Mexico City metropolitan zone, improving transportation logistics nationwide by eliminating the travel of around a million heavy vehicles yearly through Mexico City's center (SCT, 2007). Upon completion, Arco Norte is expected to produce several key social benefits, in addition to a massive reduction of congestion within the city and decrease in fuel usage of approximately 400 million gallons per year. It will lead to environmental benefits as congestion decreases and pollution improves. Moreover, it is estimated that this new route will cut travel time through Mexico City from the current four hours to an hour and a half. Furthermore, because of its size and placement, it is expected to serve as a catalyst for new industrial and commercial development in the states of Mexico, Hidalgo, Tlaxcala, and Puebla (SCT, 2007). Figure 4.25 shows the Altiplano Corridor.




Source: Cal y Mayor, 2005.d.

*Figure 4.25: Altiplano Corridor*

Figure 4.26 shows the magnitude of impact that Arco Norte will have. In addition to providing a much needed route around Mexico City, Arco Norte also links several key national highways, including México-Querétaro, México-Pachuca, Pirámides-Tulancingo, Texcoco-Calpulalpan, México-Puebla, and Mexico-Guadalajara (Melo Jimenez, 2009).



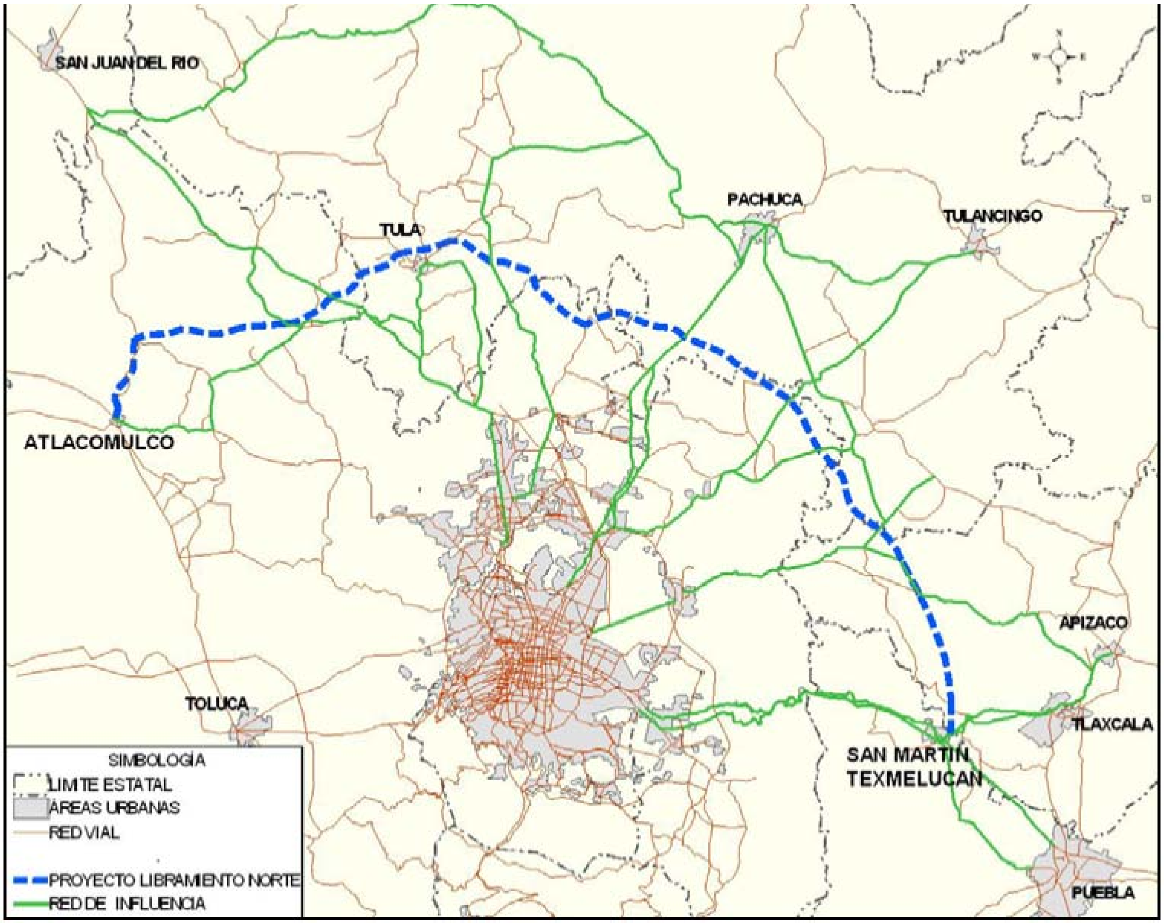

Source: Cal y Mayor, 2005.c.

*Figure 4.26: Map of Arco Norte Project*

With the development of Arco Norte, SCT and the Mexican federal government have identified and addressed a critical infrastructure need that can serve to dramatically increase internal trade as well as providing a key link for domestic traffic to different parts of the country. Additionally, as stated by President Calderon when he introduced his 2007 NIP, the first goal is to provide equal opportunities for all Mexicans, particularly those who have the least; the second is to construct and expand the infrastructure required to increase the competitiveness of the national economy; and the third is to turn Mexico into a highly competitive logistic platform. Arco Norte fits neatly within these goals by increasing competitiveness on multiple levels.

*Location*

Arco Norte passes through four states of the Republic—Puebla, Tlaxcala, Hidalgo, and Mexico—and crosses the highways Mexico-Querétaro, Mexico-Pachuca, Mexico-Tulancingo, Mexico-Puebla, and Texcoco-Apizaco, among others.




Source: Cal y Mayor, 2005.d.

*Figure 4.27: Arco Norte's Zone of Influence with Federal Highways*

Figure 4.27 shows the zone of influence of the project with respect to the federal highway system (marked in green on the figure). Arco Norte serves to link key federal highways to provide an important bypass around congested Mexico City.

*Sponsor*

The sponsor of this project is SCT, which has been planning this project since the early 1990s. The project is a PPP between SCT and Autopista Arco Norte, S.A. de C.V, which are the consortia constructing and operating this Build-Operate-Transfer (BOT) project.

### 4.3.2 History

Planning of the Arco Norte pre-dates inclusion in the NIP. Due to the hub-and-spoke design of Mexico's highway network, with Mexico City as the hub, inevitable and unavoidable congestion has plagued the city as it continues to grow. Congestion in Mexico City has been an issue for many years and consequently planning for the project can be traced back to 1992 when engineering students at the National University of Mexico (UNAM) were tasked by SCT with surveying Mexican businesses about their interest in the potential project (Hernandez, 2009.b). Although the need for the project had been established in the early 1990s, until PPPs became a feasible alternative to federally financed infrastructure projects in the early 2000s, SCT was unable to move forward with the planning process.

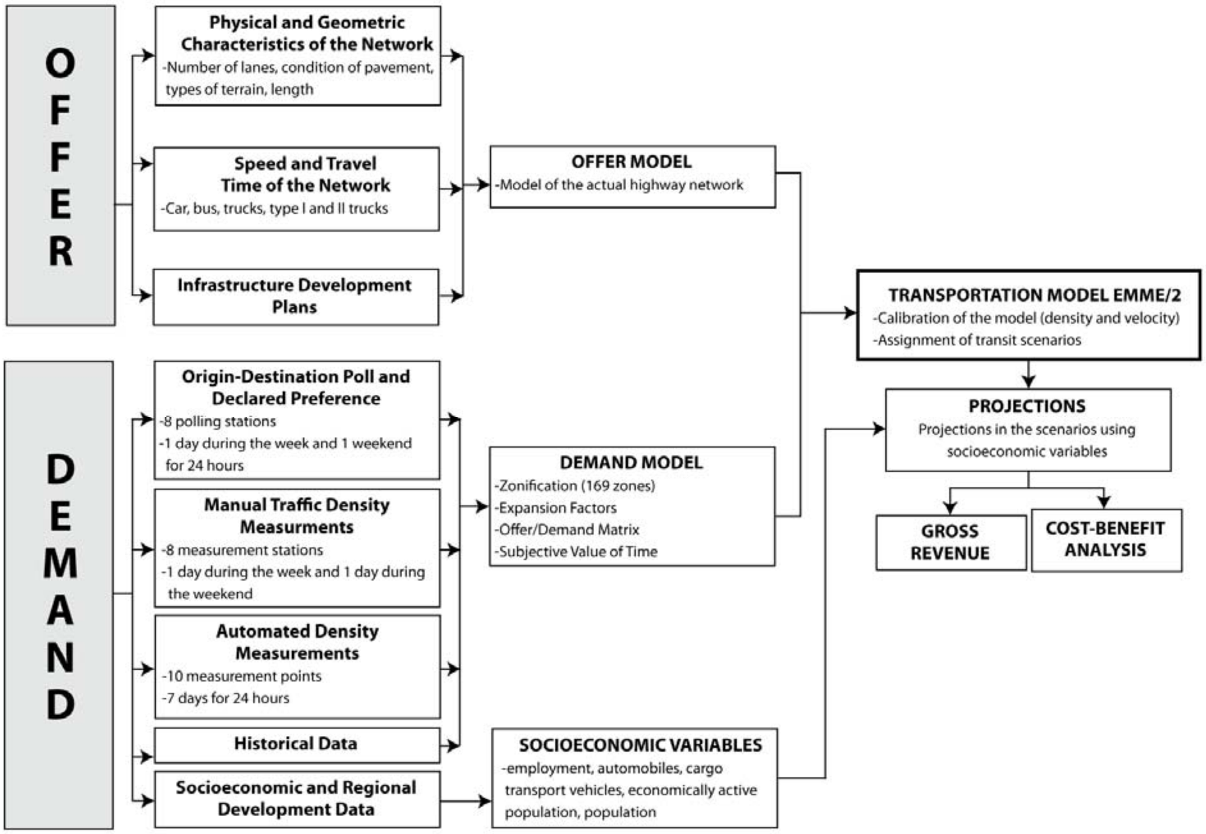
The project was developed by SCT and, in 2004, general planning began for the construction of Arco Norte by hiring the company Cal y Mayor to conduct several feasibility studies pertaining to the project—including traffic and revenue (T&R) and cost-benefit analysis. Cal y Mayor determined that the project was technically feasible as well as financially attractive for private investment, thus, SCT proceeded with the PPP concessionaire scheme. After a competitive bidding process, SCT awarded a 30-year concession to IDEAL (Impulsora del Desarrollo y Empleo de América Latina) with the option to renew for another 30 years. IDEAL created a consortium for the project—Autopista Arco Norte, S.A. de C.V.—for which the concession is titled. As an added incentive, SCT agreed to construct a portion of the road as a public works project, with Autopista Arco Norte, S.A. de C.V. constructing the rest and managing the entire highway (Melo Jimenez, 2008).

As of June 2009, parts of the project are still under construction. SCT previously estimated that the project would be completed and operational by the end of March 2009, but no notice of project completion has been received as of June 2009.

### 4.3.3 Planning

Project planning activities for Arco Norte followed generally accepted practices and did not vary much, if at all, from the norm. SCT contracted with Cal y Mayor to conduct forecasting, T&R studies as well as cost-benefit analysis. SEMARNAT completed environmental impact analysis, and ROW acquisition was completed by SCT in conjunction with their state counterparts as well as the Institute of Administration and Evaluation of National Goods (INDAABIN).

The feasibility documents received from Cal y Mayor and SCT bear striking resemblance to studies conducted for U.S. projects. Given that Cal y Mayor has an international clientele (as well as an office in Dallas, Texas), this is not entirely surprising; yet, the depth of similarity is worthy of notice. Given the documents presented for Arco Norte, it could be asserted that the methodology used in project planning in Mexico is based on the same data and information as it is in the United States and thus translates across countries. This provides a key element necessary for future collaboration because the near universality of a feasibility study allows for an immediate basis of mutual understanding and narrows the information gap. Figure 4.28 shows a flow chart of how the feasibility report was undertaken.



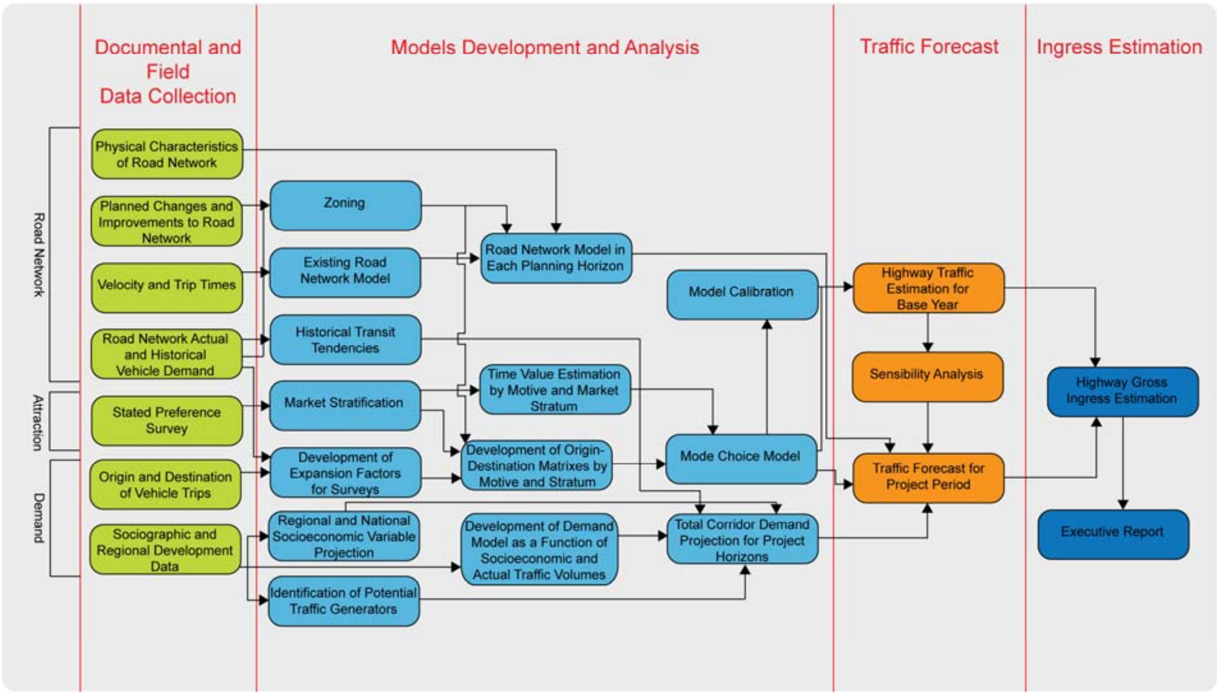

Source: Cal y Mayor, 2005.c.

*Figure 4.28: Feasibility Flow Chart 1*

*Forecasting, Traffic and Revenue Studies*

The objective of T&R analysis, termed "Supply and Demand Study" by Cal y Mayor (though equivalent to forecasting, T&R studies in the United States), was to *"determine, with a high degree of confidence, the demand expected for Arco Norte, as well forecast its growth during the next 30 years, under the assumption that the operation will be financed through payment of tolls"* (Cal y Mayor, 2005.d, p. 1-12). According to Cal y Mayor, it was essential for SCT to invest in detailed and well-researched studies, as they would form the basis for offers SCT could potentially receive during the concessionaire process.

In order to develop these studies, Cal y Mayor collected primary and secondary data (Trejo Ordonez, 2009.b). The primary data were composed of information from field studies conducted by Cal y Mayor, while the secondary data included municipal planning documents from affected municipalities, socio-economic data of the region, as well as information from other similar projects in the area that might help to indicate regional demand (Trejo Ordonez, 2009.b). Cal y Mayor conducted extensive interviews with major industries along the proposed corridor to ascertain their potential interest in and demand for the project (Cal y Mayor, 2005.d, p. 3-26). These surveys included several cement companies, noting that their propensity to utilize the bypass would have great impact on the types of materials used to construct the final route due to the heavy, damaging transport of cement. The secondary data utilized were not made available for the purposes of this case study, so the quality and the source cannot be analyzed for the purpose of comparison with the U.S. Figure 4.29 shows how the T&R analysis was undertaken.



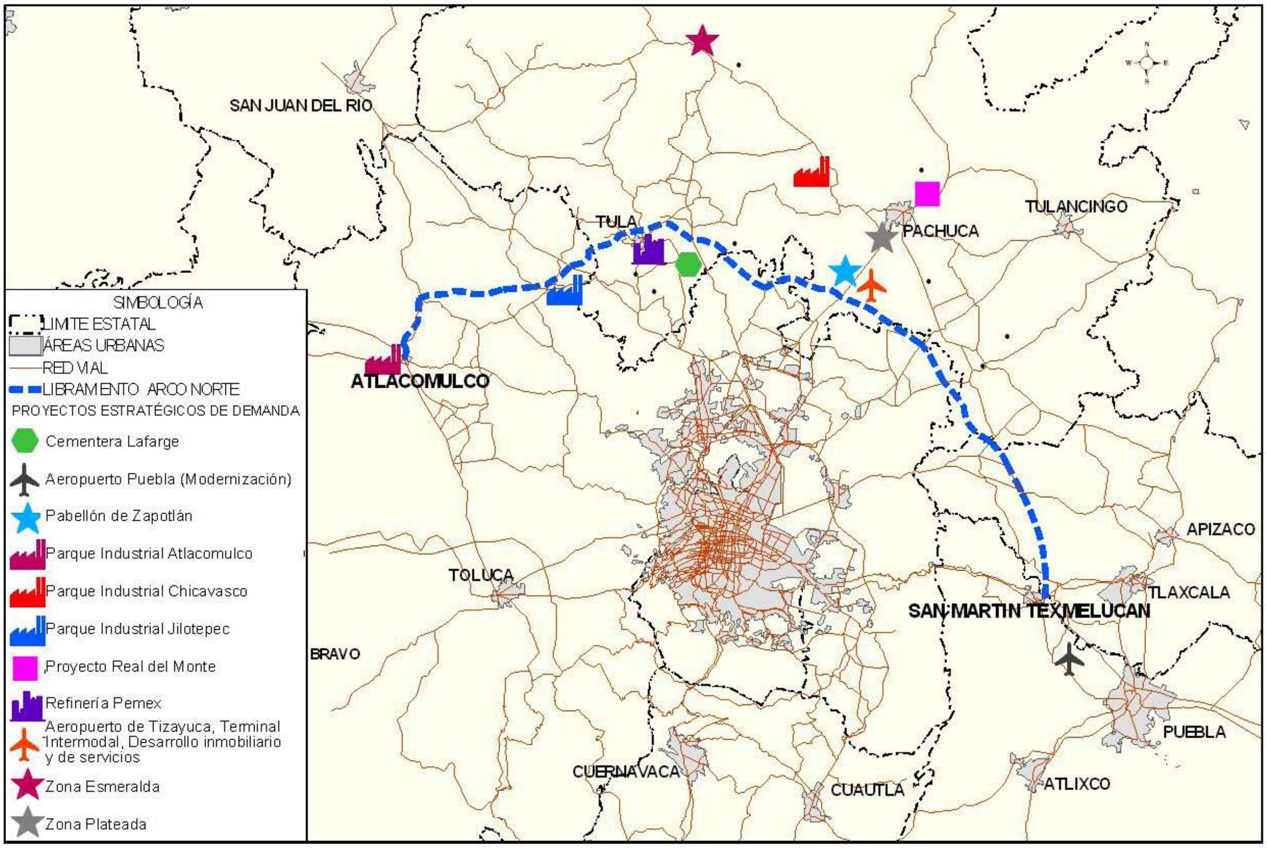

Source: Cal y Mayor, 2005.d.

*Figure 4.29: T&R Analysis Flow Chart*

In developing the data collected to determine supply and demand, Cal y Mayor was primarily concerned with six informational outcomes, described in the following sections.

<u>Traffic Analysis Zoning</u>

Cal y Mayor divided the area into smaller traffic analysis zones based on the localities and municipalities directly influenced by the project and by the highway network that links the main development areas. Within this aspect, several strategic industrial areas were identified that could impact potential demand for Arco Norte (Cal y Mayor, 2005.d, p.6-56).




Source: Cal y Mayor, 2005.d.

*Figure 4.30: Arco Norte: Strategic Industrial Areas*

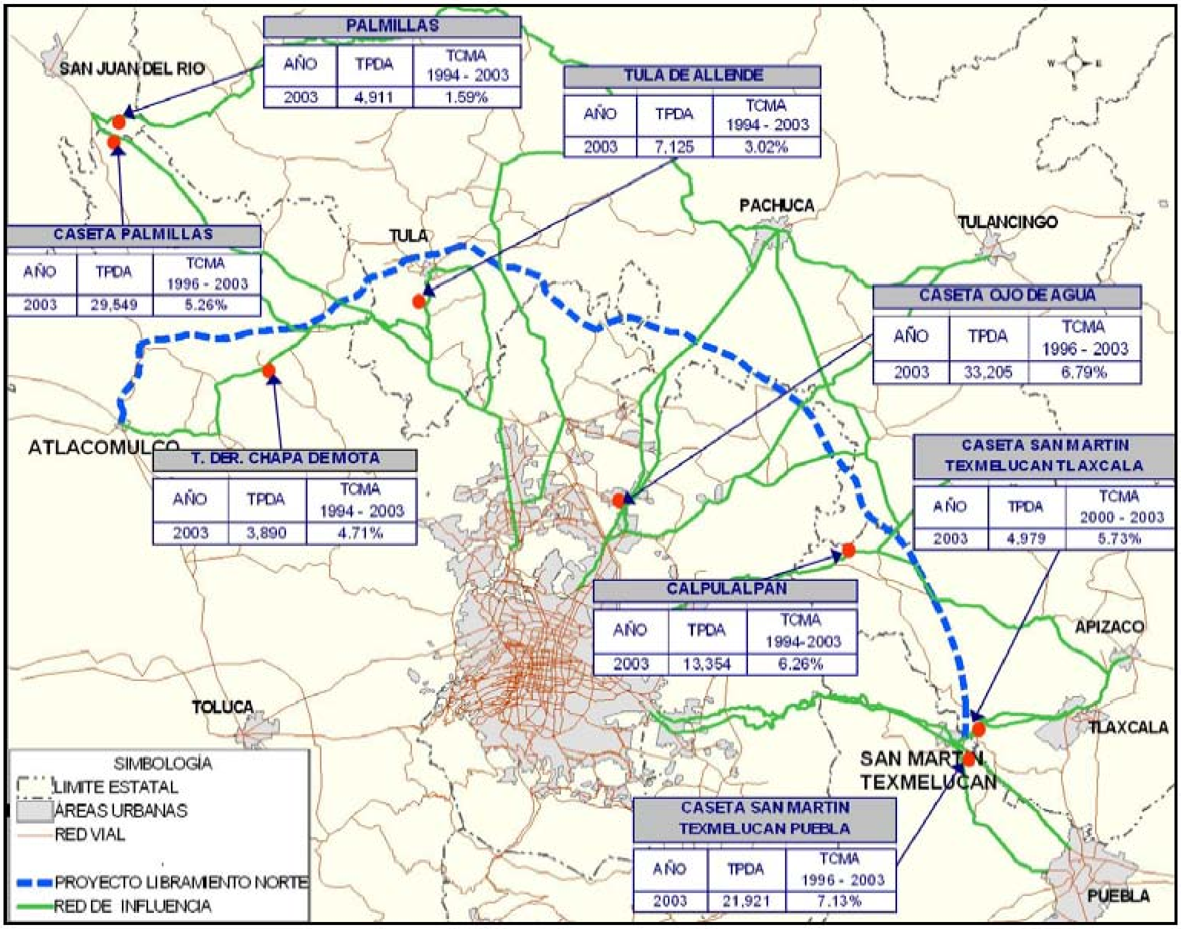
Figure 4.30 denotes strategic projects within the area that have potential future impact on Arco Norte. These projects, although not necessarily in construction or operation, were listed in regional planning documents and their trip generating capabilities were deemed such that inclusion in the planning process for Arco Norte was warranted (Cal y Mayor, 2005.d, p. 5-34).

Physical and Operative Characteristics of the Zone of Influence

Various aspects of the roads within the zone of influence were analyzed, including the width, length, pavement type, and speed limit.

Historical Traffic Trends

Using SCT data, traffic trends were established for area highways.



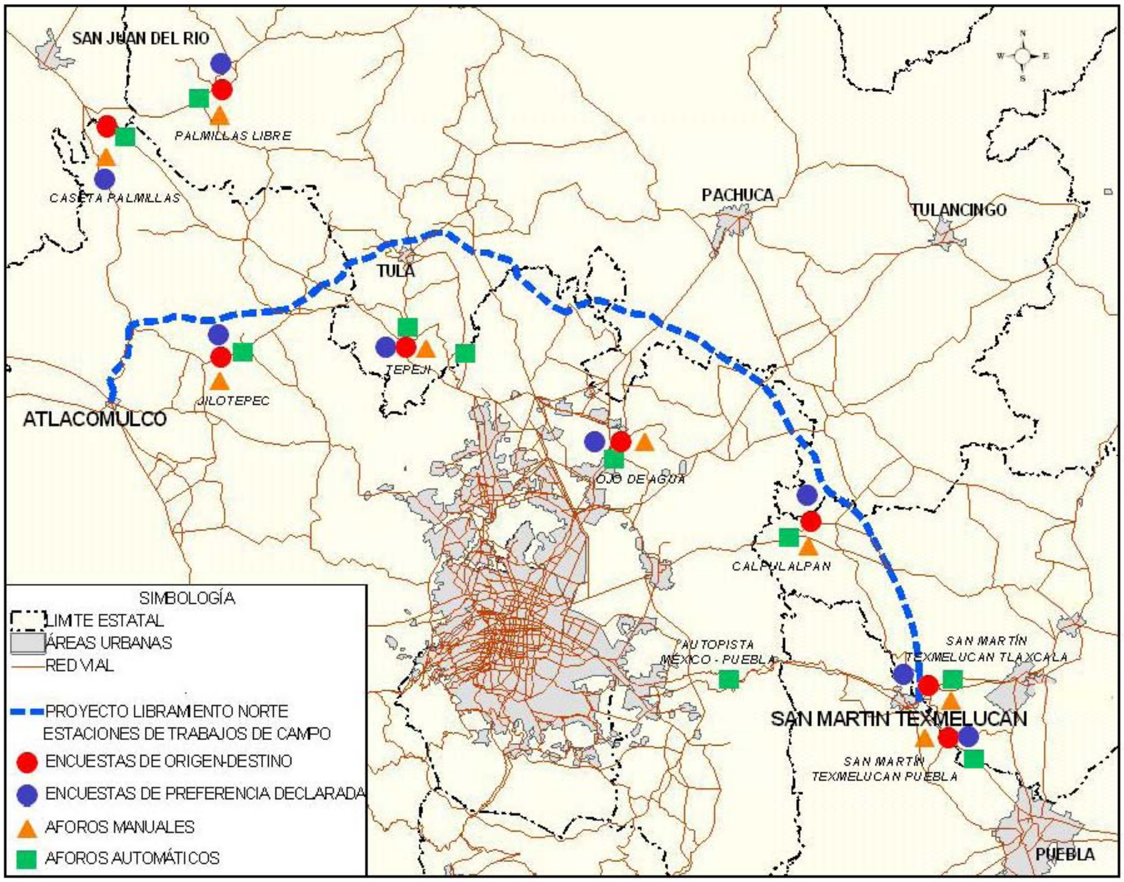

Source: Cal y Mayor, 2005.d.

*Figure 4.31: Arco Norte: Changes in Annual Average Growth*

Figure 4.31 demonstrates the changes in yearly average traffic flow. Cal y Mayor used annual daily traffic averages from 1994 to 2004 to determine the increases (or decrease) in traffic on the existing zone of influence and to project possible utilization of Arco Norte as an alternate route (Cal y Mayor, 2005.d, pp. 5-35). As the figure indicates, the increase in traffic over the 10-year period ranged from 2.37% to 11.3%, which supports evidence of increasing congestion within Mexico City as more and more people utilized the existing infrastructure for travel and trade.

Current Traffic Characteristics

Field study locations were selected for the survey and permanent stations constructed to determine daily and weekly traffic flow into and out of the city, as well as vehicle type. These data were essential for establishing the variation (down to the hour) in traffic that would be used to calculate toll fares, as well as contributing to origin-destination studies that informed the eventual placement of the road. Additionally, field studies were used to determine the physical characteristics of the highways in the zone of influence. This portion of the study was conducted through visual inspection and primarily concerned with type of land, number of lanes and physical state of the road or highway (Cal y Mayor, 2005.d. p. 2-17).




Source: Cal y Mayor, 2005.d.

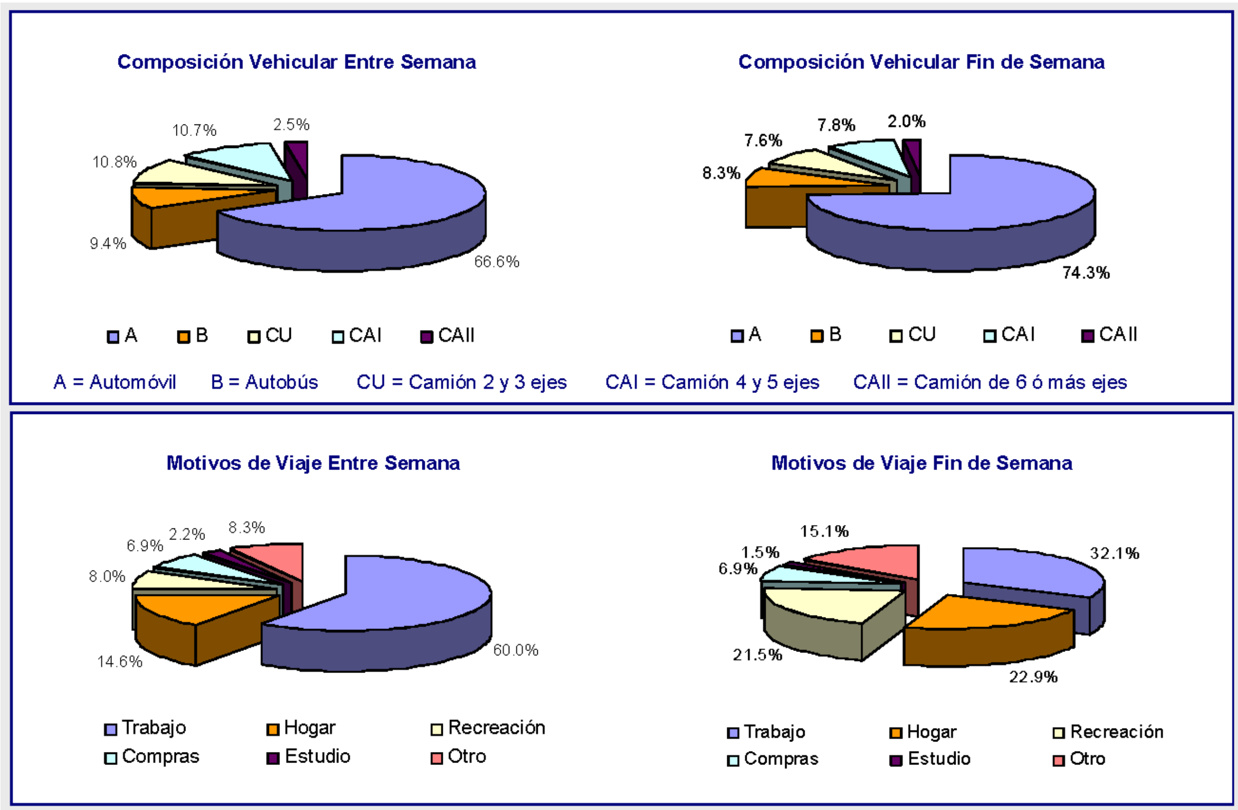
*Figure 4.32: Arco Norte: Field Study Locations*

Figure 4.32 shows the location of field studies conducted by Cal y Mayor. All of the information collected by field study was evaluated using GIS data to ensure accurate representation of the operating and physical characters of roads and highways within the zone of influence (Cal y Mayor, 2005.d, p. 3-24).

Trip Characteristics

Field study surveys were analyzed to determine the motivation for the trip and vehicle information.

Figure 4.33 demonstrates these motivations and characteristics, which, anecdotally, bear a striking resemblance to breakdowns seen in Texas and the U.S. T&R analysis. A large proportion of travel (66.6% during the week) is by automobile as opposed to truck or other vehicle (24%). The classifications used above correspond to Federal Highway Administration (FHWA) Vehicle Classification Scheme Numbers as follows: Camion Unitario CU (2, 3 and 4 axles) is equivalent to the FHWA 3, 4, 5, 6, 7, and 8, which are pickups, vans, buses (including mini school buses), and trucks. Camion Articulardo I and II (CAI and CAII) are equivalent to FHWA 9 through 13 that are 5 axles or more, and also single and multiple trailers.




Source: Cal y Mayor, 2005.c.

*Figure 4.33: Arco Norte: Trip Characteristics*

<u>User Preferences and Value</u>

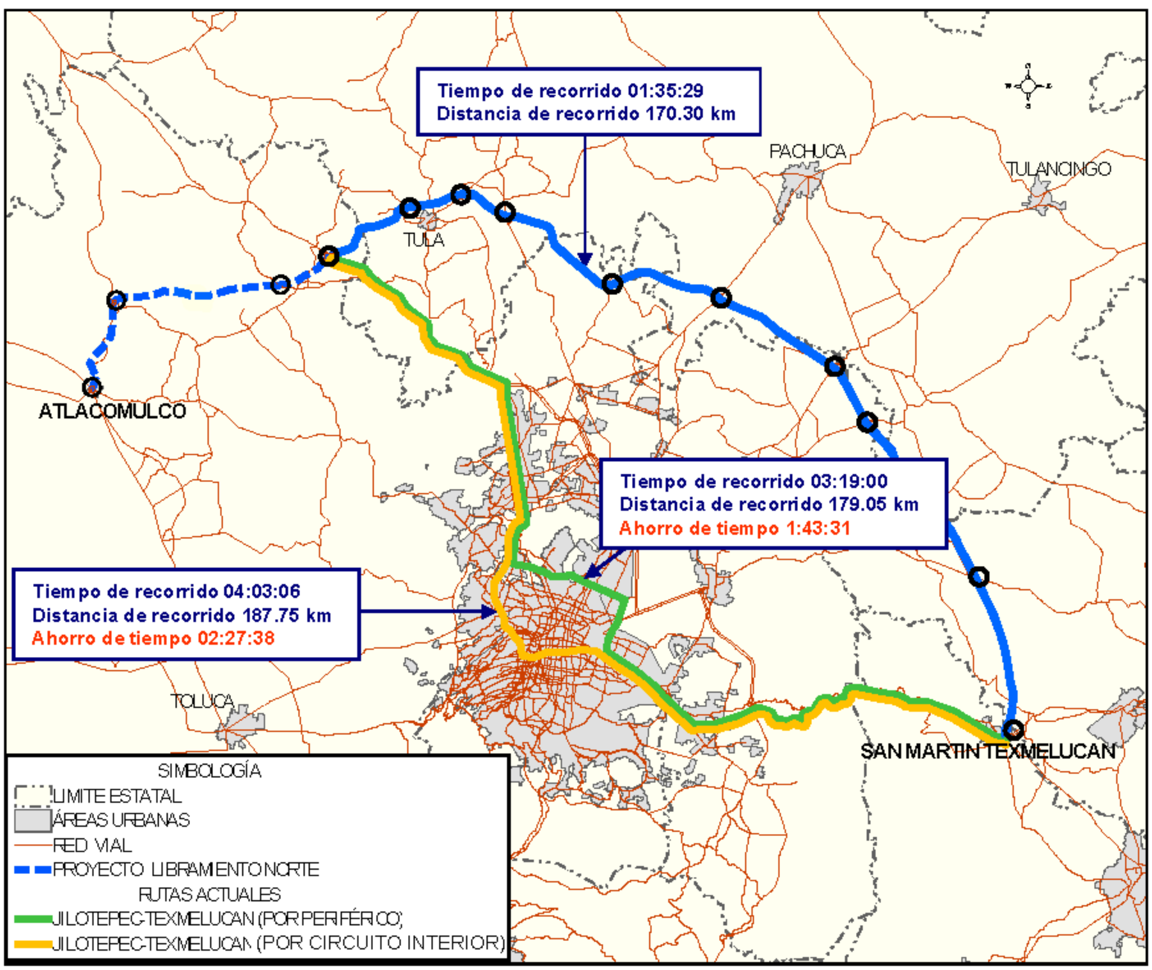
Using the surveys and information collected through the field studies, an evaluation of user preference was constructed to determine which factors would affect usage of the toll road, as well as to discern if one proposed route would be more utilized than another. Additionally, these data were used to determine specific consumer utility (in monetary terms) translated into a value per mile, which was used to calculate suggested tariffs and estimating a return on investment. The results are shown in Figure 4.34. The full time savings comparisons can be seen in Figure 4.35.

| Tipo de Vehículo | Rango de Longitud (RL) | Motivo de Viaje | Valor del Tiempo ($/min) |
|---|---|---|---|
| Automóviles | 0 < RL < 80 kms | Trabajo | 0.755 |
| | | Otros motivos | 0.724 |
| | RL >= 80 kms | Trabajo | 1.171 |
| | | Otros motivos | 1.015 |
| Camiones 2, 3 y 4 ejes | 0 < RL < 130 kms | | 1.684 |
| | RL >= 130 kms | | 1.810 |
| Camiones 5 ó más ejes | 0 < RL < 240 kms | | 2.131 |
| | RL >= 240 kms | | 6.859 |

Fuente: Elaboración propia.

Source: Cal y Mayor, 2005.d.

*Figure 4.34: Arco Norte: Time Value per Vehicle Type and Motivation*




Source: Cal y Mayor, 2005.c.

*Figure 4.35: Arco Norte: Time Savings Comparisons*

*Cost-Benefit Analysis*

According to Cal y Mayor, the cost-benefit analysis is derived from the information collected for the T&R analysis. The evaluation was not financial in nature, but rather economic, where cost relates to the actual cost of the project (including construction, ROW acquisition, and environmental mitigation) and benefits are measured according to societal improvements (including time savings and vehicle operation costs savings). As such, the financial evaluation was conducted separately and used to determine if the concession scheme was a viable method for project development (Trejo Ordonez, 2009.a).

The result of the financial studies showed indicated that Arco Norte was a viable project with specific social benefits, as well as potential financial gains (Cal y Mayor, 2005.a, p. 1-7). Furthermore, Table 4.1 shows the net value of the project to be about US$254 million. The venture is shown to be profitable and enticing for private investment. Table 4.2 shows the sensitivity analysis that Cal y Mayor undertook.

**Table 4.1: Arco Norte: Financial Analysis Indicators**

| Indicator | Base |
|---|---|
| **Internal Rate of Return (IRR)** | 15.61% |
| **Benefit Cost Ratio** | 1.48 |
| **Net Present Value (mdp)** | 2,086.74 |
| **Yield** | 13.58% |
| **Opening Date** | 2005 |

Source: Cal y Mayor, 2005.a.

**Table 4.2: Arco Norte: Financial Feasibility Sensitivity Analysis**

| | Investment 120% of base | Maintenance 120% of base | Traffic 80% of base |
|---|---|---|---|
| **Internal Rate of Return** | 13.03% | 15.40% | 12.20% |
| **Benefit Cost Ratio** | 1.26 | 1.45 | 1.18 |
| **Net Present Value** | 1,322.99 | 2,001.16 | 792.57 |
| **Yield** | 10.84% | 13.39% | 10.06% |

Source: Cal Y Mayor, 2005.a.

Additionally, as shown in Table 4.2, the venture was shown to be profitable and feasible even in the most pessimistic transit scenarios—80% of the predicted base transit rate. As stated in the executive summary of Cal y Mayor's cost-benefit analysis (Cal y Mayor, 2005.a, p. 1-7):

> The results of the evaluation of the project Arco Norte indicate that it is a viable project for society as a whole according to the assumptions put forth in the base scenario of future traffic and initial investment. The sensitivity analysis demonstrates that there is ample interest and need for the project that can support potential changes in the base scenario that effect investment, the cost of maintenance or the level of usage. On the basis of all the aforementioned elements, the recommendation of the

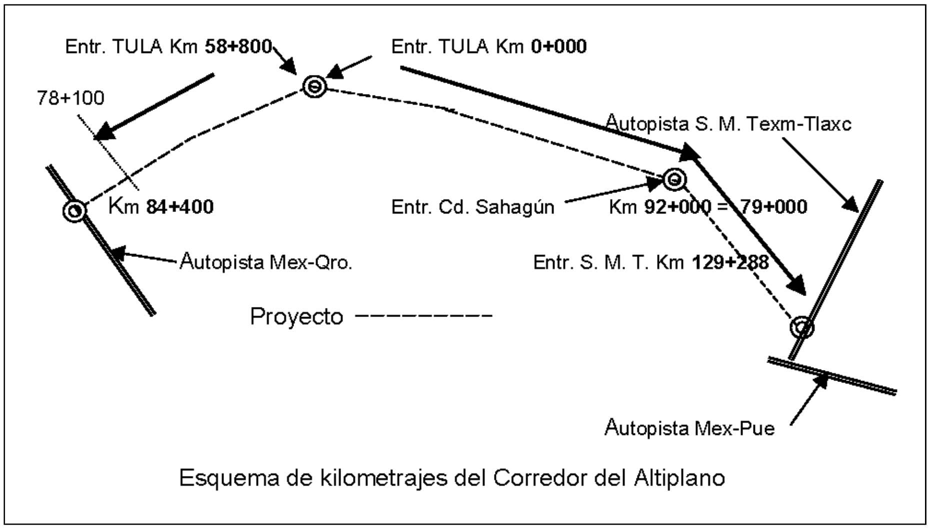
economic evaluation is the construction of Arco Norte begin as soon as possible because all of the indicators confirm that the project is viable.

Additionally, it is interesting to note that in February 2004, one year before the final cost-benefit analysis was presented to SCT, Cal y Mayor recommended that 76% of the proposed project be converted to a 4-lane as opposed to a 2-lane highway, requiring a 43% increase in the amount of private investment and a 29% increase in investment overall (Trejo Ordonez, 2009.b). The final report to SCT shows the project to be profitable despite, or perhaps because of, this planning alteration.

According to Cal y Mayor, all of the feasibility, cost-benefit, forecasting, and T&R analyses have been [relatively] accurate to date as the project progresses (Trejo Ordonez, 2009.b). Yet, despite the [relatively] accurate information in the T&R and feasibility analyses, the project has been continually delayed due to right-of-way issues. Although no one at SCT or Cal y Mayor was able to comment on the delays, many of the feasibility studies were conducted with the assumption that Arco Norte would be 100% complete and operational in 2008. Given that the project is still in construction, at certain points, it is logical to assume that continued delays would compromise original projections.

### 4.3.4 Environmental Process

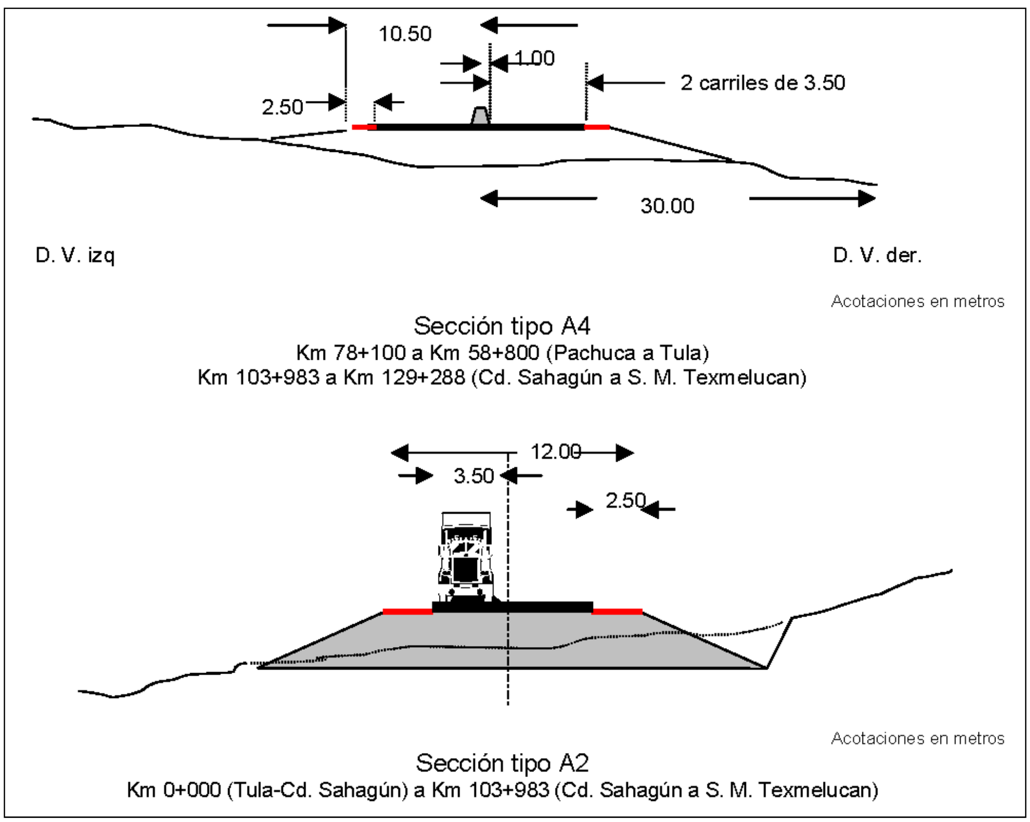
The MIA for Arco Norte is encapsulated in the MIA that was developed for the "Corredor del Altiplano." The environmental review process for the "Corredor del Altiplano" began in July 2003 and was finished in September of the same year (SEMARNAT, 2003). A much quicker time frame than is seen in traditional U.S. environmental reviews which average two to three years in length. The resulting MIA is 167 pages in length, and begins with a summary of the need for the project in order to reduce the traffic through the metropolitan area of Mexico City by providing a means for traffic traveling east-west or vice versa, whose destination is not in the metropolitan zone, to circumvent the city. The introduction to the environmental impact assessment also includes information on the exact location of the project, the land needed for completion of the project, including area needed for on/off ramps, the types and quantities of materials used in the project and where they will be sourced from, and the type and quantity of pollutants that the project will produce. The impact assessment also enumerates the environmental regulations governing the project (SEMARNAT, 2003). The MIA reviewed the follow sections of the highway (Figure 4.36).




Source: SEMARNAT, 2003

*Figure 4.36: Segments of AltiPlano and Arco Norte Highway Reviewed for MIA*

Figure 4.37 shows the cross section of the highway from milepost 78km (48 miles) to milepost 103km (64 miles).




Source: SEMARNAT, 2003

*Figure 4.37: Cross Section of Arco Norte Highway Layout*

Climatology, Hydrology, Geology

The study found that there would be two types of environmental impacts: those due to the construction of the road and those resulting from the change in use of the land needed to construct the road. The impacts related to construction are primarily confined to movement of earth for construction of the road, emissions from machinery used in construction, and waste from employees working on the construction. The impacts from the change in use of the land are reduced land for agribusiness, the destruction of vegetation, the compaction of the subterrain, and the impacts resulting from paving, such as the change in drainage and the inability for rainwater to be absorbed by areas covered by the road. Lasting impacts from maintenance were also considered, but because these would be within the existing right-of-way, they were not deemed significant (Executive Summary Austopista "Corredor del Altiplano," no date.) Figure 4.38 shows a cross section of the highway and its substructure.


Sección típica de un terraplén

Source: SEMARNAT, 2003

*Figure 4.38: Cross Section of Arco Norte Highway Sub-surface Structure*

Ecology

The MIA, though it recognizes the road as a barrier to plant and animal life in the area, found that this was not an issue in this instance because plant and animal life in the area is virtually non-existent, as most of the land was being used for agro-industry prior to the construction of Arco Norte. Because the area had already been modified by human action, the environmental impacts were considered to be less detrimental than to an area unmodified by humans (Executive Summary Austopista “Corredor del Altiplano,” no date.)

Socioeconomic Impacts

The project was found to have the most socioeconomic impact on the larger population centers along the Arco Norte, namely those that would benefit from goods transiting the highway, the removal of traffic from urban centers, and accessibility of better roads (SEMARNAT, 2003). The primary social benefits found were the removal of traffic from the metropolitan zone, a reduction in time and cost of travel, and economic benefits to populations where the project is located (Cal y Mayor, 2005.a). Figures 4.39 through 4.41 show the major occupations of the population lying in the zone of influence for Toluca, Tlaxcala, and Hidalgo.

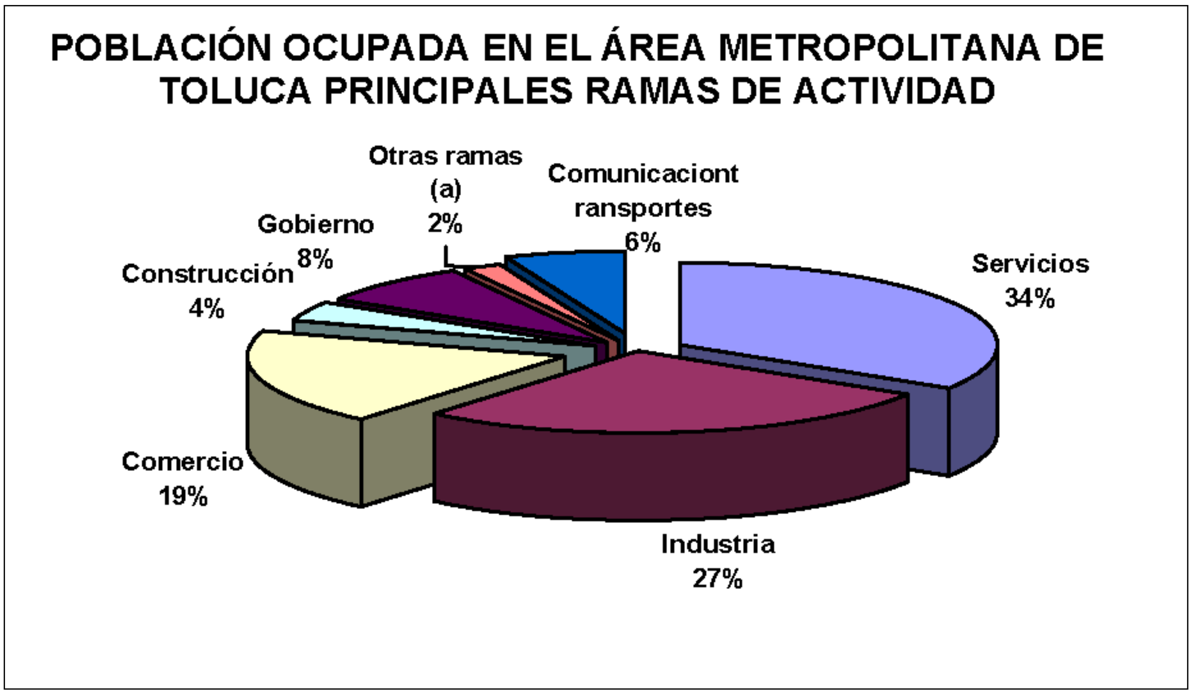



*Figure 4.39: Principal Employment for Toluca*

Source for Figures 4.37 through 4.41: Cal y Mayor, 2005.c

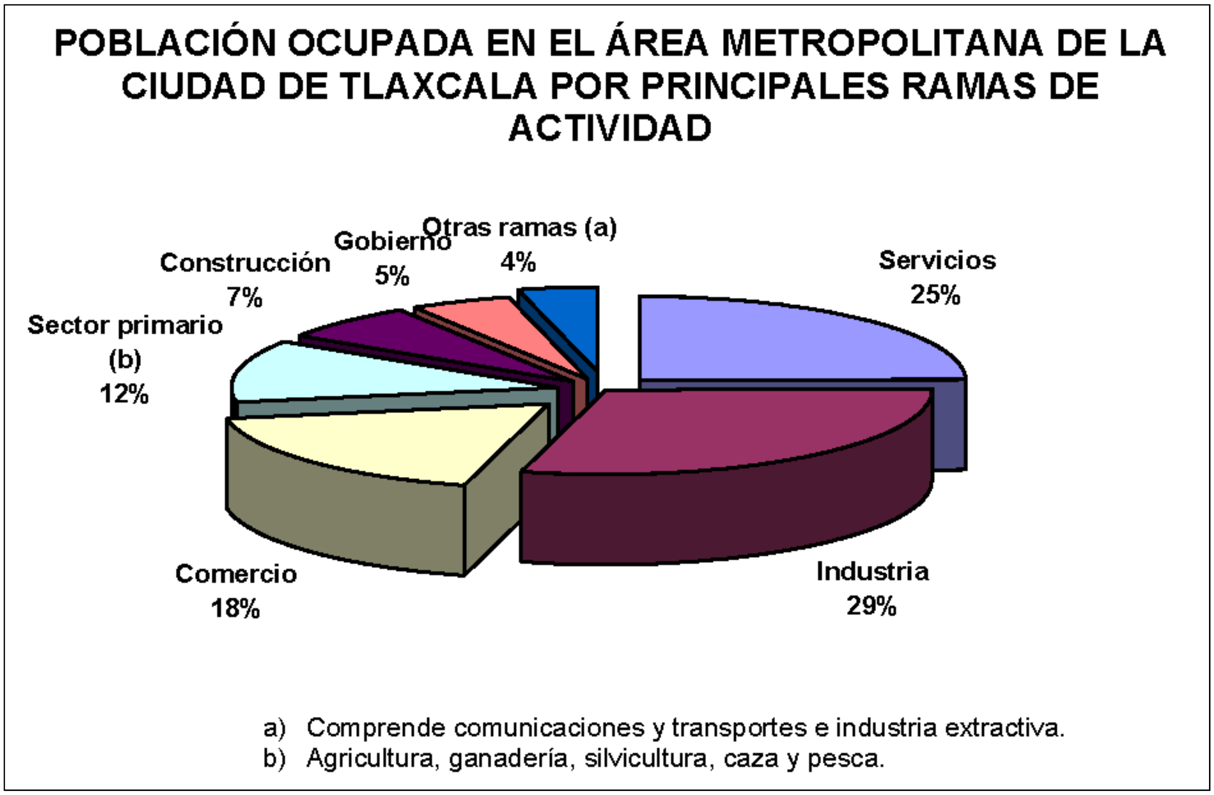



*Figure 4.40: Principal Employment for Tlaxcala*

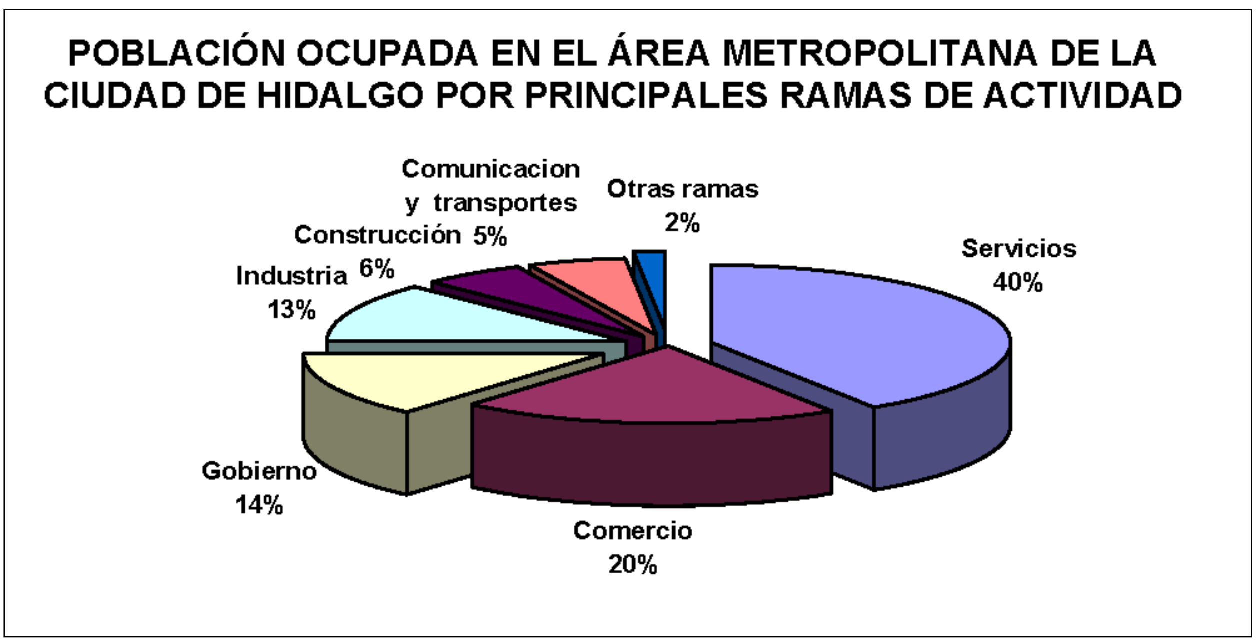



*Figure 4.41: Principal Employment for Hidalgo*

Summary of Findings

The project was found to have only a moderate impact, due mostly to the fact that many of the impacts were only temporary, and the project was given the go ahead with some means of mitigation and compensation, mainly a reforestation project to compensate for the trees that would be cut down for construction. Some methods of lessening the impact of construction include setting up retaining walls to avoid rockslides and additional erosion, monitoring emissions from machinery, and providing sanitary waste disposal for construction sites (SEMARNAT, 2003).

#### 4.3.5 Right-of-Way Acquisition

ROW for the project is the responsibility of SCT but is completed at the state level. The estimated total ROW costs (as at February 2009) was MXP$1,400 million, or about US$104 million (Melo Jiminez, 2009). Because of the size and nature of the project, ROW was, and to some extent continues to be, the biggest obstacle to completion of the project. The most serious impediment is that SCT was unable to complete all acquisitions before the project began and the concessionaire was forced to pay additional compensation to the landowners above the maximum payment authorized by INDAABIN in order to avoid further delays in the project (Trejo Ordonez, 2009.a). Additionally, the initial route for Arco Norte crossed several urban zones and SCT was charged with acquiring a large quantity of small properties, which complicated and delayed the ROW process. Arturo Trejo Ordonez of Cal y Mayor reflected that in most cases, it would have saved SCT time and money to change the route in order to avoid densely populated areas, although doing so would have decreased the benefit of Arco Norte as an economic development engine for affected communities (Trejo Ordonez, 2009.b).

One of the most complicated and interesting aspects of the ROW process came with the acquisition of a portion of ejido land. Prior to 2004, ejidos were not legally permitted to sell their land, as it was not considered private property. In 2005, SCT was tasked with acquiring this new type of land that presented unique complications given the lack of official documentation of ownership. This requires an additional step of applying for legal documents that can further delay the ROW process (Sanchez Lara, 2009). This particular section of ejido land had an unauthorized cemetery (essentially a family plot) on the property and in order to proceed with the acquisition, the cemetery needed to be moved to a new location. Upon excavation, SCT found an archeological site beneath the plot. At this point, INAH (National Institute to Anthropology and History) took control of this site and SCT was forced to change the Arco Norte's route (Sanchez Lara, 2009).

#### 4.3.6 Project Implementation

*Project Financing*

Arco Norte is being financed using a PPP concession. Due to the large-scale of the project and the potential for a financially profitable private investment, SCT chose to pursue a PPP rather than fund the entire project as a traditional public works development. However, as an added incentive for private investment in the project, SCT proposed to construct a portion of the highway as a public works project, funding it through (FINFRA). Upon completion, SCT will turn the publicly constructed portion over to the concessionaire for operations and maintenance (Melo Jimenez, 2009).

The concession began through an open-bidding process in 2005 with the required publication of the notice in two daily periodicals—one with a national audience and the other in the region in which the project was located. SCT received bids from five separate companies and evaluated the proposals on their technical and economic aspects, with particular and heavy attention to the amount of federal funds required by the concessionaire to construct and operate the project. Ultimately, the company that required the fewest federal dollars was awarded the concession (Melo Jimenez, 2009). In December 2005, SCT awarded Autopista Arco Norte, S.A. de C.V. the contract. The company is comprised of a consortium of several companies belonging to Mexican billionaire Carlos Slim, including IDEAL and IMBURSA Financial Group. This project was one of Slim's first forays into infrastructure and was cause for much publicity and speculation surrounding the decision. The concession includes the construction of 146 km of toll road and the operation and maintenance of the entire 226 km highway—including the 77.6 km constructed by SCT. The investment of private funds into the project amounts to MXP$3,331.2 million or about US$246 million. Public investment totaled MXP$2,550 million pesos or about US$188 million. The concession period is 30 years with the option to renew for an additional 30 years (SCT, 2006). Figure 4.42 shows segments of ARCO Norte that are already open.


Source: IDEAL, No date.

*Figure 4.42: Open Segments of Arco Norte*

### 4.3.7 Conclusions

*Notable Features*

Arco Norte promises to significantly impact the quality for life of the region in a positive way. In addition to saving transit time and improving efficiency, it should serve to drastically reduce traffic-related pollution within Mexico City and in the surrounding areas. Also, Arco Norte's influence as an economic development instrument could have positive and lasting impact on the economies of the states of Mexico, Hidalgo, Tlaxcala, and Puebla. The inland port being proposed at Hidalgo (Platah Hidalgo) expects to take advantage of this route and it is visualized in promotional material that Platah Hidalgo executives have showcased at conferences, for example, Salvador Elguero Molina – Director General of Plataforma Logistica Hidalgo – at the Inland Ports Across North America Conference in Laredo, Texas on February 26, 2008.

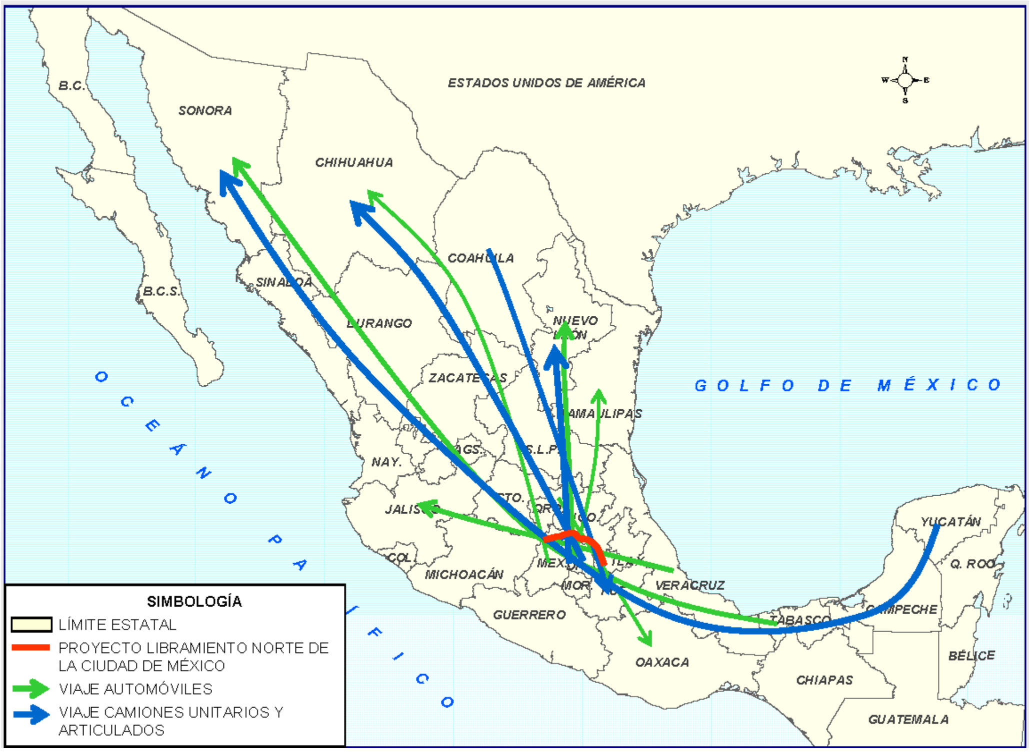
Although Arco Norte will provide numerous benefits to society, the populations and economies in the northern half of Mexico City will experience most of those benefits. Because of its location, drivers coming from the southern part of the city will still be required to navigate the congested highways traveling to and from Mexico City. Trade movements from southern Mexico as well as Central America will not benefit from this bypass. The same populations that Calderon's NIP intends to include are left out of this project. This discrepancy could be remedied by extending Arco Norte to encircle the entire metropolitan zone. At the time of this case study, no mention has been found of planning for this extension in the future.

*Best Practices*

The development and implementation of the project Arco Norte as discussed in this case study does not provide any specific examples of best practices for elaboration in this context. However, the depth and breadth of information made available for this case study by Cal y Mayor and SCT should serve to provide insight into the planning process and provide a model and basis for evaluating future projects or for collaborative ventures between Texas and Mexico.

*Impact on U.S. Transportation Systems*

Arco Norte will have minimal direct impact on the U.S. transportation system. Cal y Mayor did, as indicated in Figure 4.43, take into account traffic patterns that reach far into the northern part of Mexico—some of which obviously includes trade coming into and out of the United States—but did not conduct specific study geared toward international trade.




Source: Cal y Mayor, 2005.c, p.4

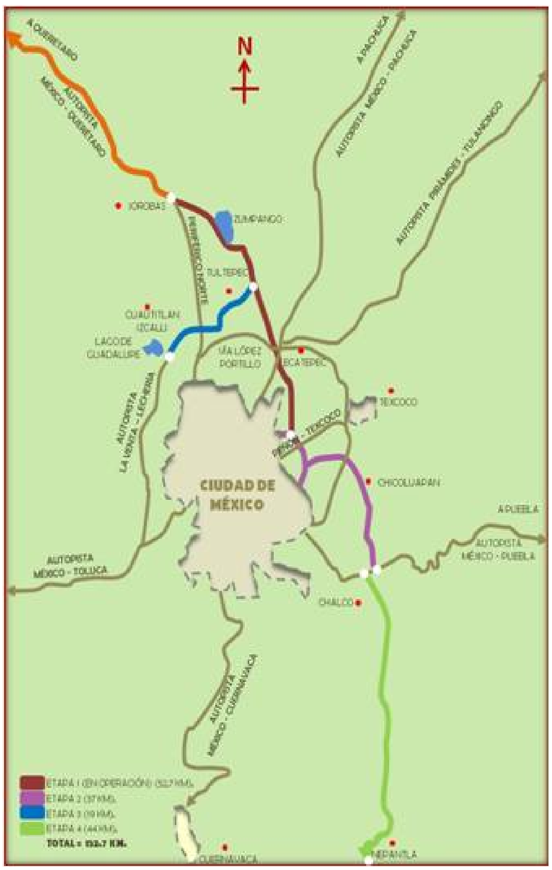
*Figure 4.43: Analysis of National/International Traffic Flow from Altiplana*

## 4.4 Circuito Exterior Mexiquense

### 4.4.1 Project Description

*Type*

Circuito Exterior Mexiquense (CEM), also known as Sistema Carretero de Oriente, is a controlled access highway with a length of 152.7 km (94.88 miles) and 18 intersections. The project is divided in four construction phases. (SAASCAEM, not dated) This project was originally conceived by the authorities of the state of Mexico with the aim of connecting the major highways surrounding Mexico City. The new road will connect the México-Querétaro highway, the México-Pachuca highway, the México-Puebla highway, and the state of Morelos, alleviating the need to enter México City to travel between the highways. Besides connecting the major highways, CEM also connects the most important urban centers with the existent industrials parks. The project will also generate economic benefits for the municipalities through which it passes as well as improving air quality in Mexico City's heavily polluted air shed. Figure 4.44 shows the route and phases of this project.




Source: [http://www.edomex.gob.mx/portal/page/portal/saascaem/autopistas/cem2](http://www.edomex.gob.mx/portal/page/portal/saascaem/autopistas/cem2)

*Figure 4.44: Mexico City and Circuito Exterior Mexiquense*

The phases of the project development and construction are divided as follows:

Phase 1: Autopista México-Querétaro—Autopista Peñón Texcoco

Phase 2: Texcoco-Autopista México-Puebla,

Phase 3: Lago de Guadalupe-Tultepec,

Phase 4: Autopista México-Puebla—border of the state of Morelos.

For the construction of the highway, several feeder and other local roads needed to be paved. Concrete bridges, underpasses and overpasses, and steel viaducts are also needed. They also improved drainage; installed additional signage, lighting, and tollbooths; laid fiber optic cable; and laid service roads. The highway has a width of 21 m (68 feet), with two lanes of 7 m (22 feet) each, separated by a central median. The highway has 2.50 m (8 feet) of excess right-of-way and an inside median of 1 meter (3 feet). The highway has a maximum grade of 4% and curvature radius of 1º 30" allowing a maximum speed of 110 km/hr (70 miles/hr) (Marquez Garcia, 2009). Figure 4.45 shows the intersection of Jorobas with this highway.

According to Manuel Ortiz, head of the Secretariat of Communications in Mexico State, the project is the only highway in Mexico that has a 24-hour monitoring system for security. This is the first highway in Mexico to have cameras to measure traffic and provide security. The cameras can also detect accidents, vehicle breakdowns, and obstructions in the lanes so users can be assisted immediately (Ibarra, 2005.c). There are also fences to reduce human and animal crossings in populated areas. There is also special fencing that, in case of an accident, prevents vehicles from falling into any bodies of water adjacent to the highway (Salvatierra, 2006).

Source: OHL Website

*Figure 4.45: Intersection Jorobas at Circuito Exterior Mexiquense*

*Phase 1*

Phase 1 is a 52.7-km (32.74-mile) toll road that runs north-south on the east side of Mexico City, starting at the intersection Jorobas, where it intersects with the Mexico Querétaro freeway and ending where it intersects with the Peñón Texcoco freeway. There are nine covered toll plazas in this phase, all with toll booths, parking, and lighting. The centralized toll system and monitoring systems are located in the second toll booth (T-2), where operations control, service, and maintenance are also housed.

This section includes a series of overpasses at the intersections with the Coyotepec-Huehuetoca road, the Mexico-Laredo rail line, the Teoloyucan Huehuetoca-road, and Santo Tomas and Castera canals. In Zumpango, there is entry and exit to the Zumpango-Melchor

Ocampo highway. The highway then crosses the Teoloyucan-Jaltenco road and Mexico-Pachuca rail line to reach Tultepec County, where toll gate T-1 is located.

In the town of Ecatepec, there is an entry to the Lecheria-Texcoco Road where toll gate A-2 is located; then the highway continues to the intersection with the Mexico-Pachuca highway, where toll gate A-4 is located, and on to the intersection of Via Morelos, Av. Central, and the Mexico-Veracruz rail line, where toll gate A-5 is located.

The highway continues through the federal zone of Lago de Texcoco reaching the intersection “Viaducto ramal Periferico,” where toll booths A6 and A7 are located. The highway ends at the intersections of Periferico highway and Peñón de Texcoco highway.

Phase 1 began operations in November 2005, three months ahead of schedule and with 10% higher usage than expected. In December 2008, the weighted annual average daily traffic was 25,184 vehicles (Sugawara, 2009). The toll rates for Phase 1 can be seen in Table 4.3.

**Table 4.3: Cost of travel Phase 1 CEM**

| Vehicle Type | Cost (MXP) |
|---|---|
| Cars | $98 |
| Buses, 2, 3 & 4 axel trucks | $147 |
| 5 & 6 axel trucks | $187 |
| 7 & more axel trucks | $245 |

*Phase 2*

The second phase of the project is 25 km long and divided into two sections: the first section is 6.6-km (4.1-miles) long and links the Peñón Texcoco freeway with the Bordo de Xochiaca. The second section is 31.3 km (19.44-miles) long and goes from the intersection Nabor Carrillo to the Mexico-Puebla highway. It is expected that the first section of this phase will be in operation by mid 2009.

*Phase 3*

The third phase is 20-km (12.42-miles) long and also divided into two sections, the first of which goes from the intersection Chamapa-Lecheria to Vialidad Mexiquense. The second section goes from there to the town of Tultepec (SAASCAEM, not dated)

*Phase 4*

The final stage will have a length of 43 km (26.71-miles), connecting the Mexico-Puebla highway with the border of Mexico state and the state of Morelos. Although this phase was planned in the original project, Conmex-OHL has not been working on this phase because the results of the first T&R analysis were not positive (see section 4.4.4). However, OHL is considering the project again. Recently, there has been discussion of developing a commuter rail line and repaving the road in Nepaantla, an area near this phase of the Circuito. Though there are no immediate plans for development, the company is considering the project again if these other two developments go forward, as they could have an impact on the cost-benefit analysis and change the dynamics of the financing and IRR for this portion of the project (Infante, 2009).

Fernando Marquez Garcia, an engineer at DIRAC (Marquez Garcia, 2009), noted that during the construction of the Circuito Exterior Mexiquense, some additional construction of facilities was required. This included construction of aqueducts, pipelines, and oil pipelines, and laying of medium and low voltage power lines, telephone lines, water pipes and drain pipes, depending on which agency the works were for. The agencies involved are PEMEX (Petroleos Mexicanos, Mexican Oil company), INAH (National Institute of Arqueology and History), CNA (National Water Commission), SAPASE (Ecatepec de Morelos Municipality's Decentralized public agency for water usage, drainage and sewerage), SACMA (Mexico City's Water System), DGSU (General Department of Urban Services), Luz y Fuerza del Centro (Mexico City's Lighting Company), TELMEX (Mexican Phone Company), MAXIGAS (Natural Gas Company), and FERROVALLE (Mexico Valley Railroad), all of whose infrastructure was impacted by the construction of the highway and service roads.

There were also four other interchanges constructed for the project:

- Vía Morelos, 606 m long
- Avenida Central, 842 m long
- Ramal Periférico, 334 m long
- Peñón-Texcoco, 447 m long

*Need Addressed*

The Metropolitan Zone of Mexico Valley (ZMVM), with its almost 20 million inhabitants, accounts for a significant amount of the economic activity in the country and is also the most important urban and consumption center in the country. Mexico is a highly centralized country, not only in politics, but also in economics and demographics, with most activity centered on the nation's capital, Mexico City.

The federal government and the Mexico City government developed a plan to control the population growth rate of the capital; it has been fairly successful as the growth rate has remained constant for the last 20 years (INEGI, website). However, it has created new population settlements around Mexico City such as Ecatepec and Netzahualcoyotl, located to the northeast and east of the city respectively, increasing the size of the metropolitan area.

The metropolitan area has been experiencing a decentralization of industrial parks in the last 20 years, partly because of the plan mentioned above and partly as a consequence of the high levels of air, water, and sound pollution, other problems created by population concentration in the city, and a major earthquake in the mid 1980s. Most of the industrial activity has moved to Toluca Valley, Queretaro, and Puebla. In 2005, there were only 54 industrial parks remaining in Mexico City (Sedeco, 2006).

As already noted the Mexican highway system was built with Mexico City at the center. Essentially, all roads lead to Mexico City. Consequently the Metropolitan Zone is highly congested, and the roadway infrastructure is not sufficient to handle the traffic volume. Figure 4.46 shows one of the major loops around Mexico City (the North Periferico) at rush hour.


Source Figures 4.46 and 4.47: Discovery Channel, not dated

*Figure 4.46: North Periferico at Rush Hour*

The major roads (Calzada de Tlalpan, Calzada Ignacio Zaragoza, Viaducto, Avenida de los Insurgentes, Rio San Joaquin) are built in a grid. Two loops, Circuito Interior and Periferico, connect the major highways. Figure 4.47 shows the major roads in Mexico City.

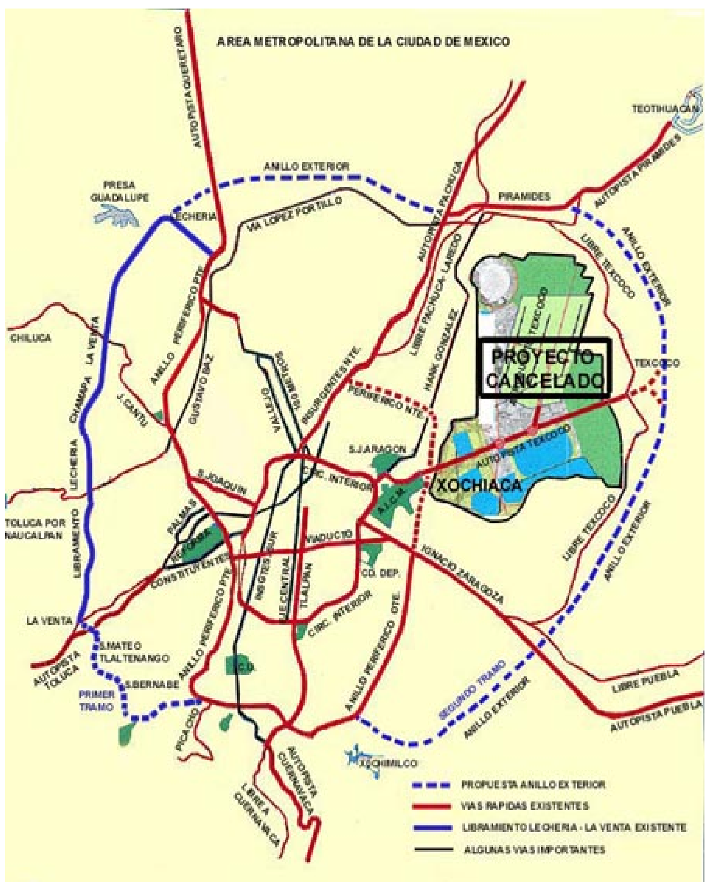



*Figure 4.47: Major Roads in Mexico City*

The dotted blue line named "Anillo Exterior" is Circuito Exterior Mexiquense. Other roads are:

- North: Periferico starts just after the toll booth of the Mexico-Queretaro highway and through Rio San Joaquin connects to the downtown area (Paseo de Reforma).
- South: Calzada de Tlalpan runs from downtown to the south of the City until reaching the Mexico Cuernavaca highway.
- East: Calzada Ignacio Zaragoza goes from Viaducto to the Mexico-Puebla and Mexico-Texcoco highways. The avenue is on the border of Mexico City and the municipality of Netzahualcoyotl in Mexico State.
- Insurgentes goes through the city, running from north to south, where it reaches Calzada de Tlalpan and the Mexico Cuernavaca highway. In the north it intersects the Mexico-Pachuca highway.
- Viaducto goes from Periferico to the International Airport.
- Circuito Interior is a complete loop that intersects Insurgentes in the north, which then goes to Mexico-Pachuca highway, reaches the airport in the east, connects with Insurgentes again in the south, and connects to the Paseo de Reforma in the west.

The Transportation Department of Mexico City estimated in 2003 that 3.2 million vehicles per day travel on Mexico City's roads: 1.9 million personal vehicles, 800,000 freight vehicles and 500,000 vehicles from the metropolitan area. Table 4.4 shows the length of Mexico City's major routes.

**Table 4.4: Mexico City Road System**

| Road | Kilometers | Miles |
|---|---|---|
| Periferico | 58.83 | 36.55 |
| Circuito Interior | 42.98 | 26.7 |
| Calzada de Tlalpan | 17.7 | 17.7 |
| Viaducto | 14.12 | 8.77 |
| Calzada Ignacio Zaragoza | 14.12 | 8.77 |
| Aquiles Serdan | 9.8 | 6.09 |
| Rio San Joaquin | 5.46 | 3.39 |
| Gran Canal | 8.41 | 5.22 |
| Subtotal | 171.42 | 106.51 |
| Ejes Viales | 421.16 | 261.70 |
| Other main roads | 320.57 | 199.19 |
| Primary roads Total | 913.152 | 567.40 |
| Secondary roads Total | 9269.062 | 5759.52 |
| Road Total | 10,182.212 | 6326.93 |

Source: Secretaria de Transportes y Vialidad, 2009.b

Recent studies indicate that 40% of traffic in the ZMVM is due to freight transport, which also has a significant impact on pollution levels in the city (UNAM, 2006). The economy of the ZMVM requires more than 390 million tons of inputs and products annually, making freight transport a necessary activity to support the economy (Secretaria de Transportes y Vialidad, 2009.a).

*Geographic Location*

Circuito Exterior Mexiquense is a semicircular highway to the east of Mexico City running north/south. The highway passes through 22 of the municipalities in Mexico state that comprise the greater metropolitan area of Mexico City. The greater metropolitan area of Mexico City is formed by the city, Tizayuca in the state of Hidalgo and the 53 municipalities of Mexico State. Total population of ZMVM was 19.2 million people in 2005, of which 45.3% live in Mexico City, 54.3% in Mexico State, and the rest in the state of Hidalgo. Of the 14,016,823 inhabitants of the state in 2005, 75% of the population lives in the 58 municipalities of Mexico State, which amounts to 54% of the total population of the ZMVM (Conapo, 2005).

### 4.4.2 History

*Project Development*

The project is a state project, and is being developed by Mexico State. The government of Mexico state, through the Ministry of Communications, commissioned Sistema de Autopistas, Aeropuertos y Servicios Conexos y Auxiliares del Estado de Mexico (SAASCAEM) to implement and monitor the project. SAASCAEM hired a construction company, DIRAC, Ingenieros Consultores, to develop the project and monitor the technical and administrative aspects of the first and second phase.

*Circuito and the National Plan*

El Sistema Carretero de Oriente, otherwise known as Circuito Exterior, is not part of the NIP, but it is part of the Program for Improving the Road Infrastructure of the state of Mexico contained in the Economic Development Plan of the State of Mexico 2005–2011. The goal of the infrastructure program is to make the connection between the Federal District and metropolitan municipalities more efficient.

Part of the strategic plan of Mexico State is the development of infrastructure as an engine of economic development: *"infrastructure is the linchpin of economic development because it increases the exchange, expands markets, leads health and education, and creates bridges between the regions"* (Estado de Mexico, 2005)

*Feasibility Study*

Cal y Mayor (C&M Associates) was hired by Obrascón-Huarte-Laín (OHL) to produce a feasibility study for Circuito Exterior Mexiquense a toll road serving the northeastern part of Mexico City's 20 million inhabitant metropolitan area (Cal y Mayor, 2002).

The main objectives of the study were:

- Forecast with a high level of reliability the type and level of traffic for the orbital toll road.

- Forecast with a high level of reliability the revenue generated by tolls.
- Provide demand information to decide the best construction strategy.

In May 2002, the company began surveys, studies, and measurements in the field, to determine the demand and supply of transport. They completed:

- 43,000 origin-destination surveys
- 5,000 + stated preference surveys
- 156 miles observed for speed and travel time
- 187 miles of existing road network analysis
- 10 automatic volume and direction traffic stations and 3 manual volume and direction traffic stations
- 192 internal zones mapped
- 32 external zones mapped

To analyze the demand, different studies were conducted for each type of vehicle: cars, 2-3 axel trucks, 4-6 axel trucks and 7 and more axel trucks. For each vehicle type, they examined the journeys, generating two major findings:

- The main source of entry to the metropolitan area is the intersection with Querétaro, and
- 2 or more axel trucks have longer travel patterns to those of cars.

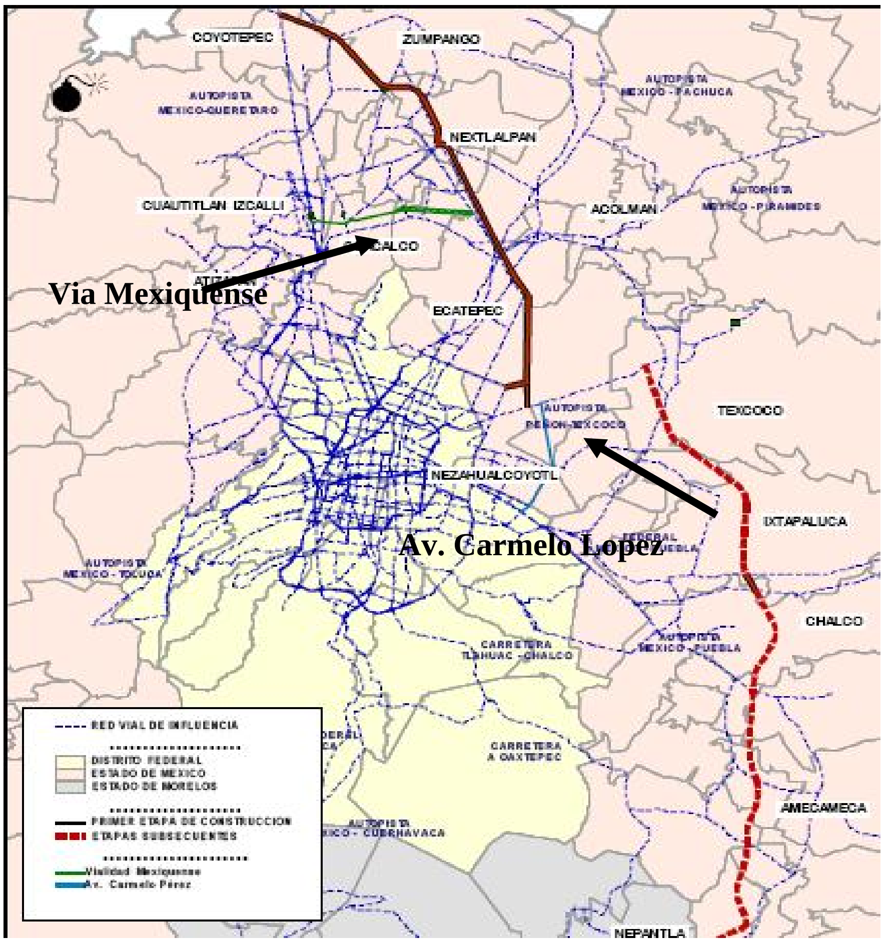
The model was calibrated so that the capacities and speeds observed were very similar to those derived from the model. Once the allocation model was calibrated it was used to determine toll prices for different travel times or patterns. This model was also made for each type of vehicle and with stratification by time travel (longer than 2 hours and shorter than 2 hours). In Table 4.5, the subjective values for time are shown:

**Table 4.5: CEM: Subjective values of time**

| Vehicle Type | Reason | Short travel pesos/min | Long travel pesos/min |
|---|---|---|---|
| Cars | Work | 0.21 | 0.52 |
| | Leisure | 0.21 | 0.64 |
| | Others | 0.28 | 0.66 |
| Buses, 2, 3 & 4 axel trucks | | 0.22 | 0.58 |
| 5 & 6 axel trucks | | 0.38 | 0.77 |
| 7 & more axel trucks | | 0.77 | 1.53 |

Source: Cal y Mayor, 2002

Subsequently, the data were used to analyze three types of design combined with three regional projects. Of these 3 designs, several subnets were analyzed leading to 23 different scenarios. From this analysis the design of the project was established in which the construction of two additional roads was incorporated: Via Mexiquense and Av. Carmelo Lopez (shown in Figure 4.48 with a green and blue line respectively).



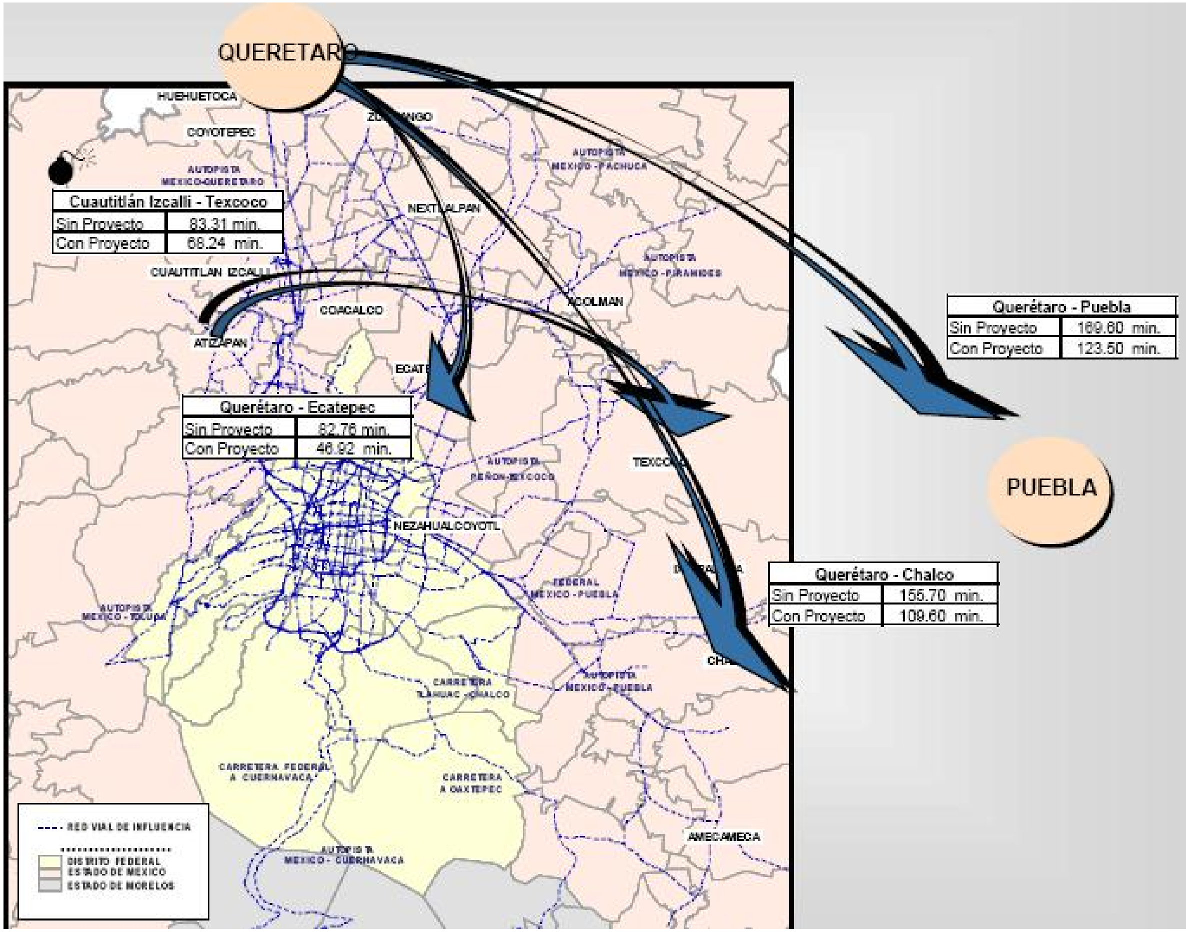

Source: Cal Y Mayor, 2002

*Figure 4.48: CEM: Original Design*

This study recommended that the first phase connect Mexico-Queretaro, Mexico-Pachuca, Mexico-Piramides, and Peñón Texcoco through 14 counties of the state of Mexico and include 9 interchanges.

Via Mexiquense connects the municipalities of Cuautitlán Izcalli, Tultitlán, Tultepec, and Coacalco Ecatepec with a length of 18.5 km and three lanes each way.

Additionally, the road system also generates an important reduction in traveling time. As shown in Figure 4.49, there is significant time savings to some of the main destinations if the origin is Queretáro. The route from Queretáro-Ecatepec saves about 35 minutes and the Queretáro-Puebla and Queretáro-Chalco routes save about 45 minutes.




Source: C&M, 2002

*Figure 4.49: CEM: Time savings*

### 4.4.3 Planning

*Forecasting traffic/revenue*

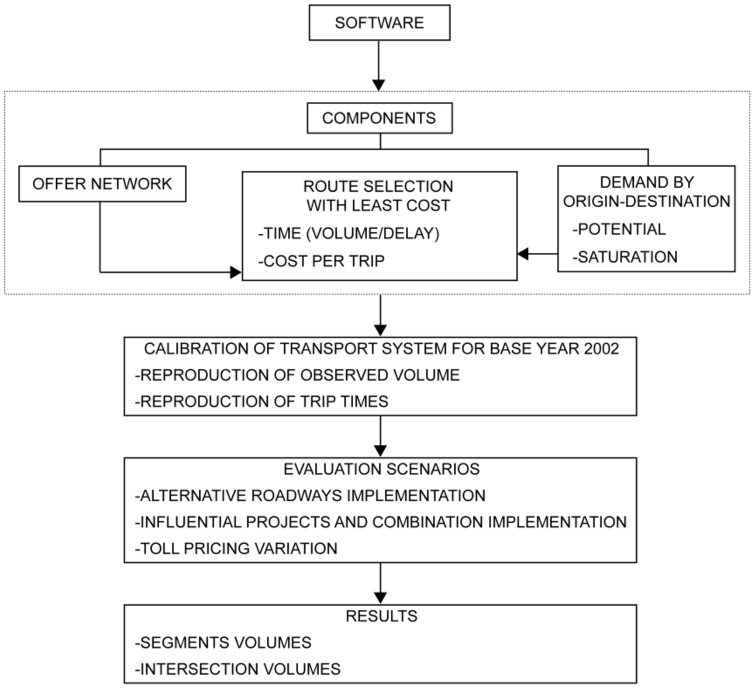
The T&R analysis was also performed by C&M Associates. In order to complete this study, it was necessary to know some characteristics of the demand in the influenced area, based on the results of the origin-destiny surveys. Table 4.6 shows the breakdown of vehicles.

**Table 4.6: CEM: Transportation Demand**

| Vehicle Type | % of total travelers |
|---|---|
| **Cars** | **66%** |
| **Buses** | **23%** |
| **2, 3 & 4 axel trucks** | **9%** |
| **5 & 6 axel trucks** | **1%** |
| **7 & more axel trucks** | **1%** |

Source: Cal y Mayor, 2002

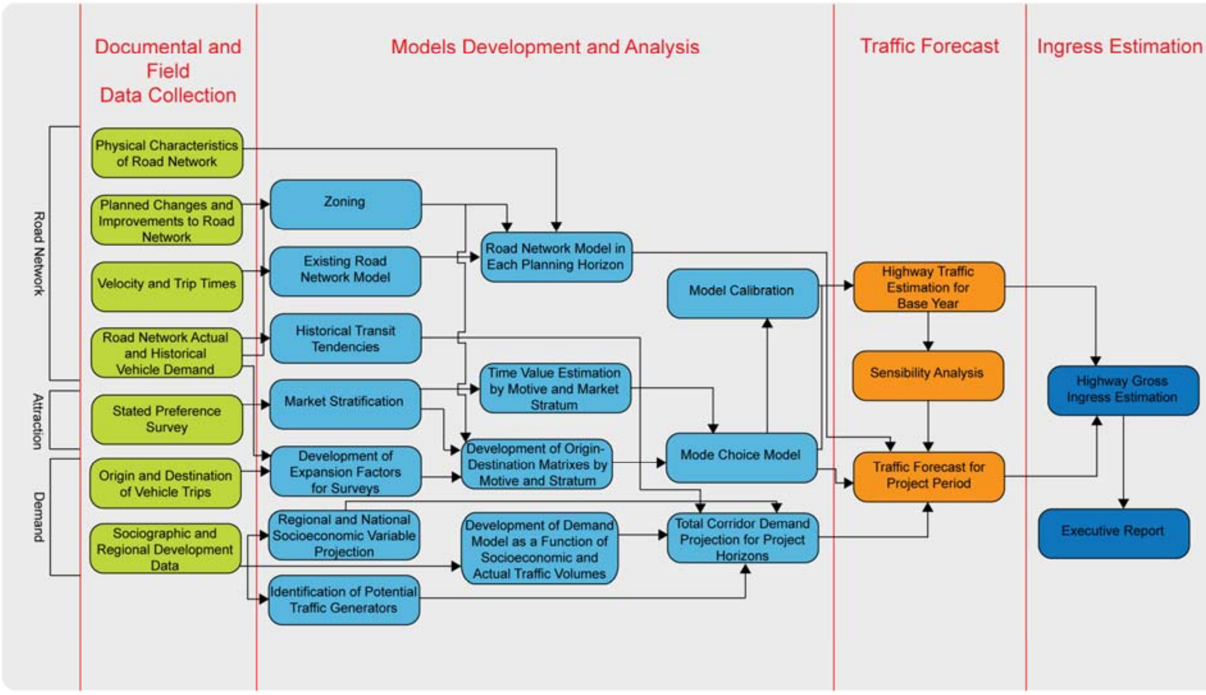
Some 86% of these trips occur at least once a week and work is the main reason for the trips. Figure 4.50 shows a flow-chart of the traffic simulation model that C&M utilized.




Source: Cal y Mayor, 2002

*Figure 4.50: Traffic Simulation model*

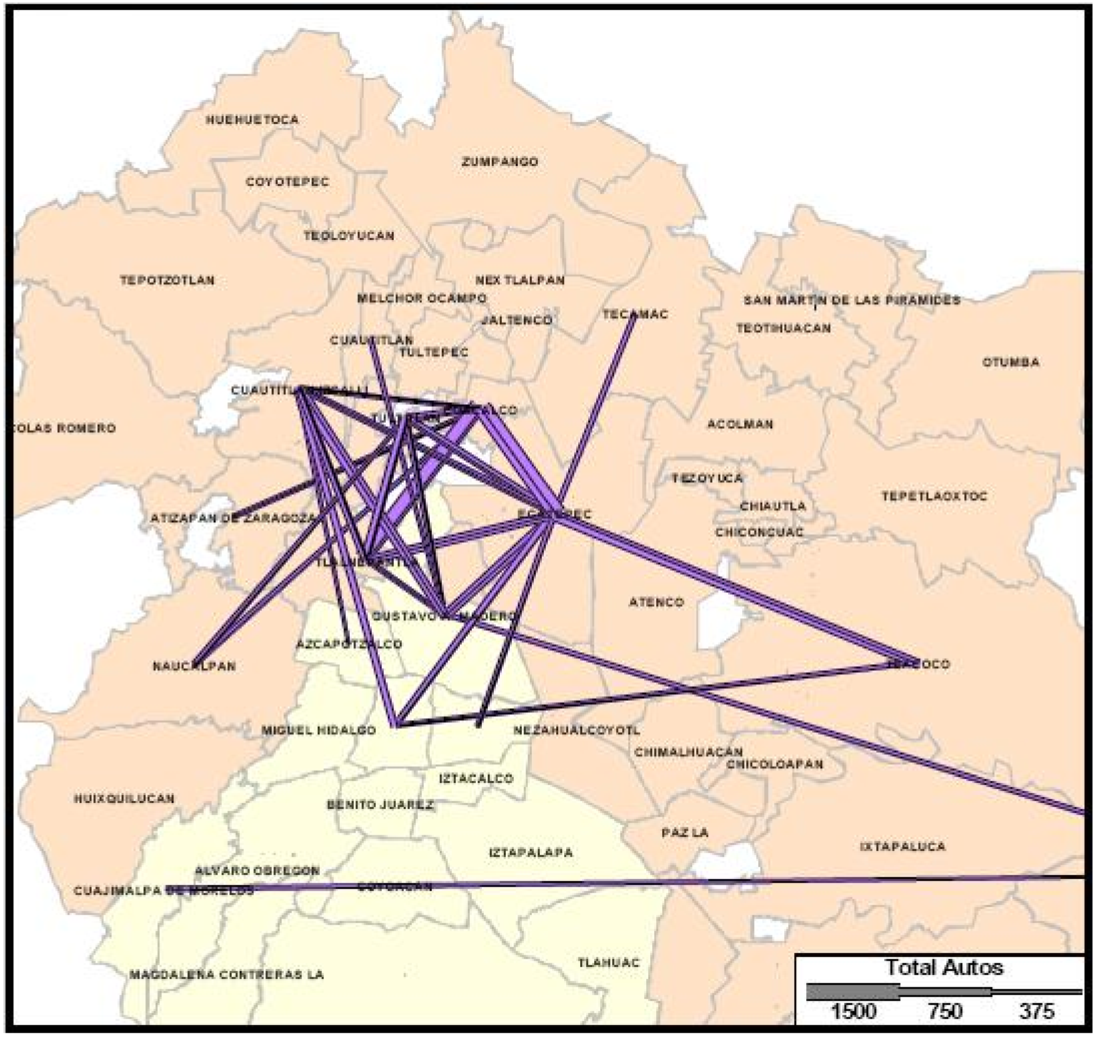
Figure 4.51 shows the methodology used for the T&R forecast (note that it is the same as used for Arco Norte and discussed earlier).




Source: Cal Y Mayor, 2002

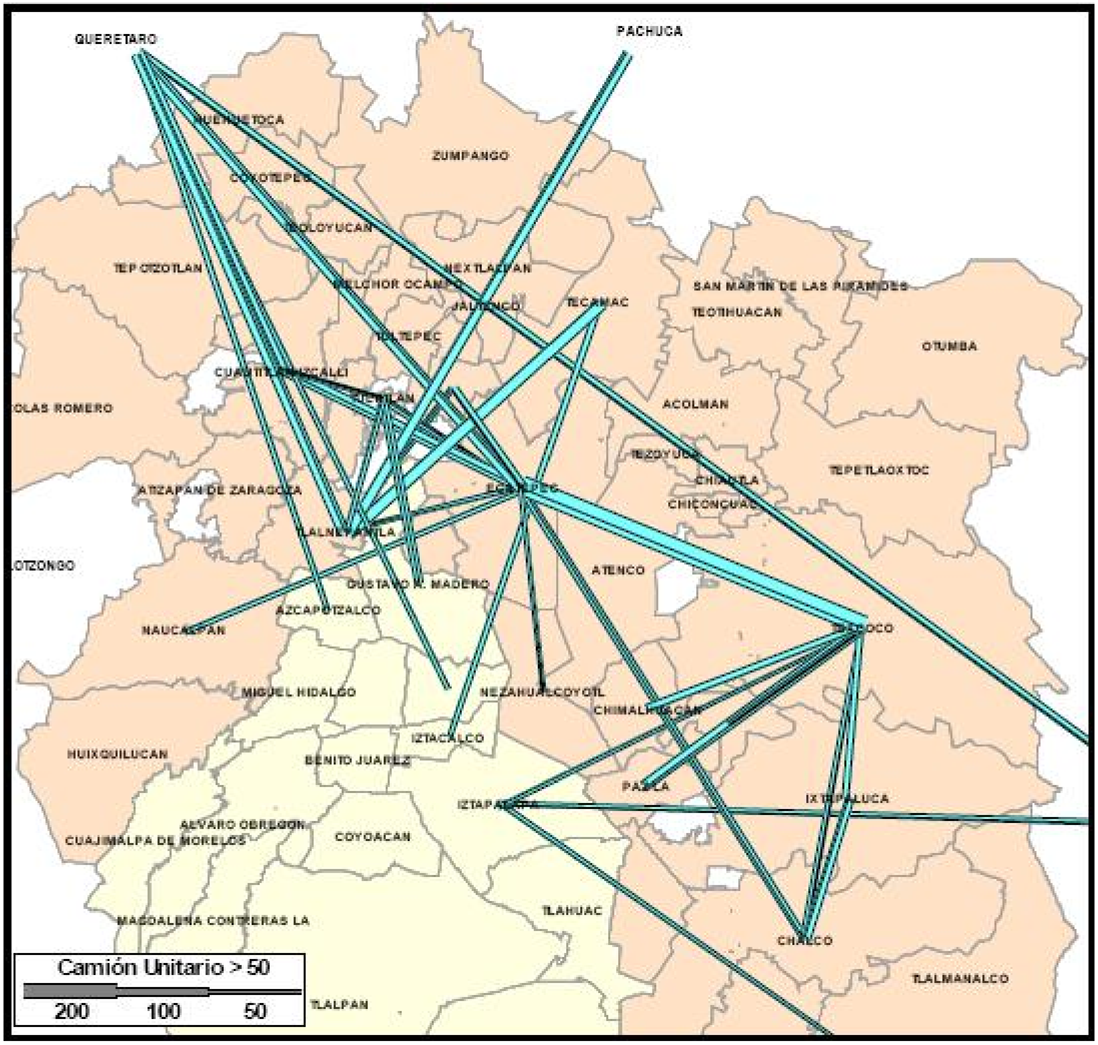
*Figure 4.51: Methodology for traffic and revenue forecasts*

This study also shows the main destinations depending on the type vehicle used. For cars, the most important destinations are Cuatitlan Izcalli, Tultitlan, Ecatepec, Tlalnepantla, Texcoco, Tecamac, Atizapán de Zaragoza, and Naucalpan, which can be seen in Figure 4.52. For trucks, the trips are much longer than those made by cars, and the main destinations are the states of Queretáro, Puebla, Pachuca, and the Mexico State Municipalities of Tultitlán, Ecatepec, Tlalnepantla, Texcoco, Naucalpan, and Gustavo A. Madero in Mexico City (Figure 4.53).




Source: Cal y Mayor, 2002

*Figure 4.52: CEM: Travel distances for cars*




Source: Cal y Mayor, 2002

*Figure 4.53: CEM: Travel distance for trucks*

The traffic projections were based on the actual number of vehicles using each of the main highways that surround the metropolitan zone and the results of the origin-destination and stated preference surveys. Some socio-economic variables like GDP, population growth rate and employment were also taken into account. The T&R estimates were done for 2006, and for 2010 through 2025 (every five years). From the 140,000 vehicles circulating everyday in this area, the estimated number of vehicles for the first phase in 2006 was 100,408 vehicles per day. During the first year of operations, the actual usage surpassed the estimates (even those of the optimistic scenario shown in the second column of Table 4.7 (Ibarra, 2005.a).

**Table 4.7: Estimated traffic for the first phase of CEM**

| Vehicle Type | Estimated Toll ($/km) | Optimistic Toll ($/km) |
|---|---|---|
| **Cars** | 76,690 | **77,885** |
| **Buses , 2, 3 & 4 axel trucks** | 17,925 | **18,124** |
| **5 & 6 axel trucks** | 4,088 | **4,136** |
| **7 & more axel trucks** | **1,725** | **1,729** |

Source: Cal y Mayor, 2002

The analysis estimated the toll rates for the first phase, which can be seen in Table 4.8.

**Table 4.8: Estimated tolls for the first phase of CEM**

| Vehicle Type | Toll $/km |
|---|---|
| **Cars** | **1.56** |
| **Buses , 2, 3 & 4 axel trucks** | **2.40** |
| **5 & 6 axel trucks** | **3.00** |
| **7 & more axel trucks** | **4.00** |

Source: Cal y Mayor, 2002

Using the socio-economic variables and the estimations for tolls and traffic, the total annual revenue expected is shown in Table 4.9.

**Table 4.9: Estimated revenue (millions of pesos) for CEM**

| Vehicle Type/ Year | Cars | Buses, 2, 3, 4 axles | 5 and 6 axles | 7 and more axles | Total |
|---|---|---|---|---|---|
| **2002** | 138,027,766 | 102,661,886 | 66,268,248 | 28,891,415 | **335,849,316** |
| **2006** | 175,248,656 | 118,238,374 | 78,079,939 | 32,138,317 | **403,705,286** |
| **2010** | 216,381,266 | 134,683,594 | 99,244,871 | 35,798,223 | **486,107,955** |
| **2015** | 276,983,704 | 161,508,042 | 120,655,238 | 40,713,063 | **599,860,047** |
| **2020** | 324,327,757 | 183,690,753 | 139,374,242 | 45,435,381 | **692,828,133** |
| **2025** | **367,757,850** | **209,370,126** | **159,034,408** | **50,746,785** | **786,909,169** |

Source: Cal y Mayor, 2002

There was no additional cost-benefit analysis completed. The forecasting study included all of the information deemed necessary to proceed with the project.

### 4.4.4 Environmental Process

All the projects that involve federal areas must be submitted to SEMARNAT in order to get approval, as required under the Law of Ecological Equilibrium and Environmental Protection (Ley General del Equilibrio Ecológico y la Protección al Ambiente).

As Circuito Exterior Mexiquense is a state project, the environment impact analysis must also be authorized by the Mexico State Environment Department (Secretaría de Medio Ambiente del Estado de México); only in the cases where the highway passes through an area of federal jurisdiction did SAASCAEM has to ask for a federal environment impact assessment.

There are two federal environment impact assessments for this project; both of them are for the second phase of the project. One of them is about the enlargement of the first section of the second phase and the other is for the construction of three bridges in the second section of the second phase. Both environment analyses were done by the firm HP Asesoría Ambiental SA de CV. These studies included a brief description of the projects, the location and geological characteristics, a regulatory review, a description of the environment of the area, and the probable environmental problems that would result from the construction of the highway. The studies also include mitigation measures for each environment component analyzed: atmosphere, water, land, flora, wildlife, landscape, and waste (SEMARNAT, 2007 & 2008).

Summary of MIA

These studies used the modified *Leopold Matrix*, developed by the U.S. Geological Survey in 1971 which is a qualitative environmental impact assessment method that creates a matrix that identifies the cause-effects relationships.[2] This matrix relates the steps and activities to implement the project (columns) with different factors and environmental components that may be affected at the site where the project will be located (lines). The first step is to identify the existing interactions (all activities arise during the implementation of a project). Subsequently, it was necessary to identify environmental factors, with the aim of detecting those aspects of the project that may involve positive or negative changes to the environmental quality. The factors identified are listed in Table 4.10:

**Table 4.10: Environmental factors for CEM**

| Environment | Impact Indicator |
|---|---|
| Atmosphere | Noise<br>Air quality (gases and suspended particles) |
| Land | Topographical features<br>Erosion |
| Water | Residual water |
| Flora | Existing vegetation |
| Wildlife | Existing wildlife |
| Landscape | Visual Appearance |
| Waste | Hazardous and no hazardous waste |
| Socioeconomic factors | Social welfare and employment |

Source: SEMARNAT, 2007

These factors were assessed using the following criteria:

- Generic (adverse/ beneficial)
- Action (direct/indirect)
- Temporality (short, median and long term)

[2] It should be noted that some environmental groups consider this methodology to be 'dated'.

- Duration (temporal/permanent)
- Reversibility (reversible/irreversible): if the environment itself is capable of returning to the original quality of the system

Impact is assessed using a scale of high (5), medium (3), and low (1). For the analysis of environment impact, both projects were divided in three stages: site preparation, construction and management and maintenance.

For the second phase construction located in the municipality of Texcoco, the MIA was released on July 2007 (reference number 15EM2007V0017). It noted that there were no protected natural areas. The area is semi-arid and plain, and therefore is not suitable for agricultural or livestock, and there are no exotic animals in danger of extinction. Table 4.11 shows the stages of construction and activities and the impacts that the MIA identified.

**Table 4.11: Environmental Impact for Section 1 Phase 2 of CEM**

| Stage | Activities | Impacts |
|---|---|---|
| **Site preparation** | Removal of soil material and grass | • Generation of suspended particles<br>• Emission of smoke and gases from machinery<br>• Noise generated by the machinery<br>• Change in the topographic features of the ground<br>• Removal of vegetation cover (erosion)<br>• Displacement of wildlife in the study area<br>• Change of scenery<br>• Urban waste generation<br>• Employment generation |
| **Construction** | Pavement<br>Drainage<br>Rights of way<br>Bridges<br>Structure<br>Signaling<br>Civil works (toll booth, offices and septic tank) | • Generation of suspended particles<br>• Emission of smoke/gases from the machinery and asphalt<br>• Noise generation by machinery heavy use<br>• Reforestation<br>• Moving fauna<br>• Change of scenery<br>• Generation of municipal waste<br>• Generation of special management of waste<br>• Generation of hazardous waste<br>• Employment generation |
| **Operation** | Toll booths<br>Management<br>Offices<br>Maintenance | • Generation of wastewater from septic tanks of offices<br>• Return of wildlife<br>• Change of scenery<br>• Generation of non-hazardous and hazardous waste<br>• Employment generation<br>• Social benefit |

Source: SEMARNAT, 2007

The environmental impact assessment for the construction of three structures in the second section of phase II was released on November 2008 (reference number 15EM2008V0026). The conclusion of this analysis was that the project is feasible because it does not produce any adverse, irreversible, or significant impacts.

The environment impact for this part of the project differs from Table 4.11 in the activities corresponding to each stage (site preparation, construction, maintenance), which are shown in Table 4.12.

**Table 4.12: Impact Indicators for Activities in Phase II Section 2 CEM**

| Environment | Impact Indicator |
|---|---|
| Site Preparation | • Cleaning and removal of grass and soil materials<br>• Loading and hauling of materials for each bridge<br>• Toilet for workers |
| Construction | • Excavations<br>• Transport of fine materials<br>• Foundation of the bridge structure<br>• Conformation of the structure of each of the bridges<br>• Toilet for workers |
| Operation | • Opening of the bridges to the public |
| Maintenance | • Cleaning and maintenance of the structure of the bridges<br>• Maintenance of the signaling at each bridge |

Source: SEMARNAT, 2008

Procuraduría Federal de Proteccion Ambiental (Federal Office of Environmental Protection), PROFEPA, is a sub-agency of Semarnat with the authority to stop construction of projects and ask for modifications to projects. According to PROFEPA (Pacheco, 2005) during the first phase, there were some problems because the government and the concessionaire did not do an environmental impact assessment and did not follow the recommendations made by PROFEPA. PROFEPA asked them to change the design of the highway because it passed through federal areas belonging to the National Commission of Water (CNA); within its recommendations, PROFEPA asked to cancel six interchanges.

### 4.4.5 Right-of-Way Acquisition

Sistemas de Autopistas, Aeropuertos, Servicios Conexos y Auxiliares (Roadway, Airport, Auxiliary and Related Services, SAASCAEM) is part of Mexico states Communications Department and is in charge of building, managing, operating, and maintaining all toll roads, as well as helping with infrastructure improvement. Among its functions are:

- Granting and declaring the termination of licenses for road and ROW use and operation.
- Issuing permits for the use of road infrastructure and the right-of-way.
- Contracts for the use and operation of road infrastructure.
- Operation and maintenance of road to determine the amount of resources to be applied for its proper functioning.

- Promote and encourage participation of private initiative in the construction, administration, operation, maintenance, rehabilitation, and maintenance of road infrastructure.

- Authorize the settings and monitor the proper implementation of the toll fees.

SAASCAEM has a specific right-of-way acquisition process. The purpose of this procedure is to conduct technical studies to determine the feasibility of an application, and issue the amount that the applicant will pay to SAASCAEM for use and the right-of-way of state highways and surrounding areas (SAASCAEM, not dated).

During the first stage of the construction, the design indicated that the route would run to one side of the general drain and major drainage canal. At that point, there were no issues; but 2 km (1.24 miles) ahead it became necessary to move the road away from the waters, so the National Water Commission would have enough space for future growth projects. Therefore, the construction company had to change the design of the road. This was a significant obstacle for beginning the construction, which delayed it by 10 months. The construction was done by sections according to the changes in the design and when the new ROW was released (Salvatierra, 2006).

Circuito Exterior Mexiquense's original design also ran through agricultural fields and private homes, so SAASCAEM had to negotiate to acquire the property. In Coyotepec the negotiations were unsuccessful. *"Originally the line was for Coyotepec, but as people did not agree with the project, it was moved to Huehuetoca, where people wanted the highway,"* said Eleazar Gutierrez, Project Director of SAASCAEM (Ibarra, 2005.a).

Paul Wallentin, director of Concesionaria Mexiquense, the company responsible for the highway project, said the National Water Commission granted the state government 36 km (22.36 miles) of land, as most of this highway will run parallel to the Grand Canal. *"Since CAN granted the concession of the land, it was necessary to reallocate water inlets and drainage pipes."*

According to the director of Concesionaria Mexiquense the other land tracts were private, so acquisition had to be negotiated so that people were satisfied with the purchase. The government even had to negotiate with people who had invaded part of the land of the former Texcoco Lake. It was a lengthy process but is now complete (Ibarra, 2005.a).

According to information of SAASCAEM, rights-of-way of the first section of phase 2 are 100% released, and from the second section there is only 8% missing. In the case of the two sections corresponding to the third stage, 90% of the rights-of-way have been acquired and are free for construction to begin.

*Public Participation*

As noted above, Circuito Exterior Mexiquense's original design ran through agricultural fields and private homes in many areas. For one community—Coyotepec—the process of acquiring ROW ran into serious problems. The community was unhappy with the process and negotiations failed regarding ROW as the community was not supportive of the project. However, the community of Huehuetoca was in support of the project and the route was re-routed through this community (Ibarra, 2005.a).

### 4.4.6 Project Implementation

*Financing*

The total cost of the first three phases of this project has been estimated at MXP$6,628 million (Bancomer, 2004), of which 40% of the investment will come from OHL over two years and the remaining 60% from a syndicate comprising BANOBRAS, the Official Credit Institute of Spain (ICO), and BBVA-Bancomer (Dario, 2004). The finance negotiations lasted more than a year because of the highway crisis of 1995 when the State bought the debt of the concessionaires after several toll projects failed; therefore, there were some trepidation by the investors and these fears had to be addressed (BBVA-Bancomer, 2004)

BANOBRAS is a Mexican public entity whose main mission is to provide financing and technical assistance to states and municipalities in the development of infrastructure and public services projects. The Official Credit Institute of Spain is a state-owned corporate entity attached to the Ministry of Economy and Finance through the Secretariat of the State for the Economy. Its financing activities seek to boost sectors such as transportation and encourage technological innovation and renewable energy projects while helping Spanish enterprises set up business ventures abroad (Instituto de Crédito Oficial, 2009). BBVA-Bancomer is structuring the deal.

This financing partnership (BANOBRAS, ICO, and BBVA-Bancomer) provided a total of MXP$2,310 million in financing for the project. This amounts to each entity providing 20% of the total financing, of roughly MXP$770 million each. BANOBRAS is providing an addition MXP$1,533 million out of its own capital resources (BBVA-Bancomer, 2004).

OHL plans to invest 30% of the project cost as equity, financing the rest with toll revenue bonds (Cal y Mayor, 2002).

In November 2008, Conmex signed a new loan for MXP$6,000 million. This loan is part of the refinancing strategy of the concessionaire. The refinancing is intended to obtain capital for the construction of Phases II and III of the highway, with a length of 59 km. The transaction was structured by BBVA Bancomer and it has been approved by BANOBRAS and Banorte Mexican Bank. The loan was granted in Mexican pesos for a period of 20 years. In addition to refinancing its current debt of MXP$3.3 million, the credit will allow CONMEX to use MXP$2,500 million to construct stages 2 and 3 of CEM after paying the restructuring costs (OHL, 2008). Table 4.13 shows the estimated cost of construction for the project.

**Table 4.13: CEM: Cost of construction**

| Stage | Cost MXP |
|---|---|
| First | **$ 3,404** |
| Second* | **$ 1,344** |
| Third* | **$ 1,496** |
| **Forth*** | **$ 1,115** |

*Estimated

Source: Sugawara, 2009

Evaluation of the project is being conducted by several international groups, including Grupo Aries for engineering; URS Corporation for traffic issues; Empresa Tarifar for tariffs and tolls; Marsch Brockman & Schuh for insurance issues, Ernest & Young for the fiscal aspects;

Mijares, Angoitia, Cortés y Fuentes for legal issues; and Galaz, Yamazaki, Ruiz Urquiza for accounting (Dario, 2004).

*Concession Process*

The request for proposals was published on October 28, 2002 in the public journal of Mexico State's government and the results were published on February 6, 2003. Mexico state's government gave the concession to Concesionaria Mexiquense, SA de CV, through public contest number SCEM-CCA-01-02 for an amount of MXP$8,581,000,000, dated February 25, 2003. The concession contract is for a period of 33 years and 11 months to build, exploit, operate, and maintain the Sistema Carretero de Oriente del Estado de Mexico.

Concesionaria Mexiquense (Conmex) is the Mexican branch of OHL Concessions, a Spanish company that has been working in Mexico since 2001. Figure 4.54 shows current and constructed OHL projects in Mexico.


Source: OHL Website

*Figure 4.54: OHL Projects in Mexico*

OHL Concessions is one of the largest investors in international infrastructure, and it is among the top ten private developers in the world. The company, a subsidiary of the OHL Group, is one of the leading construction, concessions, and services groups in Spain. It was formed in November 2000 to develop various kinds of infrastructure throughout the world, through concession contracts. Currently, the concessions division has become a strategic business line for the OHL Group (OHL, 2009).

OHL Concesiones has become a major player in the construction sector, with shares in five major transport infrastructure concessions. In the toll road area, OHL Concessions, in 2003, won the concession for the construction and operation of the Circuito Exterior Mexiquense; in late 2005 it acquired a majority stake in Company Concesionaria GANA, which is responsible for the construction and operation of the Amozoc-Perote road; and in early 2008 it was awarded two new roadway projects: Libramiento Norte a Puebla and Viaducto Bicentenario in Mexico state. OHL Concessions also operates an airport infrastructure in Mexico state through the Administradora Mexiquense del Aeropuerto Internacional de Toluca AMAIT (Toluca International Airport Mexiquense Manager), which is 49% owned by OHL Toluca. This airport is part of the Metropolitan Airports System (SMA) whose central airport is Mexico City airport and with four peripheral airports: Toluca, Puebla, Cuernavaca, and Querétaro (OHL, 2009).

### 4.4.7 Conclusions

Circuito Exterior Mexiquense is highway serving the northeastern part of Mexico City, the main purpose of which is to create an efficient channel of communication between the major highways surrounding Mexico City without the need to move through it, to avoid the traffic congestions and decrease the travel times. The project has been divided in four construction phases.

Circuito Exterior Mexiquense is a very important project that will generate social and economic benefits not only for Mexico State, but also for Mexico City and other states in central Mexico. Considering this, it is remarkable that Circuito Exterior Mexiquense is a state project in which federal government does not contribute in the design, planning, or execution of the project; it only participated through specific authorizations such as environment issues. It is also important to note that the process of bidding and the results of the same have been done with the same transparency as federally concessioned projects.

Circuito Exterior Mexiquense is the only highway in the whole country with a security system monitoring 24 hours a day not only to measure traffic, but also to provide assistance in case of accidents. This feature along with the high technical specifications makes this highway one of the best in the country.

It is interesting that the fourth stage of the project has been stopped due to the non-positive results of T&R analysis, which also shows the project is not only a necessity, but also a business.

The first phase of the highway has been operating for 3 years and the traffic expectations have been exceeded. Even though it is not cheap, people have preferred to pay a little bit more but travel a shorter time.

There were also some problems in the process. Rights-of-way and environment impact assessments were the major problems in the planning of the project. In the right-of-way topic, the main problem was the location of the project, which runs to one side of the Gran Canal, an area belonging to the National Commission of Water; during the first phase of the project, it was necessary to change the design of the highway because of this. However, Mexico State authorities learnt from this experience and in the planning process of phases two and three they obtained the right-of-way authorizations in advance; actually, this process is over for the second phase and for the third phase it is 90% complete.

# 4.5 Mexico City Commuter Rail

## 4.5.1 Project Description

*Background and Need Addressed*

The *Ferrocarril Suburbano* is a commuter train that links Mexico City to neighboring municipalities in Mexico states, such as the ones shown in Figure 4.55, and connects them to the Metro and Metrobus Systems within city. This commuter rail is a pilot project sponsored by SCT and is part of México's NIP. Line 1, currently in operation, is one of three proposed lines that will cover the northwestern, northeastern, and southeastern areas of the city using existing rail right-of-way.

At one time, rail was a significant mode of travel in Mexico. The first rail line was built in 1857 in downtown Mexico City. In the late 1800s, the lines were expanded partly to populate northern Mexico and discourage U.S. expansion (Hawley, 2006). The trains were a primary mode of travel for Pancho Villa's troops during the Mexican Revolution. However, by the 1980s, the rail lines were falling into disrepair and were sold off to private companies—who then discontinued the unprofitable passenger service in favor of freight in the 1990s (Hawley, 2006). As Mexico looked to revive rail, utilizing existing lines as part of its infrastructure development plan, the Mexico City commuter rail became a popular project. According to SCT's Deputy Communications and Transportation Secretary Aaron Dychter, the new system will primarily use 250 km (155 miles) of existing track, greatly reducing construction and ROW costs (Sourcemex, 1999).

Greater Mexico City (Zona Metropolitana del Valle de México, ZMVM) with its roughly 22 million inhabitants is the country's economic, industrial, and cultural center. The ZMVM is comprised of 16 Federal Districts, 59 adjacent municipalities of Mexico State and 29 municipalities of the state of Hidalgo (Secretaria de Desarrollo Urbano, SEDUVI, not dated). Like other fast growing cities, transportation infrastructure has not been able to keep up with population increases, and congestion and the resulting air pollution are some of the city's worst problems.


Source: Adapted from Google Maps

*Figure 4.55: Map of Mexico City and Surrounding Municipalities*

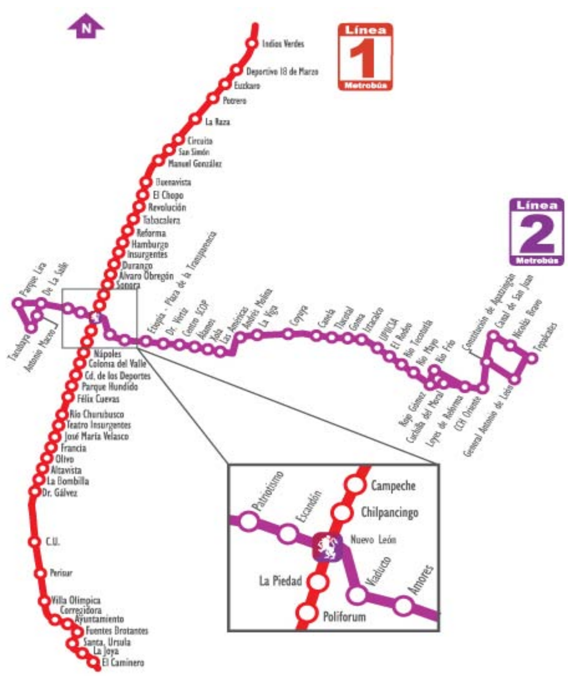
In Mexico City, there are roughly 6 million cars, with over 600 new cars entering the streets each day. Investing in mass transit is therefore necessary to reduce congestion and pollution in this ever-growing city (EMBARQ, not dated). There are currently four main mass transit systems serving the Federal District: the Metro, the Metrobús, the Trolebuses, and the Tren Ligero (light rail). The Mexico City Metro, a subway system that started in 1967, transports more than 4.2 million passengers each day to 175 stations along 11 lines (Mexico City Metro, website). Although the Metro provides an extensive route, as seen in Figure 4.56, its service is limited to the Federal District.

The same situation holds true with the Metrobús, a bus rapid transit system that opened in 2005 as the result of an effort by the city's government to reduce air pollution in the capital city while providing a more efficient transit system to its citizens. The Metrobús has replaced 372 standard buses and microbuses along 121 miles of the city's major corridors, reducing greenhouse gas emissions by 80,000 tons and transporting around 275,000 passengers per day (Metrobús Ciudad de Mexico, website). Figure 4.57 shows a map of the two lines that are currently in operation; according to Eng. Carlos Gutierrez of the Center for Sustainable Transport, there are two other lines in the planning process.

Electric Transport Services or Servicios de Transportes Eléctricos (STE), part of the government of the Federal District, operates trolley buses and a light rail in the capitol city. The trolley buses are a fleet of around 300 busses. Trolley buses come at intervals of about every 6 minutes and connect to the metro system. The light rail (tren ligero) connects to the Metro lines; it is operated by the same authority as the trolley buses. The light rail operates south of the city, offering services to the populations of las Delegaciones Coyoacán, Tlalpan, and Xochimilco. The light rail consists of 16 trains that carry up to 374 passengers each. There are 18 stations along the 26 km (16 miles) of light rail line (Servicios de Transportes Electricos).


Source: Mexico-on-line

*Figure 4.56: Map of Mexico City Metro*




Source: www.metrobus.df.gob.mx/mapa.jpg

*Figure 4.57: Map of Mexico City Metrobus Routes*

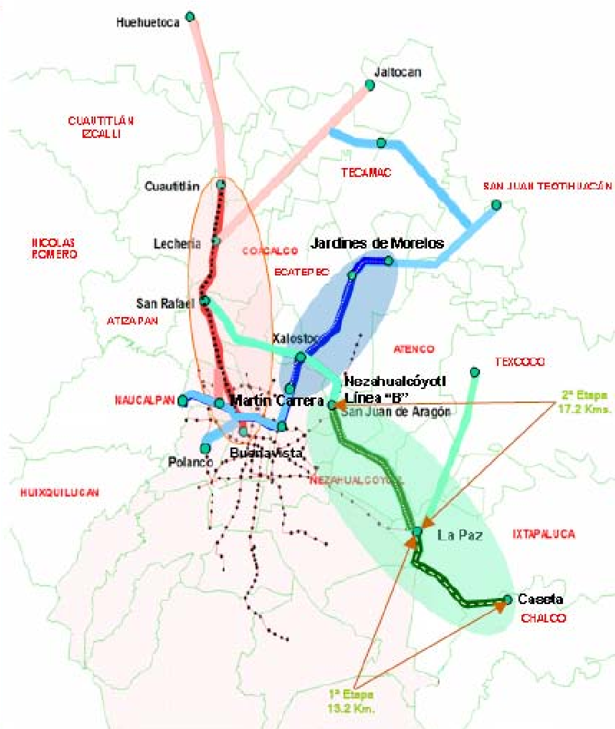
Although the government has invested in various mass transit projects, 61% of the passengers are transported by an extensive network of bus routes run by private companies, known as Convis and Microbuses (SCT website). The vast majority of these passengers are coming from outside the Federal District—commuting to and from work, school, etc.—and the four main mass transit systems do not extend beyond the Federal District. This type of mode not only increases congestion and air pollution but also passenger travel times and discomfort; once passengers get into the city in these buses there are no smooth transfers to other modes of public transportation.

The organization of the feeder/collector routes has been difficult. When Line 1 started, there was not enough capacity in the Metro and Metrobús to serve the passenger flow that was arriving at the Buenavista station. To solve this matter the Federal District's government provided free bus services through the Red de Transporte de Pasajeros (RTP), the city's public bus agency, to serve the growing demand when the commuter rail operations were initiated. RTP is now claiming the SCT has to pay the MXP$10 million in debt for the bus services (El Capitalino, 2009). Dr. Solis mentioned during site visits by the researchers in February 2009 that the one thing the SCT wishes to change for the implementation of Lines 2 and 3 is to have the feeder/collector routes already organized before the trains start operating (Solis, 2009).

The government of Mexico City has seen the need for a new system that would improve transport time, relieve congestion, and reduce air pollution. The new commuter rail system serves areas beyond the limits of the Federal District using existing rail—minimizing implementation costs—and connects it to the city's main mass transit systems. The system will be composed of three lines linking Mexico City to northwestern, northeastern, and southeastern areas of Mexico State. As seen in Figure 4.58, Line 1, which is already operational, connects the Northwest suburbs of the state, starting at Cuautitlan and traveling downtown to Buenavista. Two more anticipated lines, Line 2 and Line 3, currently in the bidding process, will connect the city center to suburbs in the Northeast and Southeast respectively. Line 2 starts at Martin Carrera in the Federal District and ends northeast of the city at Jardines de Morelos in Mexico State. Line 3 starts at La Paz and ends southeast of the city at Chalco. Additional extensions and secondary lines have also already been identified as future projects.

The commuter rail transports people further and faster than any other mode of transportation currently operating in Mexico City. The commuter rail reduces round trips to and from the city by 70% for a cost equal or less than the lower density modes it replaces; it also reduces carbon emissions by 14% (Mexico State website). It is projected that the commuter rail's Line 1 will transport an average of 320,000 passengers per day, which is about 7.6 % of the total amount of passengers currently transported by the subway system Metro (data calculated from www.metro.df.gob/mx).

| LINEA | LONGITUD |
|---|---|
| **SISTEMA 1** | |
| LÍNEA PRINCIPAL | |
| Buenavista-Cuautitlán | 27.0 Km |
| LÍNEAS SECUNDARIAS | |
| Cuautitlán-Huehuetoca | 21.0 Km |
| San Rafael-Tacuba | 10.0 Km |
| Lechería-Jaltocan | 21.0 Km |
| *SUBTOTAL* | *79.0 Km* |
| **SISTEMA 2** | |
| LÍNEA PRINCIPAL | |
| Jardines de Morelos-Martín Carrera | 21.0 Km |
| LÍNEAS SECUNDARIAS | |
| Buenavista - Polanco | 7.0 Km |
| Jardines de Morelos-Teotihuacán | 19.5 Km |
| Teotihuacán-Tecamac | 23 Km |
| Naucalpan-Martín Carrera | 19.0 Km |
| *SUBTOTAL* | *89.5 Km* |
| **SISTEMA 3** | |
| LINEA PRINCIPAL | |
| Chalco-Nezahualcóyotl (Línea B) | 30.4 Km |
| LÍNEAS SECUNDARIAS | |
| San Rafael-Nezahualcóyotl (Línea B) | 25.0 Km |
| La Paz-Texcoco | 22.0 Km |
| *SUBTOTAL* | *77.4 Km* |
| *TOTAL* | *245.9 Km* |




Source: SCT, 2008

*Figure 4.58: Map of Commuter Train Existing and Proposed Lines*

*Location*

Mexico City is the capital city of Mexico. It has a population over 8.8 million (Consejo Nacional de Poblacion, not dated). Greater Mexico City has a population exceeding 22 million (Estado de Mexico, No date). The Federal District is coextensive with Mexico City; both are governed by a single institution and are constitutionally considered to be the same entity (Political Constitution of the United Mexican States). The ZMVM is comprised of 16 Federal District delegations, 59 adjacent municipalities of Mexico State, and 29 municipalities of the State of Hidalgo (SEDUVI, No date). The ZMVM produces more than a third of the Mexico's GDP (Tourism Secretary of Mexico, not dated).

Mexico State is in the central area of Mexico. It is bordered by the states of Hidalgo and Queretaro to the north, Tlaxcala, and Puebla to the east, Guerrero and Morelos to the south and Michoacán to the west. The majority of the population of the state is within the Greater Mexico City area. Major industries include manufacturing, construction, commerce, finance, metal products, food, clothes and chemical industry, and agriculture.

*Sponsors*

The commuter rail project is a collaborative project between SCT, the government of Mexico State, the Federal District government, and Construcciones y Auxiliar de Ferrocarriles (CAF), the private concessionaire. CAF was awarded the contract to build the additional infrastructure necessary for the commuter rail, and operate the line in August 2005. In 2006 the project, which was already under construction, was made part of the NIP.

### 4.5.2 History

The commuter rail project was first conceived by SCT in 1999 during President Zedillo's term of office. The original project planned to serve 500 million passengers annually on 151 miles of existing tracks and was scheduled for completion by 2006. It was to be built in three phases using private investment for its construction and operation. Operation was to be overseen by a special government agency that would be created for that purpose. The investment for the first phase was estimated at US$589 million for 28 miles of track. The commuter rail was also expected to have connections to Queretaro in the north and Veracruz in the east (All Business, 1999).

During President Vicente Fox's term (2000 to 2006) feasibility studies were updated and the project scope was revised; the project was considered a priority by the federal government. In 2003, an "Agreement of Collaboration" between the Secretary of SCT, the Mexico state governor, and the Federal District government chief was signed. During this term the concession bidding process was started and finally awarded in August 2005 to a consortium led by the Spanish firm Construcciones y Auxiliar de Ferrocarriles (CAF).

The Mexico City suburban train project is notable because of the various levels of government and the private-sector working together throughout the process. As Business Mexico columnist Gary Deaton noted: *"One of the most surprising aspects of the project is that it is being achieved via cooperation among three levels of government and three political parties"* (Deaton, 2004). In total 11 collaboration agreements were signed by the federal government with the Mexico State government and the Federal District government (see Table 4.14 for a complete list of these agreements). Individual cities were not involved in the development of the project nor with the public works related to it. At the federal level, the project falls under the General Directorate of Rail and Multimodal Transport of SCT. At the state level, it falls under the Transport Secretariat of Mexico state and in the Federal District under the Government Secretariat, Transport and Roadways Secretariat (SETRAVI), and the Environmental Secretariat and the Delegations of Cuauhtemoc and Azcapotzalco.

**Table 4.14: List of Agreements Signed between all Government Levels**

| Parties Involved | Purpose | Dates |
|---|---|---|
| Tripart agreement between Federal Government, Mexico State Government, and Federal District Government | Initial Agreement | 11-Jun-03 |
| | Development of Lines 2 and 3 | 29-Nov-06 |
| | Development of Lines 2 and 3 | 31-Aug-07 |
| Bipartisan agreement between Federal Government and Mexico State Government | Coordination Agreement | 4-Dec-07 |
| | Coordination Agreement | 24-Jun-05 |
| | Coordination of Public Works, Services and acquisitions | 30-Jun-06 |
| | Resettlement of people and properties | 21-Sep-06 |
| | Development of Lines 2 and 3 | 11-Jul-07 |
| Specific Agreement between Federal Government and Federal District Government | Execution Agreement | 10-Feb-04 |
| | Execution Annex No. 1 | 31-Mar-05 |
| | Execution Annex No. 2 | 2-May-08 |

Source: SCT, 2008

Because the rail ROW had to be confined to existing ROW, it was necessary to construct several pedestrian and vehicle crossings. These were all part of the public works that were undertaken by the SCT. There are a total of 24 pedestrian crossings along the rail line, 9 of which are located in the Federal District and 15 in Mexico State. Figure 4.59 shows a typical pedestrian crossing found along Line 1; the total investment for these crossings was US$7.7 million[3]. A total of 15 vehicle crossings were built, 6 bridges are located in the Federal District and 9 in Mexico State. The total 5.59 miles of crossings required an investment of US$148.6 million[4] by the federal government. Table 4.15 and Figure 4.60 show the locations of the crossings.

*Figure 4.59: Mexico City Commuter Rail Pedestrian Bridges*

**Table 4.15: List of Vehicle Crossings**

| Vehicle Crossing in Mexico State | Vehicle Crossings in Federal District |
|---|---|
| 1. Fresnos | 10. Circuito Interior |
| 2. Morelos | 11. Eulalia Guzman |
| 3. Venustiano Carranza | 12. Pino |
| 4. San Antonio | 13. Cipres |
| 5. Independencia | 14. Flores Magon |
| 6. Alcantarilla 11 de julio | 15. Eje 4 Norte |
| 7. Ferrocarrilera | |
| 8. Alcantarilla Mario Colin | |
| 9. Alcantarilla Ferrovalle | |

Source: SCT, 2008

[3] Currency exchange used for September 2008 USD$1 for every MX$11 (http://www.exchange-rates.org/history)
[4] Currency exchange used for September 2008 USD$1 for every MX$11 http://www.exchange-rates.org/history)

Mexico State was in charge of acquiring the land around the rail line for the construction of the stations. The Transport Secretariat of the Mexico state, which was created in 2002, was in charge of reorganizing the bus network in the vicinity of the commuter rail to serve as feeder routes to and from the stations. Previously, many of these busses provided transportation to downtown, but were rerouted as feeder routes for the commuter rail to relieve congestion. There were 42 existing private companies that provided service to what is now Line 1. The Transport Secretariat promoted participation agreements between the independent companies and the principal organizations so they would all have the same fixed price, provided electronic pre-pay systems, substituted the older vehicles with modern ones, and regulated the service and the training requirements (SCT, 2005). The Federal District's SETRAVI coordinated the commuter train's passage into the Federal District and the intermodal connections with the Metro and Metrobús.


Source: SCT, 2008.c

*Figure 4.60: Vehicle Crossings Locations*

The concessionaire chosen for the construction of line one of the commuter rail was CAF. This Spanish company is the same one that produces the train cars used for the Metro in Mexico City. The company has more than 100 years of experience in the design, construction, and maintenance of rail equipment, but this was the first time that CAF has entered into a concession to build and operate a commuter rail line. With their products being used on almost every continent, CAF is one of the leading rail equipment manufacturers (CAF website: www.caf.net). When the concession was awarded, CAF was required to establish a Mexican subsidiary that would construct and operate Line 1; this company is called FSuburbanos C.A. de C.V. This company is in charge of the construction of the stations and will operate the system for a 30-year period. A more detailed explanation of the concession process and requirements are explained in following sections.

*Feasibility Studies*

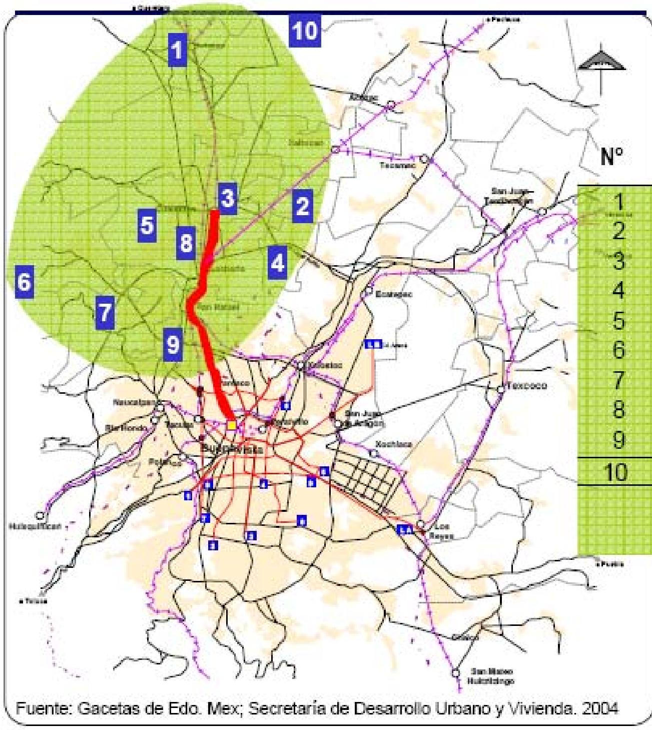
An initial feasibility study was conducted by SCT in 1997 during Vicente Fox's presidency. The study, called The System's Grand Vision, concluded that Line 1 would have a demand of 480,000 passengers per work day. Another study conducted by international consultant and MIT professor Dr. Ben Akiva in 1998 concluded a 465,000 passenger demand. This study, titled Demand Study of Buenavista-Huehuetoca Line, was based on a stated preference survey using discrete choice analysis.

In 2004, SCT conducted a second feasibility study using origin-destination and stated preference surveys conducted in the year 2000 and updated demand matrices that took into account the population growth and expected dwelling developments for the Line 1 area. Multimodal Equilibrium software, EMME 2, was used for this study. This study yielded better and more realistic results than the previous studies. Table 4.16 presents a comparison of the 2004 study with previous studies. Figure 4.61 shows that the largest multi-family developments in 2003-2004 were for the Cuautitlan and Tultitlan areas, both of which now have stations along Line 1.

**Table 4.16: Comparisons of 1997 & 2004 Commuter Rail Feasibility Studies**

| Parameter | Preliminary Results 2004 | Previous Studies |
|---|---|---|
| Annual Population increase | 4% | 2.80% |
| Annual Vehicle increase | 6% | 4% |
| Speed of travel | less than 9 mph | less than 15 mph |
| Passenger time value | 15 MXP | 12 MXP |
| Peak hour passengers | 200 thousand in 2 hours | 160 thousand in 3 hours |

Source: SCT, 2005




| Nº | Localidad | No. de Desarrollos | No. de Viviendas |
|---|---|---|---|
| 1 | Huehuetoca | 2 | 12,000 |
| 2 | Tultepec | 2 | 2, 288 |
| 3 | Cuautitlán | 3 | 11,116 |
| 4 | Coacalco | 3 | 1,767 |
| 5 | Cuautitlán Izcalli | 2 | 3,068 |
| 6 | Nicolás Romero | 1 | 1,173 |
| 7 | Atizapán | 3 | 530 |
| 8 | Tultitlán | 3 | 3,038 |
| 9 | Tlalnepantla | 1 | 190 |
| 10 | Zumpango | 1 | 25,000 |
| | Suma | 21 | 60,170 |

Source: SCT, 2005

*Figure 4.61: Approved Dwelling Developments in 2003 and 2004*

Apart from the studies conducted by SCT, the Transportation Secretariat of Mexico State also conducted a feasibility study. All of these documents were given to each of the bidding consortiums, who also conducted their own studies.

### 4.5.3 Planning

*Forecasting Traffic/Revenue*

The Level of Service (LOS) or minimum ridership was determined from the projections obtained from the feasibilities studies. SCT stated the minimum ridership required (8,000 passengers per day) and the maximum cost of the train fare. All bidders were given this information before they submitted their proposals.

CAF, the concessionaire for Line 1, also preformed forecasting/traffic and revenue studies, but as they are planning to bid on lines two and three, none of this information is publicly available.

*Cost-Benefit Analysis*

The Secretary of the Treasury and Public Credit (Secretaria de Hacienda y Credito Publica) is responsible for evaluating and approving projects that include public investment. The agency completed a cost-benefit analysis that included an executive summary, a projection of a no build situation and available alternatives, a description of the project, projections if the project was completed, sensitivity and risk analysis, and conclusions. This is required to begin the concession process of any project. In order to do the cost benefit analysis, there are studies done on demand, origin-destination, declared preferences, tariff studies, studies of materials, equipment and systems, cost studies and a business plan, among others.

As with the forecasting and traffic and revenue studies, cost-benefit analysis done by CAF was not available to the researchers due to the proprietary nature of the studies and the ongoing bid processes for Lines 2 and 3.

### 4.5.4 Environmental Process

According to SEMARNAT there was no environmental impact assessment done for the entirety of Line 1, though some assessments were done at the local level on specific construction jobs. None of the studies were available to the researchers.

Predictions made by SCT estimate that the train will lead to an annual reduction of 51,691 tons of gases and particulates. SCT also estimates that the train will produce less noise than the corresponding 5,200 transportation units with less capacity that it hopes to take out of service.

### 4.5.5 Right-of-Way Acquisition

There were already 254 km (157 miles) of existing rail line in the Federal District and therefore this project used existing ROW. The ROW is between 7 to 15 m (22–50 feet) wide, and it links to bus and metro stations. Currently, KCSM and Ferromex use this system from midnight to 6:00 a.m. Tracks are not shared during the day—freight has its own dedicated tracks in the ROW. Between 12:00 a.m. and 6:00 a.m.—when the commuter rail is not running—freight has access to the commuter rail lines. See Figure 4.62 for a view looking out of the suburban train car of the pre-existing ROW, multiple rail lines, and freight train traveling.


*Figure 4.62: Figure: Pre-existing Rail Lines*

KCSM and Ferromex purchased freight lines in the 1990s. KCSM owns a trunk route from Nuevo Laredo to Mexico City. Ferromex owns the southeastern routes to the Yucatan Peninsula and the northwestern lines to Arizona and California (Hawley, 2006). KCSM and Ferromex have contracts with the concessionaire (Aviles, 2009). The concessionaire noted that land use is changing around this commuter line. Developers bought up all free land as soon as the extension of the line to Mexico State was announced. Large sub-divisions are now being built (Aviles, 2009). See Figure 4.63 for a view of the close proximity of residential development to train tracks.

*Figure 4.63: Close Proximity of Residencies to Rail Line*

*Public Participation*

Interviewees from both SCT and CAF stated that public involvement is encouraged and desired, but that Mexico City residents do not seem particularly eager to join the process. In order to encourage public participation, SCT advertised the first step of the concession process, inviting citizen input, as well as the ability to form a consortium to bid for the project. However, there are some signs that public consideration is important to the development of this project and future projects.

For instance, one of the interviewees stated that a main lesson learned is to include interested parties earlier in the process. Specifically, SCT stated that the private bus operators gave a lot of pushback after the concession deal was in place, making it difficult to work out a sensible transportation system that integrated all modes of transportation in the area (Solis, 2009). In the future, it was suggested that local governments should be responsible for negotiating with affected parties long before the system is running or the bidding process unfolds (Solis, 2009).

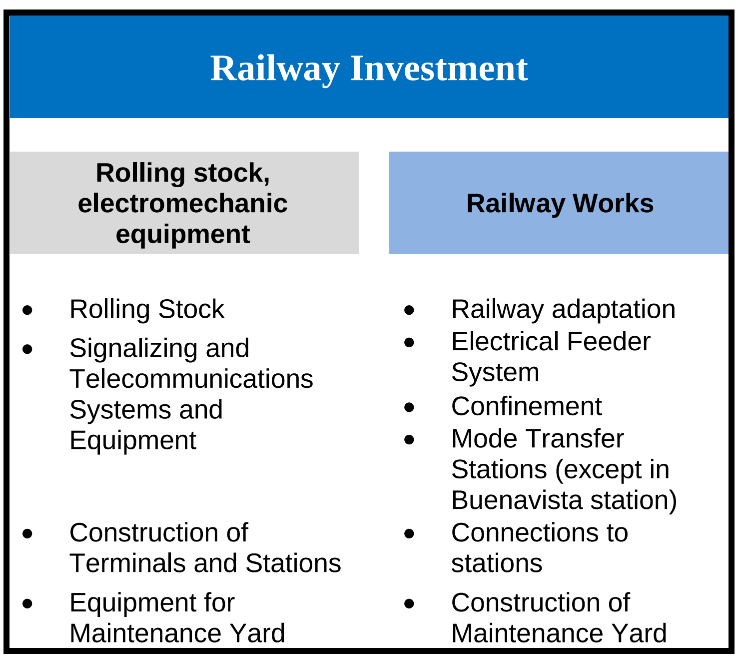
Also, while seemingly rare, there were signs that residents living near the tracks were unhappy with the new line. Resident Juan Luis Mejia Rios of Mexico City's northern Atlampa neighborhood stated that *"the train is being built according to the whims of the government and they are not taking into account the people who live here"* (Hawley, 2006). He went on to explain that residents in his apartment building are unhappy with the bridges over the tracks because it blocks light in their courtyard. Other news articles have mentioned protests by some residents who argued that the government did not provide houses that were promised to be replaced when the new terminals displaced them (http://www.jornada.unam.mx/2009 Website).

### 4.5.6 Project Implementation

*Financing*

The financing for this project is divided into two parts and came primarily from Mexico's federal government. The first part is the public works financing done solely by the federal government using public funds. The public works consist of the building of new pedestrian and vehicle crossings and right-of-way separation of the rail tracks. Resources used for these public works were included in BANOBRAS's Infrastructure Financing Fund and were offered in public tenders.

The second part of the finance scheme was the "Rail Investment" (*Inversion Ferroviaria, IF*). Funding for the IF was done by the Concessionaire with the support of the federal government. Figure 4.64 presents a schematic of what was included in the IF. The federal government only subsidized what falls under "Railway Works" (SCT, 2005).




Source: SCT, 2005

*Figure 4.64: Rail Investment (IF)*

Two trust funds were created for the development of Line 1. The first was established by the concessionaire as part of the contract requirements; it is a private trust fund for the warranty, administration, and payment fund. Public resources used to subsidized "Railway Works" are included in this trust fund. The trust fund will be in charge of the administration of all resources during the project execution and operation (SCT, 2005).

The second is a contingency fund, created to backup the partial payment of the concession debt in case there would be insufficient cash flow. These funds, used to mitigate the risks on the demand curve, are available until the debt is paid for or until they run out (SCT, 2005). Funds can be used when necessary on an automatic basis following the rules stipulated on the Trust.

All of the resources allocated to these trust funds, along with the funds used for the public works, are deposited in BANOBRAS. Resources that are not used at the end of the project execution will be returned to FINFRA.

According to a recent report presented at a seminar by SCT, the estimated cost of the entire Line 1 has been mentioned to be around US$706 million (SCT 2008.d). Mexico's federal government financed up to US$372 million for Line 1 and the rest has been financed by private investment through a concession scheme. Investment was US$239 million for the public works component and US$133 million rail works (SCT, 2008.d). Table 4.17 summarizes the investments by both parties.

**Table 4.17: Total Investment**

| | Amount (million USD) | % Investment |
|---|---|---|
| **Public Works** | **239** | |
| **Railway Works** | **133** | |
| **Total Public Investment** | **372** | **53%** |
| **Concessionaire's Investment** | **334** | **47%** |
| **Total Investment** | **706** | **100%** |

Source: SCT, 2008.d

This is a 30-year concession with a 12% rate of return (Avalos, 2008). The investment is expected to be recovered in 8 years (Solis, 2009). There is a profit share clause to pay back the federal government's share of the investment if the concessionaire makes a profit. This is determined by IRR. The concessionaire is free to develop stations and other commercial elements. Fares may be raised every three years to account for the impact of inflation.

*Concession Process*

According to Dr. Alejandro Solis of SCT, the Mexican government is moving into using concessions more often as a means of financing rail projects because it minimizes the risk to the government and assigns projects to groups who are better equipped with more capacity (Solis, 2009). The terms for the concession of passenger railway projects are outlined in the Railway Services Regulatory Law (Ley Reglamentaria del Servicio Ferroriario). This law states that the government is in charge of establishing the minimum level of service required and the maximum tariff that will be charge to users (Solis, 2009).

There are three phases in the concession process. The first is the announcement, which includes notices through various media inviting the public to participate in the development process. All interested parties can participate in an open hearing. The second phase is the consortium where interested parties get together to form a competitive "business group" to enter the bidding process. Lastly, there is the bidding process where SCT chooses a concessionaire based on the minimum fare, minimum level of service, and the bidders' technical, operational, and financial capacities. BANOBRAS carries out the bidding process as a neutral third party. The bidding is open to all national and international companies that qualify and the public announcement is made in the Diario Oficial which can be found at: www.fox.presidencia.gob.mx/actividades/?contenido=5534 .

At least one member in each consortium has to have the financial capacity to carry out the concession. The entity that will serve as operator can be either part of the Consortium or a contracted third party; either way technical capacity must be proven in order to qualify. The same thing applies for the entity serving as the contractor. All members must demonstrate their administrative and legal capacity. Participants that are qualified are allowed to change the group's conformation and incorporate new participants (SCT, 2005). Table 4.18 shows a list of the initial bidders for Line 1.

**Table 4.18: Total Investment**

**Bidders for Line 1:**

- ALSTOM
- CAF
- BOMBARDIER
- ELECNOR
- FERROSUR
- MITSUI
- SIEMENS
- INVERSIONISTAS EN AUTOTRANSPORTES MEXICANOS
- GRUPO MEXICO

Source: SCT, 2005

Of the nine companies that participated in the bidding process only two—ALSTOM and CAF—qualified. According to Mexican newspaper *La Jornada*, CAF was initially disqualified from the bidding process for Line 1 due to technical incapacities by the consortium; these allegations were not accepted by the Spanish company as they filed for a revision of their case.[5] The bidding process was then declared abandoned by the SCT and they announced a second public notice for bids one week later. The only two companies that participated in this second bidding process were ALSTOM and CAF.

The concession was finally awarded in August 2005 to CAF. CAF received a 30-year concession to build, operate, and maintain the line. Ferrocarriles Suburbanos, C.A. de S.V. (FSuburbanos), was formed under CAF to operate the train. The concessionaire noted that they won this bid based on their 'fare pricing' (Avalos, 2008); CAF's bid proposal required the lowest

[5] The researchers did not obtain any official information on this matter by any of the parties interviewed.

passenger fare. They are responsible for reaching projected ridership levels to maintain their return of investment. The contract allows for the concessionaire to develop commercial space around the stations. The contract also states that the concessionaire has five years to extend the commuter rail line another 23km (14 miles); if CAF does not undertake this expansion, SCT will open a public bid (Solis, 2009). CAF has already expressed their interest in expanding Line 1 as studies have shown that this extension will add to overall route profitability (Aviles, 2009).

Operations of Line 1 started on June 1, 2008 in five of the seven stations, 35 months after the concession was awarded. The last two stations were supposed to be ready for service for the Fall of 2008 but did not start until January 5, 2009 due to delays in the construction of pedestrian and vehicle crossings and right-of-way issues (Solis Peña, 2009). Line 1 is 27 km long with a planned 23 km extension within 5 years; the NIP includes this expansion in its 2008-2011 calendars. The NIP mentions an estimated investment of MXP1 billion for this expansion (NIP, 2007). Figure 4.65 shows a map of Line 1's seven stations; all of them are currently operational.

Of the three lines that make up the Mexico City commuter rail, Line 1 was the first one to be constructed because it had several advantages that help reduce investment costs. These included four parallel rail lines, two of which were already electrified (Presidencia de la República Press Conference, 2003). The line runs from Cuautitlán in Mexico State to Buenavista in the Federal District, where it connects with the Metro's Line B, Line 2 and Line 3, and the Metrobús; it also has connection to the Metro's Line 6 in Fortuna Station.


Source: Ferrocarriles Suburbanos, no date

*Figure 4.65: Location of Line 1 Stations*

The design demand for Line 1 is estimated at 320,000 passengers per day and over 1 million passengers per year by the third year of service (Solis, 2009). These numbers are comparable to the Chicago commuter rail operated by Metra which transported an average of 324,300 passengers in 2008 and it is much higher than the MTA Metro-North Railroad in New York, which reported a ridership of 291,900 passengers in 2008 (American Public Transportation Association, 2008). During the site visits in February 2009 the concessionaire indicated that they are currently operating around 85,000 passengers a day, stating that they were on track with their ridership forecasts (Aviles, 2009). The trains are currently operated with 6 minute headways during peak times—6:00 a.m. to 9:00 a.m. and 6:00 p.m. to 9:00 p.m.—and 10 minute headways for off-peak periods. Figure 4.66 shows the high concentration of passengers in the terminal station of Buenavista even during an off-peak traveling period.


*Figure 4.66: Figure: Passengers at Buenavista Station at Off-Peak Time*

The hours of service for Line 1 are Monday through Friday, from 5am to 12.30am; Saturday, from 6:00 a.m. to 12.30 a.m.; and Sunday, from 7:00 a.m. to 12.30 a.m. There is a modal transfer station, dubbed CETRAM, in every station (Figure 4.67). These provide access to passengers coming into the station in other modes of transport. Each of these CETRAMs has commercial spaces that are being concessioned out by FSuburbanos. When passengers access the train stations via stairs, escalators, or elevators located at street level, they go through this commercial area. The idea is to provide all kinds of retail products and necessities a passenger might need without having to go anywhere else after leaving the station (Aviles, 2009). Figure 4.68 shows one of these commercial spaces being constructed in Cuautitlán Station. The original plans showed the construction of a 1.08 million square feet shopping and entertainment center, along with a 947,000 square feet parking garage at Buenavista. This center included retail stores, movie theaters, a hotel, restaurants, and recreational and cultural areas (SCT, 2005). Currently, the concessionaire is constructing the shopping center; there was no mention of any additional construction plans. The design and construction of the stations, commercial spaces, and CETRAMs was done by the concessionaire. The stations are clean and modern in style. The designs are attractive and inviting, making it attractive and comfortable for the users.

*Figure 4.67: Transfer Station (Centro de Transferencia Modal, CETRAM)*


*Figure 4.68: Figure: Commercial Space under Construction*

The commuter rail uses electric trains that can travel at a maximum speed of 130 km/hr (80 mph) and at 65km/hr (40 mph) commercial speed. Each train unit, like the one seen in Figure 4.69, is composed of 4 carriages that can carry up to 1,100 passengers. During peak hours the train operates with two units carrying up to 2,200 passengers. The train cart model used is the same model used in Spanish rail systems, which are articulated and allows for passengers to move from carriage to carriage; refer to Figure 4.70 for a view inside the carriage (FSuburbanos website). All trains are equipped to handle passengers with visual and physical disabilities. Areas designed for these passengers have a signaling button that is used for the passenger to signal the conductor when he or she wants to get off, so more time can be provided for them to get off the train (Aviles, 2009).

Source: Ferrocariles Suburbanos, no date

*Figure 4.69: Train at Buena Vista Station*

Source: Ferrocariles Suburbanos, No date

*Figure 4.70: Inside the Train*

The cost of riding the commuter rail is comparable to the cost of the private buses it replaced. Previously, a passenger traveling from Cuautitlán to the Federal District would pay MXP $19 to MXP $20; the price for riding Line 1 is up to MXP $19 if the passenger travels by another mode to get to the station (Aviles, 2009). The cost will depend on the distance traveled by the passengers because cost varies within zones established by the concessionaire. Figure 4.71 presents a chart of these varying prices. Fare prices already include the IVA and will be automatically adjusted to account for inflation (SCT 2005).

| | Cuautitlán | Tultitlán | Lechería | San Rafael | Tlalnepantla | Metro |
|---|---|---|---|---|---|---|
| Cuautitlán | – – – | $5.50 | $5.50 | $11.00 | $11.00 | $12.50 |
| Tultitlán | $5.50 | – – – | $5.50 | $5.50 | $11.00 | $11.00 |
| Lechería | $5.50 | $5.50 | – – – | $5.50 | $5.50 | $11.00 |
| San Rafael | $11.00 | $5.50 | $5.50 | – – – | $5.50 | $5.50 |
| Tlalnepantla | $11.00 | $11.00 | $5.50 | $5.50 | – – – | $5.50 |
| Metro | $12.50 | $11.00 | $11.00 | $5.50 | $5.50 | – – – |

Source: Ferrocariles Suburbanos

*Figure 4.71: Fare Pricing*

Line 1 utilizes an electronic fare card system that has an initial cost of MXP $11.50 and it is valid for one year. In order to acquire a card a passenger will need to pay MXP $25: MXP $11.50 for the card and MXP $13.50 to serve as a balance for future trips. The card is not transferable and can be recharged at every station. The cost of a trip—between MXP 5.50 and MXP 12.50—is charged at the end of the trip as you slide your card through a reader at the turnstile. The fare card can be recharged three ways: (1) electronic machine with change option;

(2) electronic machine with no change option; (3) ticket office. Figure 4.73 shows both of these machines. The concessionaire is currently working with SCT to establish special tariffs for students, senior citizens, and tourists (Aviles, 2009).


Source: Ferrocariles Suburbanos, No date

*Figure 4.72: Rechargeable Card*


*Figure 4.73: Change Option and No-Change Option Ticket Machines*

Buenavista Station

The original Buenavista Station was constructed in the 1800s, but was demolished in the 1960s to construct a new terminal. The new station was inaugurated in 1961 and went out of service for passenger rail in 1999. The station was then remodeled for the Tren Suburbano, but the outside was kept intact, and is considered to be a historical building (Ferrocarril Suburbano de Ciudad de Mexico). Since Buenavista Station was named a historical site, the concessionaire has decided to incorporate a cultural space into the station. At the time of the researchers' visit, they were currently holding an exhibition on "CAF's Operations Around the World," effectively introducing other cultures through the lens of travel while advertising CAF's world-wide service (Figures 4.74 and 4.75).


*Figure 4.74: Cultural Exhibition at Buena Vista Station*


*Figure 4.75: CAF Advertising at Buena Vista Station*

*Construction of Lines 2 & 3*

There will be two more Lines—2 and 3. Line three was expected to be awarded in 2008 and line 2 in early 2009, but so far the concessions have not been issued. Lines 2 and 3 will also have mainly federal government and private investment funding but Line 3 will also have some funding from Mexico State government.

Line 2 will serve the northeast part of Mexico City and will have a 19-km length (Figure 4.76). This is a shortened route from the original proposal by 37.5 km (23 miles), which would cross towards the west suburb of Naucalpan. While Mexico City government mentions an additional 52 kilometer of possible expansion, those are not included in the NIP.


Source: Ferrocarriles Suburbanos~~Ferrocarriles Suburbanos~~, No date

*Figure 4.76: Location of Line 2 Stations*

Line 3 will run only in the eastern part of the city, along the border of Mexico State and Federal District and only touching the former's territory. Line 3 will have an initial length of 13 km (there could be 58 km of potential expansion). Line 3 will require MXP$3.3 billion of public investment and MXP$2.2 billion in private investment. It is expected to have a ridership of 204,065 passengers per day on work days and 114,276 on non-work days. The tender for construction of Line 3 was opened in February 2008 and the results were expected in August 2008, but the process has been suspended.

Table 4.19 shows the companies participating in the bid process for Line 3, and Figure 4.77 shows the route of Line 3.

**Table 4.19: Companies Participating in tender for Line 3**

| |
|---|
| **Construcciones y Auxiliar de Ferrocarriles S.A. (CAF)** |
| Global Via Infraestructuras S.A. y Mexicana de Global Via Infraestructuras S.A. de C.V. |
| **Grupo Mexico S.A.B. de C.V.** |
| Controladora de Operaciones de Infraestructura S.A. de C.V. y Alstom Mexicana S.A. de C.V. |
| **PCZ Construcciones, S.A. de C.V.** |
| Mitsubishi Corporation |
| **Bombardier transportation Mexico, S.A. de C.V.** |
| Siements S.A. C.V. y Siemens Innovaciones, S.A. de C.V. |
| **Compahía de Concessoes Rodoviárias México S. de R.L. de C.V.** |
| Mitsui & Co., Ltd |

Source: SCT, 2008.d


Source: Ferrocarriles Suburbanos, Not dated

*Figure 4.77: Location of Line 3 Stations*

*Recent Train Collision*

On April 18, 2009, two trains on commuter rail Line 1 collided, resulting in 109 injuries. The accident was likely caused by human error. The conductor of one train is thought to have gone through a red light in the tunnel that should have signaled a train ahead without slowing down. As the train rounded a corner, the conductor saw the train ahead and activated the emergency brake, but not in time to avoid the collision. There are two investigations into the cause of the accident, one by CAF and another by the Mexican Attorney General's office. The impact of this accident on future lines or ridership is still unclear (Solis Peña, 2009).

### 4.5.7 Conclusions

Because of the growing population and large concentration of residents commuting in and out of Mexico City, more efficient travel, less congestion, and less environmental impact were important factors for infrastructure development in this area. The development of a commuter rail system that could transport hundreds of thousands of suburban commuters each day, greatly reducing travel time, vehicle congestion, and pollution, has spanned three Mexican presidencies with continued support. This commuter rail system serves commuters between the Mexico City greater metropolitan area to municipalities in the Northwest with future extensions planned for the Northwest and Southeast.

The project initially conceived in 1999, was updated over time, and eventually became a part of the NIP. It is sponsored at all levels of government—SCT, Mexico State, and the Federal District—and includes a public-private partnership. It is unique because of the working cooperation between the different levels of government as well as the successful concession process and the positive partnership with the concessionaire. It is also unique because it is the first commuter rail project in Mexico, uses existing rail infrastructure, and vastly improves commuter efficiency, pollution, and congestion.

The concessionaire chosen for the project was Construcciones y Auxiliar de Ferrocarriles (CAF), a Spanish company. The concession process has been refined with time and, based on interviews with SCT and the concessionaire, the commuter rail concession process has been smooth and successful. The process, outlined by Mexican law, is broken down into three separate phases: the announcement, consortium, and bidding. SCT has made significant progress in keeping the three phases as open and transparent as possible, lessening corruption and public discontent. To further maintain fairness and avoid corruption, SCT used a third-party banking agent, BANOBRAS, to carry out the bidding process. SCT hopes to continue public-private partnerships for infrastructure development in the future (de Solis, 2009).

The concessionaire, CAF, won the bid in 2005 based on LOS and their fare pricing. CAF was awarded a 30-year concession to build, operate, and maintain line 1—27 km—with the option of extending line 1 service—23 km—within the next 5 years. According to CAF, the concessionaire expects to recover their initial investment after 8 years, with a 12% rate of return (Aviles, 2009). CAF has their own funding scheme, but relied on the federal government to subsidize projects falling under railway works. There were two trust funds established—one to execute the project, the other to pay down the concession debt—which were deposited into one general fund—the BANOBRAS' Infrastructure Investment Fund. The government was responsible for funding and building the pedestrian and vehicle crossings.

The commuter rail reduces a trip from the suburbs to the city from around 150 minutes to 25 minutes. It also reduces car trips by an estimated 1500 cars per day, significantly reducing the amount of congestion and pollution. It is currently transporting around 85,000 passengers per day, as projected (Aviles, 2009). It is projected that the commuter rail could transport an average of 300,000 passengers per day, and 1 million per year, after 3 years of operation. In the end, the cost to ride the commuter rail is equal or less than the cost of riding the private buses, which is between MXP $19 and MXP $20, and saves 65 minutes. Overall, it is estimated that 20,000 cars could come of the roads and diminish the 246 tons of pollution that antiquated buses release daily (Deaton, 2004). One source states it could decrease harmful emissions by 5,451 metric tons from cars and buses combined (SourceMex, No date).

So far ridership is on track as forecasted and CAF has stayed on schedule. Due to the global economic downturn, biddings of Line 3 and Line 2 have been put on hold (Telephone interview with Eng. Santos Villarreal, 21 May 2009). The electrical system is high-tech, requiring no conductors, utilizing electronic fare cards, and moving quickly with a headway of 6 minutes at rush hour.

As stated earlier, SCT said that a lesson they learned for future concession processes is to involve interested parties—the public and/or affected private companies—earlier in the process so that agreements can be reached in cooperation. In the future, it was suggested that local governments should be responsible for negotiating with affected parties long before the system is running or the bidding process unfolds (de Solis, 2009).

Mexico City commuter rail is notable for the apparent rider satisfaction, the incorporation of the commercial development facilities, and the cultural outreach and attractive design of the main stations. The buildings, machines, and service are clean, clear, and modern in style, making commuter travel easy and fun. Each station has a transfer station to other modes of travel and includes commercial space, streamlining the travel process for commuters, and providing opportunities for additional shopping and revenue.

## 4.6 Monterrey's General Mariano Escobedo International Airport Expansion

Monterrey is the capitol city of the northeastern Mexican state of Nuevo Leon, which stretches from the state of San Louis Potosi to the United States border. The city itself is home to about 1.1 million people and another 2.7 million are distributed in its metropolitan area between the surrounding cities of San Pedro Garza Garcia, Juarez, Garcia, Santa Catarina, Escobedo, Guadalupe, Apodaca, and San Nicolas de los Garza. The metropolitan area of Monterrey averages 55 inhabitants per square mile, making it the third most populous city in Mexico and the second-largest urban area in Mexico, trailing only Mexico City. The city is growing at an annual rate of 2.4% (Monterrey, No date). Monterrey is known as *la ciudad de las montanas* (the city of the mountains) because of its peculiar location, which is surrounded by the Sierra Madre Oriental mountain range (Monterrey, No date) as shown in Figure 4.78.

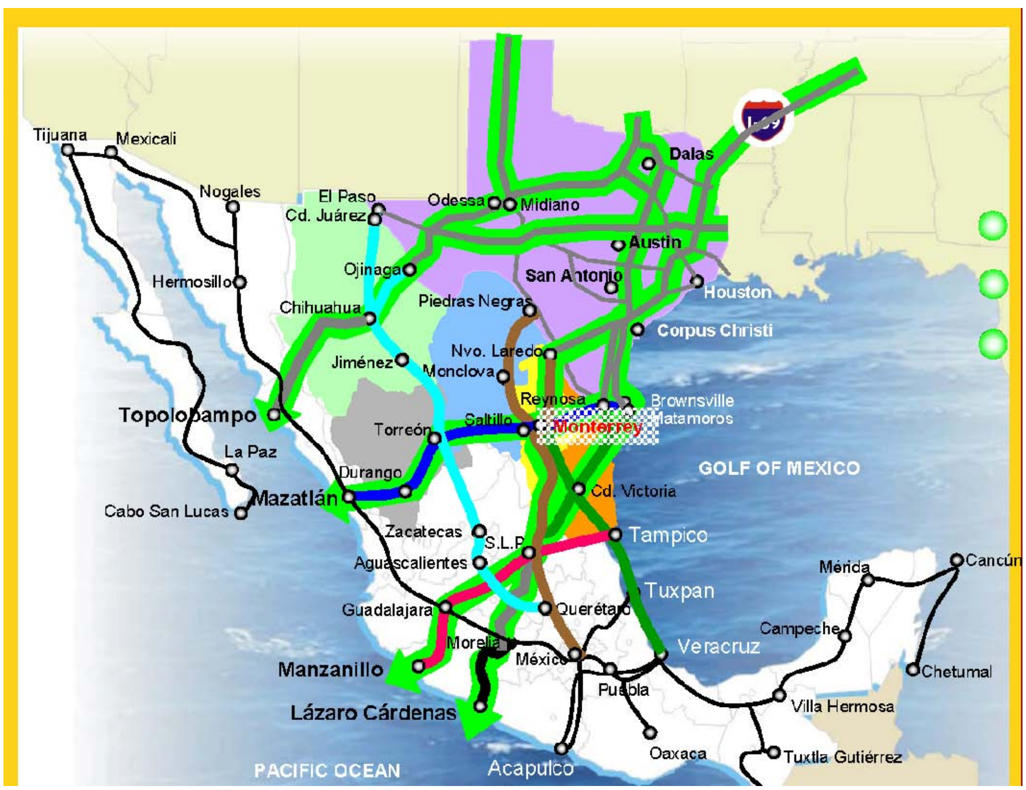
Source: (Monterrey, No date)

*Figure 4.78: Monterrey from above*

Monterrey is one of the oldest cities in Mexico. It was founded in 1596 when Don Diego de Montemayor settled the region (Monterrey, No date). During Spanish rule, Monterrey was a small city that served as a facilitator of trade between San Antonio, Tampico, and Saltillo. Tampico imported products from Europe, and Saltillo connected the northern Mexican cities to Mexico City (Monterrey, No date). In 1824, Nuevo León was established as part of the Mexican Republic. In 1885, Bernardo Reyes was named provisional governor of Nuevo Leon and changed the region into what it is today, a hub of economic development and industrial activities. Reyes developed banking institutions, government buildings, and the Gran Plaza. In addition, two of the oldest factories, Cervecería Cuauhtemoc, a brewery, and the Compañía Fundidora de Fierro y Acero de Monterrey, a foundry, were established around this time (Monterrey, No date).

In 1850, the first factory was established in Nuevo Leon. Today, more than 100,000 industries operate in Monterrey (13,251 manufacturing, 55,302 retail, 51,028 service, 1,755 other). Also created or produced in Monterrey are 75% of all glass and corn flour, 70% of all household appliances, 60% of all synthetic fibers and cement, 50% of all beer and ceramic products, and 25% of all of the steel in Nuevo Leon. In addition, Monterrey is second only to Mexico City in the production of steel, which is a motif of the airport and new expansion.

The city is only 200 miles from the U.S. border and sits on Highway 57 which connects at Laredo to IH–35 making Monterrey an ideal area for exports to the U.S, and imports into Mexico. It is responsible for 85% of Nuevo Leon's population and is home to 54% of the state's industries. Overall, Nuevo Leon is home to roughly 4% of the entire population of Mexico, but generates over 8% of the country's GDP as well as 9.4% of all of the total products in Mexico. Monterrey brought in $1.7 billion in direct foreign investment in 2002, which accounted for 11.9% of Mexico's total foreign direct investment (Monterrey, No date). For these reason, Monterrey is known as the business capitol of Mexico. Monterrey's major industries, beer, glass, steel and finance, have pushed the development of the city and created a need for increased infrastructure to handle the products created in Monterrey and also products from around Mexico that need to be shipped into the United States (Day, 2006). Figure 4.79 shows Monterrey's location and its relationship to Mexico and the interstate highway network in Texas.




Source: Alejo, 2006

*Figure 4.79: Monterrey's Location to Mexico and Texas and U.S.*

### 4.6.2 Project Description

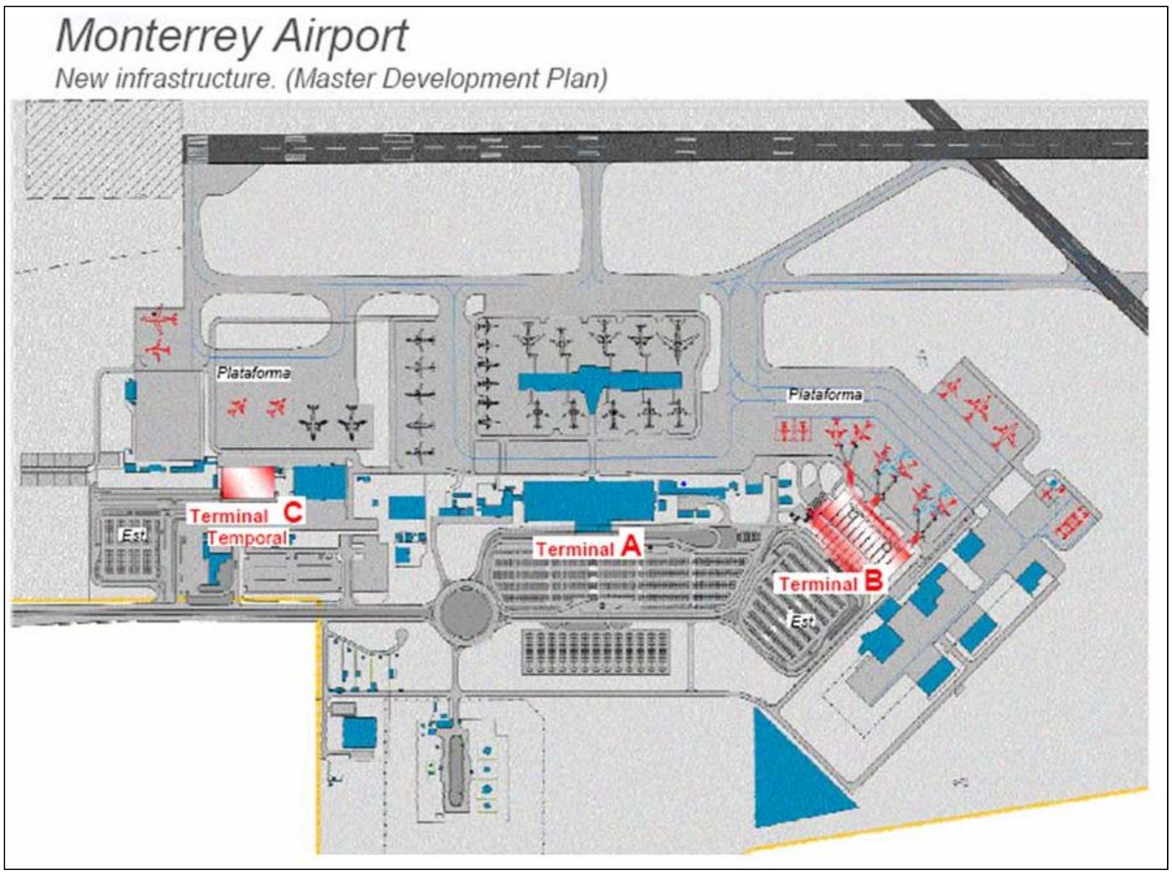
The project examined in this case study is the construction of a new passenger air terminal at the international airport in Monterrey known as the Terminal B. It is intended to relieve the chronic congestion at this airport and provide better experience for international passengers. It forms part of three terminal expansions which include Terminal A and Terminal C which were completed in 2008. The expansion of General Mariano Escobedo International Airport is sponsored by the private-sector with oversight from OMA; a private group who were given a concession to operate General Mariano Esocbedo International Airport and 12 other airports as part of Mexico's airport privatization process that began in 1998. The project continues procedures that were used during the Terminal A expansion. These private investors have invested around MXP$700 million to date, which is about US$47 million (González González, 2009). It should be noted that this expansion is not a part of the NIP introduced by President Calderon in 2007.

### 4.6.3 History

The General Mariano Escobedo International Airport was originally completed on November 25, 1970 to provide service to the Monterrey metropolitan area. It is located about 15 miles north east of Monterrey around the small city of Apodaca (Monterrey, No date). At the time, Monterrey's other airport, Del Norte, had problems with inefficiency and mismanagement. Del Norte's infrastructure was not capable of handling the increased traffic from the rapidly developing metropolis of Monterrey. In addition, the airport could not handle the amount of planes that needed to be housed in order to meet demand (González González, 2009). The final straw came in 1969 when a plane crashed on its final descent into Del Norte. The plane contained Carlos Alberto Madrazo and his wife, who were the parents of former PRI presidential candidate Roberto Madrazo Pintado (Martínez and Rodríguez, 2008). The crash, coupled with the obvious need for new facilities, left the state of Nuevo Leon with little choice. Almost immediately, plans were developed and ground was broken for a new airport. The new General Escobedo International Airport replaced Del Norte as Monterrey's foremost airport. Del Norte airport is still operational today, but is used for private purposes only (González González, 2009).

In 1998, the Mexican government privatized most of the airports around the country. In order to facilitate this change and to retain some oversight of the industry, the Mexican government created *Grupo Aeroportuario del Centro Norte* or North Central Airport Group (OMA) and *Grupo Aeroportuario del Pacifico* or Pacific Airport Group (GAP). OMA has concessions to operate thirteen airports in nine north-central Mexican states. The concessions have 50-year terms that began on November 1, 1998. The length of the term may be extended by SCT for an additional 50 years. The concessions also allow OMA the right to occupy, use, and improve land adjacent to its airports (Monterrey, No date). GAP operates twelve airports on the Pacific Coast of Mexico (M2 Communications, 2008). The Mexican government sold 15% of OMA to *Operadora Mexicana de Aeropuertos* Mexican Airports Operator, which is now called *Servicios de Tecnologia Aeroportuaria* or Airport Technology Services (SETA). SETA is a consortium of corporations like *Aéroports de Paris Management*, VINCI, and *Empresas ICA*, through its subsidiary *Aeroinvest S.A. de C.V.* In 2005, *Empresas ICA* acquired 38% of the government's shares, as well as VINCI's share of the private concession. In 2006, the government sold its remaining shares on the stock market and no longer holds any financial interest in OMA (OMA, History, not dated).

In September 2000, OMA began its management of General Mariano Escobedo International Airport in Monterrey and immediately drew up plans to expand the already built Terminal A to add an additional 5000 square feet (Monterrey, No date). The extra space was designed to draw in new business, including restaurants and other shops, as well as airlines. In fact, the addition brought in a steady stream of Mexican and international airliners that were willing to do business at General Escobedo. Airlines like Aviacsa, Aeromexico Connect, LLC Viva Aerobus, and Magnicharters all have their operational headquarters inside of the redesigned Terminal A (Monterrey, No date). The expansion of Terminal A helped OMA to realize that General Escobedo had a lot of potential and would eventually lead to the new expansion of Terminal B. Figure 4.80 shows the new infrastructure and proposed Master Development Plan for all three terminals.




Source: OMA, No date.

*Figure 4.80: Monterrey Airport Expansion Master Development Plan*

*Airport Management*

In 1998, the Mexican government passed the Law of Airports (*ley de aeropuertos*). The law effectively privatized airports around the country and designated regional management companies to operate them. One of the groups created is *Grupo Aeroportuario del Centro Norte* (OMA). OMA received concessions to operate thirteen airports in nine north-central Mexican states. The concessions have 50-year terms that began on November 1, 1998. The concessions also allow OMA the right to occupy, use, and improve land adjacent to its airports. The length of the term may be extended by the SCT for an additional 50 years (OMA, No date).

In September 2008, OMA ended its incentive program that encouraged airlines to develop new routes and increase traffic. The termination of this program, coupled with the current economic situation, has caused double-digit decreases in passenger traffic for October and November 2008, which are the most recent traffic reports. Prior to September, traffic was steadily increasing dating back to 2006 (OMA, 2008.b).

Terminal A is considered the one of the most modern airport facilities in Mexico—indeed, in Latin America. The building is divided into two concourses: the North Concourse and the South Concourse. The North Concourse is used exclusively for domestic flights and is comprised of gates A1 to A15. Aero California, Volaris, Mexicana, Click Mexicana, Aeromar, Aeromexico, ALMA de Mexico, Magnicharters, Lineas Aereas Azteca, Interjet, and Aviacsa all operate from the North Concourse with domestic flights around the country. The South Concourse, on the other hand, is used exclusively for international flights and comprised of gates B3 to B8. Aeromexico, Mexicana, Manicharters, Delta, Aerolitorial, American, Aviacsa, Continental, and Continental Express all operate out of the South Concourse (Onpedia, n.d.). In total, the airport handles about 190 direct flights each week to 10 American cities: 28 to Atlanta, 14 to Chicago, 28 to Dallas, 61 to Houston, 12 to Las Vegas, 14 to Los Angeles, 7 to Miami, 4 to New York, and 13 to San Antonio (Monterrey, No date). Terminal A has check-in facilities, baggage claim, shopping areas, restaurants, customs, and airline offices. American fast food chains like Carl's Jr., Wendy's, and Starbucks are present in the airport (González González, 2009). The structure of the airport has worked well for many years, until recently when increased passenger traffic forced OMA into building the new terminal expansion (Aguilar, 2009).

*Cargo Management*

Terminal C is the cargo terminal at General Mariano Escobedo International Airport. It serves businesses like Fed Ex, UPS, and OMA Carga. The 4,000 $m^2$ (43,056 square foot) cargo terminal handles approximately 40,000 metric tons (44,092 US tons) per year. OMA Carga handles and stores packages up to and above 4,000 kg (8818 lb) and a million dollars in value. It offers storage at varying rates for any length of time. Moreover, OMA Carga offers services like dedicated cameras for the protection of freight and international export services. In addition to the aforementioned companies, AEROUNION, Aeromexpress Cargo, American Airlines, Cold Express, Mas Air Cargo, Estafeta, Bax Global, DHL Express, and Regional Cargo all operate out of Terminal C and supply cargo services to Monterrey. The cargo area itself has two cold rooms for the storage of perishable goods. Recently, OMA announced that a joint venture with EVA air and Mexpress has made it possible to combine air-land services to Asia, decreasing transit time by half. The route will take only 2–5 days as compared to 7–14 days. Also, OMA announced that a new Monterrey-Cancun-Europe corridor has been created and will connect Monterrey to 300 international destinations (OMA, 2008.a). OMA's own company, OMA Carga, imports raw materials for use elsewhere in the country. Materials like plastics, small electronics, small auto parts, and textiles are the most commonly handled products of the OMA cargo service (Hernandez, 2009.a).

Terminal C houses the cargo area of General Mariano Escobedo International Airport, as well as the passenger service of Viva Aerobus, which offers discounted flights to select destinations. Aerobus flies to Acapulco, Aguascalientes, Cancún, Chihuahua, Ciudad Juárez, Cuernavaca, Culiacán, Hermosillo, Ixtapa-Zihuatanejo, León, Mazatlán, Mérida, Mexicali, Morelia, Puerto Vallarta, Querétaro, San Luis Potosí, Tampico, Tijuana, Torreón, Veracruz, Villahermosa, and now even Austin, Texas (Viva Aerobus, not dated).

*Current Difficulties*

<u>Space</u>

The main problem with the existing structure of General Mariano Escobedo International Airport is space. Space has become a problem in a couple of ways. First, the space available for airlines is limited and no new departures can be configured within Terminal A. Demand for more exotic destinations has been identified by OMA and the airport's current configuration cannot handle this new demand. This poses a serious economic problem for OMA and other stakeholders. Leaving excess demand unserved could lead to the development of a new rival airport and ultimately means that the airport is not being run as efficiently as possible. Second, foreign airlines have also shown an interest in joining the airlines that are already located in Terminal A. Without expansion, General Mariano Escobedo International Airport cannot accommodate new airlines, even if they do not want to house their administration units inside of the airport itself (Aguilar, 2009). Figure 4.82 shows the additional space that has been created through the use of vaulted ceilings.

*Figure 4.81: Terminal B Concourse.*

Another issue with the current configuration of General Mariano Escobedo International Airport is the limited space that stores and restaurants must share. Currently, there are restaurants and stores in Terminal A, but the lack of space limits the amount of customers that can be served and the amount of income from stores. By adding Terminal B, OMA can build more restaurants, stores, and VIP lounges and increase their earnings potential of the airport (Aguilar, 2009).

The General Mariano Escobedo International Airport complex itself has unused space that needs to be utilized. The spot that has been chosen for the new Terminal B is located on an unused lot to the east of Terminal A. Utilizing this space makes sense from an economic standpoint, especially in light of the demand for increased flights and services. An added bonus to building Terminal B is that no new runways would need to be built. Only a slight redesign of the current runway will be needed in order to meet standards (Aguilar, 2009).

Passenger Segregation

Segregation of passengers continues to be an issue for the airport. Officials at OMA named this as a chief reason for the development of Terminal B. Mixing of passengers from departure and arrival, as well as the mixing of international and domestic passengers, make securing the airport a difficult job. Passengers express frustration in not knowing exactly where they have to go to make their flight or to get to customs. Passenger traffic has generally been increasing for years at General Escobedo, with the exception of a lull in October and November 2008, and the problems of integrating different passengers will only get harder (Aguilar, 2009). Figure 4.83 shows the new separation walls in Terminal B.

*Figure 4.82: Terminal B separation walls.*

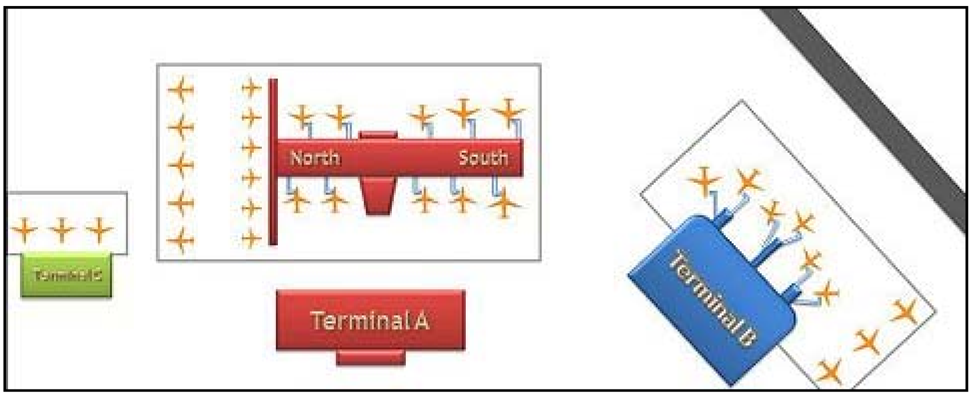
When speaking with OMA officials, the one thing that stood out was their insistence on the segregation of passengers. Over the years, Terminal A has had a lot of issues with passengers not knowing where to go and breakdowns in the flows of traffic. It was very important for OMA to construct the huge glass separation walls in Terminal B. They were determined not to let the same thing happen twice. In the process of developing the segregation plan they also found a way to lower electricity costs by using natural light. In the author's conversations with OMA officials this was the biggest lesson learned throughout their tenure as General Escobedo's administrators (Aguilar, 2009).

Also, according to Aguilar, airports are hubs for visiting traffic and are designed to be a representative of the cities that they serve. More and more, airports are designed to look and feel like their respective cities, and General Escobedo follows this pattern. General Escobedo relies on the use of large amounts of glass and metal throughout its terminals to display the industriousness of Monterrey. The airport's goals of efficiency and modernity mirror the general aesthetic of the city, effectively introducing travelers to the general feeling of Monterrey (Aguilar, 2009).

### 4.6.4 Planning

*Terminal B Expansion*

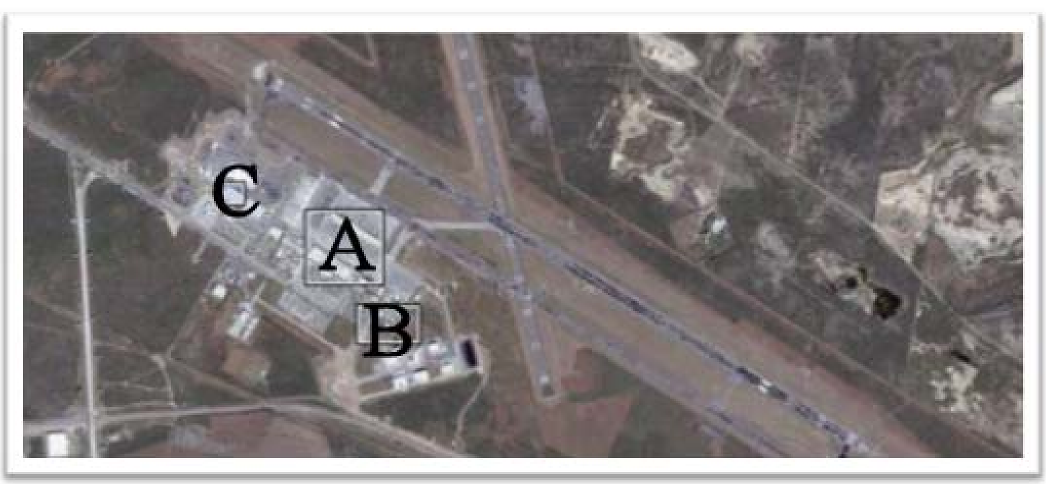
Figure 4.83 shows the site of new Terminal B in relation to the other terminals.




Source: (OMA, Construction, 2007)

*Figure 4.83: General Mariano Escobedo International Airport proposed design.*

Figure 4.84 shows an aerial view of this layout of the proposed three terminals.




Source: (Google Maps, 2009)

*Figure 4.84: Aerial Shot of General Mariano Escobedo International Airport*

The Terminal B expansion is located inside of the airport complex so no additional land was needed for this project. The expansion was described by airport officials as *"building a new airport inside of an existing airport."* Terminal B will be located to the east of Terminal A and on the opposite side of the airport from Terminal C (Aguilar, 2009). Terminal B covers 21,000 $m^2$ (226,042 square feet) with two levels and a mezzanine, with 2000 $m^2$ (21,527.8 square feet) for shops, restaurants, and other services (OMA, not dated). At its completion, the terminal will contain a huge amount of steel and glass that all will be purchased from local manufacturers. There is no formal agreement to use local products, but OMA has decided to use them at the Mexican government's request (Aguilar, 2009). It will also have six passenger runways, three contact position for regional planes, new parking for 450 vehicles, and four remote airplane parking conditions. The new runways will allow General Escobedo traffic controllers to coordinate the landing and departure of two planes simultaneously, which would make it one of the only in Latin America with that capability (SEC, 2007). Figure 4.85 shows part of the construction of Terminal B.


*Figure 4.85: General Mariano Escobedo International Airport Terminal B under construction.*

The terminal represents about a $47 million investment with expected capacity of 1.5 million passengers per year (SEC, 2007). The terminal is a part of OMA's Master Development Plan but its investment has exceeded the proposed amounts of the Master Development Plan (MDP). The design of the building was a joint venture between Victor Marquez Architectos and Aeroports da Paris Ingenieria. The design that was chosen was intended to make the airport one of the most *earth friendly* airports in Latin America. Large glass windows around the airport will allow natural light to flow into the airports and reduce electricity costs for OMA. Monterrey has an average of 14 hours of daylight per day, which is the main reason a building like this can be constructed. The windows will also create a feeling of openness and will increase how customers perceive the size of the airport (González González, 2009). To enhance this feeling, strategic colors were picked with the intention of creating a feeling of openness inside of the building. Space for historical exhibits has also been developed as can be seen in Figure 4.86.

Source: Los Contratistas, n.d.

*Figure 4.86: General Mariano Escobedo International Airport historical exhibit.*

On June 4, 2007, OMA began construction on a new Terminal B expansion at General Mariano Escobedo International Airport in Monterrey. The expansion was under development since 2001, but no physical work was done until groundbreaking in June of 2007 (Aguilar, 2009). The expansion plan is to increase the offering and scope of the airport by building a new terminal for airline passengers. New routes to France, England, and points in Europe will be the focus of this terminal. This international focus will combine with the U.S.-heavy itinerary of Terminal A in order to form a comprehensive airport that is able to reach the best tourist destinations of the world (Aguilar, 2009). The expansion will also lure new airlines into General Escobedo and it will allow the airport to control the flow of traffic by separating domestic and international departures. This terminal will be called Terminal B and will sit to the east of the existing Terminal A. It will also be a completely separate facility from Terminal C, which is a cargo terminal (Hernandez, 2009.a). Figure 4.87 shows construction of this new Terminal B.

*Figure 4.87: Terminal B Construction*

### 4.6.5 Project Implementation

*Concession for Terminal B*

Financing for the new terminal will come entirely from private investment, with oversight from OMA continuing with the procedures that were used during the Terminal A expansion. General Mariano Escobedo International Airport is privately owned and no new land had to be acquired to facilitate construction. However, OMA is allowed to use land adjacent to its current territory, but no such expropriation has taken place. OMA and its partners have decided to use only private investors in order to erect Terminal B. These private investors have invested around MXP$700 million (approximately US$53 million as of drafting) to date. There are no government contracts or incentives aside from the verbal agreement between OMA and the Mexican government to use local materials. This expansion is not a part of the NIP (González González, 2009).

Terminal B was scheduled to be completed by March 2009 and expected to be operational by June of 2009 (Aguilar 2009). The contract for the structure and foundation of the terminal was assigned to Empresas ICA with a workforce of about 700 workers (SEC, 2007). The airport's development was well underway and construction was almost completed when the authors visited the site in February of 2009. The major delay will be identifying, negotiating with, and then bringing in new airlines and developing new routes. This process is expected to take a few months and is the major delay in making the terminal fully operational (González González, 2009).

Terminal B will address General Escobedo's lack of space by doubling its passenger capacity. It will employ the use of large glass separating panels to keep international, domestic, arrivals, and departures separate. This will allow traffic to flow much more smoothly throughout the airport and will eliminate the confusion of where to go that customers currently face. The terminal will also develop six more runways to deal with the crowding during takeoffs and landings that is starting to occur now due to increased traffic. However, no external infrastructure has been developed in response to new terminal expansion. New store space will allow the airport to increase profits and give customers a better experience while not stalling the flow of traffic. In addition, there will be daycare area to ease the strain on travelers as they try to get to their destination. OMA is still in the process of finding a sponsor for this project but when it is completed it will be the first of its kind in Mexico. This is part of a strategy to attract more business passengers (Aguilar, 2009).

#### 4.6.6 Environmental Process

The Terminal B expansion has been handled in a very environmentally friendly way. OMA has conducted an environmental impact assessment but has not answered requests to share the study. The construction of Terminal A left little room for energy-saving modifications and OMA seemed determine to rectify that. Attention to details like lighting, coloring, water usage, and positioning have lowered the operating costs of Terminal B, while at the same time helping to reduce usage of nonrenewable energies. OMA officials have decided to reuse the water from the facility so that none is wasted. This could be a huge savings in the long run for OMA, as well as very environmentally friendly. The lighting of Terminal B is a unique way to lower costs and preserve the environment. Monterrey's 14 hours of light per day, in the summer, is an extremely cost-effective way of lighting the terminal and also very environmentally friendly (Figure 4.88 shows part of these glass-fronted concourses). It seems that Terminal B will be minimally invasive to the environment, and also have a lower overhead. The incredible amount of glass that was used may cost more in the short term but in the long term the glass will save OMA thousands. The use of glass also helps passengers recognize where they are by allowing them to see the totality of their surroundings. In addition, it will help the image of OMA, and help the environment. OMA's attention to environmental issues has allowed them to save money and generate publicity (Aguilar, 2009). The water supply for the entire facility will be reused and recycled through the system. If the water reserves are low, only purified water will be used to "top off" the water reservoir. The effect of these improvements is one of the most ecologically friendly airports in Latin America (Aguilar, 2009).

*Figure 4.88: Terminal B large glass walls for natural lighting.*

*Public Opinion*

The expansion of General Mariano Escobedo International Airport has been received well by the citizens of Monterrey and surrounding areas. Mexican businesses that fly as a part of their jobs will likely find the new terminal to be of great convenience to them. In addition, Mexican companies that import or export to or from the United States will enjoy the newly expanded capacity of the airport. However, perhaps the biggest driver of public opinion is the environmental awareness of OMA. Their commitment to natural lighting and reusable water has won over community members. In addition, their commitment to using only local materials from Monterrey earned them a lot of good will in the business community. Also, because OMA did not have to buy, expropriate, or confiscate any additional lands, the effect on their surrounding community was reported to be minimal (Aguilar, 2009).

### 4.6.7 Conclusions

The Terminal B expansion at the General Mariano Escobedo International Airport in Monterrey, Mexico has been constructed and will open to the public during the summer of 2009. The expansion will be located inside of the airport complex to the east of the previously expanded Terminal A. The Terminal itself is 21,000 m$^2$ with two levels and a mezzanine and 2000 m$^2$ of the airport's space will be used for shops, restaurants, and other services (OMA, not dated). The terminal contains a huge amount of steel and glass that is all purchased from local manufacturers (Aguilar, 2009). The expansion will also include six passenger runways, three contact positions for regional planes, a new parking lot for 450 vehicles, and four remote airplane parking areas. Monterrey has developed an impressive airport structure with the ability to serve all types of customers. Del Norte airport caters to the wealthy, independent traveler. Terminal C's Viva Aerobus caters to the budget-conscious traveler. General Mariano Escobedo International Airport caters to the majority of passengers, including business passengers and international tourists. When the expansion is complete, the General Mariano Escobedo International Airport will be one of the largest in Latin America.

Some of the most notable features of the expansion consist of environmentally friendly features. The use of large amounts of glass gives the terminal a free light source. The reuse of water inside of the airport is also a feature that will be marketed and used to decrease OMA's overhead. OMA's development of environmentally friendly methods of operation is notable and should be replicated by other airports. Another important feature is the use of separation walls in order to separate international and domestic passengers as well as departing and arriving passengers. This will decrease confusion and inefficiencies that are associated with passengers mixing into traffic with different destinations.

The Monterrey airport expansion will have an important impact on relations between Texas and Mexico. Terminal B will create new routes to the U.S., allowing more incoming and outgoing business flights. In addition, the new cargo terminal will allow increased cooperation between manufacturing and assembling companies in both countries. The development of Terminal C's cargo operation will play a large role in the future of the airport. The use of multinational corporations like Fed Ex will allow seamless integration of importers and exporters in both countries. Moreover, the airport expansion will bring in tourists from across the world, including the United States that want to explore the city of Monterrey. The overall impact to Texas from the expansion will come in the form of increased opportunities to integrate between the two regions.

# Chapter 5. Border Projects

## 5.1 Introduction

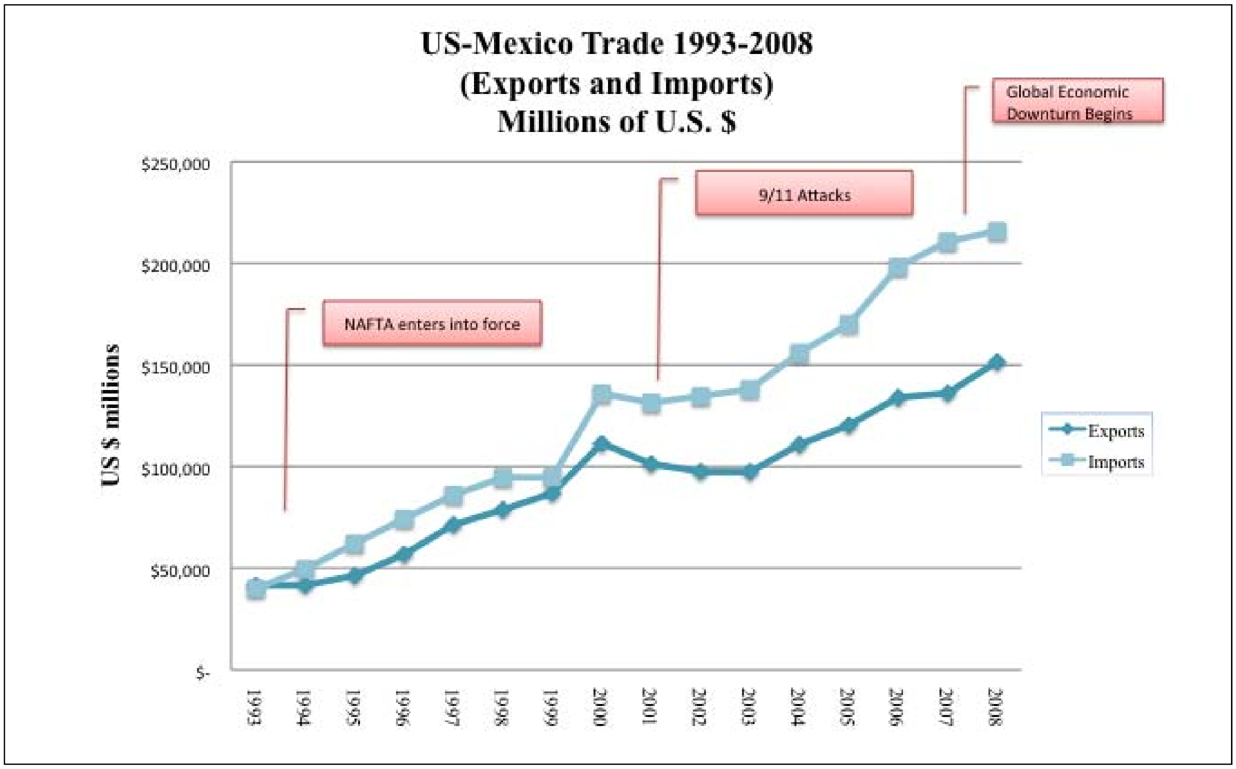
Since NAFTA went into effect on January 1, 1994, the U.S–Mexico border has experienced a dramatic increase in the trade growth and cross-border freight movement. The primary reason is that NAFTA eliminated many of the trade barriers between the United States, Canada, and Mexico. In many Mexican border cities, *maquiladora* factories (manufacturing assembly plants) were opened to take advantage of the elimination of taxes and tariffs that had hitherto been applied to trade and value-added manufacturing. Table 5.1 shows how trade has grown with Mexico since NAFTA's inception, including one year before inception, and Figure 5.1 represents these data graphically.

**Table 5.1: U.S.-Mexico Trade (Imports and Exports) 1993–2009**

| Year | Exports Total Millions of U.S. dollars * | Imports Millions of U.S. dollars * |
|---|---|---|
| **2009 (Jan to March)** | 29,087 | 38,776 |
| **2008** | 151,538 | 215,914 |
| **2007** | 136,092 | 210,714 |
| **2006** | 133,978 | 198,253 |
| **2005** | 120,364 | 170,108 |
| **2004** | 110,835 | 155,901 |
| **2003** | 97,411 | 138,060 |
| **2002** | 97,470 | 134,616 |
| **2001** | 101,269 | 131,337 |
| **2000** | 111,349 | 135,926 |
| **1999** | 86,908 | 109,720 |
| **1998** | 78,772 | 94,629 |
| **1997** | 71,388 | 85,937 |
| **1996** | 56,791 | 74,297 |
| **1995** | 46,292 | 62,100 |
| **1994** | 50,843 | 49,593 |
| **1993** | 41,580 | 39,917 |

*(not seasonally adjusted unless specified)

Source: Created from U.S. Census Data: Foreign Trade Statistics

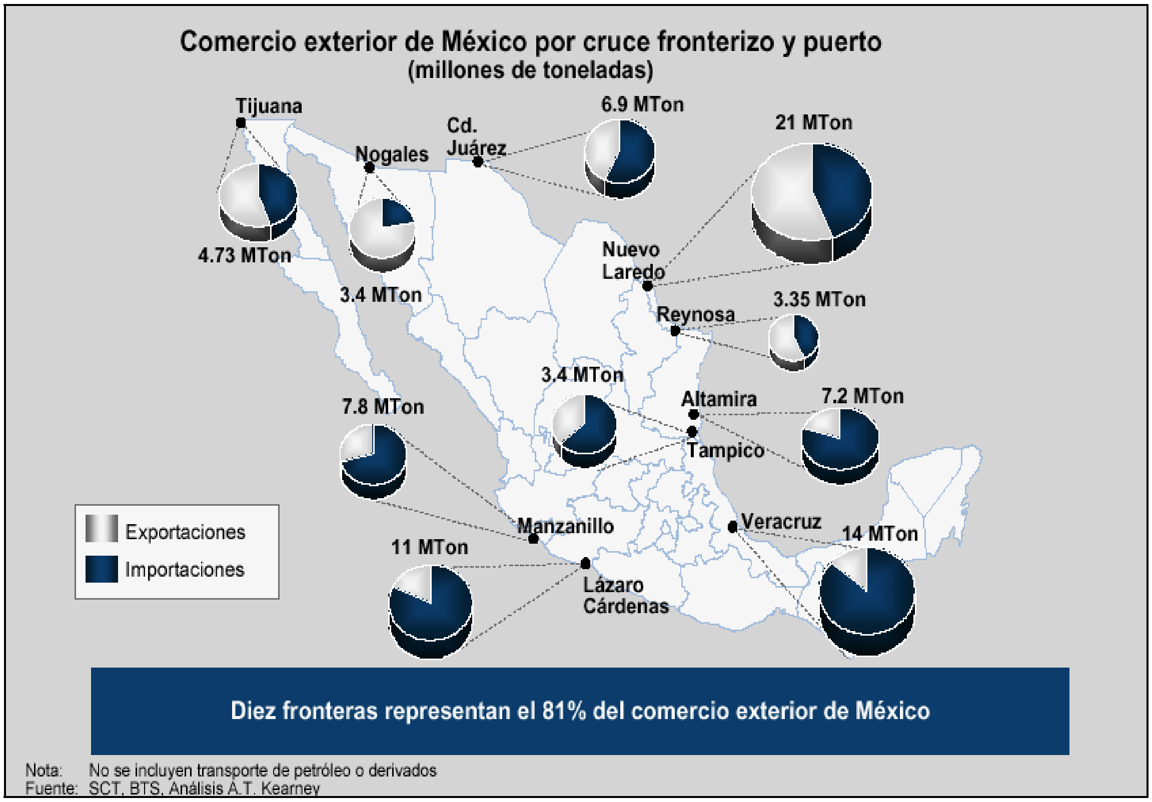



Source: Created from U.S. Census Data: Foreign Trade Statistics

*Figure 5.1: U.S. Trade in Goods Imports and Exports 1993–2008*

While global trade has slowed down since 2007 and the economic downturn is expected to continue into 2010, trade and personal travel between Mexico and the U.S. will continue to grow in the coming years. According to the Federal Reserve Bank, the U.S. economy is expected to contract between 1.3% and 2% in 2009, but rebound in 2010, with an expected growth of 3%. While trade between the U.S. and Mexico has contracted in the first half of 2009, an upturn in the U.S. economy in 2010 will likely reverse this trend. Travel by Mexican citizens to the U.S. is expected to contract in 2009, but is forecasted to see an overall growth rate of 14% from 2008 to 2014 (Travel Daily News, 2009). According to the U.S. Census, Mexico ranks as the U.S. third most important trade partner after Canada and China, respectively (U.S. Census Bureau, 2009).

Texas-Mexico trade, as can been seen in Figure 5.2, is by far the lion's share of all trade entering and exiting the U.S., with Laredo and Reynosa forming the powerhouses for import/exports to/from Mexico and Texas. According to data from NEMEX-TEX, Texas along with Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas, represents the seventh-largest economy in the world. The region has a market of more than 35 million people that produces $951 billion in goods and services. There are 88,000 km of highways, 25,000 km of railroad tracks, 29 international airports, and 15 ports (NEMEX-TEX (b), not dated).




Source: Erazo Garcia, 2008.

*Figure 5.2: U.S.-Mexico Border Trade by States*

As already noted in this report, Mexico is also initiating projects to channel trade, not just to Mexico, but also to the U.S. Projects like the expansion of the port at Lazaro Cardenas, the Mazatlan-Durango highway, and the inland ports at San Luis Potosi and Monterrey seek to utilize the excellent trade connections between Mexico and Texas to route trade through Mexico to the Texas border and into the U.S. According to Amadeo Saenz, Executive Director of TxDOT, *"the Texas-Mexico border is the principal gateway for trade between the United States and Mexico, and the Texas transportation system continues to be the single most important infrastructure link between the economies of the United States and Mexico"* (Saenz, 2007). The Texas-Mexico border currently has 26 border crossings. The names of the crossings and the city in which they are located can be seen in Table 5.2.

**Table 5.2: Texas-Mexico Border Crossings**

| City | Border Crossing |
|---|---|
| **Brownsville** | B&M Bridge<br>Gateway International Bridge<br>Veterans International Bridge at Los Tomates |
| **Del Rio** | Del Río-Ciudad Acuña International Bridge<br>Lake Amistad Dam Crossing |
| **Eagle Pass** | Camino Real International Bridge<br>Eagle Pass Bridge I |
| **El Paso** | Bridge of the Americas<br>Good Neighbor Bridge (Stanton Street Bridge)<br>Paso Del Norte Bridge<br>Ysleta-Zaragoza Bridge |
| **Fabens** | Fabens-Caseta Bridge |
| **Falcon Heights** | Lake Falcon Dam Crossing |
| **Fort Hancock** | Fort Hancock-El Porvenir Bridge |
| **Hidalgo** | McAllen-Hidalgo-Reynosa Bridge |
| **Laredo** | Gateway to the Americas Bridge<br>Juarez-Lincoln Bridge<br>Laredo-Colombia Solidarity Bridge<br>World Trade Bridge |
| **Los Ebanos** | Los Ebanos Ferry |
| **Los Indios** | Free Trade Bridge (Los Indios Bridge) |
| **Pharr** | Pharr-Reynosa International Bridge on the Rise |
| **Presidio** | Presidio Bridge |
| **Progresso** | Progreso International Bridge |
| **Rio Grande City** | Rio Grande City-Camargo Bridge |
| **Roma** | Roma-Ciudad Miguel Alemán Bridge |

Source: RJ Rivera Associates, 2008

There are 23 bridges, 2 dam crossings, and 1 hand-drawn ferry. The locations of these crossings can be seen in Figure 5.3.


Source: Texas Comptroller of Public Accounts, 2001

*Figure 5.3: Texas-Mexico Border Crossings*

The Border Governor's Conference was created in 1980. Committee members meet annually to develop collaborative action plans on shared issues and coordinate and communicate among the ten border states to address matters of common (mutual) interest (Border Governors Conference, 2007). However, as a consequence of NAFTA, many initiatives (including major federally led initiatives) have been put in place to address bi-national transportation issues along the U.S.-Mexico border. First and foremost among these initiatives is the Joint Working Committee (JWC). In April 1994, the U.S. and Mexico signed a memorandum of understanding (MOU), establishing the JWC to coordinate planning and programming of intermodal projects along the U.S.-Mexico border. The JWC's primary focus is to plan overland transportation and facilitate efficient, safe, and economical cross-border movement of people and goods. Its goals include promoting effective communication between the national governments and the ten U.S.-Mexico border-states by developing coordinated plans for land transportation, and evaluating current and future impacts of traffic demand on transportation infrastructure. It meets twice a year, once in each country.[6] The JWC creates two-year work plans to outline what business the committee will address. The current work plan covers the 2008-2010 timeframe. It includes

[6] The committee's members include the FHWA, SCT, the U.S. Department of State, the Mexican Ministry of Foreign Affairs, and departments of transportation (DOTs) for the 10 U.S. and Mexican states on both sides of the border.

among other topics the development of a Strategic Plan Monitoring Framework, border travel time studies for commercial trucks, additional work on Bottlenecks Study Phase II, and the creation of a compendium of border-wide regional master plans.

Since its inception, the JWC has compiled several studies on border transportation, including a bi-national study completed in 1998 that looked at bi-national border transportation infrastructure, trade flow processes for commercial vehicles, transportation planning processes, and ability to handle expanding cross border trade flows. It produced a database, maintained by the FHWA and the Mexican Transportation Institute, containing information on trade and traffic flows at ports of entry, socioeconomic data for border areas, and existing and planned border infrastructure improvements.[7] In September 2008, the JWC released the California-Baja California Border Master Plan (JWC Website), which forms the precursor for border master plans along the entire U.S.-Mexico border.

Juan Jose Eraso of SCT commented, at the JWC meeting held in Tijuana in December 2008, that in the 13 years that the JWC has been in existence, there have been three new crossings, two bypasses, and several concessions for highway improvements (Esther Hitzfelder, 2008).

In the U.S. federal transportation legislation put in place programs and funding to further a coordinated border infrastructure program. The 1998 Transportation Equity Act for the 21st Century (TEA-21) created the Coordinated Border Infrastructure Program (CBI), which allowed the Secretary of Transportation to distribute funds to border states to improve the safety of vehicle movement at or across the U.S.-Mexico border. States could use apportioned funds for:

1. improvements in a border region that facilitate cross-border vehicle and cargo movements;
2. construction of highways that facilitate cross border movements
3. operational improvements including e-data exchange and
4. international coordination of transportation planning and programming and border operation.

The 2008 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA:LU § 1303) continued the CBI program and allowed funds apportioned to the states to be used for the construction of infrastructure in Mexico that will facilitate cross-border movements.

At the local level here in Texas, the Texas Transportation Commission amended the State Mobility Program, Category 10, to authorize the CBI program and the addition of US$200 million in federal funding (TxDOT, 2006) that was allocated to the El Paso, Laredo, and Pharr border districts.

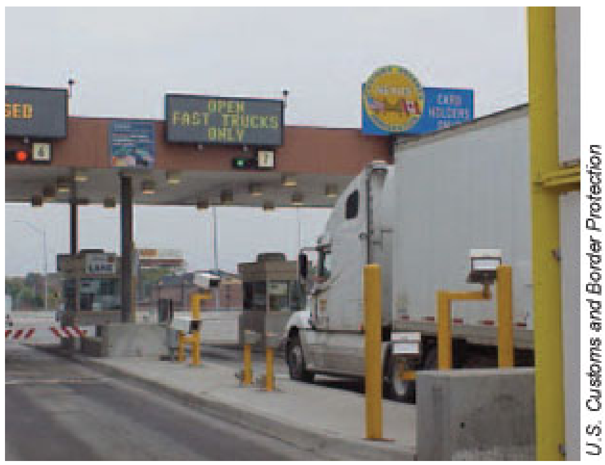
The Texas legislature also put in place mechanisms to ensure continued cooperation with Mexican counterparts. Senate Bill 569 from the 79th Texas Legislature (Regular Session) in 2005 amended Texas Transportation Code (§201.207) and required TxDOT to initiate efforts to meet at least quarterly with the department's counterparts in Mexican states that border Texas. TxDOT is required to work in conjunction with the border commerce coordinator (as well as mayors of municipalities that have a land port of entry with Mexico) to develop short and long range plans

[7] The databank is available on the Web at www.fhwa.dot.gov/binational/databank/data.html.

for cross-border activities which must be updated biannually and submitted to the Lt. Governor, Speaker of the House, and other house and senate members (Behrens, 2006)

There are currently multiple plans and projects on the Texas-Mexico border, including a cross-border rail relocation effort in El Paso and New Mexico (which were outlined in SAFETEA-LU), and plans for new passenger and rail bridges in Laredo as part of the FHWA Trans Border Congestion Initiative (Hitzfelder, 2008). Thus, continued cooperation on these planned projects is warranted by both TxDOT and other state entities.

Since the terrorist attacks of 2001, the U.S. also implemented a series of new initiatives aimed at improving border security whilst still ensuring the smooth path of trade. One such initiative is the Fast and Secure Trade Initiative (FAST). Put simply, FAST is an expedited clearance program for known low-risk shipments. Under FAST, Mexico and the U.S. have agreed to harmonize their processes for clearance of commercial shipments. FAST LANES are currently in operation in Brownsville, Laredo, and El Paso. Figure 5.4 shows a FAST lane in operation.




Source: CBP

*Figure 5.4: FAST Lane*

Another initiative is the Secure Electronic Network for Travelers Rapid Inspection (SENTRI) program (CBP, 2009). SENTRI provides an expedited U.S. Customs and Border Protection (CBP) processing for low risk travelers who have already voluntarily undergone a thorough biographical background check. Once approved the applicant is issued a RFID card to identify their record and status in CBP's database. This card is automatically detected once they arrive at a U.S. port of entry (CBP, 2009). SENTRI lanes are currently found at crossings in El Paso, Hidalgo, Brownville, and Laredo in Texas, and there is a proposal to install a SENTRI lane on the Anzalduas-Reynosa Bridge, as outlined in the case study below.

Finally, there have also been several private-sector initiatives over the past 15 years regarding border planning and trade development. For example, NEMEX-TEX was created by the Mexican border states with Texas to strengthen the economic integration of the north eastern region of Mexico with Texas (NEMEX-TEX (a), not dated). Table 5.3 shows the major indicators of this border region.

**Table 5.3: Major Indicators for North East Mexico-Texas Region**

| | CHIHUAHUA | COAHUILA | NUEVO LEON | TAMPS | NEMEX REGION | TEXAS |
|---|---|---|---|---|---|---|
| **Municipalities** | 67 | 38 | 51 | 43 | 199 | 253 |
| **Towns (+50mil hab)** | 5 | 6 | 7 | 9 | 27 | |
| **Metropolitan Areas (+500 tho)** | 2 | 3 | 1 | 4 | 10 | 6 |
| **Surface Area (Km2)** | 247,511 | 151,571 | 64,824 | 80,539 | 544,445 | 678,028 |
| **Population** | 3,382,582 | 2,427,182 | 4,153,830 | 3,009,493 | 12,973,087 | 22,490,022 |
| **Population Density (Hab/Km2)** | 13.7 | 16.0 | 64.1 | 37.4 | 23.8 | 33.2 |
| **Economically Active Population** | 1,298,618 | 970,803 | 1,842,471 | 1,277,879 | 5,389,771 | 10,917,661 |
| **GNP (millions USD)** | 27,845 | 21,850 | 47,287 | 19,560 | 116,542 | 763,800 |
| **GNP per Capita USD** | 8,232 | 9,002 | 11,384 | 6,499 | 8,983 | 33,962 |
| **Texas exports to each state in Mexico (millions USD)** | 13,659 | 3,459 | 2,501 | 6,634 | 26,253 | --- |

Source: NEMEX-TEX (b) not dated

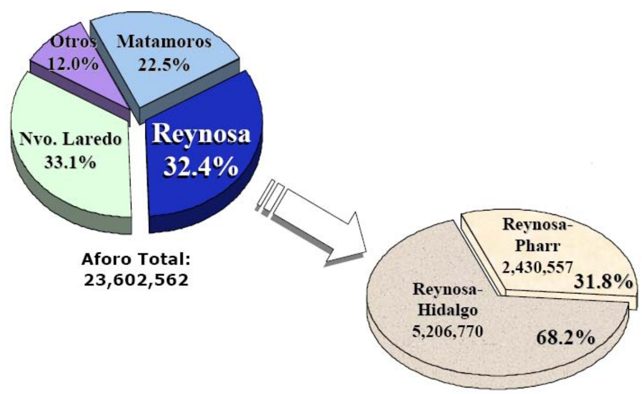
The North American Super Corridor Coalition (NASCO) has been actively involved in promoting the IH 35 Corridor from Mexico to Canada. Currently, every county and city along this corridor is a member of this group (Conde, 2008). As was noted in the proposal for this research study, another private-sector advocacy organization for the Gulf of Mexico border states, the Gulf of Mexico State Partnerships, Inc., was created as the private-sector counterpart of the official 11-state Gulf of Mexico States Accord (GOMSA). A 501c-6 not-for-profit organization, the partnership is open to businesses, chambers of commerce, economic development organizations, and non-governmental organizations interested in supporting the prosperity of the Gulf of Mexico states. The Partnership supports the Gulf of Mexico Congressional Caucus in its mission of education, consensus-building, and creation of new regional initiatives in the areas of transportation, homeland security, energy, environment, economic development, education, and international trade in the border states of the Gulf of Mexico basin (Gulf of Mexico States Partnership, 2005).

While Mexico's NIP did not overtly promote projects in the north-eastern and border regions of Mexico, a few projects were included in this program that were already in the planning and early development stages and that showed great promise for congestion relief, trade volume growth and facilitation, and air quality mitigation. This section highlights two of those projects: the Reynosa-Anzalduas Bridge and Bypass and the Matamoros/Brownsville Rail Relocation project.

## 5.2 Reynosa-Anzaldúas Bridge and Bypass

After signing of the NAFTA, commerce between the U.S. and Mexico grew rapidly, making it one of the most important drivers of development in both countries. In Mexico, export commerce accounts for more than half of the "nation's international gross product" (SCT, 2006). In 2008, surface transportation between the U.S. and Mexico hauled goods with a total value of $293 billion, 32% of which corresponded to trade with Texas (BTS, 2009). The opening of trade has brought many industries to the NAFTA corridors and a significant increase in services and employment.

This growth has brought unprecedented traffic demand to an area of the state with many infrastructure deficiencies. These deficiencies are being addressed in order to better facilitate trade and comply with the NAFTA agreement's requirements. The Mexican border currently processes more than 4 million trucks and 88 million passenger vehicles per year (SCT, 2006). As shown in Figure 5.5, the city of Reynosa is the second-largest border crossing in the eastern part of the U.S.-Mexico border. Reynosa in Mexico and McAllen in Texas are two of the fastest growing cities in the region and a new international crossing has become essential in order to serve the increasing traffic that result from development and economic growth. The Reynosa-McAllen Anzaldúas Bridge, which is part of the NIP, will provide for a new, more efficient, and safer trade route.



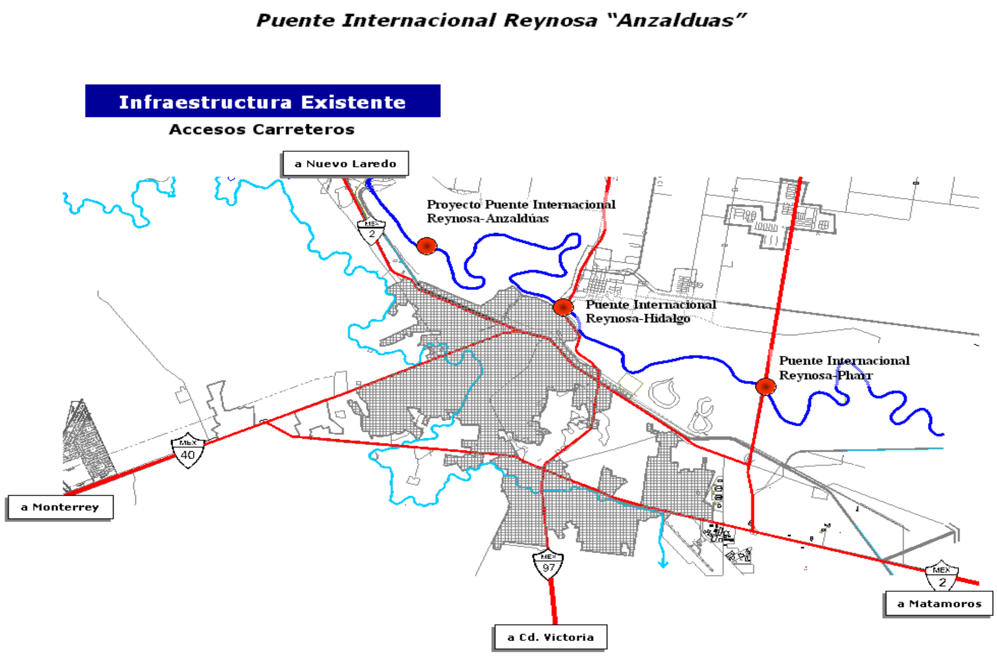

Source: CAPUFE (2004)

*Figure 5.5: Percent of vehicles crossing eastern U.S.-Mexico border*

The Reynosa-Anzaldúas Bridge and bypass connects the cities of McAllen, Texas and Reynosa, Tamaulipas. McAllen is currently the largest and fastest growing city in Hidalgo County and has a population of 130,831 (McAllen CoC, No date). Its major highways are US 83, running east to west, and US 281 running north to south; air traffic is serviced by the McAllen-Miller International Airport. The city has seen a 24.1% population growth from 2000 to 2007.

The city of Reynosa is located in the Mexican state of Tamaulipas. According to the Statistics and Geographic National Institute (INEGI, No date) 2005 census, Reynosa has a population of around 507,998 people. Located along the U.S.-Mexico border, the city has seen an average annual population growth rate of 4% during the last decade, doubling that of the state as a whole (State of Tamaulipas, No date). This growth in population has been largely driven by the increasing number of maquiladoras in the city, especially in the western region of Anzaldúas, where the new bridge will be located.

This area is currently served by two international crossings, the Reynosa-Hidalgo Bridge and the Reynosa-Pharr Bridge. Long delays at both of these bridges can occur and expansion to the existing infrastructure is difficult, particularly in the case of the Reynosa-Hidalgo Bridge because of urban land use restrictions in the area. Figure 5.6 shows a view of the existing and proposed infrastructure. The new bridge will be located on the western side of the city of Reynosa, outside of its urban area and is connected to the road that leads to Monterrey, from which 50% of vehicle crossings to the U.S. are generated (SCT, 2006).

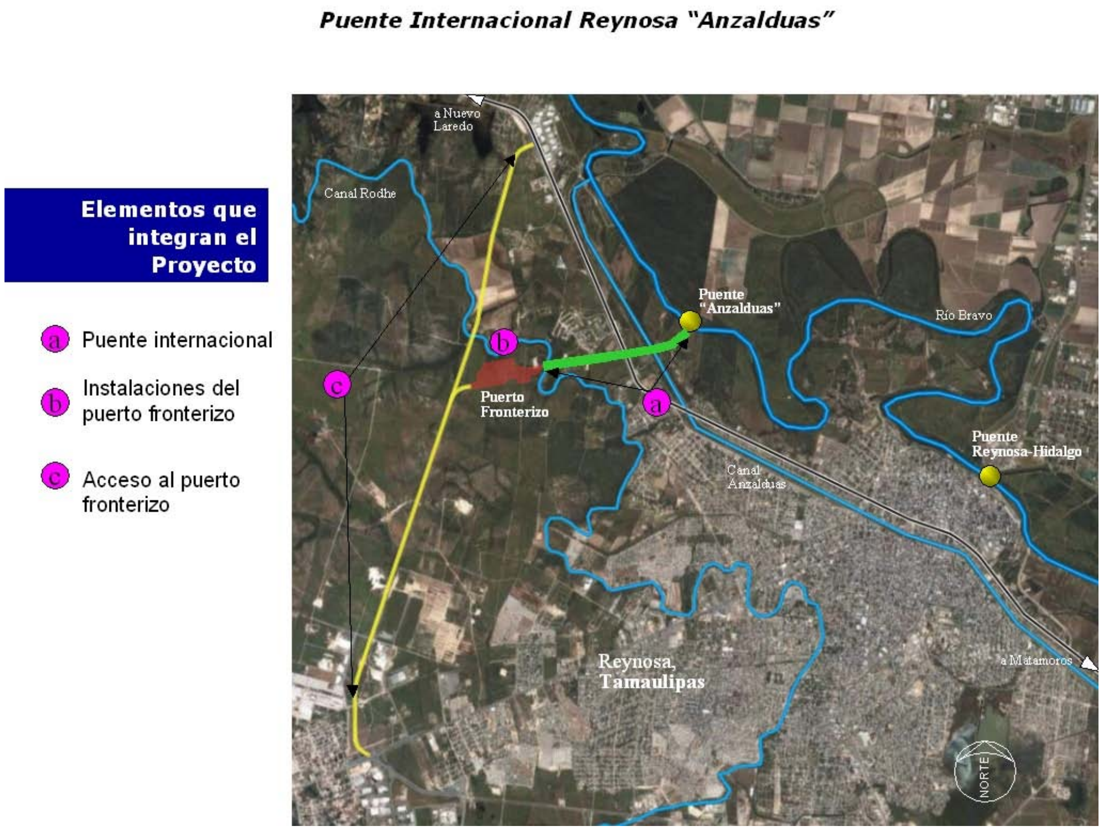



Source: SCT, 2006

*Figure 5.6: Existing and proposed bridge crossings*

### 5.2.2 Project Description

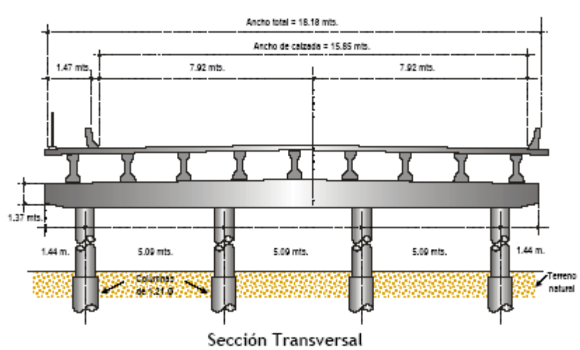
The Reynosa-McAllen Anzaldúas Bridge is an international bridge that connects the city of Reynosa, Tamaulipas on the Mexican side with the city of McAllen, Texas on the U.S. side. The Presidential Permit between both nations to build the bridge was signed in 1999 but construction of the bridge did not start until early 2007. The Anzaldúas International Bridge project, seen in Figure 5.7, consists of the construction of a bridge, a port-of-entry facility, and two access roads. The actual site for the bridge crossing has an area of 462 acres and will cross a flood plain, a wooded area, two canals (the Anzaldúas Canal and the Rodhe Canal) and the Rio Grande.




Source: SCT, 2006

*Figure 5.7: Anzaldúas International Bridge, Port of Entry and Access Roads*

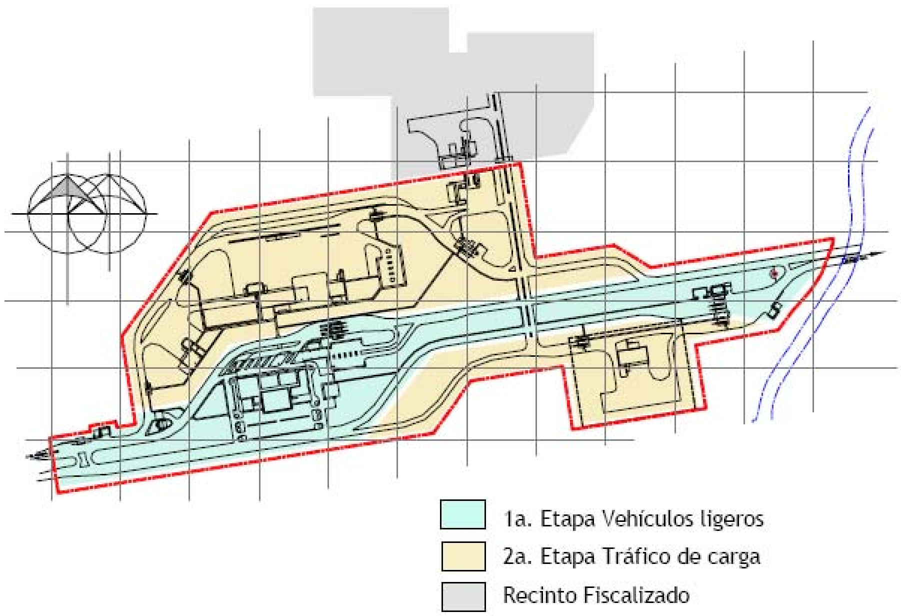
The bridge is 1.57 miles long and 60 feet wide with a 52 foot roadway. It has four vehicle lanes that are 11.5 feet wide each. Figure 5.8 shows a cross section of the bridge. When commercial traffic is allowed to use the bridge in 2015 it will already have the required capacity to accommodate such traffic.




Source: SCT, 2006

*Figure 5.8: Cross Section of bridge*

The state of Tamaulipas acquired an area of 68.7 acres for the port of entry. This facility, seen in Figure 5.9 will be constructed in two phases. The first phase includes all of the facilities to handle passenger vehicles and a tourist information center. The second phase of construction will include additional infrastructure to accommodate the commercial traffic of larger vehicles when these vehicles are permitted to cross the bridge. Although it will be built in two phases, all of the area required for the complete facility is already available.




Source: State of Tamaulipas, No Date

*Figure 5.9: Plan view of Port of Entry*

The 3.7-mile northern access road will connect the port of entry with the highway leading to Nuevo Laredo and the 2.5 mile southern access road will connect with the Monterrey-Reynosa highway. These new access roads will provide a more direct route to the industrial city of Monterrey and to the central part of Mexico, where 80% of commercial traffic is generated (SCT, 2006). SCT is simultaneously working on other projects to improve the highway network in this region, such as implementing Intelligent Transportation Systems (ITS) (Erazo, 2009.a).

*Background and Need Addressed*

*Project Elements*

### 5.2.3 History

The Anzaldúas International Bridge Project is a joint venture between the U.S. and the Mexican governments. The bridge was first conceptualized in 1990 but it was not until 1999 that the Presidential Permit was signed by President Clinton and President Zedillo of Mexico authorizing development. According to the Presidential Permit, construction of the bridge could not begin earlier than 2003 and could not become operational before 2005. Another condition stated in the Permit was that commercial traffic could not use the facility until the year 2015 or until the Reynosa-Pharr Bridge reached 15,000 vehicles per week.

On the U.S. side, the bridge is a partnership between three cities in Hidalgo County: McAllen, Hidalgo, and Mission. These three cities are in charge of the actual construction of the bridge and the southbound facilities, estimated to cost of $39 million. McAllen is in charge of 44% of the infrastructure funding, Hidalgo 33%, and Mission 23%. The U.S. federal government is responsible for the construction of the port of entry, for which $25 million was appropriated. The Texas Department of Transportation is also responsible for the funding of the project.

In Mexico, the Anzaldúas Bridge project is part of the NIP and it is being carried out as a public-private partnership. It is sponsored by the federal government, the state government, and Groupo Marhnos, the private-sector company that won the concession for the construction of the bridge. The principal federal entity responsible is SCT. SCT was in charge of conducting the market studies (feasibility studies, cost-benefit analysis, etc.), and the environmental impact assessment. It was also responsible for the bidding process and the award of the concession contract. The state of Tamaulipas was in charge of right-of-way (ROW) acquisition and the development of the Executive Plan, or project design.

The concession for the financing, construction, and operation of the bridge was awarded to Grupo Marhnos S.A. de C.V., a Mexican company. Grupo Marhnos, originally founded in 1954 as a construction company, now offers services in specialized construction, real estate development, and the operation of public infrastructure concessions (Grupo Marhnos, 15 Apr 2009). The company participated in Mexico's original concession scheme during the 1990s that resulted in several failed toll roads, and according to Eng. Stuffer the new concession scheme is much more transparent (Stuffer, 2009).

### 5.2.4 Planning

*Development Responsibilities*

There is a coordination agreement between SCT and the state of Tamaulipas that outlines each government's responsibilities. Tamaulipas was charged with ROW acquisition and the creation of the Executive Project Plan, which outlined the design of the bridge and bypass. SCT was charged with carrying out the feasibility studies and the concession bidding process. Generally, states handle the ROW, because they have easier access to the land that is available and have local knowledge of landowners and other issues that may arise in acquiring ROW. SCT expressed frustration with the Executive Plan that the state of Tamaulipas produced, and that they would like to relieve states of this responsibility in the future. As the plan was created several years ago and never updated, when the concessionaire started construction they had some setbacks due to misalignment of the roadway and port facility building. This created some delays and unforeseen costs to the construction (Erazo, 2009.a).

The concessionaire chosen for this project was Grupo Marhnos. Peter Stuffer from Grupo Marhnos said during an interview with the researchers on February 26, 2009, that he attributed the success on the Mexican side (e.g., carrying out the project on schedule and within budget) to the fact that one party was responsible for its implementation, including the two access roads, the port, and the bridge. Once built, the concessionaire will operate the bridge for 30 years, collecting the toll revenue. At the end of the 30 years, the facility will become the property of the government to maintain. At this time, INDAABIN will be responsible for the port-of-entry facility and the state of Tamaulipas will have responsibility for the roads.

*Feasibility Studies*

SCT conducted a feasibility study in order to determine if a percentage of the project could be carried out with private investments. Traffic and revenue studies, a cost-benefit analysis, and legal and environmental studies were all included as part of the feasibility study.

The feasibility study concluded that the project was attractive for private investors and could function as a private tolled concession (SCT, 2006). The traffic and revenue study and the cost-benefit analysis are explained in greater detail in the following sections.

*Traffic and Revenue Studies*

An initial T&R study was conducted as part of the market studies. This particular study was only for SCT's internal use to determine whether or not the project was feasible for a concession. Every concessionaire that was interested in bidding for the project conducted its own traffic and revenue forecasts. That way, SCT could transfer the forecast risks to the private investors (Erazo, 2009.a). The methodology used for SCT's T&R study is detailed below; the concessionaire's T&R study is not included in this report as this information is confidential.

The methodology used for the T&R study was the "user equilibrium" method using TransCad software. The principle behind this method is that, when in equilibrium, all routes that are actually used, between a given origin and destination, are equal or less than all routes that are not used. In other words, a travel path is said to be in equilibrium when travel time cannot be improved by shifting to another route. Equation 5.1 was used for this iterative process:

User equilibrium — Equation 5.1

$$t = t_f \left[ 1 + \alpha \left( \frac{v}{c} \right)^{\beta} \right]$$

Where, t = time of travel for each congested path
$t_f$ = time of travel for each free-flow path
v = demand volume of path
c = capacity of path
α, ß = calibration parameters

In order to use the TransCad software, a network has to be defined that included roads, highways, urban areas, and border crossings from the U.S. and the Mexican side. In addition to defining the network, information on the physical, geometrical, and operational conditions was required for each route. Travel data compiled for this project consisted of velocity and time of travel studies, traffic counts with vehicle classification, and origin-destination (O-D) and stated preference surveys (SPS). O-D and SPS surveys were conducted during four days at nine different locations; traffic counts were conducted in those same locations over seven continuous days. The bridge's influence area was defined from these studies and it was determined that most of the trips that would be generated by the Anzaldúas Bridge are currently being generated by the Reynosa-Hidalgo bridge and to a lesser extent by the Reynosa-Pharr Bridge. This result was expected because the Reynosa-Hidalgo Bridge is located in a dense urban area, closer to the Anzaldúas Bridge, and is currently the busiest crossing in Reynosa (refer to Figure 5.6).

After developing the trip matrix, the analysis yielded expected traffic of 7,154 vehicles per day, 97.7% of which were passenger cars and 2.3% were trucks. Only passenger cars were considered for this evaluation because truck traffic will not be allowed on the bridge before

2015. The cost of the toll was not included in the analysis because all international bridges in that area charge the same toll. Annual traffic growth for the next 30 years was estimated to be 2.96%. This was obtained from averaging the historic traffic growth rates for the access roads leading to Reynosa (Table 5.4). A 2.5% annual traffic growth was used for the economic analysis.

**Table 5.4: Historic Annual Traffic Growth**

| Highway | Annual Daily Traffic | | | | | | | Annual Traffic Growth Rate |
|---|---|---|---|---|---|---|---|---|
| | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | |
| Monterrey-Reynosa | 7,935 | 8,146 | 9,085 | 9,671 | 9,830 | 10,045 | 10,683 | 4.41% |
| Reynosa-Nuevo Laredo | 6,388 | 6,490 | 6,878 | 7,080 | 7,281 | 7,456 | 7,492 | 2.44% |
| Ciudad Victoria-Reynosa | 3,154 | 3,190 | 3,488 | 3,585 | 3,657 | 3,730 | 3,780 | 2.03% |
| **Estimated Annual Traffic Growth Rate** | | | | | | | | **2.96%** |

Source: SCT, 2006

*Cost-Benefit Analysis*

SCT conducted a cost-benefit analysis for this project to determine the full cost of the project and compare those to the direct and indirect benefits the project would bring to the area. The methodology used first required the identification, quantification, and value of all costs and benefits that are generated if the project is implemented. Those were then compared to a no-build scenario. The potential benefits identified for the Anzaldúas Bridge project were travel- time savings, border crossing time savings, and vehicle operation costs savings.

In order to estimate the benefits for travel time savings, information on vehicle travel speeds and value of travel time was needed. Information on vehicle travel speeds was obtained from the T&R study. The information used for value of travel time was obtained from the methodology developed by the Mexican Transport Institute (IMT) and approved by the Finance Ministry. Table 5.5 shows the IMT values of time for each type of passenger.

**Table 5.5: Passenger Value of Time**

| Value of Passenger's Time | |
|---|---|
| Value of Automobile Driver's Time | 22.00 $/hr |
| Value of Automobile Passenger's Time | 13.00 $/hr |
| Value of Bus Passenger's Time | 13.00 $/hr |
| Number of Passengers Per Car | 2.50 pas/veh |
| Number of Passengers Per Bus | 22.00 pas/veh |

Source: SCT, 2006, translated

Cost savings and benefits due to border crossing time savings were quantified using the average wait time of a vehicle crossing if the project was not built and the average wait time if the new crossing was built. This difference was then applied to the population of vehicles that had already been estimated would use the new crossing.

The Highway Development and Management HDM4 model was used to calculate vehicle operation costs under the Vehicle Operation Cost (VOC) sub-model. This model takes into account the characteristics of the vehicle fleet data compiled by the IMT. Table 5.6 shows the economic evaluation for the current condition (without the bridge) and if the bridge was built. All of this data yielded a 20.9% of return on investment estimate (Refer to Table 5.7).

**Table 5.6: Cost-Benefit Analysis: Current Condition vs. After Project Conditions**

| Cost Benefit Evaluation | | | | |
|---|---|---|---|---|
| | Actual | | Projected | |
| Details | Reynosa-Hidalgo International Bridge Access Road | Reynosa-Hidalgo International Bridge | Anzaldúas International Bridge Access Road | Anzaldúas International Bridge |
| Length(km) | 11.50 | 0.112 | 10.5 | 2.54 |
| Volume (veh/day) | 36,823 | 14,269 | 6,990 | 6,990 |
| A % | 81% | 99.44% | 100.0% | 100.0% |
| B % | 3% | 0.46% | 0.0% | 0.0% |
| C % | 16% | 0.10% | 0.0% | 0.0% |
| Investment (mdp) | | | 100.0 * | 419.3 * |
| Number of Lanes | 4 | 4 | 4 | 4 |
| Lane Width (mts.) | 3.5 | 3.5 | 3.5 | 3.5 |

Source: SCT, 2006

**Table 5.7: Rate of Return of Investment**

| Cost Benefit Indicators | | |
|---|---|---|
| Internal Rate of Return (TIR) (%) | Net present Value (NPV) (mdp) | Yield (TRI) (%) |
| **23.6** | 625.6 | 20.9 |

Source: SCT, 2006

A sensitivity analysis was conducted taking values in the range of 60 to 140% of the total project cost. Table 5.8 illustrates the values from the analysis showing that even when increasing the cost of the project by 40% of the initial investment, the project is still feasible.

**Table 5.8: Sensitivity Analysis**

| Tasa de variación | Investment (million dollar peso) | Internal Rate of Return IRR % | Net Present Value (NPV) mdp | Yield (TRI) % |
|---|---|---|---|---|
| 140% | 727.02 | 18.1 | 429.0 | 14.9 |
| 130% | 675.09 | 19.2 | 478.2 | 16.0 |
| 120% | 623.16 | 20.5 | 527.3 | 17.4 |
| 110% | 571.23 | 21.9 | 576.5 | 19.0 |
| 100% | 519.30 | 23.6 | 625.6 | 20.9 |
| 90% | 467.37 | 25.6 | 674.8 | 23.2 |
| 80% | 415.44 | 28.1 | 723.9 | 26.1 |
| 70% | 363.51 | 31.2 | 773.1 | 29.8 |
| 60% | 311.58 | 35.1 | 488.2 | 34.8 |

Source: SCT, 2006

### 5.2.5 Right-of-Way Acquisition

ROW acquisition for the Anzaldúas Bridge Project was conducted by the state of Tamaulipas. SCT feels that, for almost all projects, it is better to leave ROW responsibilities to state and local governments, as they have better access to the available land, and can more easily broker the conditions of exchange with the landowners (Erazo, 2009.a). Figure 5.10 shows a typical cross section of the ROW for the access roads.


Source: State of Tamaulipas, No date

*Figure 5.10: Cross Section of Roadways*

The ROW acquisitions should ideally be settled before a project is put out for tender; however, this is not always the case (Erazo, 2009.a). For the Anzaldúas Bridge and Bypass project, there are two access roads—one from the north, the Reynosa-Monterrey Highway, and one from the south, the Reynosa-Nuevo Leon highway. The southern access road was in the initial design and connects to Monterrey, but there were unanticipated costs associated with ROW that were not incorporated into Grupo Marhnos' proposal. One example of this is the northern access road that was not included in the original Marhnos' proposal, so it had to be treated as a change order.

Although the bridge does not allow commercial traffic until 2015, the ROW required retrofitting of the port-of-entry checkpoint and additional road space is already available (Erazo, 2009.a).

*Public Participation*

In the literature review conducted by the researchers, there was no mention of public participation. This could be due to the fact that the planning process for this project started more than 15 years ago. It was noted by Erazo during a live interview that throughout the concession and construction process they did have some pushback from the public regarding ROW acquisition (Erazo, 2009.a).

### 5.2.6 Project Implementation

*Financing*

There are two ways in which SCT finances highway projects. The first is through public funds from general revenues and the other is through public-private partnerships. When SCT decides to carry out a highway project, it will first conduct a market study to determine if the project could be a toll road and attract private investment. Under SCT's current procedures, all projects that are determined to be feasible toll roads will be carried out as concessions. If a road project is determined to not be toll-feasible, SCT rarely continues the project (Erazo, 2009.a). The state always has the option of carrying on the project with its own resources, but it assumes all risk. Currently, Mexico is concentrating the use of federal infrastructure funds for the development of the southeastern part of the country for which there is little possibility of private participation (Erazo, 2009.a).

The feasibility study conducted for the Reynosa Anzaldúas Bridge determined that the project would be feasible as a toll road. It determined that the total project cost would be US$51.93 million, 38.5% of which would come from public funds, acquired through FINFRA while the rest would be financed by the concessionaire.

The bid package consisted of the construction of a bridge, the port of entry buildings, and two access roads, all of which had to be financed by the winning bidder. The concession scheme for this project is of the type Build-Finance-Operate-Transfer (BFOT), meaning that each bidder had to develop their own strategy to finance the project. The winning bidder, Grupo Marhnos, used the Mexican bank Banorte to finance the project.

*Concession Process*

As mentioned above, the concession scheme used for this project was a BFOT. SCT established the maximum tariff for the toll road and the amount of years for the concession, which in this case is 30 years.[8]

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[8] Road concessions are governed by the Law of Roads, Bridges and Federal Motor Transportation (Ley de Caminos, Puentes y Autotransporte federal). This law states that the term of a road concession may not exceed 30 years. This law was discussed in greater detail in Technical Memorandum No.1.

The criterion for selecting a concessionaire includes the requirement that all bidders must first be evaluated in terms of their financial capacity and, if accepted, they then undergo a technical evaluation of their proposal. The bid is awarded to the proposal that requires the least amount of public funds.

Seven companies participated in the bidding process for this project. Table 5.9 shows a list of the companies. Of these seven bidders, two presented SCT with an upfront payment for the concession and all of the others asked for a government subsidy. Grupo Marhnos offered the highest upfront payment; the company offered US$2.2 million upfront for the project. The total investment for the project was US$66.1 million.

**Table 5.9: List of Bidders**

| |
|---|
| Date Solicited - June 1, 2006 |
| Date Awarded - June 28, 2007 |
| Concession Title signed - July 27, 2007 |
| **Bidders** |
| Compañía Contratista Nacional S.A. de C.V. |
| Consorcio integrado por: Constructora Garza Ponce S.A. de C.V. y Grupo Rio San Juan S.A. de C.V. |
| Gami Ingeniería e Instalaciones S.A. de C.V. |
| Consorcio integrado por: Construobras de la Garza S.A. de C.V. y Construcciones y Puentes de Chihuahua S.A. de C.V. |
| Consorcio integrado por: Concesionaria de Proyectos de Infraestructura S.A. de C.V, Grupo Constructor Marhnos S.A. de C.V. y Marhnos Turismo S.A. de C.V. |

*Coordination with other jurisdictions/private-sector*

Coordination of border projects is conducted by SCT at three levels: federal, regional, and local. At the federal level, SCT meets with its U.S. counterparts, such as the Federal Highway Administration (FHWA) and the Joint Working Committee (JWC) to establish the priorities of bi-national corridors. At the regional level, SCT meets with state officials from both countries to create the Border Master Plan. The planning at the local level is conducted with counties, Metropolitan Planning Organizations (MPO), specifically the Reynosa Mobility Authority (RMA), municipalities, and cities, and is concentrated on the individual needs of the local areas. From the outcome of these three levels of planning, SCT determines which projects it will push forward. However, one big difference between the Mexican and American sides is that the federal government has the majority, if not all, of the power on the Mexican side; otherwise the coordination and planning processes are not significantly different (Ramon, April 17, 2009).

SCT stated that they would like to coordinate more closely with the American side in the future (Erazo, 2009.a). SCT is trying to implement value engineering—partly replicating American practices—to do design and then figure out how to make it more effective.

During the construction of the Reynosa Anzaldúas Bridge, there have been weekly bi-national meetings between all of the project's stakeholders. Stuffer mentioned that, during project site visits, the U.S. side has been very impressed by the quality of the construction of the Mexican side of the bridge (Stuffer, 2009).

### *Project's Impact on Texas*

The project is expected to have a positive impact on trade between Mexico and Texas, especially once the bridge is open to commercial traffic. Reynosa has a thriving industrial sector. The city boasts 10 industrial parks that are home to more than 200 industries and maquiladoras operating in Reynosa employ roughly 75,000 people. The main sectors operating in Reynosa are electronics manufacturing, apparel manufacturing, and auto assembly. Reynosa is also directly connected to the industrial sector of Monterrey via highway 40, and the bridge is expected to facilitate commerce between Monterrey, Reynosa, and the U.S. The Anzaldúas Bridge Board estimates that the bridge will decrease cross border travel time by 45 to 60 minutes (Geller, 2006). This reduction will help lure new industries to the Rio Grande Valley by facilitating just-in-time delivery.

### *Overview of current operations*

The Anzaldúas Bridge was under construction at the time of this report's publication and, although there have been some setbacks, (e.g., obstructions to construction because PEMEX gas lines did not have the necessary markers), the project is still on schedule. Grupo Marhnos has completed 78% of the bridge construction, 60% of the connecting roadways, and 98% border station, as of April 2009 (Ramon, 2009.a). The bridge's completion date on the Mexican side is expected to be June 28, 2009 however; the American side is behind schedule (Stuffer, 2009). There is a clause in the concession contract that states that if the bridge cannot open on time, and generate revenue for the concessionaire, that SCT will have to pay Grupo Marhnos for the lost revenue (Stuffer, 2009). Therefore, SCT is trying to push the U.S. side to speed up their construction. On the U.S. side, TxDOT has contracted out most of the construction responsibilities, and if the contractor gets behind on construction, they are required to pay TxDOT $5,300 per day (Jorge, 2009).

One major difference between the construction process in the U.S. and Mexico is that Grupo Marhnos had enough space in their construction site to set up an area to build the bridge's elements on site. The U.S., on the other hand, used pre-cast elements for the bridge construction that had to be delivered to the project site, adding the cost of transportation and overweight/oversized permits to the overall cost of the project. Figures 5.11 through 5.13 illustrate different elements of the bridge under construction and Figure 5.14 shows an aerial view of the project's site.

Source: SCT, 2009.a

*Figure 5.11: Bridge Construction*

Source: SCT, 2009.a

*Figure 5.12: Bridge Construction*

Source: SCT, 2009.a

*Figure 5.13: View underneath the bridge*

Source: McAllen Economic Development Corporation, November 2008

*Figure 5.14: Aerial view Anzaldúas Bridge Construction*

According to George Ramon, Bridge Director for the city of McAllen, the bridge on the U.S. side is substantially complete (98%). The bridge is expected to be in full operation by October 2009. The outbound facilities—including toll stations, the administration building, the parking lot, drainage, etc.—are expected to be completed by August 2009. General Services Administration (GSA), a branch of the U.S. federal government, is building the northbound inspection facilities and expects to complete it by August 2009 (Ramon, 2009.a). TxDOT expects to be done with the access road north of the border station and the connector with Bryan Road by December 2009. The date of the opening ceremony has not been set yet.

At this point, Secure Electronic Network for Rapid Inspection (SENTRI) has not been included, but it will likely be installed in all lanes as it was on the Hidalgo Bridge (Ramon, 2009.a). Also, a deal needs to be worked out with the U.S. Department of Homeland Security Customs and Border Patrol (DHS:CBP).

When the bridge opens for operation in the second half of 2009, only passenger vehicles will be able to use this crossing because of the Presidential Permit clause that states that no commercial traffic will be allowed on the Anzaldúas Bridge until 2015 or until the Reynosa-Pharr International Bridge reaches capacity at 15,000 vehicles per week. There is potential for commercial traffic at Reynosa-Anzaldúas, and SCT has conducted formal studies to present to their U.S. counterparts, pushing to open the bridge to commercial traffic by 2011 (Erazo, 2009.a). According to SCT, the city of Pharr is the only U.S. party who is not interested in opening the bridge to commercial traffic sooner, because this would mean traffic would be diverted from the Reynosa-Pharr International Bridge.

The Mexican entities are not the only ones pushing for commercial traffic in the Anzaldúas Bridge sooner than what the Presidential Permit currently allows. In August 2008, the cities of McAllen, Hidalgo, and Mission traveled to Washington, D.C. in order to request that the permit be amended to allow for commercial traffic to use the crossing sooner. They did not protest the clause when the Presidential Permit was signed because they felt without it the permit would not be signed at all, and they thought it could easily be changed once the Anzaldúas Bridge was constructed (Jorge, 2009). According to McAllen officials, if the permit is not changed, they will lose $1 million a year after 2010 (Holeywell, 2008.a).

Another reason for changing the permit is that it makes more sense to open all possible routes to commercial traffic so that trucks can use the bridge that is closest to their destination, minimizing damage to roads, reducing fuel usage, and diminishing truck idling to improve air quality while lessening public safety concerns (Jorge, 2009).

Currently, about 9,000 commercial vehicles cross the Reynosa-Pharr Bridge each week traveling north and it appears to be at capacity (Erazo, 2009.a). SCT has conducted a formal study that shows the need for commercial vehicles to be allowed on the Anzaldúas Bridge and demonstrates that the new crossing will only divert 25-30% of the Reynosa-Pharr traffic; all other truck traffic will be because the bridge's location makes it a more convenient crossing for that traffic (Erazo, 2009.a). Officials in Pharr claim that changing the timeline on the Anzaldúas Bridge will produce great losses on the Reynosa-Pharr crossing and on the development of the surrounding areas (Holeywell, 2008.b). The city of Pharr is planning on adding a second span to their bridge to allow the existing structure to become exclusively dedicated to northbound traffic, in an attempt to relieve congestion (Holywell, 2008.a). However, the Mexican side does not appear to have any plans to expand their side of the Reynosa-Pharr Bridge.

Another request to amend the Presidential Permit was received in March 2009. The request was made to the U.S. State Department by the chairman of the Anzaldúas Bridge on behalf of the mayors of McAllen, Hidalgo, and Mission. They are requesting that an amendment be made to the article 17 of the permit, which states that the hours of operation for the international crossing shall only be twelve hours per day, seven days per week. The board is requesting that this article be removed and that the hours of operation for the Bridge be determined by demand and available resources. They are requesting that the hours be set by DHS:CBP, along with the Anzaldúas Bridge Board and Servicio de Administracion Tributaria, the Mexican customs agency. Limiting the hours of operation of the bridge would be impractical and 12 hours of operation a day would be insufficient for the projected traffic; the letter also notes that other bridges along the border with Mexico operate 18 or 24 hours a day (U.S. State Department, 2009).

A recent article published in The Monitor mentions that the U.S. State Department dropped article 17 from the permit, the Anzaldúas Bridge is now allowed to be open 18 hours a day. The lobbying for changing the timeline of when commercial traffic will be allowed on the bridge still continues. The McAllen Bridge Director, George Ramon, mentioned that in the following week they will submit an environmental impact study on the bridge as well as a traffic study, both required to allowed commercial traffic at an earlier date. In addition to receiving approval from the State Department, other agencies such as the CBP and the International Boundary and Water Commission will also have to approve this change. This could be challenging as opening the Bridge for commercial traffic before 2015 means that the CBP will have to provide additional staff at the bridge's location earlier than what was planned (Holeywell, 2009.b).

### 5.2.7 Conclusions

The Reynosa-Anzaldúas Bridge is a joint project between Mexico and the United States as outlined by a Presidential Permit signed by both sides in 1999. On the U.S. side, the bridge is a partnership between McAllen, Hidalgo, Mission, the Texas Department of Transportation, and the federal government. On the Mexican side, it is a partnership between the state of Tamaulipas, the federal government, and the concessionaire Grupo Marhnos. It is part of Mexico's NIP.

Construction did not begin until early 2007 and will likely continue until late 2009. There are two other bridges in the area, the Reynosa-Hidalgo Bridge and the Reynosa-Pharr Bridge. Once construction is complete, the Reynosa-Anzaldúas Bridge will ease congestion on these two bridges.

The Presidential Permit that authorizes this new bridge states that commercial traffic will not be allowed until 2015 or until the Reynosa-Pharr Bridge reaches capacity at 15,000 trucks per week. Parties on both the U.S. and Mexican sides are working to open up commercial traffic on the bridge sooner. The federal government on the Mexican side has already agreed to an earlier date, but the U.S. government is still collecting more information before they make a decision, which will likely not be until the fall of 2009 or later (Ramon, 2009).

The concessionaire chosen on the Mexican side for this project was Grupo Marhnos. Peter Stuffer from Grupo Marhnos said during an interview with the researchers on February 26, 2009 that, since on the Mexican side of the bridge only one party is responsible for its implementation (access roads, port, and bridge), they have been able to keep the project on schedule and within budget because they are not dependent on other contractors completing work. He also stated that Grupo Marhnos had work with the Mexican government's previous concession scheme in the 1990s and that the new process is much more transparent, fair, and well defined.

One of the key points stressed by Juan Jose Erazo was that SCT would like to coordinate more closely with the American side on future projects. He also stated that there should be a greater exchange of technology and ideas between both countries. The biggest drawback he mentioned for this project was with respect to the Executive Plan conducted by the state of Tamaulipas, which was outdated and contained several errors that increased construction costs. In the future, SCT would like to take on more responsibility for the Executive Plan.

As far as the economic impact of the Anzaldúas Bridge on Texas and trade between the two countries, the Anzaldúas Bridge Board believes that it will have a positive impact on the area's trade with Monterrey since the bridge will decrease travel time by 45 to 60 minutes (Geller, 2006). The bridge will also help lure new industries to the Rio Grande Valley by facilitating just-in-time delivery since it will provide the quickest access to an area with a high concentration of maquiladoras.

Getting the Anzaldúas bridge right and building cooperative, effective relationships with the Mexican side is considered key to future trade and infrastructure success in Texas and the United States. Based on interviews with Mexican officials, they hope to work more closely with their U.S. counterparts in the future. Both sides said they could see the benefit of more comprehensive joint planning. As Texas moves more towards public-private partnerships, its beneficial to study the concession process outlined in this case study to determine the structure of the partnership, what lessons were learned during the process, and what makes the most sense for public-private partnerships in Texas.

The next section of this report will now turn to look at another mode of transportation across the Texas-Mexico border: freight rail. This section will review the Brownsville-Matamoros West Rail Relocation Project.

## 5.3 Brownsville-Matamoros West Rail Relocation

Matamoros is located in the state of Tamaulipas, Mexico. Situated on the Gulf Coast and the Texas border, the state's economy is defined trade with the U.S. in chemicals, petrochemicals, textiles, and electronics, auto manufacturing, tourism, and oil exploration.

One of the oldest cities on the U.S.-Mexico border, Matamoros has long been an important trading hub. With NAFTA, employment increased dramatically as several international companies, predominantly American, began to operate maquiladoras plants in the city. Since 2000, employment has decreased almost 13 % in Matamoros, due to a slowdown of the maquiladora industry. However, there are still roughly 130 maquiladora employing over 50,000 people in Matamoros (Team Nafta, No date). The state of Tamaulipas accounts for roughly 11% of the total maquiladora activity in Mexico (Understand Mexico, 2007). Transport options are plentiful in Matamoros with both freight rail and trucks connecting the area with Brownsville.

### 5.3.1 Project Description

This case study examines the relocation of rail line away from the city centers of Matamoros, Tamaulipas, and Brownsville, Texas and the construction of a new international rail bridge. Figure 5.15 shows the location of this project.

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Source: Center for Disease Control, 2008

*Figure 5.15: Cameron County/Matamoros Location*

### 5.3.2 History

The history of the West Rail Relocation project can be traced back to 1973 when Brownsville was selected as one of the study sites for relocating rail outside of city centers by the Federal-Aid Highway Act of 1973. Because of many delays, construction on the first segment of track outside of Brownsville did not occur until 1992. After major construction of the Rail Relocation Demonstration Project to reroute track pertaining to port of Brownsville traffic was completed, the plan was to begin building overpasses to reduce car-rail accidents in parts of the city near the bridge where relocation was not possible (Erazo 2009.b.; de las Feuentes, 2009.a). In 2000, the City of Brownsville held public hearings on the construction of overpasses.

However, the overpasses were unpopular with the citizens of Brownsville. They wanted the rail moved completely. Soon after the hearings and weighing the costs of construction with the public's response, the Texas Department of Transportation and local elected officials decided to seek an alternative. Representatives of Brownsville, TxDOT, and Cameron County began looking to see if there was a feasible location to move the international bridge and tracks out of Brownsville (Sepulveda, 2009.a).

Once it was determined that the relocation was possible, local officials met with their counterparts in Matamoros and Tamaulipas to discuss moving the bridge. Because the same safety problems concerning the rail exist in downtown Matamoros, local officials agreed to move forward with the plan to relocate the rail lines (Sepulveda, 2009.a).

After SCT also agreed that the West Rail project was a viable project, there was an exchange of Diplomatic Notes agreeing that feasibility studies should be conducted. The current rail bridge spanning the Rio Grande connecting Brownsville, Texas and Matamoros, Tamaulipas, Mexico was originally opened July 1910 and was the first permanent bridge built across the Rio Grande. Before the bridge was constructed, only ferryboats and a pontoon bridge connected the cities. To connect the two rail lines serving the cities on the border, Congressman John Nance Gardner wrote legislation authorizing the construction of the bridge. The rail bridge spanned 227 feet and was designed as a swing bridge to allow for boat traffic on the river. However, the Rio Grande's boat traffic stopped before the bridge was completed; the bridge has only swung open one time—for an inspection in 1910 (BMBC, not dated).

In 1909, representatives of the St. Louis Brownsville and Mexico Railway and the Mexican National Railways signed an agreement making both railroads equal partners in the Brownsville & Matamoros Bridge Company to oversee construction and operation of the bridge. Now called the B&M Bridge Company, it is an American corporation jointly owned by Union Pacific Railroad (UP) and the federal government of Mexico with the representatives from both entities serving on the board or directors. The main railroads using the rail bridge today are Union Pacific and KCSM (BMBC, not dated). Figure 5.16 shows an aerial view of the B&M Bridge.

Source: BMBC, not dated

*Figure 5.16: B&M Rail Bridge*

Soon after being opened to trains, the bridge was also opened to pedestrian, horse, wagon, and carriage traffic. In 1953, the rail bridge was widened to allow for truck traffic. In 1997, a four-lane concrete bridged was constructed alongside the rail bridge and all pedestrian and automotive traffic was moved to the new addition; truck traffic on the rail bridge ceased with the construction of the Veterans International Bridge in 1999 (BMBC, not dated).

The relocation project will move the rail line away from the city centers of Brownsville and Matamoros to less congested areas. The main goals of the relocation project are the same for both Brownsville and Matamoros: reduction of traffic congestion and noise; improvement of safety and improvement of environmental conditions.

With 14 major at-grade street-rail crossings in Brownsville and 6 major at-grade crossings in Matamoros, traffic frequently backs up as trains move through town. Elimination of the crossings will not only decrease traffic congestion, but also eliminate vehicle-train accidents. Often, trains traveling through Brownsville and Matamoros carry hazardous materials. Cars carrying hazardous materials and chemicals have derailed in the past, and there is concern that this could happen again. By relocating the bridge out of the cities, the chance of more derailments and chemical spills near parks, the Gladys Porter Zoo, and the Matamoros water supply will be eliminated. Furthermore, by moving the rail line the cities will experience a decrease in noise and air pollution. Figure 5.17 shows how close the tracks run to residential areas and, in this case, a children's playground.

Source: IBWC Presentation, 2009

*Figure 5.17: Figure: Train Tracks in Downtown Matamoros near children's playground*

After completion of the relocation project, there are plans on both sides of the border to begin redevelopment of the areas immediately surrounding old rail and switchyard locations. Plans are also in the works to use the previous ROW to construct a "new transportation corridor for the two communities" (Sepulveda, 2008).

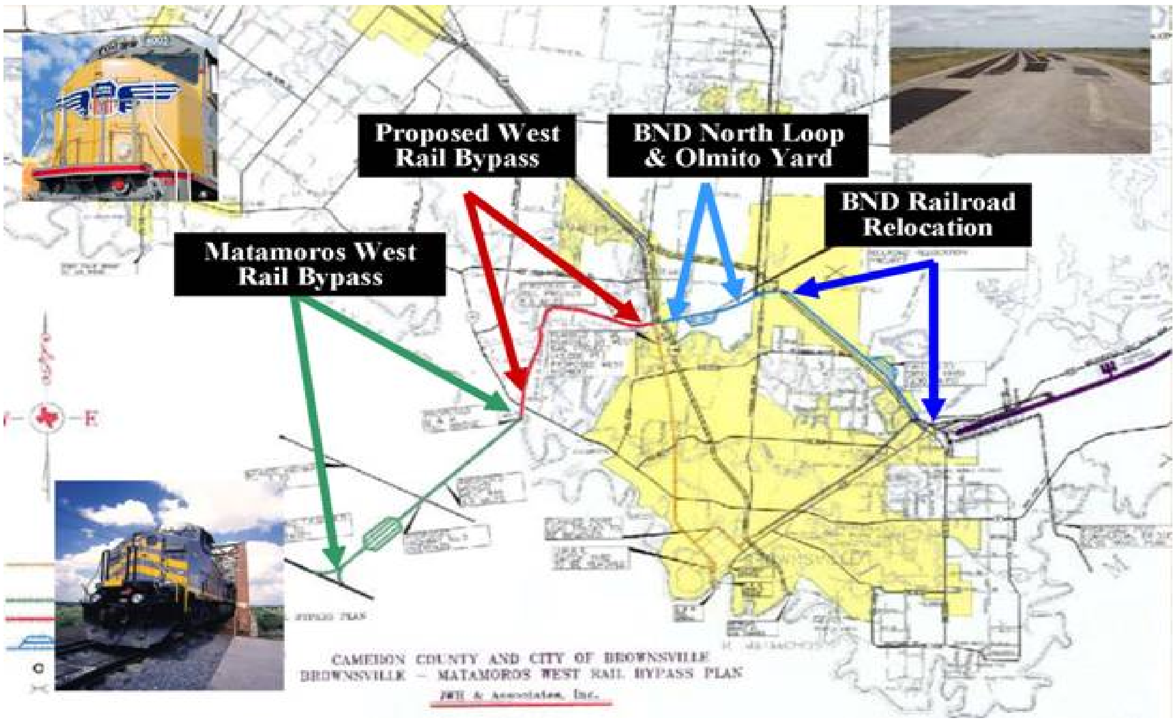
From a financial standpoint, though the relocation of the tracks is expensive, the two cities will benefit from redevelopment of the areas surrounding the current track. The railroads will also benefit by saving time and avoiding accidents and derailments in the cities. Because the trains will no longer be traveling through town and have restrictions on when they can cross the international bridge, it is expected that trains' travel time between Brownsville and Monterrey will be reduced.

### 5.3.3 Planning

Texas and Mexico follow a similar basic structure when planning a project like the Brownsville/Matamoros rail relocation. Feasibility and Traffic and Revenue (or their equivalent) studies are undertaken. The main difference is that environmental studies and ROW acquisitions are completed in different orders and often take varying amounts of time to complete. In general, Mexico can move a project along more quickly than the U.S.

Results from feasibility studies and all other studies performed on the Mexican side of the border throughout the planning process are not currently available as they could not be released before a concessionaire for the construction of the project is chosen (Erazo, 2009.b).

The rail bridge at its current location has track running to and from it through the downtown corridors in both Brownsville and Matamoros. The location that has been chosen for the new bridge is 15 river miles upriver from the current B&M rail bridge, and will allow for the rail tracks to be moved out the downtown areas in both cities. The rail will be relocated west of the city in an uninhabited local area (Sepulveda, 2008). The West Rail Bridge will be located at river mile 71.7, spanning the Rio Grande between River Bend, Texas and San Pedro, Tamaulipas (IBWC, 2009). Figure 5.18 shows a map of the project, including the relocated rail lines, new switchyards, and new international bridge. Figure 5.19 shows the Matamoros relocation in greater detail.



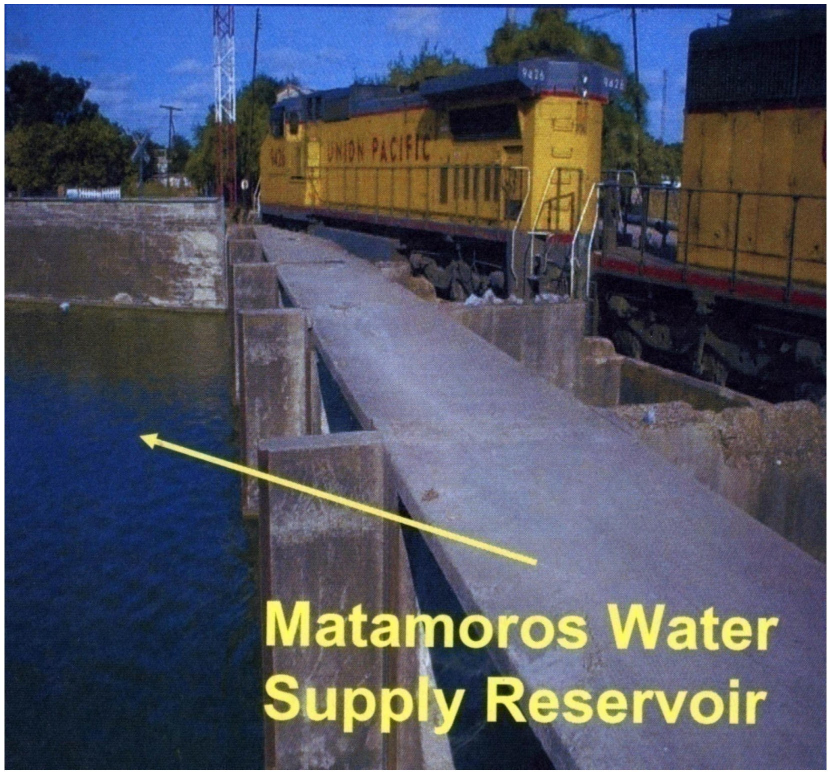

Source: IBWC, 2009

*Figure 5.18: Cameron County Map of Relocation Projects*

In Brownsville, the rail line that frequently moves trains with chemicals and other hazardous materials travels 50 feet from the football stadium, mere feet from the Gladys Porter Zoo including over a ditch that drains through the zoo, straight through the business district and adjacent to the Federal Court House. After crossing into Matamoros, the train tracks follow a path that sends trains over a bridge spanning the main Matamoros water supply reservoir, through backyards and feet from children's schools and playgrounds before arriving at the switchyard, also in downtown Matamoros. The current switchyards are located between Hidalgo and Galaena Streets and as well as between Siete and Manuel Cavazos Lerma in downtown Matamoros (Silva, 2008). Figure 5.20 shows a derailed chemical car less than ten yards from the zoo and a drainage ditch that runs through the zoo in Brownsville, and Figure 5.21 shows the tracks crossing the Matamoros water supply.


*Figure 5.19: Map of Matamoros Rail Relocation*


*Figure 5.20: Derailed chemical rail car and drainage ditch by Zoo*




Source Figures 5.19 through 5.21: IBWC, 2009

*Figure 5.21: Train running over Matamoros' main water supply.*

*Project Sponsors*

Because the relocation of the rail bridge is an international project, there are many entities that must be involved in decision making. On both sides of the border, there is a project sponsor leading the project with a project manager coordinating details among the stakeholders. The project sponsor in the United States is Cameron County, and their Mexican counterpart is the state of Tamaulipas. Throughout the research process, the many attempts to speak with a representative from the state of Tamaulipas were unsuccessful. Table 5.10 shows the various government and private-sector players involved in the project.

While Cameron County and the state of Tamaulipas are the official project sponsors, both entities work closely and share responsibilities with their counterparts in the city of Brownsville and the city of Matamoros. Local officials on both sides of the border work together as one bi-national team and travel together to both Mexico City and Washington DC to communicate with and lobby the federal departments and secretaries when necessary (Erazo 2009.b; de las Fuentes, 2009.a).

All major stakeholders in the project meet on a monthly basis to discuss the progress of the project. These meetings are led jointly by the two project managers. The two project managers are in communication on a daily basis (Sepulveda, 2009.b).

**Table 5.10: Public and Private-sector Stakeholders in Rail Relocation**

| Government, Private, and International Players in Relocation | | |
|---|---|---|
| **United States** | **Mexico** | **International** |
| *Project Sponsor:* Cameron County<br>• City of Brownsville<br>• Texas Department of Transportation<br>• TxDOT Pharr District<br>• U.S. Department of Transportation<br>• U.S. Department of State<br>• Union Pacific Rail Road<br>• Brownsville Rio Grande International Railroad<br>• U.S. Environmental Protection Agency<br>• U.S. Fish and Wildlife Service<br>• Texas Parks and Wildlife Department | *Project Sponsor:* State of Tamaulipas<br>• City of Matamoros<br>• Secretary of Transport and Telecommunications<br>• Ministry of Foreign Affairs<br>• Kansas City Southern de Mexico | • Border Environment Cooperation Commission<br>• International Border and Water Commission<br>• Border Environment Cooperation Commission<br>• Bi-national Group on International Bridges and Crossings |

Source: IBWC, 2009; Sepulveda, 2008 and 2009.a; Erazo, 2009.b; and de las Fuentes, 2009.a

On the Mexico side, SCT has coordinated all studies and INDABIN has provided land value assessments for ROW acquisition. The KCSM railroad is currently in its eleventh year of a 50-year concession to operate the rail tracks. Their track rights start at the Mexican border of the B&M Bridge and include the two switchyards that will be relocated, requiring them to play a major role in the project. Per the concession, SCT cannot change the tracks or the switchyard without explicit, written approval from KCSM. KCSM has a great deal to gain from the relocation project, in both time savings and safety. However, because they own and operate the international rail bridge that crosses in Laredo/Nuevo Laredo, they consider the Brownsville/Matamoros crossing secondary to the Laredo bridge. KCSM is involved in the technical decisions and details of the project. According to David Eaton, the Vice President of KCSM, the railroad is set to benefit from this project as the final project will be more efficient than the current set up they are working with (Eaton, 2009).

*Bridge Management*

The current rail bridge is still operated and maintained by the B&M Bridge Company, with both inbound and outbound tolls received by the American corporation. Mexican and U.S. Customs officers are on duty on their respective sides of the border (Galvan, 2009).

The only two railroads that have rights to the tracks crossing the bridge are UP in the United States and KCSM in Mexico. However, the port of Brownsville's short line railroad, Brownsville Rio Grande International Railroad (BRGR), sends one train southbound and has it returned daily. Because BRGR does not have rights to the track, they must transfer the trains' crew to a 100% UP crew at the UP switchyard before sending it over the bridge. UP crews cannot operate in Mexico just as KCSM crews cannot operate in the United States; therefore, when a train is crossing the border, the crews must switch on the middle of the rail bridge (Galvan, 2009).

Since 2005, the number of rail cars passing over the bridge has steadily decreased. In 2005, 104,396 rail cars crossed the bridge going northbound while 71,751 rail cars crossed in the southbound direction compared to 80,483 and 73,352 in 2008 (Galvan, 2009).

KCSM owns the rail bridge in Laredo and typically finds it more efficient to use the Laredo bridge over the Brownsville bridge. In an interview, David Eaton, Vice President of KCSM, said *"we like the Laredo bridge more than we like the Matamoros/Brownsville bridge, but the Brownsville bridge is an important bridge for us."* KCSM considers their most important traffic over the Matamoros bridge to be the cargo coming out of the port of Brownsville and the empty containers sent northbound into Matamoros for UP, because UP prefers their empty cars to come through Brownsville for ease of repositioning (Eaton, 2009).

Another reason KCSM prefers to send empty cars up from Mexico City to Brownsville/Matamoros is to reduce the number of empty containers traveling on the rail corridor going from Laredo to Monterrey to Mexico City. This reduces congestion on the route, leaving the route open for loaded cars, allowing those trains to increase travel speed. The route from Nuevo Laredo to Monterrey is heavier gauge track than the track on the F-Line from Matamoros to Monterrey, allowing for higher speeds and heavier cars (Eaton, 2009).

*Goals and Benefits of Project*

The main goals of the relocation project are the same for both Brownsville and Matamoros: reduction of traffic congestion and noise, and improvement of safety and environmental conditions. The removal of the tracks from the urban centers will reduce vehicle-train accidents, decrease traffic congestion, and eliminate the threat of hazardous material and chemical spills near water supplies and recreational areas. Noise pollution from the trains as well as air pollution from cars waiting at train crossings will also be reduced. The governor of Tamaulipas, Eugenio Hernández Flores, announced that the project will raise train efficiency by 70% in the area (State of Tamaulipas, 2008.a). The project is expected to significantly reduce train travel time between the two cities.

In Mexico, the relocation of the bridge will open an additional 617 acres of land for industrial development (State of Tamaulipas, 2008.a). After completion of the relocation project, Matamoros will begin redevelopment surrounding the previous ROW and switchyard locations. Plans are also in the works to use the previous ROW to construct a *"new transportation corridor for the two communities"* (Sepulveda, 2008). Officials would like to use the existing ROW to build a toll road to facilitate travel between the two cities.

### 5.3.4 Environmental Process

In Texas, before the ROW could be acquired, environmental impact studies had to be completed and environmental clearance received before issuing a Presidential Permit to construct the bridge. In Texas, because the rail line will run along federally protected land owned by U.S. Fish and Wildlife Service, there were numerous public hearings before a final location could be determined and the project could receive environmental clearance (Sepulveda, 2009.a).

While construction and demolition during the project is expected to increase levels of dust and airborne particles and create additional exhaust because of the machinery and equipment, moving the trains out of the downtown centers will decrease the overall economic impact of the trains in many ways: the trains will not cause large traffic delays forcing cars to sit idly producing high levels of exhaust; noise pollution in the city from the trains will be eliminated completely and transportation of hazardous materials through densely populated areas will also be eliminated (U.S. EPA, 2004). The U.S. Environmental Protection Agency released the Finding of No Significant Impact and Summary Environmental Assessment for the project on June 18, 2004 and it was published in the Federal Register on June 25, 2004.

On the U.S. side, a draft environmental assessment (EA) of the proposed project was prepared by Raba-Kistner Consultants Inc. and HNTB Inc. on behalf of the Presidential Permit Application (U.S. EPA, 2004) before any acquisition of ROW took place. The EA reviewed six alternatives, which included five different route alignments and a 'no-build' alternative, as is the norm in U.S. environmental reviews under the National Environmental Policy Act of 1973. The alternatives that were viewed as "not preferred" included routes that would require acquisition of additional acreage of prime farmlands, or would require geotechnical analysis and further remedial work alongside the irrigation district main reservoir, including the need to complete bridging along a greater section of the reservoir, which would add costs of approximately $3.15 million to the project (U.S. EPA, 2004). The final route that was chosen was found to require some acquisition of farmland (46 acres), but would have minimal impact on wetland areas. The general area is home two species of federally protected cats (ocelot and jaguarundi), a federally protected bird (aplomado falcon), and two plant species (Texas Ayenia and South Texas Ambrosia). Surveys of the recommend site found that the vegetation was less dense and therefore the regular presence of these species in the immediate protected area was considered unlikely. In addition to the federally protected species, however, there were 15 state-listed threatened or endangered species that may use portions of the project because of the presence of potentially suitable habitat. Because of this U.S. Fish and Wildlife Service and the Texas Parks and Wildlife Department made several recommendations to Cameron County to mitigate these effects and to undertake specific precautions during construction. Cameron County agreed to comply with these provisions (U.S. EPA, 2004). This also ensured that the U.S. and Texas could stay compliant with the provisions of the Migratory Bird Treaty Act.

Mexico's procedure was exactly the opposite. Before any environmental impact studies are started, the ROW acquisition needed to be completed. For the project to continue in its current location, standards set by the Environmental Impact Manifestation would need to be met. As of the writing of this report, the ROW acquisition has been completed, and it is unclear whether or not the environmental assessment is complete. If, after the environmental assessment is completed, it is determined the current location will not work, the search for a new location will begin. Under these circumstances, the former landowners who sold off strips of their land for the project would not be able to get their land back (de las Fuentes, 2009.b).

### 5.3.5 Right-of-Way Acquisition

While the ROW acquisition on the Texas side of the border is expected to take 18-24 months, the ROW acquisition took only approximately 60-90 days on the Mexican side of the border (Sepulveda, 2009.a).

Approximately 15 acres of land had to be acquired for the new switchyard west of Matamoros, as well as a strip of land approximately 9 miles long and 16 miles wide for the new track from the bridge to the new switchyard and then to the existing track. In general, the land acquired was being used for farming and agricultural purposes (Eaton, 2009).

General parameters on the location for the new ROW were determined by the officials representing the state of Tamaulipas and SCT with input on technical details provided by KCSM. Next, INDABIN determined the value of the land and members of a technical group composed of officials from both the State of Tamaulipas and Municipality of Matamoros held town hall style meetings with property owners to discuss the acquisition process and distribute letters of offer for the land (Erazo, 2009.b). According to SCT, *"negotiations so far have been successful"* (de las Fuentes, 2009.b). However, Eaton of KCSM said that on a few occasions the desired ROW could not be acquired either due to problems in negotiating with property owners, including unwillingness to sell their land or because of land title problems. Under these situations KCSM, provided technical assistance to route the track around the specific properties (Eaton, 2009).

Currently, KSCM has the ROW to two switchyards in the middle of Matamoros as well as the track running to and from the switchyard. The state of Tamaulipas and the City of Matamoros has purchased the new ROW that will be used for the new track and KCSM's switchyard, and will be swapping with KCSM for the ROW they currently maintain.

Under the new scenario, KCSM's operations will be more efficient as the two switchyards will be merged into one 15-acre yard that will be slightly larger than the smaller yards they are currently operating (Eaton, 2009).

*Public Opinion*

Public opinion of the rail relocation project is very positive on both sides of the border because the project will be reducing traffic congestion, noise, pollution and eliminating the risk of rail-automotive accidents and derailments in the city. The number of people negatively impacted is fairly negligible compared to those positively impacted, as the new rail lines will be located in unpopulated areas. As could be expected, there has been slight amounts of pushback from those whose land will be taken or dissected by the rail, but so far there have been no serious problems.

### 5.3.6 Project Implementation

Both Texas and Mexico have a project manager charged with coordinating activities and updating their counterparts on the progress of the project. The project managers are representatives of the two project sponsors: state of Tamaulipas and Cameron County.

*Financing*

The rail relocation project in Mexico will be financed through a 30-year concession. Construction and maintenance of the rail bridge and the new Brownsville switchyard are included in the third Northeast Highway/Infrastructure Package (Paquete de Autopistas del Noreste) of the NIP. This package of projects is focused on infrastructure developments in the states of Tamaulipas and Nuevo Leon. It includes construction of the West Rail Bridge as well as modernization and construction of 280 miles of highway and the maintenance and operation of several international bridges. Those who chose to bid will be required to bid on all projects, as the concession will be awarded to one bidder, which will likely be consortium of contractors. The package was announced on September 18, 2008 with a bid deadline of March 30, 2009. The concession was expected to be announced on April 30, 2009, but as of publication the award had not yet been made. The concession is expected to start on July 31, 2009 (Presidencia de la Republica, 2008).

It was not always the intention to have the project on the Mexico side of the border fully financed through a concessionaire. A debate on how to pay for the project lasted a couple of years. At one point, KCSM was told they would need to pay for 25% of the costs. While KCSM refused to finance 25% of the project they were undecided on whether or not to finance some portion of the project (Eaton, 2009) In April 2008 Oscar Corzo, SCT Director of Multimodal and Rail Transport said that SCT felt that the project should be funded through a public-private partnership that included KCSM (Angel Castillo, 2007). Until SCT announced the funding proposal at the end of 2008, KCSM did not know that they would not be required to provide any money for the relocation project (Eaton, 2009).

To that end, Tamaulipas and Matamoros will acquire the ROW that KCSM currently has in downtown Matamoros that has both high social and financial value, while KCSM will be provided the newly acquired land on the outskirts of the city. As of March 2009, KCSM had concerns about the concession process and who would be chosen as the concessionaire because it was unclear to them how the new bridge would be administered, how the concessionaire will set the toll on the bridge, and how much the concessionaire will be allowed to increase the toll above what is currently being charged at the B&M Bridge. Specifically, there is concern that the new toll will be substantially higher than what it is now. KCSM has been working with SCT to determine what would be a reasonable amount to set the new tolls; and KCSM is prepared to withhold authorization to change their concession if they are unhappy with the outcome of the concession process. If KCSM does not offer written authorization, the project will not be able to move forward (Eaton, 2009).

The exact location of the bridge was determined through negotiations with Cameron County, the city of Matamoros and the state of Tamaulipas. On the Mexican side, KCSM played a role in helping set specific markers on where the track and bridge should be located but followed the lead and specifications set by the state of Tamaulipas and SCT. After much negotiation a location was set and an agreement was signed by the Cameron County Judge, the Mayor of Matamoros and the governor's office in Tamaulipas. Because Cameron County was given environmental clearance at a specific river mile mark, the location cannot be changed without starting the environmental process over again. However, if Mexico decided it was necessary to move the bridge slightly, the angle at which the bridge crosses the river could change. (Sepulveda, 2009.a; Erazo, 2009.b; and Eaton, 2009).

Once the final location was set, it was determined by Cameron County that the cost of the bridge could be reduced greatly if the length of the bridge was shortened. The International Boundary and Water Commission require levees to be at least 2300 feet apart, but in this case, the levees were 4600 feet apart. However, the distance between the U.S. levee and the official international border was fairly small, while the span on the Mexican side was very large making it necessary to move the levee on the Mexican side of the bridge. With the expectation that the change in location of the levee could reduce the construction cost of the bridge from approximately $15 million to $5 million dollars, the U.S. officials approached Mexican officials with a recommendation to relocate the levee and shorten the full span of the bridge (Sepulveda, 2009.a).

To make the decision on whether or not to move the levee, a hydraulic study was conducted by Felipe Ochoa and Associates and bridge simulations were completed by HNTB.

The process took nearly two years, and Mexico ultimately decided to move the levee (Erazo, 2009.b).

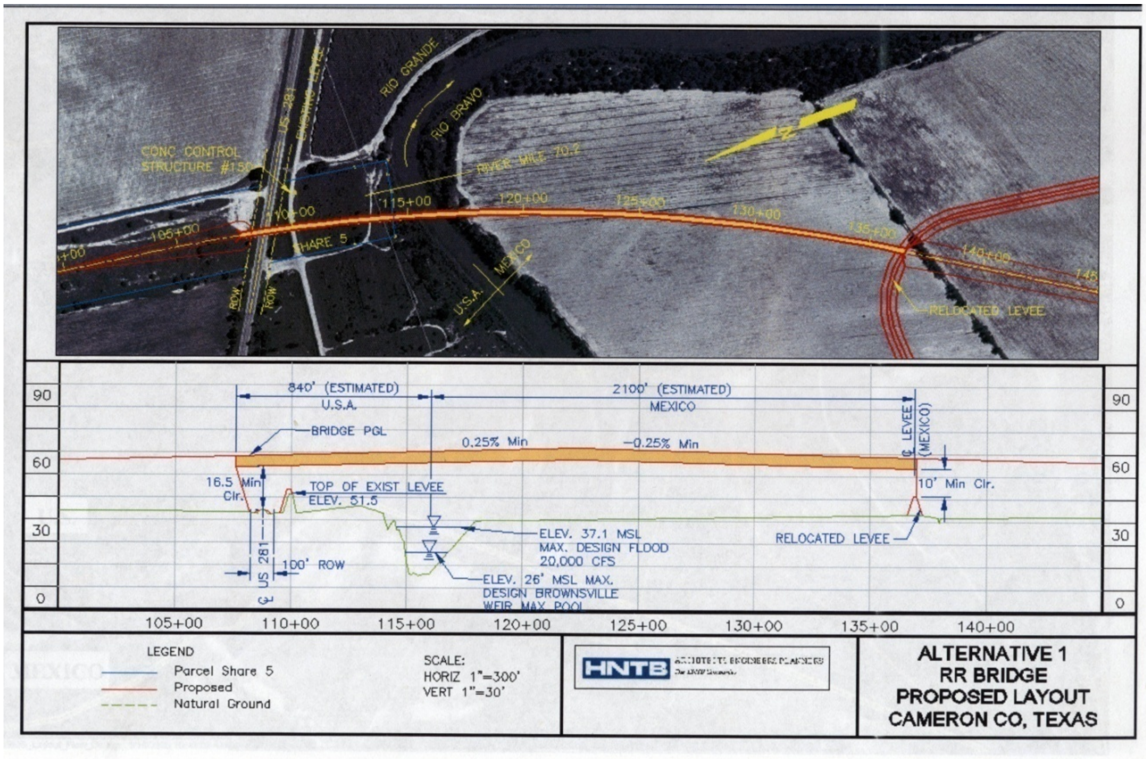
According to SCT, the cost of the moving the levee was "not much" and will save approximately MXP$2 million on the Mexican side of the project (de las Fuentes, 2009.b). The final decision to move the levee and costs of construction of the levee are the responsibility of Mexico in this project. However, it is not uncommon to have both countries working together to determine levee location with only one country relocating their levee. When planning and constructing the Veterans Bridge at Los Tomates in Brownsville, the levee on the U.S. side was reconstructed after much input from Mexico (Sepulveda, 2009.b).

The original and proposed levees are detailed in Figure 5.22 and give a good idea of just how much land can be opened up for development on the Mexico side of the border as well as how much the length of the bridge will be reduced. The rendering shows two proposed levees; the levee closest to the river basin is most closely representative of the final levee location.


Source: IBWC, 2009 presentation

*Figure 5.22: River Flow Analysis with current and proposed levees*

While the final design of the bridge has not been decided, Figure 5.23 shows a simulation provided by HNTB with the new location of the levee. The cream lines are the current levees. The orange and red lines on the Mexico side of the border were proposed levee. The final location is closest to the red mark.




Source: IBWC, 2009

*Figure 5.23: Simulation of proposed bridge (with relocated levee)*

*Technical Agreement*

Before construction can begin on the project, final technical details will need to be negotiated and agreed upon by both sides and then included in a technical agreement signed by the Mexican Secretary of Transportation and the Cameron County Judge. The technical agreement will include the project's start and end dates as well as details on financing of the project. Historically, the bridge would be financed 50% by the U.S. side and 50% by the Mexican side, but that is not a requirement. Through negotiations, it could be agreed upon that one side pays for slightly more than the other side. While the construction company selected by the U.S. side cannot work in Mexican territory and the concessionaire chosen by the Mexican side cannot go into U.S. territory for construction, it could be negotiated that the center span of the bridge be bid separately of the two current bids. In this case both countries would share costs of this separate bid negotiated by the bi-national working committee (Sepulveda, 2009.a).

In March 2009, the Mexican Secretary of Communications and Transportation and the governor of Tamaulipas were saying publicly that the bridge construction would begin in May of 2009, but so far no construction has begun. Cameron County officials say that they will not be able to start until August of 2009. However, two separate start dates can be included in the agreement with the final project being completed at the same time. In past international bridge projects, it has happened where the U.S. side actually began construction before the Mexican side, and in the end both sides finished on time and together. With this project, when the Mexican concessionaire starts construction they will need to construct the new KCSM switchyard and bridge as well as lay the track leading up to the bridge; on the U.S. side, the new switchyard is already in place and functioning, leaving only tracks to the bridge and bridge construction to be completed (Sepulveda, 2009.a).

Once a technical agreement has been negotiated and finalized, the final diplomatic notes will be exchanged, with Mexico notifying the U.S. State Department that a technical agreement has been negotiated and declare their readiness to move forward with the execution of the agreement. Then, the U.S. Secretary of State will agree and follow with a final diplomatic note to move the project forward.

Representatives from both sides of the border will continue to have a regular monthly meeting until construction is complete.

*Toll Roads*

Once the rail relocation is completed and the new international rail bridge is operational, it is expected the next major transportation project in the region will be to construct toll roads using the ROW currently used for the rail tracks running through both downtown Brownsville and Downtown Matamoros. While still in the planning phases, the Cameron County Regional Mobility Authority has already purchased the ROW from Union Pacific. Officials on the Mexican side of the border also hope to be able to use the KCSM ROW to create a transportation corridor that will provide a quicker drive time from outside of the city to downtown. If both cities build the corridor, it is expected that the current B&M Bridge will be used for vehicular traffic.

### 5.3.7 Conclusions

The West Rail Relocation in Brownsville and Matamoros offers a clear look at border coordination and collaboration among many entities. Local officials working in the interests of those directly affected by trains running through their cities have worked closely together to keep the project moving and to garner support with national officials on both sides of the border.

The U.S.-Mexico Bi-National Commission on Bridges and Border Crossings, a commission that meets every 6 months to look at all international projects from Brownsville to San Diego, recently took a close look at the Brownsville/Matamoros rail relocation project. The commission recommended that the project be used as a model for coordinating cross border projects and getting them approved (Sepulveda, 2009.a). With multiple bridge projects up and down the Texas-Mexico border currently in the planning process or already under construction, a project nearing completion that has successfully coordinated across the border and the local, state, and national level will be highly beneficial for planners in communities facing high levels of congestion.

While coordination and planning among sponsors and governmental entities has been lauded as a success, it seems as though communication to outside stakeholders and organizations has been lacking. Representatives from KCSM, the B&M Bridge Company, the port of Brownsville, and the port's short line railroad Brownsville Rio Grande Railroad all expressed concerns with not having the information they need in a timely fashion (Campirano, 2009; Galvan, 2009; Torres, 2009; and Eaton, 2009).

B&M Bridge Company currently operates the rail bridge connecting Matamoros and Brownsville, however, in speaking with the President and COO of the company, José Galván, it is clear that because the B&M Bridge Company will play no role in the operation of the new bridge, they are not involved in any aspect of the planning or decision making process. Even though the federal government of Mexico has four representatives on the board of directors, Galván says that everything he knows about the project he has received from the news. As of February 2008, the B&M Bridge company had no clear idea when train operations on their bridge will cease. He also expressed concern that B&M Bridge representatives will not be included in discussions on the potential toll road that will takeover the current rail bridge construction and operation (Galvan, 2009).

The port of Brownsville and KCSM have the same concern: crossing fees at the new bridge. Representatives of both are concerned that operators of the new bridge will have the opportunity to drastically increase the cost of fees crossing the Rio Grande River. While it was acknowledged that a fee cannot and should not be set for the entire concession because costs increase, uncertainty on how the bridge will operate escalates the price concerns as questions have gone unanswered. However, due to the fact that the bridge project cannot move forward without KCSM's approval, it is somewhat doubtful that the fee increases will be too drastic.

# Chapter 6. Other Proposed Projects in the NIP

TxDOT also requested that two further case studies were undertaken as part of the second year's research. These were the port projects at Punta Colonet and Topolobampo which had received copious amounts of press coverage. The intermodal port and rail project at Punta Colonet was a flagship project within the NIP, and had received global press coverage for its potential to become a competitor port to the West coast ports of LA and Long Beach. Researchers followed the progress of plans for the development of these ports and as at the time of publication (September 2009), the Port of Topolobampo is still a third-tier project without any time frames specified in the NIP. Development at Punta Colonet is one of the major projects listed in the NIP, but as a consequence of the economic downturn the RFP for this project has still not been released by SCT. This chapter provides the reader, with an overview of these projects and a brief update of their current status, and any other issues that have arisen surrounding these two port projects.

## 6.1 Port of Punta Colonet

Punta Colonet is currently an underdeveloped fishing village located on the Pacific Coast of the state of Baja California, about 150 miles south of Tijuana (Figure 6.1). It is the site of one of the most ambitious infrastructure projects championed by the current administration – a plan to provide an alternative port of entry to Los Angeles which is the largest container port complex in the United States, and at the time the NIP was released, was facing increasing congestion.


PEGGY PEATTIE / Union-Tribune

The sleepy, sweeping inlet of Punta Colonet in Baja California will be transformed into a multibillion-dollar container port, one of the biggest maritime transportation centers on the West Coast of North America, under a plan by Mexico's government.

Source: Lindquist, 2005

*Figure 6.1: Port of Punta Colonet*

Baja California is bounded by the Gulf of California and the Pacific Ocean in northwestern Mexico. It is bordered by the Mexican states of Baja California Sur and Sonora and lies on the international border with the United States to the south of California. Its capital city is Mexicalia (opposite Calexico CA). Other major cities that are well known to the US are Tijuana and is a major border entry port to the US, and Tecata and Playas de Rosarito. The population for Baja California was estimated at 2.8 million people in 2005, and its major industries are tourism, maquiladora manufacturing, and fishing. The port of Ensenada, which lies north of Punta Colonet is home to one of Mexico's largest fishing industries and also has limited cargo capacity. Baja California has one major highway – Highway 1 – which runs south from Tijuana. The entire Baja Peninsula was designated by UNESCO as a World Heritage Site in 2005 – the islands and coastal areas of the Gulf of California also belong to the larger gulf-wide heritage site. For these reasons, conservation interests are active in the region both in the preservation of land and marine resources given that the waters in the Gulf of California also important breeding grounds for whales and other unique species.

### 6.1.2 History

The development of a major port proposed for this area would be a new project not physically connected to existing port facilities at Ensenada. API Ensenada has been charged with promotion of the project however while the terminal may be tied for administrative purposes to the Port of Ensendada, it is intended to serve a completely different function and would not be part of the Ensenada Port Complex. Proposals to develop a container terminal south of Ensenada to act as a relief valve for the ports of Los Angeles and Long Beach have been discussed for approximately the past 10 years, particularly because of the dramatic increase in Asian trade, and the pressures on the Ports of Los Angeles/Long Beach that were seen in the early and mid 2000s. Rumors have periodically swirled that the project is imminent since at least 2005. This route would also be a1000 miles closer to the U.S. border compared to its competitor ports of Lazaro Cardenas and Manzanillo. Despite its technical proximity to the border, the port complex would still be far removed from major rail dependant population centers. Proponents of the port argue that it would be less burdensome for transpacific lines to call at a future Punta Colonet port as opposed to facility further down the Mexican Pacific coast due to a shorter overall maritime distance from Asia (International Rail Journal, 2007).

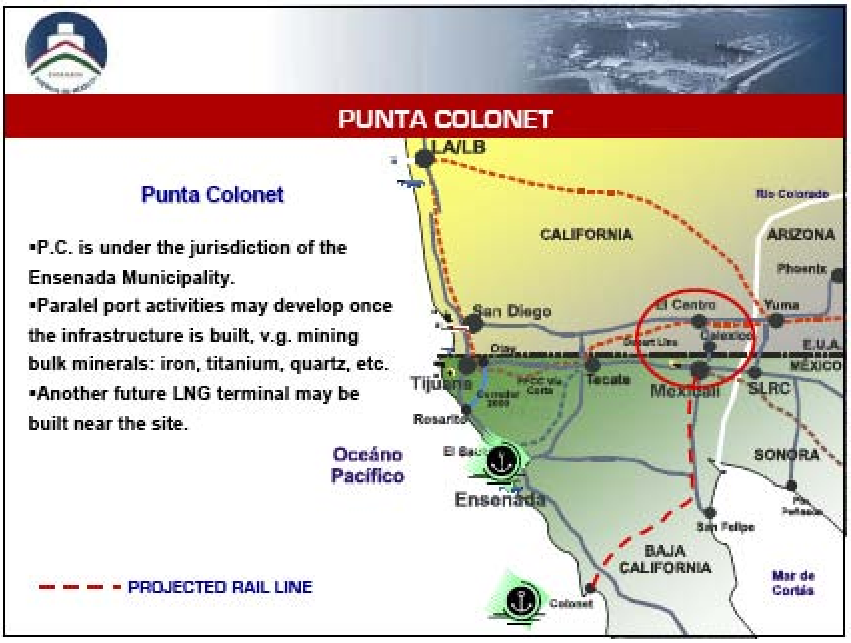

Source: Gonzalez, 2006

*Figure 6.2: Site of Proposed Port at Punta Colonet*

### 6.1.3 Planning

According to Lindquist, Baja California authorization to conduct a feasibility study was given directly by then Governor Eugenio Elorduy Walther (Lindquist 2005). The feasibility study was performed by Hutchison Port Holdings (HPH), the operator of Ensenada's cargo and cruise ship operations; and U.S. railroad company UP in 2005. News reports noted that HPH began conducting the feasibility study in 2005 in conjunction with UP. The companies later pulled out of the project, citing lack of clarity in the bidding process (Business News Americas, 2007). The cost for this project was estimated in 2005 at US$1.2 to US$2 billion.

In 2006 SCT authorized the creation of a deep sea port for this area and it was included as one of the 'flagship' projects in the NIP. Almost immediately Ferromex – who already operates a rail line in Baja) announced its intention to bid for the construction of the 180 mile rail line (Mireles, 2006). The area for the future port facility is currently not served by any rail lines. Highway 1 which runs from Tijuana south to Baja California Sur would also require major upgrades to handle increased port traffic (Figure 6.3).




Source: Gonzalez, 2006

*Figure 6.3: Port of Punta Colonet: Proposed Rail and Road Connections*

Currently Ensenada International Terminal (operated by HPH), located about 100 kilometers south of the U.S. border serves as a container and general cargo terminal for Baja California. This port began operations in 1997 when HPH was awarded a 20 year concession. In 2005 the port doubled the number of containers it handled in 2004 after the completion of a dredging project that increased the depth of its harbor to 40ft (12.2m) (Business News Americas, 2006). News reports cite that the port at Punta Colonet will ultimately cover over 30km$^2$ (7,413 acres) making it as large as LA/Long Beach combined in terms of total area. The project would require dredging to accommodate post Panamax container ships which can require up to 50 feet of draft. A breakwater with 10 to 20 berths is proposed. The project will also require a power plant and desalination plant both of which are listed in the NIP as projects for the medium term. The NIP also notes that the port will require the development of a new city and the improvement of the Trans-peninsular Highway from Manaeadero to Punta Colonet (Neyoy, 2007). As proposed, the plan envisions that by 2025 the port could have the theoretical capacity to process 6 million TEUs, thereby placing it in a similar league to the nearby facilities of Los Angeles and Long Beach.

According to Lindquist the project prompted business activity in the area even before it was officially announced and the bidding competition been created. Prices for land at Colonet, owned by small *ejido* communal groups, reportedly soared from 5 cents a square meter to $5 a square meter. According to Lindquist, 132 acres had been *'snatched up'* in 2005 with former Baja Governor Ernesto Ruffo Appel and a partner having brought one of the parcels and allegedly a nearby mountain top and right-of-way to move rock to be used in the project. Ruffo Appel announced that they had purchased 2,500 hectares (600 acres) spending about US$3 million (Lindquist, 2005).

The project has had multiple proponents, who have either developed dovetailing projects to interline with the port proposals, or have created their own port proposals. These include

Roberto Diaz a consultant and former Baja California official who put together the planning model with Ernesto Ruffo Appel and Esenada businessman Roberto Curiel Amaya. Their plan was to construct a terminal capable of processing 850,000 TEUs annually with up to 18 berths (Mireles, 2007). They also planned to build a rail line to Ciudad Juarez, as opposed to the federal plan that had proposed crossing through Mexicali and Yuma, AZ. According to news reports their company Punta Colonet Infrastructure has brought up parcels of Ejido land along the coastline (Mireles, 2007). Other groups have also shown interest and lobbied the Mexican government for this project, this includes Maersk-SeaLand, and Vida Ensenadense, an Ensanada Citizens group who identified Punta Colonet as an ideal site as an alternative to expansion of the port at Ensenada. Also Roberto de la Madrid with former Atlantic Richfield Chairman Robert O Anderson has laid out plans to transform Punta Santo Thomas into an energy center that would justify and support greater development at Punta Colonet. This includes a LNG receiving terminal, the power plan and desalination facility. Both of these projects were listed in the 2007 NIP.

However, the planning for this port has not been all smooth sailing. A mining concession in this area has presented a potential complication for the development of the Colonet project. The Federal Economy Secretariat issued a mining concession to Group Minero Lobos, to mine titanium and other metals from the seabed in the bay at Punta Colonet. This concession covers over 30,000 hectares of coastline and stretches roughly 3 miles to sea (Mireles, 2006). They issued a habeas corpus plea against the port designation in May 2005 arguing that the secretariat had granted them a 30 year concession to exploit the land, and therefore they were the sole concessionaire for the area that was allocated to the port.

UP also slowly backed away from the feasibility planning process. This was partially as a result of the community activism in Yuma on the U.S. side of the border, who objected to the rail line that would come from this port up to the U.S. entering into their community. UP had proposed a new rail line would be built from the port to Yuma Arizona to link into the company's Sunset Corridor line that runs from LA through El Paso to Chicago (Blake, 2007).

*Public Input*

There are also other issues that have surfaced around this site. First and foremost the land owned around this site is Ejidatario land. News reports throughout 2007 stated that various members of the Ejidatarios have sold out leaving other members without compensation. Figure 6.4 from the San Diego Tribune shows the make up of the Ejidatario land (San Diego Tribune, 2007).

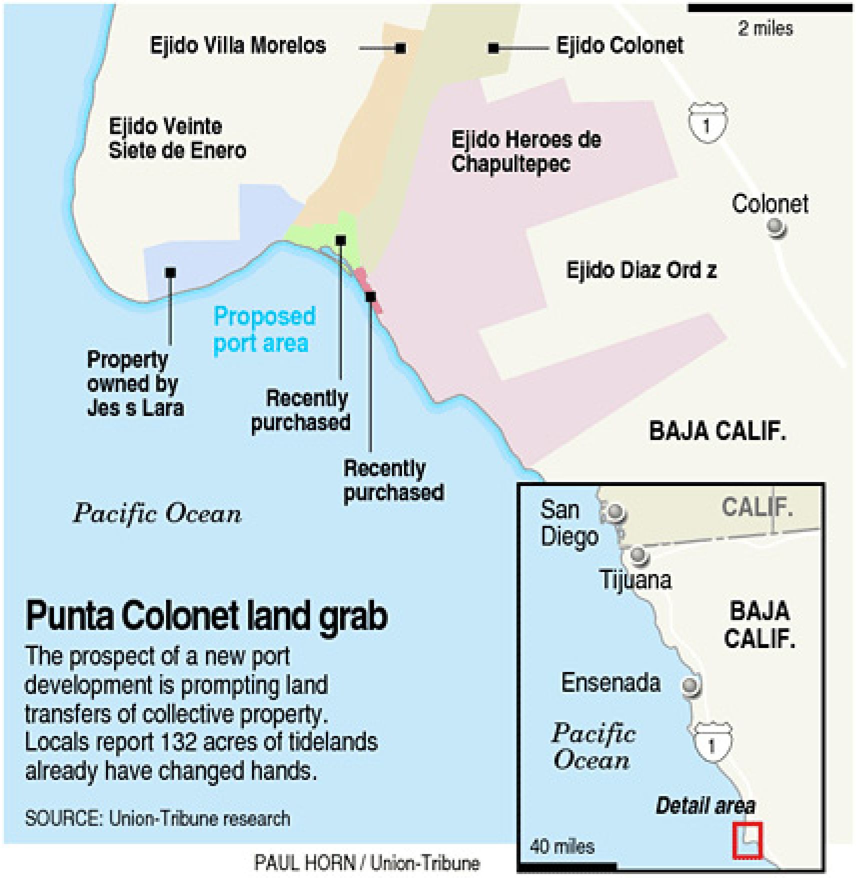



*Figure 6.4: Ejido Land at Punta Colonet*

Non-profit groups have also reviewed the proposed port. Coalition for a Safe Environment (Coalition, 2005) issued an environmental and social assessment of the proposed port in 2005. This report made multiple recommendations to offset the environmental justice impacts that this port would disproportionally induce for the low income communities that live adjacent to this facility and proposed infrastructure development. They recommended a buffer zone similar to the buffer zone that is found around the port of Altamira.

There has also been major public opposition from the U.S. side regarding rail connections into the US. Farming groups in the Yuma area in Arizona objected to potential subdivision of farming land through eminent domain (Blake, 2007). Another concern is that if Punta Colonet train traffic is added to an already congested UP line in Arizona it may create a different bottleneck.

Presently, the status of the partnership between marine and landside interests is not solidified. A consortium between HPH and UP broke down in 2007 due to the inability to find agreement with residents of Yuma, Arizona to accommodate the future rail crossing, as well as lack of clarity in the bidding process (Blake, 2007).

### 6.1.4 SCT/API Ensenada Activity

SCT originally anticipated inviting bids for the construction o the port in early 2008. However, on April 14, 2008 SCT announced that they would delay the call for bids until 2010. Business News Americas reported that this was due to a delay with SCT submission of the proper documentation for the site to SEMARNAT (Business News Americas, 2008.a). In late August 2008 UP announced that the company would be willing to invest around US$3 billion in railways related to the Punta Colonet project should it win the tender, and urged SCT to launch the tender call (Business News Americas, 2008.b). President Calderon officially announced the tender for Punta Colonet shortly after, on August 29, 2008 (Business News Americas, 2008.c). In October of 2008 the deadline for submissions for the Punta Colonet project was pushed back from August 31, 2009 to December 18, 2009 (Business News Americas, 2008.d). In January 2009 SCT announced a further postponement of the project due to the global financial crisis, but did not announce a new date. SCT also said that given the financial situation, the project was being analyzed with international financial entities, but that it was not being cancelled. SCT then announced that it invited interested companies to register by May. Then in April SCT extended the deadline for registration. In June 2009 there were reports that the tender could be released before the end of the year (Business News Americas, 2009.b) Recent news reports indicate that the tender could be released sometime in September 2009, but at the time of writing of this report SCT has still not issued a request for proposal for this project (Business News Americas, 2009.c).

### 6.1.5 Impact to Texas and US

The proposed port and rail connection at Punta Colonet can be described as a sub-corridor of the broader Asia-West Coast routing option because, if developed as currently envisioned, it will share many of the key characteristics with the existing West Coast intermodal connection. From the perspective of Texas, cargo that comes through Punta Colonet would be similar to cargo emanating from Los Angeles and Long Beach. Nevertheless, there would be a few key distinctions. The first distinctive characteristic of cargo emanating from Punta Colonet is that it would be unlikely to use any rail line other than the Union Pacific. The Union Pacific alignment is more conducive to a proposed connection with Punta Colonet than is the BNSF given that the UP line runs closer to the border in the area where the Punta Colonet connection is projected to cross. Another distinction in future Colonet traffic that would make it distinct from traffic using the existing southern California gateways is that this corridor would only be a viable option for shippers who intend to deliver containerized cargo, unbroken and unaltered, to a major inland intermodal hub such as Dallas-Ft. Worth or Chicago. While this type of cargo shipment is a very important component of the total cargo profile for the Ports of Los Angeles and Long Beach, it is not the only type or even the dominant type of cargo shipment handled by the port complex. Rather, shipments are divided into those destined for captive markets in and around the Los Angeles Long Beach area, those that are destined for transloading centers but ultimately destined for a market outside of California, and finally cargoes that will be transferred, usually by rail though not exclusively, to interior markets (Leachman, 2007). The market competition between the Ports of Los Angeles/Long Beach and the future Port of Punta Colonet would not be a competition among equals because the Port of Punta Colonet could not effectively serve these first two markets. Thus, despite its close proximity to the Ports of Los Angeles and Long Beach, the Port of Punta Colonet would not truly compete with these two port facilities in the same way that they compete with each other. Rather, Punta Colonet would compete more directly with Prince Rupert and, to a lesser extent the ports of the Pacific Northwest. In a comparative analysis of the roles played by the different West Coast gateways, Leachman and Associates argued that traffic flows to the ports of the Pacific Northwest were more elastic in the long run than those to the San Pedro bay, in large part due to the scale economies and large captive market offered by the latter (Leachman, 2007). Along these same lines, demand at Punta Colonet would be elastic and could only be successful if it could offer distinct advantages over alternative corridors in terms of lessened congestion, lower land and labor costs compared with other "alternative" corridor options such as Prince Rupert. Under one estimation, the shippers most likely to use a direct shipping model, in which little to no reconsolidation near the port of arrival, are shippers of low value per unit of weight commercial goods that are nonetheless containerized. For this reason, the analysis showed that the type of shippers most likely to utilize a direct shipment method were "large nationwide shippers of furniture and building materials" such as Home Depot and Lowes (Leachmen, 2007) For large shippers of other high value per unit of weight cargo types, an alternative transloading strategy is proposed that would likely not favor new corridor options such as Punta Colonet due to the lack of distribution infrastructure.

As of the publishing of this report, many of the basic facts surrounding the potential development of the Punta Colonet corridor were still uncertain. After suffering what appeared to be a fatal blow with the emergence of the financial crisis in the fall of 2008, Luis Tellez, the Secretary of Communications and Transportation declared the project all but dead in January of 2009, shortly prior to his sacking due to an unrelated scandal. In the summer of 2009, the Colonet project again emerged as a priority, yet pronouncements by the SCT have avoided specifics as to when construction may actually begin. (Milenio Online, 2009)

*Statewide planning considerations*

If eventually developed, the net impact would be to increase utilization of the UP transcontinental corridor east of California, leading to possible complications for El Paso. There are opportunities to develop partnerships with inland ports along UP corridor such as South Dallas intermodal facility.

## 6.2 Port of Topolobampo

The port of Topolobampo is a relatively small port located in the state of Sinaloa on the Gulf of California in northwestern Mexico. It is the bordered by the states of Sonora, Chihuahua, Durango, and Nayarit. Its capital city is Culiacán. In 2005 its population was estimated at 2.6 million people. Major industries in this area include agriculture in particular chickens and tourism particularly in Mazatlan and surrounding the Copper Canyon Route, and the world heritage site of the gulf islands.


*Source:*

*Figure 6.5: State of Sinaloa*

The port began development relatively recently, in 1991. Topolobampo, like Manzanillo, Lazaro Cardenas, and Altamira, is managed by a semi-autonomous government entity, the Administración Portuaria Integral de Topolobampo, S. A. de C. V. The port is operational and handles agricultural imports, mineral imports as well as a small amount of containers. PEMEX also has a terminal at the port that handles petroleum and petroleum derivatives. API Topolobampo currently operates the container terminal at the port, as well as a general cargo terminal (API Topolobampo, no date). Figure 6.6 and Table 6.1 show the current facilities and layout of the port, including the expansion of the port area currently underway in gold. Figure 6.7 is an aerial view of the port.


Source: API Topolobampo Website

*Figure 6.6: Layout of Port of Topolobampo*

**Table 6.1: Port Facilities at Topolobampo**

| | |
|---|---|
| **1. Rampa transbordadores API** | **16. Aduana** |
| **2. Muelle de contenedores** | **17. Muelle catamarán** |
| **3. Terminal de usos múltiples** | **18. Capitanía de puerto** |
| **4. Muelle terminal transoceánica** | **19. Muelle de transbordadores** |
| **5. Muelle No.1 PROPETOPO** | **20. Marina FONATUR** |
| **6. Instalaciones PROPETOPO** | **21. Club de playa y condominios** |
| **7. Muelle No.2 PROPETOPO** | **22. Muelle de pesca "Este** |
| **8. Bodega de Consolidación No.2** | **23. Muelle de pesca "Norte** |
| **9. Muelle de carga general** | **24. Oficinas administrativas API** |
| **10. Terminal Marítima CEMEX** | **25. Gasolinera embarcaciones pesqueras** |
| **11. Bodega de Transito No. 2** | **26. Marina club Topolobampo** |
| **12. Cobertizo** | **27. Gasolinera** |
| **13. Bodega de tránsito No. 1** | **28. Control de acceso Vehicular** |
| **14. patio recepción mineral** | **29. Varadero Bercovich** |
| **15. Bomberos operaciones API** | **30. Instalaciones CFE** |
| | **31. Terminal marítima PEMEX** |

Source Figure 6.6 & Table 6.1: Port of Topolobampo

Source: Port of Topolobampo

*Figure 6.7: Aerial View of Topolobampo*

The port is served by Ferromex Rail and limited Highways. Both road and rail connections to the interior must cross the Sierra Madres Mountain range. Ferromex's network in Chihuahua can be seen in Figure 6.8.


Source: Ferromex

*Figure 6.8: Ferromex Routes in Mexico*

### 6.2.2 History

The Port of Topolobampo serves as a cargo hub for the state of Sinaloa and surrounding regions. Its principal role in recent years has been to facilitate exports of commodities such as iron ore and corn and a more diverse range of imports, most of which are tied to the agricultural industry. Given the generally poor landside connections within the state of Sinaloa, the Port plays an important role in providing the basic inputs for the local economy. It also serves as a hub for a large number of ferry passengers. The Baja Ferry serves both passenger and freight needs between the La Paz on the Baja California Isthmus and the port of Topolobampo. Possible improvements to the rail and roadway connection to Texas, combined with planned expansions for the port itself, may lead to a different future for the Port of Topolobampo and surrounding area, yet with the isolation of the region, political instability tied to the Sinaloa cartel, increased focus on other competing projects, and a history of unsuccessful attempts to better connect the port to the rest of the country, the Mexican government is approaching the further development of the Topolobampo region with caution. As such, it is not given high priority in the national infrastructure plan. While the national plan allocates approximately MXP$600 million of public funds in order to dredge the channel and reclaim land around the terminal, there is no official allocation for new port facilities, either through public or private financing.

### 6.2.3 Planning

To the outside world, the Port of Topolobampo has long been known as a tourist destination due to its connection with the Los Mochis to Chihuahua Copper Canyon rail route. The region surrounding the Port has a unique history in that the area was originally settled by Americans hoping to establish a collectivist colony at the beginning of the 20th century. A railroad surveyor named Albert K. Owen recruited settlers from the United States and Britain to the area and developed a social economy supported by the rich surrounding agricultural soil and access to nearby mines. Owen's efforts through 1910 in establishing the Topolobampo colony along with the partnership he formed with KCS founder Arthur Stillwell are documented in the Register of Topolobampo collection at the University of California, San Diego. From the beginning, the role of Topolobampo was uncertain as it was simultaneously sought for its isolation, first by individuals such as Owen and recently by eco-tourists, and for its potential as a trade gateway by Arthur Stilwell and later transportation oriented interests. A thorough analysis of the history of the Topolobampo to Texas route by John Leeds Kerr, published in 1968 demonstrated that the specific alignment of interests in the West Texas energy sector with the Port of Topolobampo was already in place by the 1960s when the final stretches of the South Orient railroad were completed, yet at the time there were no modern marine facilities at the Port. With the Mazatlan Durango Highway, and Manzanillo and Lazaro Cardenas port expansions underway, it remains to be seen what the realization of these competing projects will mean for the port's future uses.

The development of the Port of Topolobampo was a priority of the Salinas administration and was one of the major port upgrades that was completed in the era immediately prior to the privatization of the Mexican port system. Puertos Mexicanos opened the port to commercial traffic in June of 1991 with the intention of opening up the state of Sinaloa and its rich agricultural production to world markets. Andres Caso Lombardo, who was at the time the Secretary of Communications and Transportation, ambitiously described the future function of Topolobampo in the following way "It is more than anything the take-off point so that all of Mexico will become linked to our project of integration into the Pacific Basin" (Traffic Management). Thus, the vision of Topolobampo as an Asian gateway was in place prior to port privatization. While it was hoped that Topolobampo and its connection to the South Orient railroad would make it attractive for container strings, the Port was not developed for this purpose after the privatization process, which concentrated funding into the Port of Manzanillo. The viability of the Port as a potential container center was also hurt by the compelling economics of larger container vessels without shipboard cranes which emerged as the dominant model in the 1980s and 1990s. The access channel to Topolobampo was not as deep as the channel to Manzanillo. Furthermore, the port had a much smaller surrounding market which made it less attractive as a major port of call for container strings.

In 2005-2007, the state of Sinaloa made a concerted effort to help develop a container terminal at Topolobampo. Despite initial interest from a Spanish firm, no firm commitment was negotiated. Development at the port took another blow when the release of the national infrastructure plan did not rank marine development at Topolobampo highly and did include a significant prioritization of two other projects that were seen to divert interest elsewhere. The Mazatlan Durango highway, which will benefit the state of Sinaloa in many ways, nevertheless came at the expense of a hoped for road linkage connecting Topolobampo to Chihuahua. Furthermore, discussion of port improvements of the small facilities of Guaymas, Topolobampo, and Mazatlan was overwhelmed a sustained focus on the mega project of Punta Colonet.

On project that has gotten underway at the port is the expansion of the port area that was discussed earlier in this case study. The port plans to use material from a 7 hectare area to fill in 32 hectares of land previously covered in water, thereby expanding the port. The plan is shown in Figure 6.9 below.


Source: API Topolobampo, No date.

*Figure 6.9: Topolobampo Port Area Expansion*

The beginning stages of filling in the water areas can be seen in figure 6.10 below.

Source: API Topolobampo, No date.

*Figure 6.10: Topolobampo Port Area Expansion, reclaimed areas*

German Rivera, of the Sinaloa Development Council, stated that port developments, with the exception of the area expansion seen above, have largely been put on hold while the proposed improvement of the rail line linking the Port to Chihuahua has reached a "dead end" due to a lack of interest by Ferromex in putting investment into the line. Finally, a new Port Coordinator at SCT is currently in the process of reassessing the strategy of port investments around the country, and it remains to be seen where Topolobampo will fit into that plan.

In short, Topolobampo is a port that has a potentially critical role to play in the development of one of Mexico's most agriculturally productive regions. Throughout its history, the Port has suffered from being alternatively overpromoted or ignored. In the long run, the port is likely to benefit from a realistic and consistent assessment of its strengths and weaknesses

Topolobampo is geographically the closest Mexican Pacific Port to Texas. However, its location near the Sierra Madre Occidental has meant that it is not easily accessible. Direct road connections from the port area to the U.S. border are essentially non-existent and the rail connection is currently restricted to short single stack trains. There would be multiple hurdles to be overcome if Topolobampo expansion is to be realized. These include, most importantly, environmental concerns regarding the World Heritage Site of the islands and regions adjacent to the Gulf of California and the Copper Canyon Route which is a major tourism generator for this region.

### 6.2.4 Impact to Texas and US

Still, the Port of Topolobampo is seen as a potential gateway for a new intermodal corridor that would allow Asian cargo to bypass the US west coast and enter Texas at Presidio en route to Dallas, in a similar manner to cargo entering Mexico at Lazaro Cardenas and reaching the US via Laredo. The general term that is used in the promotion of this corridor alternative is La Entrada Al Pacifico or "entrance to the Pacific." The proposal is particularly popular among business groups in West Texas (specifically the cities of Midland Odessa) where it is hoped that the establishment of new freight corridors could lead to an economic revitalization and job creation. However the communities in Alpine, Marfa and Presidio have fought against this route and will continue to do so, for various reasons, including rural potential land acquisitions required to complete the corridor.

In order to be properly developed, the "La Entrada" project would have to upgrade rail facilities not only on the Mexican side but also on the US side given that the rail facilities at the Presidio crossing are, for all practical purposes, abandoned (Texas Comptroller, 2003). So essentially, La Entrada al Pacifico is linked to expansion of Topolobampo but Topolobampo expansion also requires linkage into the United States for its success as well as components that have been placed in the National Infrastructure Plan released under President Calderon. These include dredging of the port for deep water connectivity, renovations, and upgrades at the port and the development of a LNG facility. The national plan also includes improvements to the road segments with funding for the Choix to San Rafael segment of the highway. These are currently scheduled to begin in 2009 with completion scheduled for 2012. The port renovations were scheduled for a 2008 start with completion expected by 2010. API Topolobampo recently completed the dredging of the navigation channel to a draft of 39". The new channel depth was inaugurated with the sailing of the ship BM Lucky Viship for China, containing 50,500.182 tons of iron ore. The previous maximum had been 45,000 tons (API Topolobampo, 2009).

According to the MOTRAN website, work has been taking place to upgrade highway connections in Chihuahua and Sinaloa. These include 35 miles of highway between Ojinaga and Manuel Benavides in Chihuahua as well about a ¼ of the work on a relief route around this city which will provide direct access to Presidio/Ojinaga Ports of Entry for trucks. Sinaloa has expanded 13 miles of highway from San Blas to El Fuerte Highway and 9 more miles were expected to be expanded in 2008/2009 (this route is referred to as the Copper Canyon Highway). Sinaloa was also expected to expand 4 miles from El Fuerte to Choix in 2009. El Fuerte saw its portion of Highway expanded to four lanes. All of these will aid in upgrading the road system which on the Sinaloa side is relatively poor and could not handle large truck traffic increases. Upgrade to rail will also be a critical component to Topolobampo's future success. The current rail track is single track and is restricted to short single stack trains. According to sources interviewed during this project, for a route to be viable to link into the U.S. market trains would need to be at least 100 cars long at minimum. Currently on the route over Copper Canyon Ferromex can only load up to 18 cars because of steep grades along the route. The number of cars possible is therefore too low to make this route viable. The rail connection into Texas over the old Southern Orient (SORR) line is also very weak with current speeds only being 10 mph. Also the rail bridge at Presidio/Ojinaga burned down in 2008, and for Topolobampo to send volume by rail to the US the border crossing would have to be rebuilt. Currently there is discussion over the future of the SORR. The Sunset Commission Report to the Texas Legislature regarding TxDOT recommended that TxDOT sells this route. TxDOT commissioned a report to review the market value of the SORR. This was estimated at a current valuation of \$30.2million, which was the net liquidation value determined by estimating the value or track and materials. The estimated cost to rehabilitate SORR is approximately \$150 million (Saenz, 2009). Even if this line did come to fruition railroads that were interviewed didn't think it would be economically viable given Manzanillo's and Lazaro's proposed expansion plans and their easy access to rail and highway networks to the central Mexico triangle area, as well as the U.S.

# References

Ayala, Diego. "Tramititis detiene el gasto anticrisis-B." Excelsior. February 23, 2009. Available at: http://www.exonline.com.mx/edicionimpresa/20090223/nacional/PR090223_01A.pdf Accessed on: March 18, 2009.

BBC News. "Mexican state governor promotes trade with Texas." BBC Monitoring Latin America. February 11, 2006. Accessed through Lexis Nexis Academic at the University of Texas Library on May 19, 2009.

Container Management. "Logistics Encourage Sector Growth." November 2008: 13-4.

Cepeda, Francisco. "Proyectan Desarrollar Distribucion." Palabra. March 3, 2008. Accessed through Factiva at the Univesity of Texas Library on May 26, 2009.

Economist Intelligence Unit. "Mexico Risk: Infrastructure Risk." No date. Accessed through Factiva at the Univesity of Texas Library on May 26, 2009.

Hernandez, Julián. "Firma API Tampico Convenio de Transporte." El Norte. June 20, 2007. Accessed through Factiva at the Univesity of Texas Library. Accessed: May 26, 2009.

Lloyd's List. "Mexican congestion-busting land transport scheme not ready." November 22, 2004. Accessed through Lexis Nexis Academic at the University of Texas Library on May 19, 2009.

Martner, Carlos and Aurora Moreno. "The Restructuring of Mexican Ports and Modal Integration of Transport in Mexico." Instituto Mexicano del Transporte. November 13, 2002. Available at: www.eclac.cl/transporte/perfil/iame_papers/proceedings/Martner_et_al.doc. Accessed: May 26, 2009.

Mexico Experience. "Mexico in Facts and Figures." 2007. Available at: http://www.mexperience.com/discover/discov_ff.htm. Accessed: May 26, 2009.

National Infrastructure Program (NIP). Presedencia de la Republica, Mexico. Available at: http://www.infraestructura.gob.mx/pdf/NationalInfrastructureProgram2007-2012.pdf.

National Mortgage News. "Developers Partner in Mexican CRE Venture." June 21, 2004. Vol. 28, No. 39. Accessed through Factiva at the Univesity of Texas Library on May 26, 2009.

Rota, Valerie. "Mexican Peso Declines From Six-Month High as Economy Plunges." Bloomberg. May 20, 2009. Available at: http://www.bloomberg.com/apps/news?pid=20601086&sid=aaWIW0mZXd_A&refer=news. Accessed: May 29, 2009.

Sánchez, Julián."Paro técnico en GM afectará a 10 mil obreros." El Universal. May 25, 2009. Accessed through Factiva at the Univesity of Texas Library on May 26, 2009.

Secretaría de Comunicaciones y Transportes (SCT). "Puertos Conferencia de Prensa." January 13, 2009. Available at: http://www.sct.gob.mx/fileadmin/CGPMM/Vida_Portuaria/PresentacionLTK_Cconferencia.pdf. Accessed: March 10, 2009.

Thomson, Adam. "Crisis tests zealous plans." Financial Times. November 17, 2008. Available at: http://www.ft.com/cms/s/0/0ee29a32-b1de-11dd-b97a-0000779fd18c.html?nclick_check=1. Accessed: March 8, 2009.

Travel Daily News."U.S. Commerce Department forecasts rebound in international travel to the US by 2010." May 29, 2009. Available at: http://www.traveldailynews.com/pages/show_page/31204-US-Commerce-Department-forecasts-rebound-in-international-travel-to-the-US-by-2010. Accessed: May 29, 2009.

Understand Mexico."Tamaulipas Investment Guide." 2007. Available at: http://www.understandmexico.com/mexico/states/Tamaulipas. Accessed: May 26, 2009.

US Commercial Service. "Procurement Opportunities: Mexico's National Infrastructure Program." May 3, 2009. Available at: http://www.buyusa.gov/mexico/en/infrastructure.html. Accessed: May 19, 2009.

**PORTS**

Alperowicz, Natasha. "U.S.-Mexico Consortium Plans Altamira Complex." Chemical Week. 1998. Vol. 160, No. 14. Accessed through Business Source Complete, EBSCO*host* at the University of Texas Library on March 18, 2009.

Administración Portuaria Integral de Altamira S.A. de C.V. (API Altamira). Available at: http://www.puertoaltamira.com.mx/. Accessed: March 19, 2009 (a).

API Altamira. Altamira Port Handbook 2008- 2009. Land & Marine Publications Ltd., 2008. Brochure (b).

API Altamira. "Programa Maestro de Desarrollo Portuario 2007-2015." 2006 (c). Available at: http://www.puertoaltamira.com.mx/spanish/pmd/PMD.pdf. Accessed: March 18, 2009.

Administración Portuaria Integral de Lázaro Cárdenas S.A. de C.V. (API Lázaro Cárdenas). "Master Development Plan Port of Lázaro Cárdenas." November 2006. Available at: http://puertolazarocardenas.com.mx/Docs%20pdf/marcolegal/programa_maestro_2006_2011.pdf. Accessed: April 12, 2009.

API Lazaro Cardenas. "Port Lázaro Cárdenas Keeps Innovating." No date (b).

API Lazaro Cardenas. "Zone of Influence." No date (c). Available at: http://puertolazarocardenas.com.mx/api/index.php?option=com_content&task=view&id=41&Itemid=56. Accessed: February 17, 2009.

API Lazaro Cardenas. "Port Lázaro Cárdenas Starting a New Era." Presentation. November 2008.

API Lázaro Cárdenas."Historic Port Movement." 2009 (a). Available at: http://puertolazarocardenas.com.mx/Docs%20pdf/Puerto/Mov_Historico.pdf. Accessed: February 27, 2009.

API Lazaro Cardenas. "Recibe Puerto Lázaro Cardenas Premio Nacional de Calidad." April 6, 2009 (b). Available at: http://www.puertolazarocardenas.com.mx/api/index.php?option=com_content&task=view&id=163&Itemid=10. Accessed: April 14, 2009.

Administración Portuaria Integral de Manzanillo S.A. de C.V. (API Manzanillo). "Programa Operativa Annual." 2008 (a). Available At: http://201.144.41.210:7778/pls/portal/docs/PAGE/APIMAZ/ARCHIVOS/poa_2008.pdf. Accessed: June 3, 2009.

API Manzanillo. "Entran en Operación Dos Nuevas Grúas en SSA." May 28, 2008(b). Available at: http://www.puerto-de-manzanillo.com.mx/php/esp/seccion-01.php?eCodSeccion=2110485. Accessed: March 15, 2009.

API Manzanillo. January 7, 2009 (a). Available at: http://www.puerto-de-manzanillo.com.mx/. Accessed: March 15, 2009.

API Manzanillo. "Licitacion API MAN TEC II." January 13, 2009(b). Available at: http://www.puerto-de-manzanillo.com.mx/php/esp/seccion-01.php?eCodSeccion=2110540. Accessed: March 15, 2009.

Asia in Focus. "South Korea's POSCO builds steel sheet plant in Mexico." August 10, 2009. Accessed through Factiva at the University of Texas Library on August 24, 2009.

Badillo, Javier, Assistant Manager of Promotion, API Altamira. "Port Altamira: Industrial Development Complex." Presentation. 2009 (a).

Badillo, Javier, Assistant Manager of Promotion, API Altamira. Interviewed by Angela Mora and Caitlin Morris on February 27, 2009, in Altamira, Tamaulipas, Mexico (b).

BreakBulk.com. "Texas Makes Port of Brownsville Overweight Corridor Permanent." May 21, 2009. Available at: http://www.breakbulk.com/content/?p=684. Accessed: May 21, 2009.

Business News America. "Manzanillo expansion work to go to auction." November 26, 2003. Accessed through Factiva at the Univesity of Texas Library on May 19, 2009.

Business News Americas."Bids on Manzanillo port Zona Norte work to start mid-08." September 26, 2007 (a). Accessed through Factiva at the Univesity of Texas Library. Accessed: March 16, 2009.

Business News Americas. "McDermott Expects Altamira Yard to Start Ops Year-End.". November 9, 2007 (b). Accessed through Factiva at the Univesity of Texas Library on August 23, 2009.

Business News Americas. "Maersk interested in TEC concession at Lázaro Cárdenas port." February 25, 2008. Accessed through Lexis Nexis Academic at the University of Texas Library on April 12, 2009.

Business News Americas. "SCT launches US$744mn tender for Manzanillo port expansion." January 14, 2009. Accessed through Factiva at the University of Texas Library on May 19, 2009.

Business Wire. "KCS Announces New, Daily, Dedicated Train Service Along Its International Intermodal Corridor." June 7, 2006. Accessed through Lexis Nexis Academic at the University of Texas Library on April 12, 2009.

Chemical Market Reporter "Investments at Altamira." July 19, 1999. Issue 256, Vol. 9. Accessed through Business Source Complete, EBSCO*host,* at the Univesity of Texas Library on March 20, 2009.

Chemical Week. "Product Focus: Carbon Black." January 19, 2009. Accessed through Factiva at the Univesity of Texas Library on August 24, 2009.

Commission for Environmental Cooperation (CEC). "CEC receives submission on wetlands in Manzanillo, Mexico." February 6, 2009. Available at: http://www.cec.org/news/details/index.cfm?varlan=English&ID=2820. Accessed: March 15, 2009.

Container Management. "Logistics encourage sector Growth." November 2008: 13-4.

de la Vega Tirado, Pamela, Gerente de Comercialización de la Administración Portuaria Integral de Manzanillo. Personal email with Laura Tibbitt on February 22, 2009.

Dow Jones International. "Mexico's TMM To Sell Assets For $120M To Lower Debt." April 14, 2003. Accessed through Factiva at the Univesity of Texas Library on March 16, 2009.

El Financero. "Mexico: SSA Mexico completes expansion of Manzanillo container terminal." March 26, 2009. Accessed through Factiva at the Univesity of Texas Library on May 19, 2009.

Enfasis Logistica. "Anuncia puerto de Altamira el desarrollo de nuevos negocios." 2009. Available at: http://www.logistica.enfasis.com/notas/12534-Anuncia-puerto-de-Altamira-el-desarrollo-de-nuevos-negocios. Accessed: August 20, 2009.

Estache, Antonio, Gonzalez, Marianela and Trujillo, Lourdes. "Efficiency Gains from Port Reform and the Potential for Yardstick Competition: Lessons from Mexico." July 2001.

Export Today's Global Business. "Ports News." 16 (2000): 76. Accessed through Business Source Complete, EBSCO*host*, at the Univesity of Texas Library on March 20, 2009.

Ezquerra de la Colina, Jose Luis. Manzanillo, Colima: Historia y Futuro del Desarrollo Turistico y Portuario del Litoral. 2006.

Flores-Díaz, Mauricio, Mauricio Flores Diaz, Gerente Comercial/Commercial Manager, SSA-Marine Mexico Specialized Container Terminal Manzanillo. Interviewd by Rachel Niven and Laura Tibbitt on January 8, 2009 in Manzanillo, Colima, Mexico.

Gomez, Francisco. "Altamira, en riesgo por fallo judicial." El Universal. June 9, 2009 (a). Available at: http://www.eluniversal.com.mx/nacion/168806.html. Accessed: June 10, 2009.

Gomez, Francisco. "El Jefe Diego gana 1,500 mdp a la SCT." El Universal. June 9, 2009 (b). Available at: http://www.eluniversal.com.mx/primera/33112.html. Accessed: June 10, 2009.

Gomez, Franciso. "Ordenan la restitucion de predios a clients de Diego." El Universal, June 10, 2009 (c). Available at: http://www.eluniversal.com.mx/nacion/168842.html Accessed: June 10, 2009.

Gomez, Francisco. "La SCT dap or perdido litigo con Jefe Diego." El Universal, June 10, 2009 (d). Available at: http://www.eluniversal.com.mx/primera/33119.html. Accessed: June 11, 2009.

Gomez, Francisco. "SCT: es un abuso; no pagara a Jefe Diego." El Universal. June 11, 2009 (e). Available at: http://www.eluniversal.com.mx/primera/33122.html. Accessed: June 11, 2009.

Greenpeace. "El gobierno debe rechazar la ampliacion del Puerto de Manzanillo." March 3,2005 (a). Available at: http://www.greenpeace.org/mexico/news/gobierno-debe-rechazar-ampliac. Accessed: March 6, 2009.

Greenpeace. "Incumple API de Manzanillo con los requerimientos para ampliar el Puerto, Semarnat debe rechazar el proyecto." March 3, 2005 (b). Available at: http://www.greenpeace.org/mexico/prensa/releases/incumple-api-de-manzanillo-con. Accessed: March 6, 2009.

Gutiérrez Santiago, Isaac Daniel. "Operating Annual Program 2008." 2008. API Lázaro Cárdenas. Available at: http://puertolazarocardenas.com.mx/Docs%20pdf/marcolegal/POA%202008.pdf. Accessed: April 3, 2009.

Hoy Tamaulipas. "Gobernador trae de la India otra empresa para Altamira." October 1, 2008. Available at: http://www.hoytamaulipas.net/?PHPSESSID=f1147b4523bed51065def2f17389949b&v1=notas&v2=51523&tit=Gobernador_trae_de_la_India_otra_empresa_para_Altamira. Accessed: August 20, 2009.

Houston Chronicle. "Mexico sinks millions into modernizing port." April 22, 1989. Accessed through Factiva at the Univesity of Texas Library on April 7, 2009.

International Finance Corporation (IFC). "Summary of Project Information." December 17, 2003. Available at:

http://www.ifc.org/ifcext/spiwebsite1.nsf/1ca07340e47a35cd85256efb00700cee/BDDADCDFE0381C7785256E000059B50A. Accessed: January 30, 2009.

Invertia. "Busca SCT 22,000 mdp en licitaciones enmedio de recesión" January 14, 2009 (a). Available at: http://usa.invertia.com/noticias/noticia.aspx?idNoticia=200901141411_TRM_77753938&idtel=. Accessed: March 18, 2009.

Invertia. "Maritime highways collapse, auto exportation falls 70%." February 18, 2009 (b). http://ve.invertia.com/noticias/noticia.aspx?idNoticia=200902181416_TRM_77843315&idtel=. Accessed: March 18, 2009.

Invertia. "(SCT) Inicia Construccion Libramiento Altamira, Inversion 240 MP." February 23, 2009 (c). Available at: http://ar.invertia.com/noticias/noticia.aspx?idNoticia=200902232052_INF_423057. Accessed: March 18, 2009.

La Región Tamaulipas "Protegiendo empleos fortalecemos a Tamaulipas y a familias: Gobernador." April 3, 2009 (a). Available at: http://www.laregiontam.com.mx/?op1=notas&op2=5576. Accessed: March 18, 2009.

La Region Tamaulipas. "Presentan primera plataforma que J. Ray Mc Dermott hace en Altamira." April 20, 2009 (b). Available at: http://images.google.com/imgres?imgurl=http://www.laregiontam.com.mx/imagen.php%3Fid%3D2133&imgrefurl=http://www.laregiontam.com.mx/%3Fop1%3Dnotas%26op2%3D6170&usg=__GGdmizAxU52_M3DdNTZ5FNjOHbY=&h=345&w=460&sz=31&hl=en&start=65&tbnid=McWvXEYtaf2wSM:&tbnh=96&tbnw=128&prev=/images%3Fq%3DJ%2BRay%2BAltamira%26gbv%3D2%26ndsp%3D18%26hl%3Den%26sa%3DN%26start%3D54 Accessed: August 23, 2009.

Latin Trade. "Mexico." Latin Trade 14 (2006): 9-10. Accessed through Business Source Complete, EBSCO*host,* at the Univesity of Texas Library on March 20, 2009.

Lloyd's List. "Privatization—Consortia Win Out in Bidding Round for Mexican Terminal Concessions." July 21, 1995. Accessed through Factiva at the Univesity of Texas Library on March 16, 2009.

Lloyd's List. "Special Report: Mexico: Rapid Expansion for TMM." February 8, 1996. Accessed through Factiva at the Univesity of Texas Library on March 16, 2009.

Lloyd's List. "Rolling up its sleeves to get the job done." December 4, 2002. Accessed through Lexis Nexis Academic at the University of Texas Library on May 19, 2009.

Lloyd's List. "Hutchison and SSA Marine go head to head in Mexican volumes battle: Proposal to expand the Jones Act to other Nafta members has ignited optimism." January 16, 2004. Accessed through Factiva at the Univesity of Texas Library on March 16, 2009.

Lloyds List. “HPH plans to usurp rivals with $ 500m port upgrade.” July 27, 2005 (a). Accessed through Lexis Nexis Academic at the University of Texas Library on May 19, 2009.

Lloyd’s List. “Manzanillo confirms its pole position among ports with strong box growth.” July 27, 2005 (b). Accessed through Lexis Nexis Academic at the University of Texas Library on May 19, 2009.

Lloyds List. “Transpacific sees new services as lines look for congestion-free alternatives to US ports.” July 27, 2005 (c). Accessed through Lexis Nexis Academic at the University of Texas Library on May 19, 2009.

Lloyd’s List. “Mexico ready to pounce when US ports are saturated, says Fox.” July 25, 2006. Accessed through Lexis Nexis Academic at the University of Texas Library on May 19, 2009.

Lloyd’s List. “Lázaro Cárdenas gets a makeover; Hutchison has invested £220m to develop Mexico’s newest container facility.” September 24, 2007 (a). Accessed through Lexis Nexis Academic at the University of Texas Library on April 12, 2009.

Lloyd's List. “Manzanillo moves into overdrive; Port smashed through 1m teu barrier in 2006 and has posted more impressive figures this year.” September 24, 2007 (b). Accessed through Lexis Nexis Academic at the University of Texas Library on May 19, 2009.

Lloyd’s List. “Maersk gets set for Latin expansion; Manzanillo ‘saturation’ prompts second Lázaro Cárdenas terminal.” February 28, 2008 (a). Accessed through Lexis Nexis Academic at the University of Texas Library on April 12, 2009.

Lloyd’s List. “New berth lures lines to Lázaro Cárdenas.” July 14, 2008 (b). Accessed through Lexis Nexis Academic at the University of Texas Library on April 12, 2009.

Lloyd’s List. “Intermodal corridors have 'big potential'.” September 30, 2008 (c). Accessed through Lexis Nexis Academic at the University of Texas Library on May 19, 2009.

Lloyd’s List. “Manzanillo to get big makeover; New box terminal is mooted for congested port as it aims to keep pace with double-digit growth.” September 30, 2008 (d). Accessed through Lexis Nexis Academic at the University of Texas Library on May 19, 2009.

Lloyd’s List. “Top carriers flock to Lázaro Cárdenas.” September 30, 2008 (e). Accessed through Lexis Nexis Academic at the University of Texas Library on April 12, 2009.

Monterrey (Gobierno de). No date. Available at: http://www.monterrey.gob.mx/. Accessed: April 19, 2009.

Marine Link. “J. Ray Completes PEMEX Maloob-C.” August 13, 2009. Available at: http://www3.marinelink.com/Story/ShowStory.aspx?StoryID=216388. Accessed: August 23, 2009.

Morales, Roberto.“Gobierno licita nueva terminal portuaria en Manzanillo; Duplicarán capacidad portuaria de Manzanillo.” El Economista. June 26, 2008. Accessed through Lexis Nexis Academic at the University of Texas Library on May 19, 2009.

Nelson, Rainbow. “Maersk drops Manzanillo for rival terminal: Three services moving to Hutchison’s Lázaro Cárdenas facility by the end of August.” Lloyd’s List. June 4, 2004. Accessed through Lexis Nexis Academic at the University of Texas Library on April 12, 2009.

Nelson, Rainbow. “Overhaul of transport links fuels the agenda; Mexican president Calderon says improvements to infrastructure are key to kickstarting economy.” Lloyd’s List. September 30, 2008. Accessed through Lexis Nexis Academic at the University of Texas Library on April 12, 2009.

NOTIMEX Agencia Mexicana de Noticias. “Inconforma a HPH cession a groupo TMM de frente de auga en Manzanillo.” July 3, 2002 (a). Accessed through Factiva at the Univesity of Texas Library on May 19, 2009.

NOTIMEX Agencia Mexicana de Noticias. “Investigan Cesion de Espacio de Muelle en Puerto de Manzanillo.” August 1, 2002 (b). Accessed through Factiva at the Univesity of Texas Library on May 20, 2009.

NOTIMEX Agencia Mexicana de Noticias. “Instalarán planta productora de negro de humo en Altamira, Tamaulipas.” October 1, 2008. Accessed through Factiva at the University of Texas Library on August 24, 2009.

Palos Najera, Armando. Port of Lazaro Cardenas. Presenation at Global Goods Movement Panel at National Association of Industrial and Office Properties, South Corridor Economic Development Conference. Riverside, CA. October 26, 2007. Available at: http://www.authorstream.com/Presentation/Natalya-22799-globalgoods-Global-Goods-Movement-Panel-Agenda-Market-Economic-Shifts-Country-GDP-Mainland-China-Container-Port-as-Entertainment-ppt-powerpoint/ Accessed: September 15, 2009.

Pargal, Sheoli. “Regulatory Environment for Private-sector Participation in Infrastructure, in *Mexico: a Comprehensive Development Agenda for the New Area*.” World Bank 2001: 12

Peniche Ruiz, Marco Antonio, Terminal Superintendent, Kansas City Southern de México. Interviewed by Laura Tibbitt and Rachel Niven on January 6, 2009 in Lázaro Cárdenas, Michoacán, Mexico.

Peralta, Marco and Quintero, Adriana. “Country Focus: Mexico From the source downstream; Transportation and Logistics Connecting to and from Mexico.” Chemical Week. March 29, 2006. Accessed through Lexis Nexis Academic at the University of Texas Library on April 12, 2009.

Pineda, Adriana, Director of Commercialization, ATP. Interviewed by Angela Mora and Caitlin Morris on February 27, 2009, in Altamira, Tamaulipas, Mexico.

Port World. “Houston.” 2009. Available at: http://www.portworld.com/topography/port_us_hou_hub.html. Accessed: March 16, 2009.

PR Newswire.“TMM Expands Ports Partnership with SSA.” October 18, 2000 (a). Accessed through Factiva at the Univesity of Texas Library on March 16, 2009.

PR Newswire. “Transportacion Maritima Mexicana Reports Higher Year-Over-Year Revenues Third Quarter, Reduction of Debt, Interest Expense Quarterly Earnings Affected By One Time Write Downs.” October 26, 2000 (b). Accessed through Factiva at the Univesity of Texas Library on March 16, 2009.

Pujol de Alba, Lic. Oscar, Gerente de Terminal Manzanillo, Ferromex. Interviewd by Rachel Niven and Laura Tibbitt on January 8, 2009 in Manzanillo, Colima, Mexico.

Rodríquez Hernández, Amaranta, Head of Customer Service, Independent Port Administration of Lázaro Cárdenas. Interviewed by Laura Tibbitt and Rachel Niven on January 7, 2009 in Lázaro Cárdenas, Michoacán, Mexico.

SCT. “Puerto Lázaro Cárdenas.” No date. Brochure.

SCT. “Delegados Federales Estado de Colima.” June 8, 2007. Presentation.

SCT. “Comunidad Portuaria.” 2008. Brochure (a).

SCT. “Informe Estadistico Mensual: Movimiento de Carga, Buques y Pasajeros.” December 2008 (b). Available at: http://e-Marchsct.gob.mx. Accessed: March 15, 2009.

Secretaría de Comunicaciones y Transportes (SCT). “Puertos Conferencia de Prensa.” January 13, 2009 (a). Available at: http://www.sct.gob.mx/fileadmin/CGPMM/Vida_Portuaria/PresentacionLTK_Cconferencia.pdf. Accessed: March 10, 2009.

SCT. “Fortalecen inversiones al Puerto Altamira, ventana comercial del país.” January 16, 2009 (b). Available at: http://www.sct.gob.mx/despliega-noticias/article/fortalecen-inversiones-al-puerto-altamira-ventana-comercial-del-pais/. Accessed: August 20, 2009.

Smith, Anne Kates. “A Rail Stock for the Long Haul.” Kiplinger. February 6, 2008. Accessed through Lexis Nexis Academic at the University of Texas Library on April 12, 2009.

Terminales Portuarias del Pacifico (TPP). “Connectivity.” Not dated. Available at: http://www.tpp.com.mx/english/infrastructure/connectivity.html. Accessed: April 12, 2009.

Upstream. “Whole New Ball Game South of the Border.” September 21, 2007. Accessed through Factiva at the University of Texas Library on August 23, 2009

Weissert, Will. “Mexico, top private interests look to revamp ports.” The Associated Press. March 21, 2006. Accessed through Lexis Nexis Academic at the University of Texas Library on April 12, 2009.

Wood, Andrew. "BASF picks Altamira as site for complex." Chemical Week. 158 (1996): 12. Accessed through Business Source Complete, EBSCO*host,* at the Univesity of Texas Library on March 18, 2009.

Wong, Leong Mein. "PSA completes study to upgrade 4 Mexican ports." Straits Times. May 24, 1991. Accessed through Factiva at the Univesity of Texas Library on May 18, 2009.

**INLAND PORTS**

Alejo, Francisco Javier. "Monterrey Logistics International Port." National Association of Regional Councils. 2006. Available at: http://narc.org/uploads/File/Transportation/Freight%20Summit/Alejo_NARC.pdf. Accessed: July 10, 2009.

Allen Development of Texas LLC, "Dallas Logistics Hub", Dallas: The Allen Group, 2007 (Brochure).

Allen Group. "Dallas Logistics Hub. State of Nuevo Leon, Mexico and the Dallas Logistics Hub Sign Historical Memorandum of Understanding." Press Release. June 1, 2007. Available at: http://www.dallashub.com/uploadedFiles/News/PR_Archive/2007/06-Jun/06_01_07_TAG_and_INVITE_Sign_MOU.pdf . Accessed: June 4, 2009.

Association of Mexican Industrial Parks (Asociacion Mexicana de Parques Industriales) (AMPIP). Advantages of Industrial Parks in Mexico: Bancomex Investment Forum. Presentation by Claudia Avila Executive Director. September 2006. Available at: www.ampip.org.mx. Accessed: July 10, 2008.

AMPIP Industrial Parks Classification Standard. NMX-R-046-SCR-2005. Available at: http://www.ampip.org.mx/pdf_ingles/norma.pdf. Accessed: June 1, 2009.

Asociación Mexicana del Transporte Intermodal A. C. Ubicación de terminales. Not dated. Available at: http://www.amti.org.mx/u_terminales.htm. Accessed: September 14, 2009.

Business Wire. "Hines And Grupo Valoran Announce Development Of New Intermodal Industrial Park In San Luis Potosi, Mexico; Marks the Fourth Major Industrial Park Developed by Hines in Mexico." 10 June 2004. Available at: http://findarticles.com/p/articles/mi_m0EIN/is_2004_June_10/ai_n6063064. Accessed: February 9, 2009.

Business Wire Latin America. "Mexico-based INVITE and Texas-based Dallas Logistics Hub sign memorandum; State of Nuevo Leon, Mexico and the Dallas Logistics Hub Sign Historical Memorandum of Understanding", June 4, 2007. Accessed through Lexis Nexis Academic at the University of Texas Library on November 11, 2008.

Cardenas, Gylmar, Director of Development and Industry Promotion, San Luis Potosi State. "San Luis Potosí México." Presentation. February 13, 2009.

Castillo Mireles, Ricardo. “Mexico prepares to open its first FTZ.” Outsourced Logistics. February 14, 2005. Available at: http://outsourced-logistics.com/global_markets/outlog_story_6942/. Accessed: March 22, 2009.

Cepeda, Francisco. “Proyectan Desarrollar Distribucion.” Palabra. 3 Mar. 2008. Accessed through Factiva at the University of Texas on 26 May 2009.

Conde, Francisco, Director of Special Projects & Communications, SuperCorridor Coalition Inc. “NASCO’s Mission: To enhance economic development and security along the NASCO corridor.” Presentation at LBJ School of Public Affairs, October 7, 2008.

Contreras, Jose Luis, Secretary of Communications for San Luis Potosi, San Luis Potosi State, and Cardenas, Gylmar, Director of Development and Industry Promotion, San Luis Potosi State. Interviewed by Jamie McAllister and Maria Fernanda Gutierrez on February 13, 2009 in San Luis Potosi, Mexico.

Day, Paul. "Monterrey: North Star Shines." Mexico Connect. January 1, 2006. Available at: http://www.mexconnect.com/mex_/travel/bzm/bzmmonterreyreport.html. Accessed: March 30, 2009

Expanding Markets. “Goods Movement Trends in Mexico.” Winter 2007 Edition. Available at: http://www.naiop.org/developmentmag/expandingmarkets/index.cfm?content=200704.cfmAccessed: June 1, 2009.

FedEx. “FedEx Opens Mexico Domestic Hub in San Luis Potosí.” February 9, 2009. Available at: http://news.van.fedex.com/node/12772. Accessed: March 19, 2009.

Forbes.com. “Alfonso Gonzalez Migoya profile.” Available at: http://people.forbes.com/profile/alfonso-gonzalez-migoya/20836. Accessed: February 10, 2009.

Franco Eluteri & Associates. Interpuerto Monterrey Inland Port and Logistics Gateway Factsheet. Available at: http://francoeleuteri.com/Interpuerto_Web_Page_Draft_26Nov07.pdf. Accessed: June 4, 2009.

Gomez, Nancy Lorena. “Project Nuevo Leon ‘Interpuerto Monterrey.” El Porvenir. Not dated. Available at: http://www.elporvenir.com.mx/notas.asp?nota_id=211079. Accessed April 22, 2008.

González González, Hugo, Logistic Development Director, INVITE. Interviewed by Edmund Gordon and Rebecca Takahashi on January 15, 2009 in Monterrey, Nuevo Leon, Mexico.

González Migoya, Alfonso, CEO Servicios Interpuertos. Interviewed by Edmund Gordon and Rebecca Takahashi on January 15, 2009 in Monterrey, Nuevo Leon, Mexico.

Guyette, James “Mexico Gains Ground Globally.” SearchAutoParts.com. March 1, 2009. Available at: http://www.search-autoparts.com/searchautoparts/Distribution/Mexico-gaining-ground-globally/ArticleStandard/Article/detail/583748?contextCategoryId=41884. Accessed: March 22, 2009

Halff Associates, Transportation. Available at: http://www.halff.com/services/transportation.php. Accessed: April 29, 2009.

Hausman, W.H. *Supply Chain Performance Metrics.* Stanford University: Management Science & Engineering Department. 2000. The Practice of Supply Chain Management. Kluwer: UK

Harrison, Robert., Loftus-Otway, Lisa, Shakyaver, Ajay. “Incorporating Inland Port Strategies Into TxDOT Planning.” Center for Transportation Research: Texas, U.S. Research Report 0-4083-01-1. July 2005. Available at: http://www.utexas.edu/research/ctr/pdf_reports/5_4083_01_1.pdf . Accessed: May 27, 2009.

Hernandez, Julián. “Firma API Tampico Convenio de Transporte.” El Norte. June 20,2007. Accessed through Factiva at the University of Texas on May 26, 2009. Hines Real Estate. “Hines Property Search.” No date. Available at: http://www.hines.com/property/detail.aspx?id=517. Accessed March 22, 2009.

Hines Real Estate. “Parque Logístico.” Available at: http://www.hines.com/property/detail.aspx?id=517. Accessed: February 8, 2009

Hines Real Estate “Regional Offices.” Availabale at: http://www.hines.com/contact/offices/southwest.aspx. Accessed: March 11, 2009.

Hines Real Estate. “Hines And Grupo Valoran Announce Development Of New Intermodal Industrial Park In San Luis Potosi, Mexico.” June 9, 2004. Avaialble at: http://www.hines.com/press/releases/06-09-04.aspx. Accessed: January 20, 2009.

Iliff, Lawrence. “Dallas Mayor Tom Leppert Pitches City’s business Potential in Monterrey.” Dallas Morning News. January 31, 2008.
Avaialble at: http://www.allengroup.com/uploadedFiles/News/In_The_News/01_31_08_dallas_mayor_tom_leppert.pdf. Accessed: February 8, 2009.

Import Administration “Where are zones currently located?” Available at: http://ia.ita.doc.gov/Ftzpage/info/location.html. Accessed: February 21, 2009.

INVITE. “Misión y Visión.” No date. Available at: http://www.nl.gob.mx/?P=invite_misionvision. Accessed: February 21, 2009.

Kansas City Southern Railroad. “History of Kansas City Southern.”. 2007. Available at: http://www.kcsouthern.com/en-us/KCS/Pages/History.aspx. Accessed: February 9, 2009.

Leitner, Sara, J., and Harrison, Robert. “The Identification and Classification of Inland Ports.” Center for Transportation Research: Texas, U.S. Research Report 0-4083-1. August 2001. Available at: http://www.utexas.edu/research/ctr/pdf_reports/4083_1.pdf. Accessed: May 27, 2009.

Logistik Free Trade Zone. "About Logistik." 2008.Available at: http://logistikftz.com/index.php?option=com_content&task=view&id=48&Itemid=62. Accessed: March 29, 2009.

Logistics Park. Avaialble at: http://www.interpuerto.com.mx/Pages_Main/info/info.asp. Accessed: March 15, 2009.

Macias, Raquel, Corporate Communications Coordinator and Vladamir Robles, Institutional Relations Manager, North Zone Kansas City Southern de Mexico. Interviewed by Edmund Gordon and Rebecca Takahashi on January 14, 2009 in Monterrey, Nuevo Leon, Mexico.

Méndez, Angélica "Parque Logístico recibe el certificado de Cumplimiento Ambiental." Alianza Automotriz. January 3, 2007. Available at: http://www.alianzaautomotriz.com/articulos.php?id_sec=16&id_art=703. Accessed: March 20, 2009.

Mexico Industrial Maps "San Luis Potosí Industrial Map." November 2008. Available at: http://www.mexicoindustrialmaps.com/mim_new/Ciudades/?Ciudad=9. Accessed: March 20, 2009

Miller, Richard, Assistant Vice President Mexico Business Unit, BNSF Railway Company."BNSF Railway Mexico Overview." Presentation. October 14, 2008.

National Mortgage News. "Developers Partner in Mexican CRE Venture." June 21, 2004, Vol. 28, No. 39. Accessed through Factiva at the University of Texas on May 26, 2009.

North American Free Trade Zone Organization (NAFTZ) "What are FTZs?" 2005. Available at: http://www.naftz.org/index_categories.php/ftzs/4. Accessed: February 8, 2009.

Padilla, Jesus, "Decree Signed for the Monterrey Inland Port", El Universal. April 21, 2008. Available at: http://www.eluniversal.com.mx/notas/500619.html. Accessed: April 24, 2009.

Petterson, Johan, "INVITE, Executive Vision for Interpuerto Monterrey" Free Trade Alliance. September 13, 2007. Available at: http://www.freetradealliance.org/admin/images/docs/IPANA/6-NAIPN%20Interpuerto%20Monterrey%20Johan%20Petterson%20%5BCompatibility%20Mode%5D.pdf. Accessed: April 24, 2009.

Prozzi, Jolanda., Henk, Russell., McCray, John., and Harrison, Rob. "Inland Ports: Planning Successful Developments." Center for Transportation Research: Texas, U.S. Research Report 0-4083-2. October 2002. http://www.utexas.edu/research/ctr/pdf_reports/4083_2.pdf. Accessed: May 27, 2009.

Robles, Vladimir, Institutional Relations Manager, Zona Norte, KCSM. Inteviewed by Rebecca Takahashi and Edmund Gordon on January 14, 2009 in Monterrey, Nuevo Leon, Mexico.

San Antonio Free Trade Alliance. "Interpuerto Monterrey Logistics Gateway: Executive Vision." Avaialble at: http://www.freetradealliance.org/admin/images/docs/IPANA/6-

NAIPN%20Interpuerto%20Monterrey%20Johan%20Petterson%20%5BCompatibility%20Mode%5D.pdf. Accessed: March 10, 2009.

Sánchez, Julián."Paro técnico en GM afectará a 10 mil obreros." El Universal. May 25, 2009. Factiva. Accessed through Factiva at the University of Texas on 26 May 2009.

SCT. "Mission and Vision of the SCT." January 25, 2009. Available at: http://www.sct.gob.mx/informacion-general/ Accessed February 22, 2009.

Secretaría de Desarrollo Economico (SEDECO). "Business Guide 2008." Brochure.

Secretary of Economic Development, Tourism Department, Municipality of Monterrey. "Experience Monterrey Tourist Information Service." Available at: http://turismo.monterrey.gob.mx/eng/experiencemty/monterreycityof_mountains.html. Accessed: March 31, 2009.

Simchi-Levi, David, Kaminski, Philip and Simchi-Levi, Edith. Designing and Managing the Supply Chain. Irwin McGraw-Hill, Boston, 2000.

Travel Daily News."U.S. Commerce Department forecasts rebound in international travel to the US by 2010." May 29, 2009. Available at: http://www.traveldailynews.com/pages/show_page/31204-US-Commerce-Department-forecasts-rebound-in-international-travel-to-the-US-by-2010. Accessed: May 29, 2009.

Understand Mexico. "San Luis Potosi Investment Guide". 2007. Available at: http://www.understandmexico.com/mexico/states/San/Luis/Potosi#state-data. Accessed: March 20, 2009.

Urban Development Agency of Nuevo Leon (DUNL). "Advanced Report from the Peripheral Region," 2007.

Vlasic, Bill and Nick Bunkley. "Obama is Upbeat for G.M.'s Future." New York Times. June 1, 2009. Available at: http://www.nytimes.com/2009/06/02/business/02auto.html?em. Accessed: June 1, 2009.

**HIGHWAYS/COMMUTER RAIL/AIRPORT**

AGIM Corporation.Monterrey, Neuvo Leon. Available at: http://www.agimmobilier.com/resource-center/Monterrey.htm. Accessed: March 29, 2009.

Aguilar, Alberto. "Analiza SCT ajustar calendario para Sistema 3 del tren suburbano". Not dated. Availalble at: http://www.zocalo.com.mx/seccion/opinion-articulo/analiza-sct-ajustar-calendario-para-sistema-3-del-tren-suburbano/. Accessed: May 19, 2009.

Aguilar, Juan Manuel Jauregui, Terminal Project Leader, OMA. Interviewed by Edmund Gordon and Rebecca Takahashi. January 13, 2009, Monterrey, Mexico.

Alejo, Francisco Javier. "Monterrey Logistics International Port." National Association of Regional Councils. 2006. Available at: http://narc.org/uploads/File/Transportation/Freight%20Summit/Alejo_NARC.pdf. Accessed: July 10, 2009.

All Business. "Government Plans Commuter Rail System for Mexico City." March 24, 1999. Available at: http://www.allbusiness.com/north-america/mexico/165768-1.html. Accessed: April 19, 2009.

American Public Transportation Association. Commuter Rail Public Transportation Ridership Report, Fourth Quarters 2008. Available at: http://www.apta.com/research/stats/ridership/riderep/documents/08q4cr.pdf. Accessed: May 27, 2009

Amezcua, Rosalba. "Abrirá licitación para tren suburbano". Available at: http://www.radiotrece.com.mx/2009/02/12/abriran-licitacion-para-tren-suburbano/ Accessed: May 19, 2009.

Athie-Rubio, Amado. Asssistant Director of Project Formulation, SCT Highway Development Department. Personal email with Ernest Worley on April 2, 2009.

Avalos, Fernando. Financial Director, Ferrocarriles Suburbanos, Interviewed by Lisa Loftus-Otway. August 15, 2008, Mexico City, Mexico.

Aviles, David. Head of Internal and External Communication, Ferrocarriles Suburbanos, Interviewed by Kate Mason and Beatriz Rutzen. February 27, 2009, Mexico City, Mexico.

Banco Nacional de Obras y Servicios Públicos, SNC, Informe Anual 2004, Mexico, 2004.

Barrera, Juan. "Atrasan apertura de estación del Tren Suburbano Inauguración podría ser a finales de este mes, anuncian." El Universal, Published: December 20, 2008. Available at: http://www.eluniversal.com.mx/ciudad/93273.html Accessed: May 26, 2009

BBVA-Bancomer. "BBVA Bancomer financiará y estructurará el Sistema Carretero del Oriente del Estado de México." December 6, 2004. Available at: http://www.bancomer.com.mx/salaprensa/cornu_comup_061204.html. Accessed: March 19, 2009.

Border Cold Storage. "Border Cold Storage – Map." 2009. Available at: http://www.bordercoldstorage.com/directions.html. Accessed: April 20, 2009.

Business News Americas. "Ten consortiums present bids for Durango-Mazatlán highway". June 11, 2008 (a). Accessed through Factiva at the University of Texas Library on March 19, 2009.

Business News Americas. "SCT awards Las Adjuntas-Puente Baluarte highway construction contract". July 22, 2008 (b). Accessed through Factiva at the University of Texas Library on March 19, 2009.

Business News Americas. “SCT deputy minister: Durango-Mazatlán highway construction is on schedule”. August 1, 2008 (c). Accessed through Factiva at the University of Texas Library on March 19, 2009.

Business News Americas. “ICA—Goldman Sachs win first re-concessions packages”. August 7, 2008 (d). Accessed through Factiva at the University of Texas Library on March 19, 2009.

Business News Americas. “Paper: SCT to announce Durango-Mazatlán concession winner next week”. September 9, 2008 (e). Accessed through Factiva at the University of Texas Library on March 19, 2009.

Business News Americas. “SCT: Puente Baluarte construction 32% complete could finish by 2010”. February 26, 2009. Accessed through Factiva at the University of Texas Library on March 19, 2009.

CAF Ferrocarril suburbano de la Zona Metropolitana del Valle de México (ZMVM). Available at: http://www.caf.net/download.php?file=img/pdf/mexico.pdf. Accessed: April 24, 2009.

Calderón Hinojosa, Felipe, President, Mexico. “Presentation of the National Infrastructure Plan.” Speech. June 17, 2007. SCT. Available at: http://www.presidencia.gob.mx/prensa/?contenido=31057. Accessed May 3, 2009.

Cal y Mayor and Associates, Inc. “Cost Benefit Analysis: Arco Norte.” Feasibility Study. Produced for SCT. March 2005 (a).

Cal y Mayor and Associates, Inc. “Executive Report: Cost Benefit Analysis: Arco Norte.” Feasibility Study. Produced for SCT. March 2005 (b).

Cal y Mayor and Associates, Inc. “Executive Report: Forecasting Traffic and Revenue.” Feasibility Study for Arco Norte. Produced for SCT. March 2005(c).

Cal y Mayor and Associates, Inc. “Forecasting Traffic and Revenue: Arco Norte.” Feasibility Study. Produced for SCT. March 2005 (d).

Cal y Mayor Associates, Inc. “Traffic and Revenue Qualifications: Circuito Mexiquense.” Fall 2002.

Camara Nacional de Autotransportes de Carga (CANACAR), *Un Siglo Sobre Ruedas: de la Concesion a la Globalizacion*, CANACAR, Mexico D.F., 2006.

Center for Sustainable Transport. Cleaner Healthier Air: Retrofit a Step Forward. August 2006. Available at: http://www.embarq.org/sites/default/files/Cleaner_healthier_air.pdf Accessed: June, 5, 2009.

Cisneros, Loziza Cecilia. Department of Finance & Planning of Rail Projects, Secretaria de Comunicaciones y Tranportes (SCT). Interviewed by Lisa Loftus-Otway on August 15, 2008, Mexico City, Mexico.

CONAPO. "Delimitación de Zonas Metropolitanas 2005." Available at: http://www.conapo.gob.mx/index.php?option=com_content&view=article&id=133&Itemid=292 . Accessed: May 3, 2009.

Consejo Nacional de Población. "Proyecciones de la Población de México 2005-2050." Not dated. Available at: http://www.conapo.gob.mx. Accessed: March 2, 2009.

Corporate Mexico "Highway rescue report released." September 3, 2002.

Customs and Border Patrol. "SENTRI program description." July 6, 2009. Available at: http://www.cbp.gov/xp/cgov/travel/trusted_traveler/sentri/sentri.xml. Accessed: August 8, 2009.

Dario, Celis "Desarrollan anillo carretero", Periodico el Mural online, Tiempo de negocios, October 2004. Available at: http://www.skyscrapercity.com/showthread.php?t=214592. Accessed: February 18, 2009

Davis, Lucas. Driving Restrictions and Air Quality in Mexico City. Resources for the Future Weekly Policy Commentary. August 18, 2008. Available at: http://www.rff.org/Publications/WPC/Pages/08_15_08_Driving%20Restrictions%20and%20Air%20Quality%20in%20Mexico%20City.aspx Accessed: June 5, 2009.

Day, Paul. "Monterrey: North Star Shines." Mexico Connect. January 1, 2006. Mexico Connect. Available at: http://www.mexconnect.com/mex_/travel/bzm/bzmmonterreyreport.html. Accesed: February 20, 2009.

Deaton, Gary. "Respite Comes by Rail: New Train Linking Mexico City with State of Mexico Expected to Slash Commute Times, Decrease Air Pollution." Business Mexico. Available at: http//www.thefreelibrary.com. Accessed: May 3, 2009.

Demographia Monterrey. "Urban and Suburban Growth." 2001. Available at: http://www.demographia.com/db-monterrey.htm. Accessed: March 29, 2009

Discovery Channel. Periferico at Rush Hour. Not dated. Available at: www.treehugger.com/files/2008/01/car_use_doubles.php. Accessed: May, 21, 2009.

e-Comunicaciones y Transportes "Tren Suburbano, ejemplo de conservación del medio ambiente: Treviño Landois". Available at: http://www.e-gobierno.gob.mx/wb2/eMex/eMex_2d826_not277_tren_suburban. Accessed: May 21, 2009

El Capitalino. "Calderón inaugura las últimas 2 estaciones del Tren Suburbano, pese a trabajos inconclusos." March, 11, 2009. Available at: http://elcapitalinoaldia.blogspot.com/2009_03_11_archive.html Accessed: June 5, 2009.

El País. "CAF se adjudica la construcción del primer ferrocarril suburbano de la capital de México." August 25, 2008. Available at : http://www.elpais.com/articulo/economia/CAF/adjudica/construccion/primer/ferrocarril/suburbano/capital/Mexico/elpepieco/20050825elpepieco_3/Tes. Accessed: May 22, 2009

El Universal. "SCT evalúa cambios al sistema del Suburbano". Published: April 21, 2009. AVailable at: http://www.eluniversal.com.mx/notas/592512.html. Accessed: May 19, 2009.

EMBARQ. The WRI Center for Sustainable Transport. Not dated. Available at: http://www.embarq.org/en/project/mexico-city-metrobus. Accessed: April 30, 2009.

Engel, Eduardo, Ronald Fischer, and Alexander Galetovic. "Public-Private Partnerships: When and How." December 2008. MIT CTL Lunch Time Lectures. Available at: http://ctl.mit.edu/public/engel_slides.pdf. Accessed: March 11, 2009.

Estado de Mexico. "Tren Suburbano de la Zona Metropolitana del Valle de México." No date. Available At: http://www.estadodemexico.com.mx/especiales.item.6/tren-suburbano-de-la-zona-metropolitana-del-valle-de-mexico.html Accessed: May 22, 2009.

Estado de Mexico. "Plan de Desarollo Estado de Mexico 2005-2011." 2005. Available at: http://www.edomex.gob.mx/desarrollosocial/doc/pdf/plandesarrollo.pdf. Accessed: May 19, 2009.

Felipe Ochoa y Asociados, S.C (FOA). Estuido Costo-Beneficio de la Autopista Durango – Mazatlan. March, 2005. Prepared for Secretaria de Comunicaciones y Transportes Subsecretaria de Infraestructura Unidad de Autopistas de Cuoto.

Ferrocarriles Suburbanos. No date. Available at: http://www.fsuburbanos.com/secciones/operacion/costo_viaje.php. Accessed: May 19, 2009.

Fimbres-Castillo, Jose. Project Coordinator and Project Supervisor, SCT Highway Department. Interviewed by Ernest Worley. February 25, 2009, Mexico City, Mexico.

Florida, Richard. *The Rise of the Mega Region.* October 2007. The Martin Prosperity Institute: Joseph L Rotman School of Management University of Toronto. Available at: http://www.rotman.utoronto.ca/userfiles/prosperity/File/Rise.of.%20the.Mega-Regions.w.cover.pdf. Accessed: August 21, 2009.

Florida, Richard. "The Rise of the Mega Region." Wall Street Journal. April 12, 2008. Avalable at: http://online.wsj.com/article/SB120796112300309601.html. Accessed: August 21, 2009.

Glaxiola Lopez, Jose. "Historia general de Sinaloa: Epoca prehispanica". El colegio de Sinaloa, 2005.

González González, Hugo, Logistic Development Director, INVITE. Interviewed by Edmund Gordon and Rebecca Takahashi on January 15, 2009 in Monterrey, Nuevo Leon, Mexico.

Gonzalez de Cosio, Francisco. "Historia de Obras Publicas en Mexico". Secretaria de Obras Publicas. 1971.

Google Maps. "Monterrey, Mexico.". Available at: http://www.satellite-sightseer.com/id/6789/Mexico/Nuevo_Leon/Monterrey/Monterrey. Accessed: April, 6, 2009.

Gutierrez de Quevedo, Carlos Gutierrez, Ing. Planner of Tranportation Systems, Center of Sustainable Transport (CTS); and Blancas, Silvia, Center for Sustainable Transport (CTS). Interviewed by Kate Mason and Beatriz Rutzen on February 25, 2009 in Mexico City, Mexico.

Hawley, Chris. "Mexico Reviving Travel by Train: Billions poured into new Billet, Suburban Train," Republic of Mexico City Bureau. Available at: www.azcentral.com. Accessed: May 3, 2009.

Hernandez, Diego Saldivar, Operation & Sales Warehouse Manager, OMA Carga. Interviewed by Edmund Gordon and Rebecca Takahashi. January 13, 2009 (a), Monterrey, Mexico.

Hernandez, Salvador Lucio. General Manager of Right-of-Way and Manager of Highway Concessions, SCT. Interviewed by Angela Mora and Caitlin Morris on February 25, 2009 (b) in Mexico City, Mexico.

Herrera, Llanos and Chavez. "Calderón inaugura las últimas 2 estaiones del Tren Suburbano, pese a trabajos inconclusos," La Joranda. Available at : http://www.jornada.unam.mx/2009/01/06/index.php?section=estados&article=028n1est Accessed: May 27, 2009

Hibler, Michelle. "Taking Control of Air Pollution in Mexico City." August 12, 2003. The International Development Research Center. Available at: http://www.idrc.ca/en/ev-31594-201-1-DO_TOPIC.html. Accessed: June 5, 2009.

Ibarra, Mariel, "Proyectan para junio Circuito Exterior." Periódico Reforma. January 18, 2005 (a). Accessed: March 23, 2009.

Ibarra, Mariel, "Rebasa expectativas Circuito Mexiquense." Periódico Reforma. June 11, 2005 (b). Accessed: May 9, 2009.

Ibarra, Mariel. "Vigilan a usuarios del Circuito Exterior." Periódico Reforma. August 7, 2005 (c). Accessed: April, 23 2009.

IDEAL (Impulsora del Desarollo y el Empleo en America Latina) "Valle de México Northern Bypass: Arco Mexico.". Available at: http://www.ideal.com.mx/site/index.php?option=com_content&task=view&id=33&Itemid=125. Accessed: May 3, 2009.

Infante, Geovanni. Engineer. Cal y Mayor Associates. Telephone interview with Alejandra Cruz-Ross, April 30, 2009.

Instituto Nacional de Estadistica y Geografia (INEGI). No date. Website. Available at: http://www.inegi.org.mx/inegi/default.aspx. Accessed: March 19, 2009.

Instituto Nacional de Estadistica y Geografia (INEGI). "Censos." 2007. Available at: http://www.inegi.org.mx/inegi/default.aspx?s=est&c=10202. Accessed: March 19, 2009.

Instituto de Crédito Oficial, About ICO, 2009. Available at: http://www.ico.es/web/contenidos/4/1017/index.html. Accessed: April 23, 2009.

Laboratorio de Transporte y Sistemas Integrales, UNAM. "Estudio integral metropolitano de transporte de carga y medio ambiente para el Valle de México." Instituto de Ingeniería, UNAM, 2006.

La Jornada. " En una semana, otra convocatoria para el tren suburban: SCT." Published: 6 July 2005. Availableat: http://www.jornada.unam.mx/2005/07/06/020n1eco.php Accessed: May 27, 2009

La Jornada. "Caótico arranque de operaciones del Ferrocarril Suburbano; culpan a la SCT." Published: 2 June 2008. Available at: http://www.jornada.unam.mx/2008/06/02/index.php?section=capital&article=041n1cap Accessed: May 26, 2009

La Jornada. "Calderón inaugura las últimas 2 estaciones del Tren Suburbano, pese a trabajos inconclusos." January 6, 2009. Available at: http://www.jornada.unam.mx/2009/01/06/index.php?section=estados&article=028n1est. Accessed: May 5, 2009.

Levy, Sidney M. Build, Operate, Transfer: Paving the Way for Tomorrow's Infrastructure. New York: J. Wiley & Sons, 1996.

Lopez , Claudia Guevara. Manager of Communication and Public Relations , Ferrocarriles Suburbanos. Interviewed by Lisa Loftus-Otway on August 15, 2008 in Mexico City, Mexico.

M2 Comunications. "Mexican airport operators GAP and OMA report traffic statistics for June." July 9, 2008. Accessed: February 20, 2009.

Marquez Garcia, Fernando. Engineer. Dirac Ingenieros Group (DIRAC). Interviewed by Fernanda Guitterez and Jamie Mcallister on February 11, 2009, Mexico City, Mexico.

Martínez, Agustín, and Rodríguez, Lucero. "Recovered remains of the victims of avionazo." September 19, 2008. Millenio. Available at: http://www.milenio.com/node/98326. Accessed: February 21, 2009

Martinez-Salgado, Hilda. Director of Air Quality, Center for Sustainable Transport. Interview by Lisa Loftus-Otway on August, 14, 2008 in Mexico City, Mexico.

McAllen Chamber of Commerce (CoC). No date. Available at: http://www.mcallen.org/. Accessed: May 23, 2009.

Melo Jimenez, Agustin. General Manager of Highway Development, SCT. Interviewed by Angela Mora Caitlin Morris on February 25, 2009, Mexico City, Mexico.

Mexico Airport. "Monterrey - Mariano Escobedo - International. Airport." Available at: http://aeropuertosmexico.com/Ingles/index.php?option=com_content&task=view&id=258&Itemid=359. Accessed: February 19, 2009.

Mexico City Metro. Available at: http://www.metro.df.gob.mx/index.html. Accessed: May 21, 2009.

Mexico City Metrobús. Available at: http://www.metrobus.df.gob.mx/ . Accessed: May 21, 2009.

Molina, Luisa and Molina, Mario (eds.). "Air Quality in the Mexico Megacity: An Integrated Assessment." 2004. Dordrecht: Kluwer Academic Publishers.

Northeastern Mexican State and State of Texas Partnership (NEMEX-TEX). "Nuevo Leon Factsheet." Available at: http://www.nemex-tex.org/Nuevo%20Leon.aspx. Accessed: March 29, 2009.

NOTIMEX Agencia Mexicana de Noticias. "Ejido Administrators Block Construction of the Durango-Mazatlan Highway." August 4, 2004. Accessed through Factiva at the Univesity of Texas Library on May 19, 2009.

OHL Inc. Available at: http://www.ohlconcesiones.com/html/espanol/mexico.html. Accessed: June 4, 2009

OHL. "Conmex obtiene un préstamo para su financiación." Noticias. 2008. Available at: http://www.ohlconcesiones.com/html/espanol/noticias_detalle.aspx?IdCont=464 Accessed: April 23, 2009.

OHL. "Concesiones en el Mundo: México, Actividades y Concesiones." 2009. Available at: http://www.ohlconcesiones.com/html/espanol/mexico.html Accessed: April 23, 2009 (a).

OHL. "Quienes somos." 2009. Available at: http://www.ohlconcesiones.com/html/espanol/quienes_somos.html Accessed: April 23, 2009 (b).

OMA. "History." No date. Available at: http://www.oma.aero/en/about/history.htm. Accessed: February 19, 2009.

OMA. "OMA Carga increases connectivity in Monterrey." April 18, 2008. Available at: http://www.oma.aero/assets/007/5785.pdf . Accessed: March 29, 2009 (a)

OMA. "OMA announces end of incentive program." September 10, 2008. Available at: http://www.oma.aero/assets/007/5791.pdf. Accessed: March 29, 2009 (b).

Ortega-Noriega, Sergio. "Breve historia de Sinaloa." Colegio de Mexico, 1999.

Perry, Frederick and Rehman, Scheherazade, Trucking Laws in Mexico and Changes After the NAFTA: A Paradigm for the FTAA?, in *31 Transp. L. J. 95*, 2004.

Persad, K.R., C.M. Walton, and J. Wilke. October 2005. Alternatives to Non-Compete Clauses in Toll Development Agreements, Report No. FHWA/TX-07/0-5020-1, Center for Transportation Research, The University of Texas at Austin.

Pertack, Ing. Mauricio Trejo. Director de Comercialization y Administración de Riesgo, CAF Mexico. Interviewed by Lisa Loftus-Otway on August 15, 2008 in Mexico City, Mexico.

Portal de Desarrollo. "Impulsa SCT Transporte masiivo de pasajeros por ferrocarril." July 16, 2007. Available at: http://www.portaldeldesarrollo.org/news.php?idseccion=16&ref=/salud/index.php&idnoticia=545&Ver=vermas>. Accessed: April 24, 2009.

Presidencia de la República. Press Conference: "Proyecto del Ferrocarril Suburbano de la Zona Metropolitana del Valle de México." Published: June 11, 2003. Available at: http://fox.presidencia.gob.mx/actividaes/?contenido=5534. Accessed: April 24, 2009.

Ramon, George. Bridge Director for the city of McAllen, Tx. Phone interview with Beatriz Rutzen on April 27, 2009.

Reinhardt, W.G. "Tepic Toll Road: The Best Deal that Didn't Close in 1994." Public Works Financing. 1994, Issue 12. Westfield:NJ.

Rouaix, Pastor. Geography of the State of Durango "Geografia del estado de Durango". Mexico: Editorial del Magistrado, 1980.

Rubio, Amado Athie (SCT). Public Private Partnerships for Highways in Mexico. May 2007. Presented at the Canada-United States Transportation Border Working Group, Border Finance Workshop, Chicago Illinois. Available at: http://www.thetbwg.org/meetings-archive-BFW-200705_e.htm. Accessed: September 14, 2009.

Sanchez Lora, Ricardo . Manager of Right-of-Way, SCT. Interviewed by Angela Mora and Caitlin Morris on February 25, 2009 in Mexico City, Mexico.

Sanchez, Ing. J. Santos Villarreal, Director of Evaluation and Control, Secretaria de Comunicaciones y Tranportes (SCT). Interview by Kate Mason and Beatriz Rutzen. February 26, 2009, Mexico City, Mexico.

SAASCAEM. "Permiso para el uso y aprovechamiento del derecho de vía de las autopistas estatales de cuotas y zonas aledañas." Estado de México. Available: http://www.edomex.gob.mx/portal/page/portal/saascaem/derechovia. Accessed: February 17, 2009.

SAASCAEM. "Planeación Estratégica." Estado de México. 2008 (a). Available at: http://www.edomex.gob.mx/portal/page/portal/saascaem/quienessomos/planeacion. Accessed: February 17, 2009.

SAASCAEM. "Circuito Exterior Mexiquense." Estado de México. 2008 (b). Available at: http://www.edomex.gob.mx/portal/page/portal/saascaem/autopistas. Accessed: February 17, 2009.

Salvatierra, Hugo. "Un libramiento para la Ciudad de México." Obras Web. 2006. Ed. 399. Available at: http://www.obrasweb.com/art_view.asp?seccion=CONSTRUCCIONES&revista=399. Accessed: February 17, 2009.

SCT. "Transporte Ferroviario Multimodal." No Date (a). Available at: http://www.e-comunicacionesytransportes.gob.mx/index.php?option=com_content&view=article&id=52:transporte-ferroviario-multimodal&catid=55:transporte-ferroviario-multimodal&Itemid=68. Accessed: April 24, 2009.

SCT. "Tren Suburbano" Video. No date (b). Available at: http://dgttfm.sct.gob.mx/index.php?id=712. Accessed: May 19, 2009.

SCT. "Tren Suburbano" Video. No date (c). Available at: http://cs.sct.gob.mx/fileadmin/fs/index.htm Accessed: May 19, 2009.

SCT. "Nueva Ley publicada en el Diario Oficial de la Federación el 12 de mayo de 1995." 1995. Available at: http://www.sct.gob.mx/fileadmin/normatividad/transporte_ferroviario/1Ley_Reglamentaria_del_Servicio_Ferroviario.pdf. Accessed: May 19, 2009.

SCT. "Ferrocarril Suburbano Cuautitlan – Buenavista." June 7, 2005. Available at: http://www.diputados.gob.mx/comisiones59legislatura/transportes/foro/junio7_05_Comision_Transporte.pdf. Accessed: April 24, 2009.

SCT. "Public-Private Partnerships for Highways in Mexico." May 2007. Available at: www.thetbwg.org/meetings/NBF/200705/public%20private.ppt. Accessed: March 12, 2009.

SCT. Manual Estadistico del Sector Transporte, 2007 (a). Available at: http://www.imt.mx/archivos/Publicaciones/Manual/mn2007.pdf. Acesed: September 14, 2009.

SCT. "Autopista Mazatlán-Durango." 2008 (a). Available at: http://www.sct.gob.mx/uploads/media/080722_Conferencia_de_prensa_-_Durango-Mazatlán.pdf. Accessed: May 4, 2009.

SCT. "Comunicado de Prensa No. 019 – Se anuncia la licitación del Sistema 3 del Tren Suburbano para el Valle de México." January 30, 2008 (b). Available at: http://www.sct.gob.mx/despliega-noticias/browse/30/article/comunicado-de-prensa-no-019-se-anuncia-la-licitacion-del-sistema-3-del-tren-suburbano-para-el-val/?tx_ttnews%5BbackPid%5D=20&cHash=c8eafe7a25. Accessed: May 21, 2009.

SCT. "Proyectos de Movilidad Urbana y Suburbana: "Tren Suburbano" Zona Metropolitatana del Valle de México." April 2008 (c). Available at:

http://www.bancomext.com/Bancomext/aplicaciones/directivos/documentos/OscarCorzo.pdf. Accessed: April 24, 2009.

SCT. "Trenes Suburbanos de la Zona Metropolitana del Valle de México." September 2008 (d). Available at: http://www.conae.gob.mx/work/sites/CONAE/resources/LocalContent/6153/2/innovaciones_transporte_publico.pdf. Accessed: April 25, 2009.

SCT. "Proyecto Autopista Durango-Mazatlan." 2009. Brochure (a).

SCT. "Conoce todo acerca del Tren Suburbano." March 10, 2009 (b). Available at: http://www.sct.gob.mx/despliega-noticias/article/conoce-todo-acerca-del-tren-suburbano/. Accessed: May 21, 2009.

SCT. "Comunicado de Prensa No. 088 – Pone en Marcha el Presidente Felipe Calderón Recorridos del Tren Suburbano." July 5, 2009 (c). Available at: http://www.sct.gob.mx/despliega-noticias/article/comunicado-de-prensa-no-088-pone-en-marcha-el-presidente-felipe-calderon-recorridos-del-tren-sub/tren%20suburbano/?tx_ttnews%5BbackPid%5D=20&cHash=cc22bec979. Accessed: May 19, 2009.

Secretaria de Desarrollo Metropolitano, México. "Delimitación de la Zona Metropolitana del Valle de México." Not dated. Available at: http://www.edomex.gob.mx/portal/page/portal/sedemet/mm. Accessed: March 2, 2009.

SEMARNAT. "Estado Actual del Tramite, Corredor de Altiplano." Not dated (a). Available at: http://www.semarnat.gob.mx/Pages/Consultatutramite.aspx?bita_numero=15EM2003V0015. Accessed: June 4, 2009.

SEMARNAT. "Manifestación de Impacto Ambiental Corredor del Altiplano." 2003. Available at: http://www.semarnat.gob.mx/Pages/Consultatutramite.aspx?bita_numero=15EM2003V0015. Accessed: June 4, 2009.

SEMARNAT. "Manifestacion del Impacto Ambiental Mazatlan-Durango." June 15, 2005.

SEMARNAT. "Manifestación de Impacto Ambiental del proyecto Ampliación del Tramo 1, mediante la construcción del subtramo km 50 + 853.189 al km 54 + 728.00 del Sistema Carretero de Oriente del Estado de México, Mejor conocido como Circuito Exterior Mexiquense." 2007. Available at: http://www.semarnat.gob.mx/Pages/Consultatutramite.aspx?bita_numero=15EM2007V0017. Accessed: May 11, 2009

SEMARNAT. "Manifestación de Impacto Ambiental del proyecto Construcción de tres estructuras en zona federal del tramo carretero de la fase II tramo 2 del Circuito Exterior Mexiquense, Mexico." 2008. Available at: http://www.semarnat.gob.mx/Pages/Consultatutramite.aspx?bita_numero=15EM2008V0026. Accessed: May 11, 2009.

Secretaría de Transportes y Viavilidad, Gobierno del Distrito Federal. "Ferrocarril Suburbano de la Zona Metropolitana del Valle de México." Available at: http://www.setravi.df.gob.mx/suburbano/tren_suburbano.pdf. Accessed: April 24, 2009.

Secretaria de Transportes y Vialidad. "El transporte factor de cohesión social." 2009 (a). Available at: http://www.setravi.df.gob.mx/reportajes/r_transporte.html. Accessed: May 4, 2009.

Secretaria de Transportes y Vialidad. "Vialidades, las venas de la Ciudad, México, D.F." 2009 (b). Available at: http://www.setravi.df.gob.mx/reportajes/r_vialidades.html. Accessed: May 4, 2009.

Secretaría de Desarrollo Urbano y Vivienda (SEDUVI). No date. Available at: www.seduvi.df.gob.mx. Accessed May 4, 2009.

Solis, Dr. Alejandro, Coordinator of Advisement to the Subsecretary of Transport, Secretaria de Comunicaciones y Tranportes (SCT). Interviewed by Kate Mason and Beatriz Rutzen on February 26, 2009, in Mexico City, Mexico.

Solis Peña, Margarita. "Lista, primera etapa del tren suburbano" El Financiero. April 3, 2008. Available at: http://www.elfinanciero.com.mx/ElFinanciero/Portal/cfpages/contentmgr.cfm?docId=113245&docTipo=1&orderby=docid&sortby=ASC. Accessed: June 4, 2009.

Solis Peña, Margarita. "Descarten Cancelar Concesión a Ferrocarriles Suburbanos." El Financiero. April 22, 2009. Acccessed through Factiva at the University of Texas on June 1, 2009.

SourceMex Economic News and Analysis. "Government Plans Commuter Rail System for Mexico City." No date. Available at: http://www.allbusiness.com. Accessed: April 26, 2009.

SourceMex Economic News and Analysis. "Government cancels project connecting Mexico City & Guadalajara; Mexico City Suburban Train to start in 2007." August 23, 2006. Available at: http://www.encyclopedia.com/doc/1G1-150007308.html. Accessed: April 24, 2009.

STE (Servicios de Transportes Electricos). No date. Available at: http://www.ste.df.gob.mx/servicios/index.html. Accessed May 21, 2009.

STE. "Planea SCT proyectos por nueve mil millones de dólares para transporte masivo." 12 February 2009. Available at: http://www.ste.df.gob.mx/servicios/lineas.html Accessed: May 21, 2009

Sugawara, Mario Alpizar. Director Gneral Adjunto Concesionaira Mexiquense, Conmex. Prsonal Email with Fernanda Guiterez, February 13, 2009.

Tourism Secretary of Mexico City. "Getting Around." Not dated. Available at: http://www.mexicocity.gob.mx/contenido.php?cat=10300&sub=0. Accessed: April 30, 2009.

Transport Topics. “Mexico Buys Privatized Roads: Ambitious Toll program Acknowledge as Failure.” September, 1, 1997. Accessed through Lexis Nexis Academic at the University of Texas on March 19, 2009.

Trejo Ordonez, Arturo. Concession Projects Leader, Cal y Mayor. Interviewed by Angela Mora and Caitlin Morris on February 24, 2009 (a) in Mexico City, Mexico.

Trejo Ordonez, Arturo. Concessions Project Leader, Cal y Mayor. “Technical Aspects—Arco Norte.” Presentation. 24 February 2009 (b), in Mexico City, Mexico.

US-Spain Business Website. “Industry Reports: Public Infrastructure and equipment concession in Spain.” November 2006. http://www.us.spainbusiness.com/icex/cma/contentTypes/common/records/viewDocument/000.bin?doc=4070990. Accessed: February 19, 2009

United States Securities and Exchange Commission (SEC). “OMA Begins Construction of Terminal B at Monterrey International Airport." June 2007. Accessed through Lexis Nexis at University of Texas at Austin on February 20, 2009.

UNAM. Estuidio integral metropolitan de transporte de carga y medio ambiente para el valle de Mexico. Laboratorio de Transporte y Sistemas Integrales, Mexico, Insitututo de Ingenieria. Mexico City, Mexico. 2006.

Vision: 2030. Mexican Federal Government, 2007. Available at: www.vision2030.gob.mx. Accessed: May 4, 2009.

Viva Aerobus. “Destinations.” Available at: http://www.vivaaerobus.com/mx/destinos.htm. Accessed: February 25, 2009.

Wall Street Journal. “Grupo Aeroportuario Ctr Nort OMAB. Market Watch 2006.” Available at: http://www.marketwatch.com/tools/quotes/profile.asp?symb=omab. Accessed: March 3, 2009.

Webb, Mary and Clark, Jackie. “Jane’s Urban Transport Systems 2008-2009.” London, England: Jane’s Information Group, 2008. p. 244.

World Airport Guide. “Monterrey General Mariano Escobedo International Airport.” Available at: http://www.worldairportguide.com/airport/243/airport_guide/North-America/Monterrey-General-Mariano-Escobedo-International-Airport.html. Accessed: February 22, 2009.

World Trade Press. “Population Density Map of Mexico.” Available at: www.bestcountryreports.com/.../Mexico_Pop.jpg. Accessed: May 19, 2009.

Yates, Charles M. “Toll Roads in Mexico and Argentina.” The 22nd European Transport Forum September 12-16, 1994.

**BORDER PROJECTS**

Ángel Castillo, Miguel. "New railway bridge built Brownsville-Matamoros." Directorio T21. July 4, 2008. Available at: http://www.t21.com.mx/news/news_display.php?story_id=8607. Accessed: April 22, 2009.

Behrens, Michael. "Cross Border Transportation and Infrastructure Report." Texas Department of Transportation. December 2006. Available at: http://tti.tamu.edu/documents/TTI-2006-6.pdf. Accessed: June 2, 2009.

Border Governors Conference. "Technical Secretariat Report." 2007. http://www.gobernadoresfronterizos.org/index.php?lang=en. Accessed: June 2, 2009.

Brown, Robin. "Clinton Awards Anzalduas Bridge Permit." States News Service, July 27, 1999.

Brownsville & Matamoros Bridge Company (BMBC). "Historic Rio Grande." Not dated. B&M Bridge Company.

Campirano, Eduardo, Port Director and COO, Port of Brownsville. Interviewed by Lauren Rose on February 23, 2009 in Brownsville, Texas.

Center for Disease Control. Preventing Chronic Disease. Volume 5: No. 4. October 2008. Available at: http://www.cdc.gov/pcd/issues/2008/Oct/bmscp_map.htm. Accessed: April 24, 2009.

Conde, Francisco, Director of Special Projects & Communications, SuperCorridor Coalition Inc. "NASCO's Mission: To enhance economic development and security along the NASCO corridor." Presentation at LBJ School of Public Affairs, October 7, 2008.

Cuan Chin Yu, Manuel. Subdirector of International and Intersecretarial Affairs, Secretaria de Comunicaciones y Tranportes (SCT). Interview by Kate Mason and Beatriz Rutzen on February 26, 2009 (a) in Mexico City, Mexico.

Cuan Chin Yu, Manuel. Subdirector of International and Intersecretarial Affairs, Secretaria de Comunicaciones y Tranportes (SCT). Interviewed by Ernest Worley on February 27, 2009 (b) in Mexico City, Mexico.

de las Fuentes, Arturo. President, Cruces y Puentes Internacionales, SCT. Interviewed by Ernest Worley on February 27, 2009 (a) in Mexico City, Mexico.

de las Fuentes, Arturo, President, Cruces y Puentes Internacionales, SCT. Personal Email with Lauren Rose on April 1, 2009 (b).

Eaton, David, Vice President Corporate Affairs & Right-of-Way Protection, Kansas City Southern de Mexico. Telephone interview by Lauren Rose on March 2, 2009.

El Economista. "Proponen crear tres nuevos cruces fronterizos." June 26, 2007. Available at: http://elconomista.com.mx/articulos/2007-06-26-39365. Accessed: February 10, 2009.

En Linia Directa. “Arrancó construcción de puente internacional Reynosa Mission "Anzalduas" June 29, 2007. Available at: http://www.enlineadirecta.info/nota.php?art_ID=27196&titulo=Arranc__construcci_n_de_puente_internacional_Reynosa_Mission__Anzalduas_.html. Accessed: February 13, 2009.

Erazo Garcia, Juan Jose, Project Director Technical Coordination of Intermodal Planning Road Infrastructure, SCT. Interviewed by Lisa Loftus-Otway on August, 13, 2008 in Mexico City, Mexico.

Erazo Garcia, Juan Jose, Director of Intermodal Projects, SCT. Interviewed by Kate Mason and Beatriz Rutzen on February 26, 2009 (a) in Mexico City, Mexico.

Erazo Garcia, Juan Jose, Project Director Technical Coordination of Intermodal Planning Road Infrastructure, SCT. Interviewed by Ernest Worley on February 27, 2009 (b) in Mexico City, Mexico.

Galvan, Jose, President and COO, Brownsville & Matamoros Bridge Company. Interviewed by Lauren Rose on February 23, 2009 in Brownsville, Texas.

Geller, Mark. “Anzaldúas Bridge is a Go.” The Monitor. March 22, 2006. Available at: http://www.redorbit.com/news/science/438580/anzalduas_bridge_is_a_go/. Accessed: March 19, 2009.

Gulf of Mexico States Partnership. “About Us: Factsheet. 2005.” Available at: http://www.gulfofmexicostatespartnership.com/about.html Accessed: May 28, 2009.

Holeywell, Ryan. “Bridge beef: Competing interests pit McAllen against Pharr in fight over Anzaldúas.” The Monitor. August 20, 2008 (a). Available at: http://www.themonitor.com/articles/mcallen-16203-bridge-anzalduas.html?orderby=TimeStampAscending&oncommentsPage=1&showRecommendedOnly=1. Accessed: April 18, 2009.

Holeywell, Ryan. “Opening of Anzalduas International Bridge delayed.” The Monitor. October 28, 2008 (b). Available at: http://www.themonitor.com/articles/bridge-19174-international-federal.html. Accessed: April18, 2009.

Holeywell, Ryan. “McAllen, Pharr at odds over extending Anzaluas Bridge’s operating hours.” The Monitor. June 4, 2009. Available at: http://www.themonitor.com/articles/mcallen-27270-odds-anzaluas.html Accessed: June 5, 2009.

InfoSel Financiero. “Esperan Crecimiento del 4.7% en infraestructura.” December 2, 2008. Accessed through Factiva at the University of Texas on April 15, 2009.

International Boundary and Water Commission (IBWC). Brownsville Matamoros West Rail Relocation Project. Presentation given to researchers from February 11, 2009.

Mario Jorge, District Engineer Pharr District, Texas Department of Transportation. Interviewed by Kate Mason on 17 April 2009.

KNVO Television. "Inician construcción de Nuevo Puente Anzaldúas." October 27, 2008. Available at: http://knvotv48.com/archives/10937. Accessed: December 15, 2008

McAllen Economic Development Corporation. "Reynosa Community Profile." No date. Available at: http://www.medc.org/reynosa_profile.php. Accessed: March 30, 2009.

McAllen Economic Development Corporation. "Anzalduas International Bridge." November 2008. Available at: http://www.medc.org/anzalduas_international_bridge.php?sub=ab. Accessed: May 28, 2009.

Nation's Cities Weekly. "Border Trade Project Receives Final Presidential Authorization." October 4, 1999. Accessed through Factiva at the University of Texas on April 18, 2009.

NEMEX-TEX. "Mission Statement." Not dated (a). Available at: http://www.nemex-tex.org/index.aspx. Accessed: June 3, 2009.

NEMEX-TEX. "Regional: Major Indicators Factsheet." Not dated (b). Available at: http://www.nemex-tex.org/majorindicators.aspx. Accessed: June 3, 2009.

North American Super Corridor Coalition. "About NASCO: Factsheet. 2004-2008." Available at: http://www.nascocorridor.com/. Accessed: May 28, 2009.

Osborne, James. "U.S. Section of Bridge OK'd." The Monitor. No date. Available at: http://www.missioneda.com/En-News/1107. Accessed: August 19, 2009.

Pinkerton, James. $30 million "Bridge gets final OK /Latest link to Mexico expected to boost trade and development." Houston Chronicle. August 1, 1999. Accessed through Factiva at the University of Texas on April 15, 2009.

Presidencia de la Republica. "Luis Téllez announced Concession Package Autopistas Northeast." September 18, 2008. Available at: http://www.presidencia.gob.mx/prensa/sct/?contenido=38762. Accessed: April 18, 2009

George Ramon, Bridge Director, Reynosa – Anzaldus Bridge, McAllen, Texas. Interviewed by Lauren Rose on February 24, 2009 in Brownsville, Texas.

George Ramon, Bridge Director, Reynosa – Anzaldus Bridge, McAllen, Texas. Telephone interview by Kate Mason on April 17, 2009 (a).

RJ Rivera Associates. "Texas Mexico Border Crossings Study." June 2008. Available at: http://www.txdot.gov/project_information/projects/border_crossing/crossings.htm. Accessed: March 15, 2009.

Saenz, Amadeo. "Texas-Mexico Strategic Investment Commission Report 2007." Texas Department of Transportation. November 30, 2007. Available at: http://www.sos.state.tx.us/border/forms/reports-07/txdot-07.pdf. Accessed: June 2, 2009.

SCT. “Análisis de factibilidad del proyecto Puente Internacional Reynosa “Anzaldúas” (Tamaulipas).” Subsecretaria de Infraestructura, Dirección General de Desarrollo Carretero. January 2006.

Sepulveda, Pete. County Coordinator, Cameron County  Cameron County, Texas and Tamaulipas, Mexico.  “A West Rail Relocation Plan; Brownsville, Texas, USA; Matamoros, Tamaulipas, Mexico.” February 13, 2008.  Hard copy, presentation given to Lauren Rose.

Sepulveda, Pete, County Coordinator, Cameron County.  Interviewed by Lauren Rose on February 24, 2009 (a) in Brownsville, Texas.

Sepulveda, Pete, County Coordinator, Cameron County. Personal email with Lauren Rose on April 3, 2009 (b).

Silva, Eric. “SCT Confirms Construction of Rail Bridge.” City of Matamoros. July 3, 2008. Available at: http://www.matamoros.gob.mx/prensa/superboletin.asp?IdBoletin=298.  Accessed: April 22, 2009.

State of Tamaulipas.  “More and better bridges to with U.S. to deal with NAFTA: Governor.” Governor of Tamaulipas. April 28, 2008 (a). Available at: www.tamaulipas.gob.mx/saladeprensa/boletines/download.asp?file=/saladeprensa/archs/042008/28/com1622.doc.  Accessed: April 18, 2009

State of Taumaplipas, Mexico and Cameron County, Texas, “Brownsville/Matamoros West Rail Relocatioin Project. El Paso Presentation.”  February 13, 2008 (b).

Stuffer, Peter.   Technical Subdirector, Grupo Marhnos. Interviewed by Kate Mason and Beatriz Rutzen on February 26, 2009 in Mexico City, Mexico.

Texas Center for Border Economic and Enterprise Development. “Truck Crossings.” Texas A&M University. 2009. Available at: http://texascenter.tamiu.edu/texcen_services/truck_crossings.asp?framepg=datatruck.  Accessed: August 15, 2009.

Texas Comptroller of Public Accounts.  “A Review of the Texas Department of Transportation: January 2001.” 2001. Available at:  http://www.window.state.tx.us/txdot/txdot700.html. Accessed:  March, 30, 2009.

Texas Department of Transportation. “Response to Secretary of state Phil Wilson Survey Questions: Texas-Mexico Strategic Investment Commission Report for 2007.” November 30, 2007. Available at: http://www.sos.state.tx.us/border/forms/reports-07/txdot-07.pdf Accessed: May 28, 2009.

Texas Transportation Commission. “Meeting Minutes.” Texas Department of Transportation. March 30, 2006. Available at http://www.dot.state.tx.us/publications/commission/2006_meetings/minute_orders06/mar30/6c.pdf. Accessed: May 28, 2009.

Team NAFTA Website. “Matamoros Industrial Profile.” No date. Available at: http://www.teamnafta.com/index.php/Market-Profiles/matamoros-manufacturing-industrial-maquiladora-mexico.html. Accessed: April 22, 2009.

Torres, Norma, President and COO, Brownsville & Rio Grande Int’l Railroad. Interviewed by Lauren Rose on February 23, 2009 in Brownsville, Texas.

US DOT, Bureau of Transportation Statistics (BTS). “U.S. Surface Transportation Trade with Mexico.” RITA - Research and Innovative Technology Administration, Bureau of Transportation Statistics Available at: http://www.bts.gov/press_releases/2009/bts014_09/html/bts014_09.html Accessed: April 13, 2009.

US FHWA: Joint Working Committee. Meeting Notes of Esther Hitzfelder, TxDOT, December 1-3, 2008, Tijuana, B.C. Mexico.

United States Census Bureau. “Top Trading Partners- Total Trade, Exports, Imports. Year to Date.” March 2009. Available at: http://www.census.gov/foreign-trade/balance/c2010.html#2009 http://www.census.gov/foreign-trade/statistics/highlights/top/top0903yr.html. Accessed: June 1, 2009.

United States Department of Homeland Security: Customs and Border Patrol (DHS:CBP). “Commissioner Bonner Dedicates Fast Lane In Laredo.” April 15, 2004. Available at: http://www.cbp.gov/xp/cgov/newsroom/news_releases/archives/2004_press_releases/042004/04152004.xml. Accessed: May 28, 2009.

U.S. State Department. “Receipt of Request To Amend the Presidential Permit for an International Bridge on the U.S.-Mexico Border Near McAllen, TX, and Reynosa, Tamaulipas.” March 23, 2009. Federal Register.

U.S State Department. “Notice of Issuance of a Presidential Permit to the cities of McAllen, Hidalgo and Mission, Texas, To construct, operate and maintain an international bridge, its approaches and facilities at the international boundary between the United States and Mexico.” August 12, 1999. Federal Register.

United States Environmental Protection Agency (U.S. EPA). “Finding of No Significant Impact and Summary Environmental Assessment; Brownsville/Matamoros West Rail Relocation Project--Cameron County, TX.” Federal Register. June 25, 2004. Vol. 69, No. 122. Available at: http://www.epa.gov/EPA-IMPACT/2004/June/Day-25/i14468.htm. Accessed: June 3, 2009.

**PORTS: PUNTA COLONET AND TOPOLOBAMPO**

Administracion Portuaria Integral de Topolobampo S.A. de C.V. Website. http://www.apitopo.com.mx/

API Topolobampo. “El Puerto de Topolobampo lanza 2 convocatorias públicas nacionales.” July 9, 2009. Available at: http://www.puertotopolobampo.com.mx/joomla/index.php?option=com_content&task=view&id=229&Itemid=10 . Accessed: September 9, 2009.

API Topolobampo. "Se inaugura ampliación del canal de navegación." August 21, 2009. Available at: http://www.puertotopolobampo.com.mx/joomla/index.php?option=com_content&task=view&id=232&Itemid=10 . Accessed: September 9, 2009.

API Topolobampo. No date. Available at: http://www.puertotopolobampo.com.mx/joomla/index.php?option=com_frontpage&Itemid=105 . Accessed: September 9, 2009.

API Topolobampo."Proyecto Ampliación Zona Suroeste y Dragado Canal de Acceso al Puerto de Topolobampo, Sin." No date. Presentation.

Baja Insider Newspaper. Major Seaport Proposed for Baja California Norte. Not dated. Available at: http://www.bajainsider.com/environment/port-punta-colonet.htm Accessed July 21, 2008.

Blake, Cary. Yuma Farmers Skeptical of Union Pacific's Move to Derail Proposed New Railroad. Western Farm Press June 2, 2007. Available at: http://westernfarmpress.com/mag/farming_yuma_farmers_skeptical/ Accessed July 21, 2008.

Business News Americas. "Investments in port developments multiplying." May 26, 2006. Accessed through Factiva at the University of Texas on September 14, 2009.

Business News Americas. "Union Pacific, HPH withdraw joint bid for Colonet megaport project." May 11, 2007. Accessed through Factiva at the University of Texas on September 14, 2009.

Business News Americas. "Punta Colonet US $5bn port project delayed until 2010." April 14, 2008. Accessed through Factiva at the University of Texas on September 14, 2009 (a).

Business News Americas. "Union Pacific willing to invest US$3bn for railroads associated with Punta Colonet." August 28, 2008. Accessed through Factiva at the University of Texas on September 14, 2009 (b).

Business News Americas. "Calderón officially launces tender for US$4.9bn Punta Colonet Project." August 29, 2008. Accessed through Factiva at the University of Texas on September 14, 2009 (c).

Business News Americas. "Analyst: Presidential plan won't have immediate effects." October 10, 2008. Accessed through Factiva at the University of Texas on September 14, 2009 (d).

Business News Americas. "SCT Delays Punta Colonet Port Tender." January 14, 2009. Accessed through Factiva at the University of Texas on September 14, 2009 (a).

Business News Americas. "Governor: Punta Colonet tender could be launched by year-end." June 8, 2009. Accessed through Factiva at the University of Texas on September 14, 2009 (b).

Business News Americas. “SCT says flagship projects will go ahead despite financial crisis.” September 2, 2009. Accessed through Factiva at the University of Texas on September 14, 2009 (c).

Coalition for a Safe Environment. Punta Colonet Baja California Mexico Proposed International Port Preliminary Public Health, Public Safety, Environmental, Economic Assessment Report (With Similar Impacts To The Port Of Ensenada & Other Potential New Locations ). November 14, 2005. Available at:

Comision Federal de Competencia Mexico. Public Bidding to Award a Contract for the Partial Transfer of Rights to Use Operate and Exploit for Topolobampo. May 24, 2006. Available at: http://www.cfc.gob.mx/english/index.php?option=com_content&task=view&id=1294&Itemid=300. Accessed: July 18, 2008.

Gonzalez, Carlos Juaregui. Port of Ensenada. Presentation to the Faster Freight Cleaner Air Conference, California 2006. Available at: http://www.fasterfreightcleanerair.com/past.html. Accessed August 26, 2009.

International Railway Journal. Mexico to launch Punta Colonet Project in 2008. November 26, 2007. Accessed through Lexis-Nexis.

Leachman, Rob. Elasticity Analysis of Asian Imports Through the Ports of Seattle and Tacoma. Leachman & Associates LLC. December 3, 2007. Available at: http://www.leg.wa.gov/JTC/Documents/Freight/012308LeachmanPP.pdf. Accessed: October 22, 2009.

Lindquist, Diane. Mexico Plans an Alternative to the Jammed Docks in L.A, Long Beach. San Diego Union Tribune. August 14, 2005. Available at: http://www.signonsandiego.com/news/mexico/20050814-9999-1n14port.html. Accessed: July 21, 2008.

Mex Economic News & Analysis on Mexico. Proposed Port Projects in Mexico Would Create Alternatives to Congested Southern California. November 1, 2007. Available from through http://www.allbusiness.com/north-america/mexico/3911963-1.html. Accessed: July 21, 2008.

Midland Odessa Transportation Alliance. La Entrada Al Pacifico: Corridor to the Pacific. Background Sheet. Not dated. Available at: http://www.motran.org/background.html. Accesed: August 29, 2009.

Milenoi Online. Alista SCT bases para licitar Punta Colonet: La revisión incluye la cifra de inversión de 5 mil mdd, requerida para la obra. September 25, 2009. Available at: http://impreso.milenio.com/node/8646709. Accessed: September 29, 2009.

Mireles, Ricardo Castillo. Mining Groups Fights Over Rights to Build Mexico’s Newest Port. Outsourced Logistics. December 11, 2006. Available at: http://outsourced-logistics.com/global_markets/outlog_story_8370/index.html. Accessed July 21, 2008.

Mireles, Ricardo Castillo. Search is on for more West Coast ports. May 3, 2005. Available at: http://outsourced-logistics.com/global_markets/outlog_story_7130/. Accessed July 21, 2008.

Mireles, Ricardo Castillo. Bids to Begin to Build A Port. June 18 2007. Available at: http://www.outsourced-logistics.com/global_marketsoutlog_story_8801/index.html Accessed: July 21, 2008.

Neyoy, Cesar. Punta Colonet Update Part II. Yuma Sun. April 12, 2007. Available at: http://www.yumasun.com/onset?id=33323&template=article.html. Accessed: July 21, 2008.

Outsourced Logistics. It's a Go for Port Colonet. October 16, 2006. Available at: http://outsourced-logistics.com/global_markets/outlog_story_8240/index.html Accessed July 21, 2008.

Outsourced Logistics. Bids to Begin to Build a Port. June 18. 2007. Available at: http://outsourced-logistics.com/global_markets/outlog_story_8801/index.html Accessed July 21, 2008.

Portworld. Mexico to Open the Bidding for Punta Colonet. April 2, 2008. Available at: Accessed July 21, 2008.
http://www.portworld.com/news/2008/04/71201?gsid=04ac9f3d8e54133689f9f9046f0085b8&asi=1

Saenz, Amadeo . The Feasibility of Selling the South Orient Railroad. Texas Department of Transportation. February 26, 2009. Available at: ftp://ftp.dot.state.tx.us/pub/txdot-info/library/pubs/gov/sunset/south_orient.pdf Accessed: August 18, 2009.

Sage, Fran. La Entrada feasibility Study: At the Crossroads. 2008. Created for the Sierra Club – Texas. Available at: http://www.texas.sierraclub.org/bigbend/la%20entrada%20pt2.htm

Texas Comptroller of Public Accounts. Trade Corridor links Texas to Mexico's West. March 2003. Available at: http://www.window.state.tx.us/comptrol/fnotes/fn0303/from.html. Accessed: Augusts 29, 2009.

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