Toward Understanding the Pedestrian Travel on the Paso Del Norte Bridge: Phase I – Development of a Conceptual Data Inventory Framework
**Title and Subtitle**

**TOWARD UNDERSTANDING THE PEDESTRIAN TRAVEL ON THE PASO DEL NORTE BRIDGE:**

**PHASE I – DEVELOPMENT OF A CONCEPTUAL DATA INVENTORY FRAMEWORK**

**Abstract**

The Paso del Norte (PDN) Bridge is without doubt one of the busiest cross-border footpaths along the United States-Mexico border and is expected to continue dominating the total pedestrian crossings in El Paso over the next decades. The bridge provides a conveniently central connection between the United States and Mexico, which supports the economic development of both El Paso and Ciudad Juárez. On the other hand, long queues and protracted wait times have become a substantial issue for cross-border travelers. In recent years, pedestrian crossings on the PDN bridge have demonstrated significant declines. Though it is likely that a primary cause for this might be the inordinate amount of time waiting to cross the border, the causes may also include many other factors, such as security issues, peso devaluations, and migration in response to violence. The broad objective of this project is thus to contribute toward understanding the cross-border travel behavior decisions, exploring the factors influencing their travel, and the issues they have been facing as well as providing insights to mitigate these issues, with a focus on pedestrians crossing PDN bridge. To achieve project objectives, the research team structured the work to be conducted in two phases. This report constitutes the current first phase of the study, which provides a first step toward examining the pedestrian travelers’ choices crossing the border by developing a conceptual framework to create a data inventory required for an analysis. Specifically, the report includes a synthesis of the existing literature, definition of the study area, and identification of proposed primary data source (based on a local travel survey) and secondary data sources (primarily based on spatial variables). The results of the first phase of this study will be used in the second phase as the basis for a focused analysis and input to a robust model to understand the factors affecting the travel choice decisions of PDN pedestrians.
TOWARD UNDERSTANDING THE PEDESTRIAN TRAVEL ON THE PASO DEL NORTE BRIDGE:
PHASE I – DEVELOPMENT OF A CONCEPTUAL DATA INVENTORY FRAMEWORK

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DISCLAIMER

This research was performed by the Center for International Intelligent Transportation Research, a part of the Texas A&M Transportation Institute. The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein.
EXECUTIVE SUMMARY

The Paso del Norte (PDN) Bridge is without doubt one of the busiest cross-border footpaths along the United States-Mexico border and is expected to continue dominating the total pedestrian crossings in El Paso over the next decades. The bridge provides a conveniently central connection between the United States and Mexico, which supports the economic development of both El Paso and Ciudad Juárez. On the other hand, long queues and protracted wait times have become a substantial issue for cross-border travelers. It has been conjectured that waiting times adversely affect regional economic growth in the region, and potentially the cross-border demand on the bridge, including both motorized and non-motorized demand. In recent years, pedestrian crossings on the PDN bridge have demonstrated significant declines. Though it is likely that a primary cause for this might be the inordinate amount of time waiting to cross the border, the causes may also include many other factors, such as security issues, peso devaluations, and migration in response to violence.

Those impacted by this incomplete understanding of cross-border travel include not only pedestrians and motorists who cross the border using the PDN bridge on a regular basis, but also companies that suffer losses in productivity and revenue, the commercial retail sector of El Paso, and the general public in both communities north and south of the border. These communities are impacted in myriad ways well beyond mere travel time delay and economic impacts; air quality is substantially affected by congestion and, of course, any inefficiency of pedestrian travel makes this cleanest of modes less attractive as a travel choice. Also impacted are local, regional, and national authorities that are charged with addressing mobility, safety, security, personal and public health, and socio-economic needs.

The broad objective of this project is thus to contribute toward understanding the cross-border travel behavior decisions, exploring the factors influencing their travel, and the issues they have been facing as well as providing insights to mitigate these issues, with a focus on pedestrians crossing PDN bridge. To achieve project objectives, the research team structured the work to be conducted in two phases. This report constitutes the current first phase of the study, which provides a first step toward examining the pedestrian travelers’ choices crossing the border by developing a conceptual framework to create a data inventory required for an analysis. The results of the first phase of this study will be used in the second phase as the basis for a focused analysis and input to a robust model to understand the factors affecting the travel choice decisions of PDN pedestrians. Overall, the results of this project will assist decision makers to accurately examine the current pedestrian travel behavior and improve decision makers’ understanding of the underlying variables influencing pedestrian travel.

As a first step to achieve project objectives, this study starts with a focused literature review, which provided a broad overview of the influential factors, issues and concepts important to be considered in a pedestrian cross-border analysis/modeling. Next, as each region has its own characteristics, the research team described and identified unique characteristics and operational details about the PDN bridge. The insights obtained from the synthesis of literature, the study area identified, as well as the local knowledge of researchers were then used to develop a data inventory framework. This included examination of primary data sources required for the study, which is based on a developing a local travel survey. While the actual survey will be finalized in
In the second phase of this study, the current study provided an initial framework, including a sample survey and possible additional questions as well as a description of the survey implementation process proposed to be adopted in the second phase of the study. Finally, the study was concluded by exploring the wealth of secondary data sources (such as spatial variables that can be obtained using Geographical Information Systems tools) to support the primary data gathering instrument for this research: the survey of pedestrian travelers crossing the United States-Mexico border at the Paso del Norte Bridge in the downtown El Paso-Ciudad Juárez area.

The current research, as well as the intended data gathering and subsequent analysis/modeling, will provide great insights into the behaviors motivating (or discouraging) El Paso’s pedestrian border crossers, and contribute substantially to the local agencies’ analysis toolbox when considering proposed policy changes, capital improvements, and techniques to market cross-border travel to this population. Furthermore, the work completed in this research will not only be applicable for the PDN bridge, but also be substantially beneficial to provide a basis for other border bridges in the Paso del Norte Region. The improved understanding yielded from this research has potential application well beyond the geographic limits of this study; this research will be directly applicable to other cross-border bridges with pedestrian traffic along the United States-Mexico border and may be applicable indirectly to other borders, as well.
CHAPTER 1: INTRODUCTION

The United States (U.S.)-Mexico land border crossings are some of the busiest in the world, substantially contributing to the economic growth of both nations (1). While Mexico is the second-leading destination for U.S. exports, the U.S. is the first-leading destination for Mexico’s, with an approximate total of $400 billion dollars in bilateral trading per year (2).

The border crossings in the El Paso-Ciudad Juárez region are among the most active along the U.S.-Mexico border, with the Paso del Norte (PDN) Bridge being one of the busiest border crossings for both motorized vehicles and the pedestrians. The PDN bridge joins the central business districts of both the City of El Paso and Ciudad Juárez, and serves as an important economic, cultural, and social connection between both communities. The importance of the PDN bridge to the two communities is demonstrated by the recent and ongoing investments by the City of El Paso pedestrian amenities and services (3).

On the other hand, pedestrian crossings on the PDN bridge have demonstrated significant declines in recent years: the PDN served almost 7.3 million northbound pedestrians in 2002 (and 8.7 million at its highest, in 1973); but only 3.8 million northbound pedestrians in 2011 (4). These figures are a cause for concern for a variety of reasons, not least of which is the importance of these visitors for the local economy (5, 6, 7). For instance, shopping trips constitute one of the most important cross-border trip purposes (8, 9). However, El Paso business revenue has recently been declining as well and it has been conjectured that a primary cause might be that shoppers from Ciudad Juárez are not willing to spend an inordinate amount of time waiting to cross the border (10, 11). New technologies for identification and tolling are intended to address border wait time; yet they can involve burdensome preplanning for users (in the case of the SENTRI card*, for instance), and ramp-up periods as technical problems are addressed and users adjust to implementation (12, 13). Meanwhile, the full picture of influences that affect pedestrian cross-border travel, and by extension El Paso’s retail economy, is a complex issue demanding further clarification. For example, it is unclear if border wait times, peso devaluations, migration in response to violence in Ciudad Juárez, or some other factor has the largest effect, and what other factors might mitigate these issues; certainly some combination of many factors is at play. What is clear is that the tension between national security initiatives and procedures and local cultural

* “SENTRI cards are WHTI (Western Hemisphere Travel Initiative) compliant documents for entry into the U.S. by land or sea, and also provide expedited travel to approved members between the U.S. and Mexico border.” Source: U.S. Customs and Border Protection (CBP), available at http://www.cbp.gov/xp/cgov/travel/trusted_traveler/sentri/.
and commercial realities in El Paso is palpable. In fact, as indicated by Muriá and Chávez (14), “U.S. border authorities faced a dual contradictory challenge of ‘enforcement’ and ‘facilitation’: enforcement at the border to prevent the smuggling of undesired products and people, and facilitation of trade, business and leisure travelers such as businessmen, tourists and shoppers.”

Interestingly, while many prior research studies have focused on examining motorized traffic, there has been minimal research directed at understanding pedestrians’ travel choices. The PDN not only carries the bulk of pedestrian travel across all El Paso bridges, it likely demonstrates characteristics representative of other international bridges with heavy pedestrian flows. This study’s overall objective is thus to examine PDN pedestrian travel, explain influences on that travel, and contribute toward understanding the pedestrian travel behavior decisions crossing an international border bridge. The current research exercise, as well as the intended data gathering and subsequent analysis/modeling, will provide great insights into the behaviors motivating (or discouraging) El Paso’s pedestrian border crossers, and contribute substantially to the local agencies’ analysis toolbox when considering proposed policy changes, capital improvements, and techniques to market cross-border travel to this population.

BACKGROUND

In 2011, with 13.41 million visitors, Mexico represented the second highest visitor market to the U.S. behind Canada and the fourth highest market in visitor spending, at $9.4 billion (15). The U.S. Department of Commerce forecasts that Mexican visitors will increase between 3 to 5 percent each year, increasing over 1.5 million, 11 percent, to 14.95 million by 2016 (16). In 2011, Mexico represented 27 percent of total international travelers to the U.S.; by 2016, even with increased travel from other countries, travelers from Mexico will still represent almost one quarter of all visitors (17). The focus of this research study is a finite slice of this population group and its reciprocal, visitors to Mexico; yet this joint population—pedestrian cross-border travelers between the U.S. and Mexico—is large and substantially important to both Texas and the U.S.

The U.S. and Mexico share both a history and a population that spans the political border. The Spanish, in colonizing North America, established settlements as far north as Arizona, New Mexico, and Texas well before these areas became part of the U.S. (18). The U.S.-Mexico Chamber of Commerce recognizes 14 sister cities along this shared border (19). These sister cities span the political border and yet share a common experience in a diversity of ways: many families straddle the border, living on one side and working, shopping, and making necessary trips to the other side (20); the citizens of these cities may be more tightly intertwined socially, economically, and in daily travel patterns, than they are with other cities in their own country (21,
22, 23, 24). Just as significant, it is not just travel within these city pairs that is important: of all U.S. exports to Mexico, the travel and tourism industry makes up a substantial 36 percent (25). Cross-border shopping, for instance, has received greater recognition and study in recent years as a major economic force in the border region, for both sides of the border (26, 27, 28). The economic importance of visitor cross-border travel for both countries cannot be overstated.

The PDN bridge, located in downtown El Paso, across from Ciudad Juárez, Mexico, is the busiest cross-border path for pedestrians in El Paso. This centrally-located bridge provides an excellent connection between the U.S. and Mexico—not only for commute trips but also for non-commute-related trips—which supports the economic development of both El Paso and Ciudad Juárez. This bridge is representative of many of the bridge crossings along the entire U.S.-Mexico border, serving as a vital and vibrant connection not only between sister cities, but also between the two countries.

And yet, pedestrian crossings on the PDN bridge have been decreasing over recent years. As shown in Figure 1, in contrast to the 3.8 million-figure in 2011, the bridge served (at its highest) 8.7 million northbound pedestrians in 1973 and almost 7.3 million northbound pedestrians in 2002 (29).

![Figure 1 - Paso del Norte Bridge Non-Commercial Volumes, 1968–2010](source)

Source: Texas A&M Transportation Institute, 2012, based on data from the Border Region Modeling Project.

As previously mentioned, the issue of falling pedestrian crossings and what is causing this phenomenon is producing considerable debate. The causes likely include not only cross-border wait times that might be resulting from increased security measures, but a complex combination of other influences. As shown in Figure 2, the reduced volumes of pedestrians follows a recent trend of reduced cross-border volumes overall for El Paso bridges. It is not unlikely to believe
that external causes might be to blame for decreases over the past half-decade: the 2007–2009 global recession and recent increased violence in Mexico. Indeed, similar recent patterns of decline in non-commercial vehicles and pedestrians have also been observed at the San Ysidro Port of Entry between San Diego, California, and its sister city Tijuana, in Mexico (30). However, there is also clear evidence that wait times at the Ports of Entry are playing a considerable role across the border (31, 32, 33, 34). Wait times overall are increasing at El Paso border crossings and multiple groups are working to recommend and implement solutions so that these external causes to the decreased crossings are not exacerbated by local operational capacity issues (35, 36). This study is intended to examine a larger spectrum of influences on cross-border travel to ensure a full understanding of potential causes and solutions to decreasing pedestrian crossings.

Figure 2 - Total Annual Persons Crossing into El Paso by Mode, 1995 to 2011


A fundamental issue is that pedestrian travel in general gets less urgent attention than vehicular travel. As noted earlier, while the above challenges have attracted many researchers’ attention toward examining and understanding the travel decisions of individuals that cross the border, many prior research studies have been limited to examining motorized traffic. In fact,
there is not a comprehensive research study explicitly focusing on pedestrian travel behavior in the field. Pedestrians represent a very important market segment to understand: they have unique needs different from motorized travelers, and understanding those needs can empower policy makers to improve PDN mobility, thereby sustaining a significant driver in El Paso’s economy. The PDN carries the lion’s share of pedestrian travel across all El Paso bridges and serves as a vital social, cultural, and economic connection between and at the heart of the two communities of El Paso and Ciudad Juárez. PDN pedestrians are commuting to work and school, conducting personal business including health services, shopping, visiting family and friends, engaging in tourism, and countless other activities. Notably, their activities are not constrained to the distance they can reasonably walk—many are engaging in multimodal travel, transferring from and to other modes on either side of the border. Given this context, the recent drop in pedestrian travel across the PDN and other El Paso bridges is alarming in its implications and is deserving of closer attention.

Cross-border traffic is anticipated to increase as the world emerges from the recent recession (38). Pedestrian traffic will increase with that trend, as expected for the PDN bridge. For example, UTEP predicts a 2.1 percent annual growth for the northbound pedestrian crossings, reaching 11.7 million by 2029, and it is expected that PDN will continue dominating the total pedestrian crossings. The question is how to maintain (at a minimum) or improve cross-border mobility for pedestrians in a context of increasing demand and shrinking resources. In general, for all modes, improved efficiency is often proffered as an overarching solution, and yet formulating specific improvement strategies depends upon a fundamental understanding of the variables influencing travel. Pedestrian travel has similar influential variables, yet there is not the level of investment in analysis tools to understand these variables; as a result, improvements that benefit pedestrian travel are often seen as amenities rather than as improvements to facilitate pedestrian travel. Decisions to invest increasingly scarce resources depend upon analysis methodologies and tools that accurately represent current travel behavior and reasonably forecast future behavior. In addition, decision makers are demanding tools that evaluate proposed improvement strategies in terms of quantitative performance measures. Pedestrian travel, so important to the communities of El Paso and Ciudad Juárez, sorely lacks such analytical tools.

Those impacted by this incomplete understanding of cross-border travel include not only pedestrians and motorists who cross the border using the PDN bridge on a regular basis, but also companies that suffer losses in productivity, the commercial retail sector of El Paso, and the general public in both communities north and south of the border. These communities are impacted in myriad ways well beyond mere travel time delay and economic impacts: air quality is substantially affected by congestion and, of course, any inefficiency of pedestrian travel makes this cleanest of modes less attractive as a travel choice. Also impacted are local, regional, and national authorities that are charged with addressing mobility, safety, security, personal and public health, and socio-economic needs. Indeed, broadening analysis methods to consider the full picture of cross-border travel, pedestrians included, is fully compatible with recent greening and sustainability initiatives (39, 40).
STUDY PURPOSE

With the above context in mind, the study purpose is to examine PDN pedestrian travel and develop a model to explain the influences. In other words, we aim to develop one or more pedestrian choice models to interpret and evaluate the factors influencing pedestrian’s travel behavior decisions in general, and specifically pedestrians crossing an international bridge at the Paso Del Norte Region.

To achieve project objectives efficiently and strategically, the research team has structured the work to be conducted in two phases as shown in Figure 3. The current first phase, Phase I of the study, provides a first step toward examining the pedestrian travelers’ choices crossing the border by developing a conceptual framework to create a data inventory required for an analysis. The results of the first phase of this study will be used in the second phase as the basis for a focused analysis and input to a robust model to understand (the factors affecting) the travel choice decisions of PDN pedestrians.

In particular, Phase I of this study is addressed in this report and covers: the study purpose definition, a literature synthesis, the development of a survey instrument for primary data collection, and the identification of secondary data sources for model inputs. Phase II follows this current effort by conducting the survey of pedestrians crossing the PDN bridge, gathering the secondary data sets, and formulating an analysis approach that best describes the travel choice decisions of PDN pedestrians.
Primarily, this study addresses a need sorely lacking in the field of cross-border analysis: a pedestrian-oriented model, which examines influences on travel behavior. This study also supplements previous work done to improve the examination of cross-border travel generally.

REPORT ORGANIZATION

To obtain the best value from the research, the analysis and modeling should be based on a wide range of data sources. The current phase thus provides a first step toward examining the pedestrian travelers’ choices crossing the border by developing a conceptual framework to create a data inventory required for the analysis. To develop this data inventory framework, the research will be divided into three work tasks, as shown in Figure 4.

Under Task 1, the researchers synthesized literature relevant to this study. As further detailed in Chapter 2, the purpose of this task is to explore previous approaches and inputs for this type of analysis along the dimensions of international bridge travel and pedestrian travel behavior generally, and to identify key variables needed to support a pedestrian analysis and model specifically.

Chapter 3 describes and defines the study area. Although not a formal task, describing and identifying unique characteristics and operational details about the Paso del Norte Bridge was a critical step in this Phase I process. This study area definition provides both limits to and ideas for variables that might be relevant for analysis. For example, U.S. Customs and Border Protection procedures mandate that bus passengers must disembark from buses for processing. This relatively recent change in procedure has resulted in an increase in the number of pedestrians at the PDN bridge, while overall border vehicle crossings have gone down in recent years.

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Figure 4 - Study Approach: Phase I

Source: Texas A&M Transportation Institute: Center for International Intelligent Transportation Research, 2012.

Under Task 2, the research team identifies potential primary data source describing unique PDN bridge pedestrian travel behaviors. Chapter 4 elaborates on the survey purpose and instrument to meet Phase II analysis needs, and briefly describes proposed survey implementation details.
Task 3 research efforts support the analysis by identifying secondary datasets as indicated by previous research. Chapter 5 details these datasets and briefly mentions the likely resources to acquire the data that will be necessary under Phase II to manipulate the data into usable format.

The tasks above, comprising Phase I of this study effort, provide the first and a very important step to obtain a clear understanding of pedestrian travel behavior at the PDN bridge. Chapter 6 concludes the Phase I research effort and positions the study within the context of Phase II.
CHAPTER 2: LITERATURE SYNTHESIS

In the larger context described in the preceding chapter, this study’s focus is upon formulating a disaggregate approach for modeling pedestrian cross-border travel. In this first research task, researchers undertook a focused literature review to identify the key variables needed to support a pedestrian analysis. The review also considered relevant documentation and studies on Texas border crossings. Subsequent chapters will apply insights gleaned from this literature review to identify the primary and secondary data sources necessary to examine the influences upon (pedestrian) travel decisions of individuals that cross the border.

This exercise yielded a wealth of insight and information useful for the proposed analysis framework. Of these, the following resources stand out among those discussed below:

- The University of Texas at El Paso’s Border Regional Modeling Project (on-going), for its approach and annotated data sets;
- San Ysidro Pedestrian Crossing Report (2010), for its relevance with respect to study demographic and analysis approach;
- Ghaddar and Brown’s profile of the cross-border Mexican shopper (2005); and

ECONOMIC IMPORTANCE OF CROSS-BORDER (PEDESTRIAN) TRAVEL

Much of the analysis of border crossings is motivated by the economic importance of these crossings to the countries on either side of the border. Of these types of analysis, commercial freight understandably gets the bulk of attention. However, studies that do incorporate the economic impacts of non-commercial travelers, passenger vehicles and/or pedestrians, have found a substantial impact of cross-border pedestrian travel on local and regional economies. Of these, the most relevant to the current study follow.

Border Regional Modeling Project

Among these other references, The University of Texas at El Paso’s on-going Border Regional Modeling Project (BRMP) is prominent for several reasons (41). Conducted out of an independent research unit of the University of Texas at El Paso, Department of Economics & Finance, Dr. Tom Fullerton heads a team that applies the Borderplex Econometric Forecasting Model, a model encompassing El Paso and Las Cruces on the U.S. side and Ciudad Juárez and Chihuahua on the Mexico side, to forecast short- and long-term trends affecting area policy and development issues. This resource offers first and foremost several publications made available online:
• Quarterly economic forecasts, offering and up-to-date perspective on regional economic news based upon a consensus approach with experts from both sides of the border;

• Borderplex Economic Outlook, typically looking forward two years;

• Borderplex Long-Term Economic Trends to 2027; and

• Other reports and references, including some available by purchase.

For the purpose of this current study, an extremely valuable resource offered by BRMP is the online availability of the input data sets. These data sets are well documented, including source annotations, and assembled for long historical periods, as available. The study team for this project will use these data sets for insight into the data available for use for this current study.

Other Resources on the Economic Effects of Cross-Border Travel

A 2004 study, “Regional and National Economic Impact of Increasing Delay and Delay Related Costs at the Windsor-Detroit Crossings”, focused upon passenger vehicles crossing the U.S.-Canadian border and their economic impact in the post-September 11 years. The examination addressed only recreation and shopping trips, and vacation trips not, for example, work commute trips. Econometric simulations based upon secondary data sources indicate that increased congestion and delays for these trips do constrain the growth of trip-making and result in economic output and employment losses. Notably, this study found that the losses would primarily affect the Canadian side, due to the different nature of activities occurring in each direction: the recreational and shopping activities occurring in the U.S. to Canada direction were assumed to redistribute on the U.S. side under a congested scenario, thus resulting in a positive impact of congestion for the U.S. The study did find that the combined effects of commercial and non-commercial vehicle congestion were negative for both countries and that reliability of travel time is a significant factor for commercial vehicles (42). Pedestrian travel was not specifically considered in this study.

The 2006 study, “Economic Impacts of Wait Times at the San Diego-Baja California Border,” was similarly based upon economic analysis to demonstrate lost economic opportunities due to border crossing congestion. The methodology related to non-commercial travel considered trips by purpose, time, and destination, as well as sensitivity by trip purpose to border crossing delay. In this case, this study included also a four-month long survey: 3,603 cross-border travelers at the San Ysidro, Otay Mesa, and Tecate Ports of Entry (POEs). The economic impacts due to border delay in 2005 were found to be high on both sides of the border; for passenger (non-commercial) travel, the regional impacts were found to represent the bulk of the impacts because most passenger travel stays within the region. The study also included future scenarios and impact estimations (43).

A 2009 study by the University of Arizona Economic and Business Research Center for the Arizona Office of Tourism updates previous similar studies conducted since the 1970s concerning the impact of Mexican cross-border activity on Arizona’s economy (44). The methodology included surveying outbound Mexican visitors at four land-border Ports of Entry
and the Phoenix and Tucson airports. Economic impacts were assessed using IMPLAN® input-output models and found generally to be significant, and more so closer to the border, as might be expected. Most relevant for the current study were findings related to travel behavior, for example trip purpose and trip mode, as well as the survey instrument and approach, which are discussed under those sections, to follow.

Numerous other references mentioned throughout this report document the economic importance of cross-border travel generally and pedestrian travel in particular; these are described in other sections focused on particular topic areas.

CROSS-BORDER TRAVEL TRIP PURPOSES

As the summaries of the above studies and anecdotal evidence from the popular press demonstrate, the trip purpose for cross-border travel generally falls into some well-defined areas. Generally, shopping is the primary reason that Mexican nationals cross into the U.S., followed by visiting family and friends, and working.

Tourism, Including Retail Shopping and Health Services

Tourism trips encompass a variety of dimensions: proximate- and long-distance destinations; one-day and multi-day excursions; single- and multi-purpose intents; recreational and non-recreational needs; and many others. While the El Paso/Ciudad Juárez POE may indeed serve a number of long-distance through trips by individuals just “passing through” from origins and destinations outside of either city, the majority of pedestrian trips crossing in the El Paso area are likely to represent trips with both origin and destination internal to the joint metropolitan area. As demonstrated by several studies, many of these tourism trips will involve, or even be precipitated by, a retail motivation (45, 46, 47, 48). Hence, cross-border retail behavior gets substantial attention in the following pages.

Cross-border retail shopping is big business for the border region and the State of Texas. In 2005, Ghaddar and Brown examined Mexican shoppers doing business in the U.S., using existing data sources and focusing on the entire U.S.-Mexico border, bounded by a 100-kilometer buffer. They describe how malls, plazas, and downtown areas have flourished in response to shopping demand from each side of the border (49). One example is McAllen, along the border in Texas: although the city’s 2004 median per capita personal income is among the lowest in the U.S., McAllen’s La Plaza Mall is reported to have sales well above average among the 171 malls owned by the mall owner nationwide. This advantage is attributed to Mexican shoppers, who make up 36 percent of McAllen retail sales (50).

In a 2006 study, Cañas, Coronado, and Phillips corroborated the above findings, describing the border on the U.S. side as “actually an export industry—in most years contributing to a U.S. trade surplus in cross-border shopping” (51). Their paper noted the nature of employment in the retail sector serving an important role, by providing opportunity for lesser-skilled workers. The paper described Coronado’s approach on behalf of the Federal Reserve Bank of Dallas to estimate how much of local retail sales were being generated by Mexican shoppers. For El Paso over the period of the late 1970s to 2001, this percent was the lowest of the Texas border cities studied, at 11 percent. The reason suggested was the size of El Paso relative to the other Texas
cities—the proportion of retail sales dependent on Mexican shoppers was lower compared to all retail sales in El Paso.

The complexity of factors influencing retail outcomes in the border area hinders easy explanations. As a dynamic microcosm of international trade (52), the border area has received a wealth of attention in studies and reports focused upon the determinants of retail marketing and shopping behaviors.

Cross-border Shopping: Terminology and Theory

In the general study of shopping behavior, the term “outshopping” is defined as shopping outside of one’s hometown. Cross-border shopping is a subtype of outshopping and of course, has some unique aspects from other types of outshopping. There are a variety of studies available on international cross-border shopping, even from other borders than that of the U.S., providing important insights into the subject.

Out of these, for instance, Baruca and Zolfagharian provide a recent investigation synthesizing the literature on international cross-border shopping to date. The study demonstrates persuasively that many studies have tended to fall on one side or the other of a typological line; cross-border shopping is the result of either utilitarian (economic/rational) or hedonic (pleasure-or thrill-seeking) motivations (53). Several key points of their discussion:

• Supporting the utilitarian side, studies have shown that low prices of goods and services and perceived quality, as well as economic variables such as per capita income, currency exchange rate, and tax changes do influence cross-border shopping decisions along borders around the world, including the U.S. borders.

• Supporting the hedonic side, cross-border shoppers around the world often exhibit, as well, an enjoyment in the cross-border experience itself such as “returning with bags full of objects and minds with full of memories.”

• Shoppers from either side of the border likely have differing motivations for their retail activities, for example:
  a) intrinsic cultural differences (e.g., consumerist tendencies or liking to shop as a family activity, or enjoyment with shopping experience across the border).
  b) differences related to the experience (e.g., secure and safe environment, perception of retailer integrity being higher on one side, experiencing a different culture).

According to the authors, different motivations between shoppers from each side are more likely where there is a strong socio-economic differential, as is the case between the U.S. and Mexico.

The following sections reference the above terminology and typologies as the literature review now focuses upon specific groups and aspects of the cross-border shopping activity.
Mexican versus U.S. Shoppers

Ghaddar and Brown profile of Mexican shoppers doing business in the U.S. found a distinct profile among pedestrian border crossers versus travelers of other modes. The pedestrian Mexican shopper (54):

- Accounts for 20 to 25 percent of border-crossings;
- Predominantly enters and leaves the U.S. in the same day;
- Crosses less frequently in Texas than in California, although pedestrians overall cross the border more frequently than those using other modes; and
- Spends on average $30 per trip (in 2003, versus $80 for bus, $100-200 for personal vehicle, and $1,000 for airplane travelers).

General Mexican shopper traits, regardless of mode, include:

- High brand loyalty, price- and quality-consciousness;
- Favorable views of U.S. products.

In addition to calling for more in-depth research at main locations, Ghaddar and Brown concluded by noting a need to decrease cross-border wait times to facilitate crossing frequency and volume.

In 2006, Guo, Vasquez-Parraga, and Wang explored Mexican national’s motives to shop in the U.S. (55). The perspective is marketing and business, though with a decidedly psychological perspective. In their analysis, a correlation is confirmed between shopping and motives that the authors describe as “immediate” or “outer” motives—product quality, service quality, safer and cleaner environment, wider variety, reliable guarantee, fashion consciousness, and shopping enjoyment as a family activity. They also identify “higher” or “inner” psychological needs for shopping, based upon Maslow’s (1964) categorization of human needs. With a caveat that their sample size was relatively small (300 persons interviewed via a mall intercept survey), their examination confirmed the correlation of the four outer variables with shopping frequency. Results for the inner variables were mixed: for the purpose of the current study, the variable that appears most applicable for examination is the need for rule of law, that is, the safety of the shopping environment.

Baruca and Zolfagharian’s own qualitative investigation of consumer flows in both directions between the U.S. and Mexico confirm the findings of these previous studies: utilitarian motivations predominate, but hedonic motivations are also in play (56). Because their research took place in the Rio Grande border region in Texas, their findings are highly relevant for this study of El Paso cross-border pedestrian activity. Their data acquisition method included participant observation and semi-structured interviews with residents in the region on both sides of the border. Their analysis approach followed a technique discussed in Miles and Huberman (57): they coded and reviewed the qualitative data for results according to a thematic outline suggested by an initial data review. As a result of their examination, they assert that:
• For Mexican shoppers, observed consumer traits were consistent with previous studies—they have a strong economic motivation with regard to price, quality, and variety. Hedonic motivations included:

  a) Those related to trip preparation, memories of the trip, and images of pleasure and escape to a nicer environment, even if some components of the trip were disappointing; some of this behavior was related to an apparent higher propensity of Mexican shoppers to travel and shop as a family activity;

  b) Reconnecting with friends and family in the U.S.; and

  c) A faith in the trust and order of the U.S. system, being treated fairly by U.S. retailers, in contrast to deception and misrepresentation perceived in Mexico.

• For American shoppers, the primary economic reason cited was cost (less expensive medical products and services were highlighted); hedonic factors included:

  a) Good service and perceived “authenticity” of Mexican service providers;

  b) Great food;

  c) Laid back atmosphere; and,

  d) Of the American shoppers, there were two further subsets noted in this study, both of which experienced their trip as an adventure, though for different reasons:

      • Those connected to the Mexican culture through family or history, and
      • Those unconnected to the culture, but appreciative of it.

Health Services, Including Pharmaceuticals Shopping

Health services procurement, especially the purchase of over-the-counter and prescription pharmaceuticals, is significant and growing (58). Lower cost, ease of purchase, more items sold over the counter, less stringent restrictions on who can write prescriptions, these are all reasons cited in a 1998 report by the Texas State Comptroller examining this phenomenon (59). It is also indicated in the report that the U.S. Customs and Border Protection allows an individual to transport drugs for personal use, with some limitations. As mentioned above, Baruca and Zolfagharian found that less expensive medical products and services were a primary economic motive for American cross-border shoppers (60).

Two of the studies are noteworthy here as they are particularly related to the case of El Paso for the cross-border purchase of medications and health care. First, in their 2009 study, Byrd and Law (61) examined El Paso resident’s health-care service usage/purchase in Mexico. In their study, the authors conducted a cross-sectional telephone survey of El Paso residents aged 18 years or older. According to the results of this study, most of the respondents crossed the border for pharmacy services due to lower cost of the products. In addition, not having a health insurance was identified as one of the primary factors increasing cross-border pharmacy
shopping as this may be the only option for such people of getting the medicine without prescription. In addition, Hispanic ethnicity, previous residency of Mexico (in particular Ciudad Juárez), language barriers, and younger age were also positively associated with the cross-border health care and pharmacy shopping.

In 2009, Rivera et al. (62) also studied cross-border purchase of medications and health care using data from a U.S.-Mexico binational survey of 1000 randomly selected adults on both sides of the border. The main objective of the study was to assess frequency of pharmaceuticals shopping as well as use of health care services across the border. The results of the study indicated considerable differences between El Paso and Ciudad Juárez residents crossing the border for purchase of medications. For instance, it was found that lack of health insurance was more of a prevalent factor for crossing the border to purchase medications for the residents of Ciudad Juárez then for El Paso residents. In particular, the residents of Ciudad Juárez without insurance were three times more likely to purchase medications in the U.S. (compared to Ciudad Juárez residents with health insurance) while the prevalence ratio was 1.4 for El Paso residents without insurance (compared to health insured El Paso residents). Furthermore, in El Paso, younger women were found to be more likely to cross-border while, in Ciudad Juárez, older men and more educated individuals had a higher likelihood to cross the border to purchase medications.

Other Attractions

The 2009 study by for the Arizona Office of Tourism found that, for traditional tourism trip purposes, casinos in Tucson and Phoenix are the most popular attractions, with zoo parks the second most visited attraction (63).

For El Paso-area pedestrian border crossers, a predominant influence on cross-border retail activity is the shared sister-city culture; that is, shoppers consider options on both sides of the border when they make their shopping decisions. For those who can cross the border legally and are prepared to tolerate the anticipated wait time at the Port of Entry, their retail trips likely conform to the findings by various authors as described above and on a variety of dimensions.

Social Visits

After shopping, the next most common reason that Mexican nationals cross the border into the U.S. is visiting family or friends (64). This finding was corroborated by the Baruca and Zolfagharian qualitative investigation of consumer flows in both directions in the Rio Grande Border region (65). A 2004 study of border issues in the San Diego-Tijuana border region, an area with similarities to the Paso del Norte Region, contracted a study in the early 2000s, which found that 40 percent of those surveyed from Tijuana had family and relatives in the U.S. On the U.S. side, over 26 percent of San Diego County’s population was Hispanic according to year 2000 census data. This study also mentioned remittances as an indicator of connections between those in the U.S. and those in Mexico. It was maintained that migrants from Mexico to the U.S. have strong ties to Mexico, but that frequency of return is highly dependent upon legal status (66).
Work Commute

After shopping and visiting family and friends, the work commute is the next most common reason for Mexican nationals to cross the border into the U.S. (67). Many people along the border have heard of the Bracero program between the U.S. and Mexico; this was in fact a series of agreements starting after the end of World War II and continuing formally until 1964 to satisfy U.S. agricultural labor needs (68).

And yet, despite this history, a 2004 study of border issues in the San Diego-Tijuana border region provides an interesting perspective, contrasting the stereotypical image of the persons migrating for work. According to this study, Mexican Census data from 2000 demonstrated that Mexican residents living in Tijuana who were commuting into the U.S. had relatively high education levels and over 70 percent owned their own homes (69).

More recently, but also in the San Diego/Tijuana area, Muriá and Chávez’s 2011 article “Shopping and Working in the Borderlands” explore the apparent contradiction between the two stated objectives of border enforcement and free trade, and thus how residents in the region have adapted to this contradiction. They note the importance of understanding that border residents are both consumers and workers. By their estimate, 30,000 to 50,000 people cross from Tijuana into San Diego County daily to work (70).

Education Commute

As mentioned above with respect to the work commute trip purpose, the shared self-identification of El Paso and Ciudad Juárez residents as a joint community is a fundamental and continuous influence on cross-border commuting for the school trip purpose. The Texas State Comptroller of Public Accounts noted, in its 1998 Border Study report, the “borderless” concept in Texas education. Four of the state border universities exist in one of the sister-city communities: University of Texas at El Paso, Texas A&M International University in Laredo, University of Texas at Pan American, and University of Texas at Brownville in South Texas. By 1991, nonresident tuition and fees had been waived by the Texas Legislature for needy students from Mexico enrolled in public colleges throughout the state. In fiscal year 1996, this applied to 1,732 Mexican students, nearly 80 percent of them enrolled at University of Texas at El Paso (71).

A 2008 article published by the National Education Association discusses the cross-border phenomenon for a different sister city pair in Texas, Brownsville and Matamoros in South Texas. Noting the same cross-cultural and intertwined general experience already described, the educational aspect is no different. Students regularly travel across the border, primarily in the U.S. direction, to fulfill their educational needs; education is neither free nor mandated in Mexico. The Brownsville Independent School District works proactively and cooperatively with their Mexican side counterparts to serve this population. The article notes in particular the challenge of serving a more transient population along the border, attributing it primarily to seasonal agricultural migration by students’ families: the mobility rate along the Texas border is 24 percent, compared to 21 percent in non-border Texas areas (72).
More recently, in 2011, CBP noticed an increase in pedestrian crossings across the PDN in the mornings; they added a special lane serving students before 7 a.m. and 9 a.m. It has been theorized that this increased flow is a result of Mexican parents placing their children in El Paso schools due to increased violence in Ciudad Juárez (73).

**Other Trip Purposes**

There are a variety of trip purposes which motivate a decision to travel as a pedestrian across an international border. The influences explored above appear to predominate. Influences listed in Table 1 arose as part of the literature review, but were determined to either have little influence relevant to our study or to be difficult to incorporate for practical reasons. This list is certainly not exhaustive of all of the other possible trip purposes, merely provided for example.
### Table 1 - Other Trip Purpose Examples

<table>
<thead>
<tr>
<th>Trip Purpose</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illicit Drug Use</td>
<td>In 2006, Michelle Firestone Cruz and others conducted a qualitative exploration of the role of gender in injection drug use behavior in Tijuana and Ciudad Juárez. Their findings indicate that males are more likely to inject drugs at non-home venues and that females were more likely to purchase drugs and return home to use them. Ciudad Juárez is described as exhibiting relatively high drug use in the population and being located “along a major international drug route.” A “tremendous” social inequity between the sides of the border is noted as an exacerbating factor (74).</td>
</tr>
<tr>
<td>Prostitution</td>
<td>The 2006 study by Michelle Firestone Cruz and others on the role of gender in injection drug use behavior in two U.S.-Mexico border cities, Tijuana and Ciudad Juárez, noted a relevant factor being that if a woman was involved in the sex trade, it made her much more likely to inject drugs outside of the home (75). A United Nations study on the role of gender and trans-national border crossing also explores this issue (76).</td>
</tr>
<tr>
<td>Underage Drinking</td>
<td>Although not an illegal activity in Mexico, this topic is included generally for our study purposes under other retail activities. It nonetheless is thought to be a significant explanatory variable for trip-making by persons under age 21 and especially during the evening and night hours. A study by Voas et al. (2007) discusses this phenomenon and the findings from studies in both the San Diego-Tijuana and El Paso-Juárez border areas; the study includes methodological insights, as well as data that indicate the potential scale of the issue in terms of number of related border crossings (77).</td>
</tr>
<tr>
<td>Gambling</td>
<td>The 2009 study by for the Arizona Office of Tourism of Mexican cross-border activity in Arizona found that casinos in Arizona attracted a fair percentage of trips (78). To date, the Tigua Indian tribe in El Paso has not been allowed to maintain a casino along the lines of what other U.S. Indian tribes run; nonetheless, they continue to implement other types of games and ventures in a similar vein (79).</td>
</tr>
</tbody>
</table>

*Source: Texas A&M Transportation Institute, 2012.*
INFLUENCES ON CROSS-BORDER TRAVEL

In addition to the trip purpose, or need to travel, as discussed above, other influences on travel behavior can be those that affect travel generally, such as general economic health on either side of the border, and factors specific to a particular community or crossing.

Currency Movements

It has been said that peso devaluations causing retail sector downturns in border communities on the U.S. side is common knowledge (80). Indeed, the effect of exchange rate has been widely studied for international border crossings across the world. In 2000, Fullerton examined the effect of exchange rate valuation shifts on international border crossings at the Texas-Mexico border. He analyzed monthly northbound crossings to El Paso, the peso/dollar exchange rate, and the consumer price indices of Mexico and the U.S. The results of the study indicated non-random results for all northbound bridge traffic on the three bridges studied, over the period from January 1979 through July 1988. In a 2006, Cañas, Coronado, and Phillips found that El Paso retail sales were less affected by exchange-rate fluctuations than were the other cities. “Less affected” may be the operative term here, given the history recited by Hadjimarcou and Barnes: peso devaluations in 1976, 1982, and 1994 were noted to have substantially affected retail border sales (81). The 1994 devaluation, in fact, may have been one factor in the decline of retail sales following the North American Free Trade Agreement (NAFTA) (82). The variety of findings indicates that sensitivity to the peso’s value may in fact be highly dependent upon the particular location and type of trade occurring.

Port of Entry Operational Characteristics, including Wait Time

It is generally acknowledged that security measures overall cause delay that affects cross-border travel (83, 84, 85). Even prior to September 11, border crossing management was an issue—a necessity, and yet necessary to be managed to avoid constraining legal commerce (86, 87). The NAFTA went into effect in 1994, with the stated purpose of freeing commercial trade between Canada, the U.S., and Mexico. From 1990 to 1996, the total of vehicles and pedestrians crossing through the Texas-Mexico border increased more than 40 percent (88). In the same time period, as discussed by Andreas efforts such as Operation Hold the Line substantially increased efforts to stop illegal immigration at the border, resulting in greater scrutiny of the documents of cross-border travelers at the POEs, as well. Enforcement along the U.S. side of the border increased substantially to accommodate the traffic increase and intensity of scrutiny expected (89).

Security measures put in place following September 11th had both positive and negative effects. Even prior to 2001, a 1998 Texas Comptroller report described a situation where at least five Texas state agencies, U.S. Customs Service, and Immigration and Naturalization Services agencies enforced traffic, generally uncoordinated (90). Several actions on the federal level affected this environment:

- The USA Patriot Act (91), signed into law in the immediate aftermath of September 11th, dramatically increased support for border security, including direct funding.
Both the USA Patriot Act and the Enhanced Border Security and Visa Entry Reform Act of 2002 (92) called for improved accuracy, tamper resistance, and interoperability of visa control systems (93).

The Intelligence Reform and Terrorism Prevention Act of 2004 (94) called for the Western Hemisphere Travel Initiative (WHTI). WHTI standardized documents to include use of Radio Frequency Identification (RFID) technology, which facilitates traveler identification, a stated goal of the initiative is to also facilitate U.S. citizen entry and that of legitimate foreign visitors: while addressing U.S. border security, the RFID technology can also expedite cross-border travel (95). RFID technology has enabled the implementation of “Ready Lanes,” in use on the PDN bridge, to expedite in-vehicle travelers with WHTI-compliant documents (both U.S. citizens, as well as non-U.S. citizens) (96).

Secure Electronic Network for Travelers Rapid Inspection (SENTRI) is one of the “Trusted Traveler” programs run by U.S. Customs and Border Protection. It is the program specifically serving non-U.S. citizen, non-commercial travel between the U.S. and Mexico. SENTRI cards are also WHTI-compliant documents; that is, they use RFID technology to expedite entry into the U.S. It applies to both passenger vehicle travel and pedestrian travel; for the PDN bridge, one pedestrian lane is dedicated to expediting travel for those with SENTRI cards (97, 98).

The U.S. Customs & Border Protection provides bridge crossing information online, including hours of operation, types of modes that can use each bridge (commercial, passenger vehicle, and pedestrian), and wait times for each mode. Data are refreshed hourly and a smartphone application is available, providing an option to travelers for real-time information to make travel decisions.

Again, actions to support security have likely had both positive and negative results, although generally it appears that the increased security measures have largely had a negative impact on wait times, even as technological tools are improving (99, 100). Low utilization of the SENTRI lines at both the San Ysidro POE (San Diego/Tijuana) and PDN (El Paso/Juárez) POEs, both high-volume pedestrian POEs, have been noted (101, 102). In response, a “Pedestrian Reengineering Project” pilot project was implemented by the CBP starting in November 2011 at the PDN bridge. Under this pilot, CBP solicited participation of pedestrian border crossers in a program to use both biometrics (digital fingerprints) and RFID cards to enable expedited their crossing the PDN bridge (103). By February 2012, with the pilot still on-going, findings were positive. For those travelers using the RFID technology, the time savings can be significant: almost a third of daily crossings at the PDN bridge were using the program and it was estimated that wait times overall had been reduced 26 percent. Individual users reported reducing their wait time from up to 2 hours to 20 minutes (104). A lack of CBP staffing to direct flow and assist travelers with using the technology has been noted by various parties (105, 106); however, the program is demonstrating positive results for some users (107).
Perception (and Reality) of Personal Safety

Personal safety has been an issue for a lot longer than the Mexican Drug War of the late 2000s. To introduce the subject of border-area crime, the 1998 report by the Texas State Comptroller describes a 1997 mass shooting in Ciudad Juárez by four suspected drug traffickers. The shooting resulted in the deaths of five civilians and an off-duty law enforcement officer (108). Drug-related violence along the U.S.-Mexico border is still an issue in 2012 and without question, the violence has escalated significantly since 2006, when the Mexican federal government in effect, declared war on drug cartels and organized crime (109). Although the violence has predominantly been confined to the Mexican side of the border, violent incidents have occasionally spilled over to the U.S. side, as evidenced by the June 2010 incident when seven cross-border bullets shot in Ciudad Juárez reached the El Paso City Hall (110).

Regardless of the violence being relatively isolated to the Mexican side of the border, its effects have been disastrous for the joint community of El Paso and Ciudad Juárez (111, 112). Cross-border travel by pedestrians may be responsive to this violent scenario in ways both predictable and surprising. Quite understandably, as the Mexican governmental control of the situation has weakened, the flow of illegal contraband has increased; measures to interrupt the flow of illegal drugs through Ports of Entry have resulted in increased delays for legitimate travel and commerce as indicated in a special report by Shirk (113). In another example, it has been pointed out in the same report that 10 percent of gun dealers in the U.S. are located along the Mexican border; this statistic sheds an uncomfortable shadow on the concept of the retail shopping by cross-border travelers.

Another posited reason for decreasing pedestrian flows across the border is simply fewer people in the Ciudad Juárez as a result of the Drug War—either migration northward into El Paso or southward deeper into Mexico (114). Rios’ 2011 study examines the former issue, asserting that although Mexican immigration into the U.S. as a whole is declining, Mexican migration is increasing for U.S. border communities. She makes a further case that the nature of this migration is fundamentally different from prior waves: a predominant share of these migrants is wealthier, enter the U.S. legally, and continue to maintain some daily activities, for example work commute trips, in Ciudad Juárez. Instead of migrating to escape economic hardship, these migrants have moved their families a short distance across the border to escape violence in Ciudad Juárez (115). In fact, this phenomenon of a Mexican middle class migrating to the U.S. to escape the violence has been called the “Mexodus” (116, 117) and is supported by other observations, as well.

Internal migration in Mexico southward and away from the violence has been documented, as well, primarily working class or poor who cannot afford to leave Mexico (118). In 2010, net migration from the state of Chihuahua to other Mexican states was outward bound by 27,074 people; this and other census data in Mexico tend to support the theory that internal migration is responding to drug-related violence (119). Unfortunately, at least anecdotally as reported by the popular press, these people are either not finding the same economic opportunities further south in Mexico that they had formerly along the northern border (120). This suggests a possibility that some may return to Ciudad Juárez in response to a sustained decrease in violence.
Violence in Ciudad Juárez has decreased notably in 2012. Although the Mexican government has made assertions that this decrease reflects progress its military-style war on the drug cartels, other sources credit a defeat of one Mexican gang over another in the area [(121)]. The July 1, 2012, presidential election and the change of government in November 2012 are likely to result in a shift of tactics by the Mexican government toward the drug cartels; it is difficult to predict what that shift will be or how cross-border migration and traffic flows will be affected.

Gender

In the resources cited up to this point, gender has hardly been mentioned as playing a role in the travel choices of pedestrian cross-border travel. Yet, along some international borders, it is clear that gender is highly significant. Sa’ar in 2004 communicates that for an Israeli Palestinian, being female may on the one hand hinder personal travel because of lingering skepticism about female roles as consumers and a broader antagonism toward modernization. On the other hand, crossing nearby borders to conduct shopping may liberate women from local societal expectations of gender roles. Overall, Sa’ar asserts that mass consumption is just as likely to promote traditional gender roles as to transform them [(122)]. Gender will manifest itself differently as a factor on cross-border travel depending upon the cultures on each side of the border in question.

The United Nations documents a case for the feminization of trans-national migration over time, starting with an initial study in 2004 focusing on remittances and by 2010 widening the scope of study to explore other issues. The paper reveals a variety of motivations, both connective (to support a family in the country of origin, as one example) and disconnective (to escape an abusive relationship, as another). The focus is on migration for longer periods of time, weighing the development benefits of remittances against the impacts of losing these females in their original roles (for example as caregivers) [(123)]. In so doing, this paper provides insights into many influences applicable to cross-border pedestrian travel between the U.S. and Mexico.

Whereas the U.S. female stereotype orders her clueless husband around and the Mexican female stereotype defers to her dominant husband, gender roles in both countries are much broader than these simplistic stereotypes suggest. As the above studies hint, the influence of gender on international cross-border travel is likely equally complex.

Other Influences

There are a variety of factors that definitely do or can play a role in the decision to travel as a pedestrian across an international border. The influences explored above appear to play a predominant role. In addition to the ones aforementioned, there may be many other variables influencing the decision to cross the border (for variety of reasons) such as age, language status, lack of insurance, family status, income level, etc., some of which were identified throughout the report. Influences listed in Table 2 were also explored as part of the literature review, but determined to either have little influence relevant to our study or to be difficult to incorporate for practical reasons.
**Table 2 - Other Potential Influences**

<table>
<thead>
<tr>
<th>Influence</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seasonal Trends</td>
<td>Although fluctuations were observed on a month to month basis, an analysis of the Nogales POEs from 1995 to 2008 showed very little basis for a seasonal adjustment of the non-commercial modes, including pedestrian travel (seasonality was noted for commercial traffic) (124).</td>
</tr>
<tr>
<td>Illegal Immigration Trends</td>
<td>Of course a substantial hindrance to cross-border travel generally is an individual’s legal status and documentation to enter the country. A 1994 research effort documents the effects of Operation Hold the Line between September 1993 and April 1994; this operation by the Immigration and Naturalization Service (INS) and the El Paso sector Border Patrol represented a monumental shift from interception of illegal immigrants headed through El Paso and on to other destinations within the U.S. to blocking these immigrants from crossing the border into El Paso at all. This study used Border Patrol and INS apprehension data to gauge the success of the Operation; the well-known limitations of this approach were acknowledged (125). Another study, by the United Nations, further explores the issue of so-called “irregular migratory status” with respect to gender (126).</td>
</tr>
</tbody>
</table>

*Source: Texas A&M Transportation Institute, 2012.*

**BORDER CROSSING ANALYSIS APPROACHES AND MODELS**

Given the purpose of this study is the preparatory steps for building a disaggregate pedestrian cross-border travel model, the literature review sought out in particular those studies and previous research regarding cross-border travel analysis approaches. The studies presented here demonstrate the vast range of analysis approaches utilized for examining the border: from broad econometric models, regional transportation system models, operational analysis, and even multi-resolution modeling techniques.

**Currency Movements and International Border Crossings Study (2000)**

In the year 2000, Dr. Fullerton, who currently leads the Border Region Model Project, published an insightful paper examining the effect of exchange rate valuation shifts on international border crossings at the Texas-Mexico border. His analysis framework was dynamic, looking at monthly northbound crossings to El Paso, the peso/dollar exchange rate, and the consumer price indices of Mexico and the U.S. (127). The model approach he used to model the number of people crossing each of the three bridges under examination included use of two autoregressive integrated moving average (ARIMA) time series techniques:
Univariate equations were estimated for each of the bridges’ total number of crossings and the series alone was examined to see if it had any predictive power (Box-Jenkins approach); and

Univariate model of the real exchange rate was developed.

Residuals from these series were then cross-correlated and tested to see if monthly crossings can be explained by movements in the real exchange rate. For all northbound bridge traffic on the three bridges studied, over the period from January 1979 through July 1988, results were non-random, responding within an 8-month time frame. For the PDN bridge in the downtown area where pedestrian crossings pre-dominate, cross correlation results do suggest that change to cross-border traffic downtown can be forecasted by exchange rate movement, although with a 2–4 month lag. The relationship is the opposite from expected; however, as the purchasing power of the dollar increases (in response to peso devaluations), northbound traffic increases (with a short lag). Fullerton’s assumption is that this reflects increased U.S. tourist shopping in Ciudad Juárez and returning from their shopping trips or meals on the El Paso side. Fullerton notes that his findings contradict the common understanding that peso devaluations cause retail sector downturns in border communities on the U.S. side. Nonetheless, his results indicate that the aggregate increase in northbound crossings and commuter activity for the metropolitan border area as a whole, for example through increased tourism and higher in-bound assembly plant payrolls, (due to gain in dollar purchasing power) outweigh the affect to reduced retail sales to Mexican shoppers (due to the loss in peso purchasing power).

For future analysis, Fullerton proposed examination of a broader time period, as well as incorporation of regional business cycle indicators including payroll series data for El Paso non-agricultural or manufacturing employment and Ciudad Juárez maquiladora employment estimates.

SANDAG Cross-Border Traveler Model

The San Diego Association of Governments (SANDAG) is composed of 19 local governments, 18 cities and the county. San Diego shares a 15-mile border with Tijuana and the San Ysidro POE has been identified as the busiest international land-border crossings in the Western hemisphere (128, 129). While there is a rail crossing at the San Ysidro-Puerta México POE, the crossing does not serve commercial vehicle traffic, is open for service seven days a week and 24 hours a day, and serves heavy volumes of pedestrian traffic (130, 131). In these aspects, the San Ysidro bridge is particularly similar to El Paso’s PDN bridge. Studies of the San Ysidro bridge and travel modeling in the SANDAG area therefore provide excellent perspective on border crossing research and techniques for this study. The 2006 study, “Economic Impacts of Wait Times at the San Diego-Baja California Border” was previously referenced (132).

At the regional planning level, the SANDAG modeling process addresses cross-border travel as part of its Interregional Commute Model (IRCM), which is one of four demographic, economic, and land use modeling models that are applied in conjunction with the regional transportation model, which is a four-step model. SANDAG is in the process of transitioning toward an activity-based model for the long-term; a cross-border model will continue to be a component under the activity-based approach (133).
Border Wizard Port of Entry Tool

Because wait time at the Port of Entry itself is generally agreed to be a significant hindrance to cross-border travel, understanding the effect and influence of Port of Entry operations is critical. U.S. Customs and Border Protection makes real time cross-border travel times (updated hourly) easily accessible through its website. Their stated goals for travelers are 15 minutes for NEXUS lanes (applicable to passenger vehicles and not available at the PDN bridge) and 50 percent of the general traffic lane wait times for the Ready Lanes (applicable to passenger vehicle and pedestrian lanes, both are available at the PDN bridge) (134). Nonetheless and quite naturally due to security precautions and the complexity of managing all of the ports of entries nationwide, operations at particular ports of entry can be somewhat of a black box.

Recognizing the need for a better understanding of these operations in order to study improvements, the United States Federal Highway Administration (FHWA), General Services Administration (GSA), United States Customs and Border Protection (CBP), and Immigration and Customs Enforcement (ICE) jointly developed the Border Wizard tool. It is a simulation tool for cross-border movements of automobiles, buses, trucks, and pedestrians. With entry of port facility and operational data, the Wizard can be used to construct (for new locations) or modify border station design and operations features. The tool includes simulation of all Federal inspection activities for any land border crossing in the U.S. (135). Described as a priority technology for FHWA in 2005, the tool was being used in case studies including El Paso for transportation planning purposes (136); examples cited in 2005 referenced commercial applications exclusively. FHWA’s online description in 2012 describes on-going analysis and testing for linking the Border Wizard to other planning tools, including travel forecasting models. In addition, ICE is described as collecting data at major border stations for use to examine its own process improvements. The Border Wizard software is available for purchase through GSA, with further information provided (137).

TxDOT Border Crossing Travel Times Study (2008)

In 2007, the Texas Department of Transportation (TxDOT) began a study of Border Crossing Travel Times (138). The Final Study Report for the TxDOT El Paso District was completed in June 2008. The overall purpose of the study, which addressed all Texas border crossings, was to assess short-term improvements that could improve vehicle and pedestrian flow at each crossing. The needs assessment of the system found the following concerns at the PDN bridge:

- Disruption of free flow of traffic because of POE operations. It was noted that POE activities are out of TxDOT’s control and a necessary component of the POE, and
- Safety concerns related to the heavy volume of pedestrian traffic and vehicles near the POE and in the downtown area.

The analysis approach was heavy on traffic operational analysis of vehicle flow; however it did include a strong stakeholder input component and did include consideration of pedestrians. For the final recommendations of study included traffic signals with pedestrian phasing in the downtown area and options to separate pedestrian and vehicle flow on the El Paso side of the bridge.
El Paso Regional Ports of Entry Operations Plan (2011)

The recent El Paso Regional Ports of Entry Operations Plan (2011) included both econometric and operational approaches to provide recommendations for short-, medium-, and long-term improvements for the POEs under study. This study, although it addressed pedestrian needs with respect to safety because of the intermix with vehicle traffic in the area of the PDN, was predominantly geared toward vehicular flow improvement.

BEHAVIORAL CHARACTERISTICS OF CROSS-BORDER TRAVEL

Because of the importance of cross-border transactions to local, regional, and national economies, the behavioral characteristics of cross-border travel have been studied extensively. The following studies demonstrate findings generally for cross-border travelers along the border between the U.S. and Mexico, not necessarily limited to pedestrian travel.

Economic Impacts of Wait Times at the San Diego-Baja California Border (2006)

The 2006 study, “Economic Impacts of Wait Times at the San Diego-Baja California Border” was described previously for its demonstration of the economic impacts of cross-border travel. The methodological approach for non-commercial travel considered trips by purpose, time, and destination, as well as sensitivity by trip purpose to border crossing delay. In this case, this study included a four-month long survey; 3,603 cross-border travelers at the San Ysidro, Otay Mesa, and Tecate POEs were asked questions including trip origin and destination, trip purpose, expected POE wait times (average equal to about 45 minutes per crossing), time sensitivity, and average spending per trip. The study team then used this information and secondary data sources to estimate (in a spreadsheet) the number and impact of trips lost due to border delays. The model for vacation, recreation, and shopping trip purposes was estimated separately from the model for the work trip purpose and the freight-trip methodology was entirely separate from both. A panel of experts was utilized at various points of the study to scrutinize assumptions and provide input on areas of uncertainty. The study also included future scenarios and impact estimations (139). Surveyed respondent characteristics are shown in Table 3; trip characteristics examined are shown in Table 4.

Mexican Visitors to Arizona, 2007-08 (2009)

A 2009 study for the Arizona Office of Tourism of Mexican updated previous studies on cross-border activities of Mexican nationals in Arizona. The study included a survey component for four land-crossing and two airport Ports of Entry. A total of 3,012 surveys were collected (140). Most relevant for the current study were findings related to travel behavior, for example trip purpose and trip mode, as well as the survey instrument and approach, which are shown in Table 3 and Table 4.


In 2010, the South County Economic Development Council (SCEDC) in the San Diego area published a report summarizing the findings from a survey conducted of 1,175 pedestrians crossing at the San Ysidro POE during July 2010. The primary motivation was to try to assess
why the SENTRI program, a “Trusted Traveler” programs run by U.S. Customs and Border Protection to facilitate non-U.S. citizen, non-commercial travel between the U.S. and Mexico, was not being used by more travelers. The reason for the SCEDC’s interest was the understanding of delay’s effects to the regional economy, as has been previously described in the 2006 report, “Economic Impacts of Wait Times at the San Diego-Baja California Border.” Of the respondents, some of the responses are summarized here (141):

- 54 percent are Mexican citizens; 30 percent, U.S.; 14 percent, Green Card holders; 1 percent, European; 1 percent, dual citizenship (most U.S. and Mexico).

- 24 percent cross the border daily; 33 percent, several times a week; 17 percent, weekly.

- Shopping was the number one response for trip purpose, at 31 percent, with 75 percent of this group being Mexican citizens crossing into the U.S. for this purpose.

- Visiting friends or family was the second most commonly cited reason for crossing, at 24 percent; for business/work, 23 percent; each of the following, in descending order, were under 9 percent: school, tourism, medical services, and other. Because the survey was conducted during the summer season and during the day, responses may not be representative of a typical 24-hour period.

- Only 5 percent of respondents were SENTRI cardholders; the most common reason provided was insufficient value compared to the cost or effort to apply.

- Respondents’ recommendations for border efficiency included a need for more open lanes, especially during peak times (42 percent), faster inspection by CBP agents (25 percent), finishing on-going expansion projects at the POEs (11 percent), need for new infrastructure (9 percent), improved technologies such as smart cards, scanners, and biometric technologies (4 percent), more SENTRI enrollment (4 percent) and other (2 percent and, of this number, cutting in line was indicated as a major problem increasing wait time on both sides of the border).

The San Ysidro and PDN POEs share a similar characteristic in both having high pedestrian volumes. In addition, because the PDN bridge has a SENTRI lanes that is also underutilized, this study and the questions specific to the use of the SENTRI lanes is of particular interest for the current study. Surveyed respondent characteristics are shown in Table 3; trip characteristics examined are shown in Table 4.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender*</td>
<td>X</td>
<td>X**</td>
<td></td>
</tr>
<tr>
<td>Country Where Living Currently</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Year Born (age) (min. 18)</td>
<td>X</td>
<td>(min. 18)</td>
<td>X**</td>
</tr>
<tr>
<td>Latest grade or level of school completed</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Income level</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Profession (if work-related trip)*</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Citizenship</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Resident Status in Mexico (required)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City of Residence</td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Source: Texas A&M Transportation Institute, 2012, based upon studies as cited, except:
* Gender and involvement in the sex trade were also examined as part of the Firestone Cruz, Michelle, et al. (2006) study.
** Participants’ gender and age was collected by visual observation and not asked directly.
Table 4 - Trip Characteristics Examined by Study

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Trip Purpose(s)*</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Traveling with Others</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Primary Origin and Destination for Trip</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Length of Stay</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>If Overnight, Where (Friends, Hotel, etc.)</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>How Much Did You/Will You Spend During Trip?</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Spending Breakdown by Type</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Number of Trips Over a Specified Time</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Comparison of Total Trips to Previous (why change?)</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Travel Mode</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Why Did You Choose This Mode?</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Specific Retail Attractions Visited</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Specific Other Attractions Visited (can include friends)</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Anticipated Border Wait Time</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If Real Wait Time Had Been Known Prior, Would Decision to Make Trip Have Changed?</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If You Had Not Made This Trip, How Would You Have Spent the Money Instead? (U.S.? Mexico? Saved?)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>If a Work Trip, If Wait Time Had Been 1 Hour Longer, Would You Have Worked that Full Hour?</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If a Work Trip, If the Wait Time Were Two Hours Every Day, Would You Still Work Across the Border?</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If the Wait Time Were Two Hours Every Day, Would You Make Any Other Changes to Your Living or Work Arrangements?</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did You Use a SENTRI Lane?**</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Source: Texas A&M Transportation Institute, 2012, based upon studies as cited, except:
* Gender and involvement in the sex trade were also examined as part of the Firestone Cruz, Michelle, et al. (2006) study.
** The 2010 study focused several questions on the SENTRI card program and traveler recommendations for increasing border crossing efficiency.

OTHER RELEVANT LITERATURE

In addition to resources above already referenced, there have been numerous studies of the U.S. border areas, both Canadian and Mexican, demonstrating the border’s import to the U.S. Among the references examined for this literature review were various items that were not directly pertinent to the study at hand, and yet they offered some valuable aspect or perspective.

Bordering the Future Study by the Texas Comptroller (1998, 2001)

In 1998, the Texas Comptroller of Public Accounts published an online report called The Border: Where We Stand. This document covered a broad range of border issues, including transportation, education, workforce concerns, and the economy. Key statistics were updated in January 2001. This document provides a broad perspective on concerns from the State of Texas perspective.

Texas-Mexico International Bridges and Border Crossings: Existing and Proposed (2011)

Each year, TxDOT updates a report on its border crossings. Entitled the Texas-Mexico International Bridges and Border Crossings: Existing and Proposed, 2011 (148) this most
recently available report serves as an annual benchmark of construction project progress and plans for the bridges.

**Caltrans Border Bottleneck Study (2004)**

A 2004 border bottleneck study by Caltrans was focused on vehicular flow only, but the study team was interested in the approach this study used for defining the POE study area for analysis (see Figure 5) (149). For that study, the POE area was divided into sections N1 through N6 and issues and challenges for each of those areas were examined separately.

![Figure 5 - Definition of the POE Study Area for Bottleneck Analysis](image)

*Source: Bottleneck Study: Transportation Infrastructure and Traffic Management Analysis of Cross-Border Bottlenecks (2004)*

**CHAPTER SUMMARY**

In this first research task, researchers undertook a focused literature review to cross-border behavior to identify the key variables needed to support a pedestrian analysis and/or model. The resources above pertaining to Texas Border crossings and the PDN bridge are further referenced in Chapter 3 and will continue to be applied as the research study moves forward. Subsequent
chapters will apply insights gleaned from this literature review to identify the primary and secondary data sources necessary to examine the influences upon travel decisions of individuals that cross the border. Before identifying the data sources to be used for analysis, the next chapter will describe the proposed case study area for analysis.
CHAPTER 3: STUDY AREA DEFINITION: PASO DEL NORTE (PDN) BRIDGE

The Paso del Norte Region, encompassing El Paso and Cuidad Juárez, provides a research opportunity under live conditions—the prospect to both improve quality of life and opportunity for area residents and through travelers, and demonstrate solutions and tools applicable elsewhere along the U.S. border. The focus of the current investigation is the Paso del Norte International Bridge (PDN), located in downtown El Paso. This chapter describes the PDN, pertinent history, its context within the system of border bridges in the area, and focuses upon its service related to pedestrian travel between the two countries, the U.S. and Mexico.

Subsequent chapters will identify the primary and secondary data sources necessary to examine the influences upon travel decisions of individuals that cross the border. The researchers will conclude with a proposed conceptual framework for this examination to be implemented in Phase II of this analysis.

DESCRIPTION

The PDN crosses the Rio Grande river between El Paso, Texas, in the U.S. and Cuidad Juárez, Chihuahua, in Mexico. The PDN Bridge has four lanes and serves only northbound, non-commercial, passenger vehicles, as well as a high number of pedestrians.

Figure 6 - Paso del Norte Bridge from Above

Source: Texas A&M Transportation Institute, December 2006.
The PDN is known locally under other names including the Santa Fe Street Bridge, the Puente Benito Juárez, Puente Paso del Norte, Paso del Norte Bridge, and Puente Juárez-Santa Fe. The City of El Paso is the U.S. owner and operator of this bridge. TxDOT identifies two needs for the PDN bridge on its website: improvements for traffic flow approaches and departures, as well as safety improvements for pedestrians using the bridge to access bus stations nearby.

For the PDN bridge, the City of El Paso charges a USD $0.50 toll per southbound pedestrian as of 2012. Northbound tolls for pedestrians are MXN $3.00 (or USD $0.23). An automatic vehicle identification system, whereby travelers may pre-pay tolls on an “epToll” card, is in operation on the Zaragoza and Good Neighbor (Stanton Street) bridges, but not for the PDN bridge.

**PDN BRIDGE TRAFFIC**

The PDN Bridge serves only northbound passenger (non-commercial truck) vehicles, buses, and pedestrians. Both the downtown bridges, PDN and the Good Neighbor Bridge, each carry heavy flows of non-commercial traffic between the two cities’ commercial cores. Northbound (Ciudad Juárez to El Paso) pedestrian traffic on the PDN bridge is charted for the period of 1995 to 2011 in Figure 7. For comparison, total northbound pedestrians for other El Paso bridges are also shown. It is clear that pedestrian travel on the PDN represents the majority of pedestrian cross-border travel for El Paso, although the share of pedestrian traffic on other bridges is increasing as a percentage of total pedestrian traffic.

The PDN bridge serves a variety of trip purposes, primarily non-commercial (and not freight) due to the restrictions against commercial traffic. As mentioned previously, El Paso and Ciudad Juárez span the Rio Grande and this international political border and yet share a common experience: many families straddle the border, living on one side and working, shopping, and making necessary trips to the other side; the citizens of these cities may be more tightly intertwined socially, economically, and in daily travel patterns, than they are with other cities in their own country.

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2 The Mexican side of the bridge is owned and operated by the Mexican government through CAPUFE (Caminos y Puentes Federales de Ingresos), a federal agency.
Figure 7 - Paso del Norte Bridge and All El Paso Bridges Northbound Pedestrian Traffic, 1995 to 2011


The PDN bridge carries the bulk of pedestrian traffic across all El Paso area border bridges. Pedestrians’ origins and destinations may not be limited to how far a person can reasonably walk, however. That is, many people crossing the PDN bridge as pedestrians are utilizing other modes on either or both ends of their trip. Consideration of these different modes of travel is critical to estimating a model of pedestrian behavior. These modes may include, for instance:

- Pedestrians for Entire Trip,
- Bicycle Mode for Entire Trip,
- Bus Passengers Disembarking for Port of Entry Processing,
- Pedestrians Accessing Public Transportation, and
- Pedestrians Accessing Private Transportation.
Of all U.S. exports to Mexico, the travel and tourism industry makes up a substantial 36 percent (156). As mentioned previously, cross-border shopping has received more interest as it has been recognized as a driving economic force for border economies north and south of the border (157, 158, 159). Locally, anecdotal evidence has always been apparent. It may be that increased security in response to the September 11, 2001, terrorist attacks in the U.S. has motivated increased research into this economic force to provide additional considerations to weigh. Another alternative is that as the Latino population increases as a proportion of the U.S. population, economic connections that always existed may be emerging for notice. Regardless of the impetus, retail activity is clearly a component motivation for cross-border travel.

Sometimes the shopping may not be the primary trip purpose, but occur as part of the trip, for example in the queue to cross the bridge, as local salesmen target waiting vehicle and pedestrian travelers (see figure to right). Even when not engaged in shopping, citizens from both sides of the border frequently travel across the border to visit family and experience a different culture; cross-border waits affect these activities and their inclination to make these trips (160).

Given the integrated nature of the El Paso and Ciudad Juárez communities as already described, it is hardly surprising that a fair number of trips on the PDN are work commute trips. These trips are occurring in both directions. Certainly, a broad number of commute trips may be attributed to the location of maquiladoras on the Mexican side of the border and increased globalization of the North American economies (161).

Equally part of life’s activities, many residents in the area commute daily across the border to attend classes (162). Students cross primarily in the U.S. direction to fulfill their educational needs; education is neither free nor mandated in Mexico (163). As aforementioned, more recently, in 2011, CBP added a special lane between 7 a.m. and 9 a.m. to serve students; it is conjectured that the noted increase has resulted from security concerns of attending schools in Ciudad Juárez (164).

Without a doubt, a large component of the influence on travel for the PDN bridge is its location and nearby land uses. As noted in the TxDOT 2008 Border Crossing Travel Time Study, the bridge is located in downtown El Paso and the associated land...
uses on the El Paso side of the PDN bridge reflect this: there is dense commercial, civic, and even residential land use in the area (see Figure 8). The Ciudad Juárez side is possibly even denser in the areas surrounding the PDN bridge.

Understanding the PDN bridge function also entails understanding its relationship to the other border crossings in the Paso del Norte system, summarized in Table 5 and discussed in the next section.
Figure 8 - Land Use and Constraints Map for the El Paso Side of the Bridge (2008)

### Table 5 - PDN and Neighboring Bridge Characteristics

<table>
<thead>
<tr>
<th>Bridge Name</th>
<th>Other Names</th>
<th>Commercial Service*</th>
<th>Private Vehicle Service*</th>
<th>Pedestrian Service*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Teresa Border Crossing (located in new Mexico)</td>
<td></td>
<td>6 a.m. to midnight 1 lane  * “Lane closed” 6/28</td>
<td>6 a.m. to midnight 2 lanes</td>
<td>N/A</td>
</tr>
<tr>
<td>Paso del Norte International Bridge (PDN)</td>
<td>Paso del Norte Bridge, Santa Fe Street Bridge, Puente Benito Juárez, Puente Paso del Norte and Puente Juárez-Santa Fe</td>
<td>N/A</td>
<td>Northbound only 24 hours/day 12 lanes Incl. Ready Lane from 6 a.m. to 10 p.m.</td>
<td>24 hours/day 14 pedestrian lines Incl. Ready Lane from 6 a.m. to 10 p.m. $0.50/southbound pedestrian</td>
</tr>
<tr>
<td>Good Neighbor Bridge</td>
<td>Stanton Street Bridge, Stanton DCL</td>
<td>N/A</td>
<td>6 a.m. to midnight 3 lanes “Lanes closed” except for SENTRI lanes were open, no standard lanes.</td>
<td>N/A</td>
</tr>
<tr>
<td>Bridge of the Americas (BOTA)</td>
<td></td>
<td>24 hours/day 6 lanes</td>
<td>24 hours/day 14 lanes Incl. Ready Lanes</td>
<td>24 hours/day 4 pedestrian lines</td>
</tr>
<tr>
<td>Ysleta -Zaragoza Bridge</td>
<td>Zaragoza- Ysleta Bridge</td>
<td>24 hours/day 7 lanes</td>
<td>24 hours/day 12 lanes Incl. Ready Lanes</td>
<td>24 hours/day 3 pedestrian lines Incl. SENTRI lane</td>
</tr>
<tr>
<td>Fabens-Caseta Bridge</td>
<td>Puente La Caseta, Tornillo-Guadalupe</td>
<td>N/A</td>
<td>6 a.m. to 10 p.m. 2 lanes</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* Not all lanes are open all the time.

Texas-Mexico International Bridges and Border Crossings: Existing and Proposed, 2011.
PDN BRIDGE SYSTEM

Without a doubt, traffic on the PDN bridge is influenced by not only its sister and most proximate bridge, the Good Neighbor Bridge, but also the other bridges operating in the Paso Del Norte area, summarized in Table 5.

Twenty-three bridges serve international vehicular traffic along the Texas border with Mexico. Four are within the City of El Paso. As shown in Figure 9, the three other border crossings in El Paso are the Bridge of the Americas, Good Neighbor Bridge, and the Zaragoza/Ysleta Bridge. The Good Neighbor Bridge is closest to the PDN bridge and they are often considered to operate as a pair, since the PDN bridge serves only northbound vehicles.

The Fabens-Caseta Bridge is a two-lane, light-duty bridge southeast of El Paso that does receive traffic overflow from the El Paso bridges (165). The Santa Teresa border crossing also has two lanes and is located in New Mexico.

Figure 9 - Paso del Norte Region Bridges
Source: Texas A&M Transportation Institute, November 2012.
PORT OF ENTRY OPERATIONS AND IMPROVEMENTS

Border security operations have been cited as a hindrance to cross-border flow both before and after the increase of security in response to September 11th (166, 167, 168). Nonetheless, efforts are continually being made to make these operations more efficient. The United States General Services Administration owns the border station itself, which was completed in 1967. The station was renovated in 1991.

By 2009, the POE station was last renovated and expanded to:

- increase the number of pedestrian lanes from five to 14;
- increase vehicle crossing lanes from nine to 11 lanes, with a twelfth possible;
- include all vehicle crossing lanes having RFID technology to read traveler documents, and computerized license plate readers and processing; and
- include radiation monitors (169).

The POE construction completed in 2009 was intended to meet a deadline set by the WHTI, which was described in Chapter 2. The primary result of WHTI relevant for this study is the introduction of RFID technology to facilitate traveler identification while addressing U.S. border security (170). RFID technology has enabled the implementation of “Ready Lanes,” lanes dedicated to in-vehicle travelers with WHTI-compliant documents. This includes U.S. citizens, as well as non-U.S. citizens, with this type of documents (171).

The bridge remodeling completed in 2009 resulted in the addition of one pedestrian lane for pedestrian travelers with a SENTRI card (172). Secure Electronic Network for Travelers Rapid Inspection (SENTRI), also described in more detail in Chapter 2, is a program intended to facilitate non-U.S. citizen, non-commercial travel between the U.S. and Mexico. SENTRI cards are also WHTI-compliant documents, using RFID technology. SENTRI applies to both passenger vehicle travel and pedestrian travel; for the PDN bridge, one pedestrian lane is dedicated to expediting travel for those with SENTRI cards (173, 174). Unfortunately, adoption of SENTRI has been problematic. Low utilization of the SENTRI lines has been identified as an issue at both the San Ysidro POE (this was actually the motivation for the 2010 survey conducted at the San Diego/Tijuana POE and described in Chapter 2) (175). The PDN SENTRI lane opened in 2009 and, according to CBP themselves, attracted only a “handful of users per day” in 2011 (176). The survey of San Ysidro users concerning SENTRI found issues of lack of knowledge and confusion about the program (177); these are likely factors for the Cuidad Juárez population, as
well. In addition, the process to get a SENTRI card could be considered burdensome, including a $122.25 fee for five years, successful background check, fingerprint submission, and an interview with CBP (178).

As mentioned before, the “Pedestrian Reengineering Project” is a pilot project that was implemented by the CBP starting in November 2011 to use both biometrics (digital fingerprints) and RFID cards to enable expedited travel for pedestrians on the PDN bridge (179). By February 2012, with the pilot still on-going, findings were positive. For those travelers using the RFID technology, the time savings can be significant: almost a third of daily crossings at the PDN bridge were using the program and it was estimated that wait times overall had been reduced 26 percent. Individual users reported reducing their wait time from up to 2 hours to 20 minutes (180). One complaint continues: a lack of CBP staffing to direct flow and assist travelers with using the technology (181, 182, 183); reportedly, in 2011, the City of El Paso even offered to help pay for additional U.S. federal government staff at the crossings (184).

A $12.6 million project to further upgrade pedestrian components of the PDN bridge and its sister Good Neighbor bridge began in December 2010 (185) and were scheduled for completion in March 2012 (186). The amenities most recently under construction were supposed to improve channelization of flow through the different lines available (187), as well as new electronic toll operations and amenities such as artwork, and new canopies for the pedestrians in both directions on the PDN bridge (188).

The City of El Paso provides a link on their website, example shown in Figure 10, which provides a live feed from the U.S. Customs & Border Protection website of El Paso area bridge information, including hours of operation, types of modes that can use each bridge (commercial, passenger vehicle, and pedestrian), and wait times for each mode. Data are refreshed hourly, and a smart phone application is available, providing an option to travelers for real-time information to make travel decisions.
While this study is focused on pedestrian travel on the PDN Bridge, it is critical to have an overall understanding of the larger travel influences that are occurring for the international bridges in El Paso overall. Many of these travel influences have a direct effect on pedestrian flow and on the PDN Bridge flows.

From a commerce perspective, with respect to both commercial and tourism, the international bridges located in El Paso offer almost direct access to Interstate 10, the southernmost west-coast to east-coast connection to:

- Nine primary interstate north-south facilities accessing the rest of the U.S.;
- Intermodal port facilities including those in Los Angeles, Houston, New Orleans, and Mobile; and
- Some of the largest U.S. population centers including Los Angeles, San Antonio, and Houston.

El Paso itself is a commercial and tourist destination. With a population of over 649,121 in 2010, El Paso is the sixth largest city in Texas and ranked 19th in the U.S. (189). El Paso population grew significantly between 2000 and 2010, by 15.2 percent (190). Over the same period, Ciudad Juárez also grew: expanding 8.4 percent to 1.32 million in population (191).
Total annual persons crossing into El Paso via the international bridges is previously charted for the period of 1995 through 2011 in Figure 2 in the first chapter. As can be seen, persons traveling by passenger vehicle represent the majority of travelers entering El Paso. Pedestrians represent the next largest group of individuals crossing.

Indeed, it is critical to fully appreciate that external-level influences that may be affecting PDN traffic. Figure 11 revisits data presented earlier, with northbound pedestrian traffic shown for both the PDN bridge and all El Paso bridges combined. As demonstrated previously, PDN bridge pedestrian flows have represented the majority of pedestrian crossing trips in El Paso for some time, although the percentage of pedestrian trips occurring at other El Paso bridges is increasing. The purpose of Figure 11 is to present some potential causal events that have affected all of the El Paso bridge pedestrian flows, including the PDN bridge. These influences have been theorized by a variety of sources and demonstrate the complex forces influencing border travel and that this current work effort will attempt to account for in the Phase II survey data acquisition and analysis.

![Figure 11 - Paso del Norte Bridge and All El Paso Bridges Northbound Pedestrian Traffic, 1995 to 2011, with Potential Events Affecting Crossing Traffic](image-url)

The events shown in Figure 11 include:

1994 – NAFTA implementation facilitated integration of the U.S. and Mexico economies, resulting in a surge of commercial travel between the two countries, catalyzing the maquiladora industry, and increasing both vehicular and pedestrian travel across the PDN other border bridges (192, 193).

2001 – Increased security as a result of the September 11, 2001, terrorist attacks slows both vehicular and pedestrian travel across the bridge (194).

2006 – Mexican government crackdown on drug cartels and resulting violence decrease cross-border traffic in at least two ways: decreasing interest by U.S.-origin travelers in entering Ciudad Juárez and residential location transitions out of Ciudad Juárez into El Paso (including U.S. citizens previously locating in Ciudad Juárez because of a lower cost of living) (195).

2008 – Global recession begins, decreasing employment in both cities, and in particular affecting the maquiladoras in Ciudad Juárez (from 2008 to mid-2011, a 30 percent reduction in the maquiladora workforce) (196).

As the above exercise demonstrates, a wide variety of external factors may be influencing vehicular and pedestrian flows across the El Paso bridges. These factors may not be identifiable through a noticeable change in flows, as the events cited above appear to do. Nonetheless, these influences are likely to be playing some sort of role. Other examples of external factors may or may not include: overall economic conditions, peso fluctuations (197), shifting populations between the two cities, even U.S. Department of State travel advisories (198).

Focusing back upon the PDN bridge itself, it is just as likely that there are numerous direct influences involved at this bridge-specific level, such as bridge-specific delay, changes at neighboring bridges, or a procedural change such as bus passengers being asked to disembark for border processing. Sifting through these influences to better understand pedestrian travel behavior at the PDN bridge in recent history will provide decision makers a valuable tool for projecting and influencing pedestrian cross-border flow in the future.

CHAPTER SUMMARY

This chapter describes the Paso del Norte Bridge in El Paso, a heavily traveled, centrally located bridge with heavy pedestrian flows. Various characteristics of PDN travel were explored, including modes, trip purpose, as well as potential pedestrian traffic influences that will be further explored as the study moves into Phase II of detailed examination. The following chapter describes the development and plan for implementation of the local travel survey, which serves as the primary data source reflecting unique PDN bridge pedestrian travel behaviors.
CHAPTER 4: PRIMARY DATA SOURCE

The insights obtained from the above synthesis of literature, the study area identified in the previous chapter, as well as the local knowledge of researchers will be used to develop the data inventory framework. A local travel survey, focusing on pedestrians and to be conducted at the border under Phase II of this research effort, serves as the primary data source reflecting unique PDN bridge pedestrian travel behaviors.

As part of this task, researchers focus on the survey questions and survey process to understand various dimensions of border-crossing walk trips. While the actual survey will be finalized in the next phase, example survey questions and a sample survey have been developed here, as well as a framework for survey administration, which will guide survey implementation in Phase II.

EXAMPLES OF PREVIOUS SURVEYS

The study team, through the literature review, identified several resources that provided insights for development of the survey instrument for this study.

The 2006 study “Economic Impacts of Wait Times at the San Diego-Baja California Border” included a four-month long survey of 3,603 cross-border, non-commercial travelers at the San Ysidro, Otay Mesa, and Tecate POEs. The study was aimed at examining the economic effects of congestion due to cross-border movement of vehicular traffic (both auto and freight) as well as pedestrian travel. The survey instrument is provided in the study’s Final Report (199).

The 2009 study for the Arizona Office of Tourism of Mexican cross-border activity in Arizona also included a survey component. Because of the variety of locations surveyed—four land-crossing and two airport POEs—the survey instruments were tailored into modules that included area-specific questions. The report document includes a copy of the survey instrument in English; the survey was conducted in Spanish and administered by bilingual students from the University of Arizona, as well as a few professional interviewers as necessitated by the schedule. A total of 3,012 surveys were collected and weighted by mode of travel, port of entry, and size of party (200).

For the 2010, San Ysidro Pedestrian Crossing study, 1,000 pedestrians were surveyed crossing at the San Ysidro POE during July 2010. Surveyors were located outside the POE on the U.S. side, with unprecedented access provided by the CBP to survey all pedestrian crossers. Survey respondents were randomly selected and asked questions face to face in either English or Spanish, with pre-established, open-ended questions. The survey was conducted July 13 through 31, 2010.
SURVEY PURPOSE AND INSTRUMENT

A local survey serves a unique purpose: it provides sample data to connect the variables that influence travel decisions to the decisions made. This is the reason that the survey data are considered the primary data source. The survey will be conducted at the border and be designed to understand various dimensions of border-crossing walk-trips, both those specific to the PDN bridge and likely representative of decisions made in similar circumstances at other border crossing locations. Based on the synthesis of literature conducted in the previous sections as well as the example surveys reviewed, it is clear that there are many questions waiting to be answered to draw a complete picture of pedestrian crossing behavior at the border. Due to time and budget constraints and for efficiency purposes, of course, it is not possible to ask all such questions at once. Therefore, the main purpose of the survey has been defined to specifically respond to the needs of the area to improve cross-border mobility for pedestrians in a context of increasing demand and shrinking resources. For instance, recent events both local and international likely necessitate additional specific questions, including traveler response to new electronic purchase machines, or recently completed pedestrian amenities. Similarly, perception of future change in violence or perception of local economic improvements can shape the survey questions.

In this context, Phase II of this project will finalize the survey questions building upon the current work by holding roundtable discussions with the local agencies to more closely capture the local needs. Table 6 demonstrates example questions ranging from general trip-related questions to demographic ones, to demonstrate the direction the survey may take to gather the primary data set. A sample survey that focuses on understanding the general walking behavior of pedestrians crossing the bridge is presented in Appendix A.

**Table 6 - An Example List of Potential Survey Questions**

<table>
<thead>
<tr>
<th>Trip-related Questions (General)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where did you start your trip today?</td>
</tr>
<tr>
<td>Did you change your mode of travel during your trip?</td>
</tr>
<tr>
<td>What is your trip destination?</td>
</tr>
<tr>
<td>How long will you stay in the country?</td>
</tr>
<tr>
<td>How often do you cross the border as a pedestrian?</td>
</tr>
<tr>
<td>What other modes of travel (besides walking) have you or will you use during your trip?</td>
</tr>
<tr>
<td>Do you have access to a car or motorcycle you could use to cross the border instead of walk?</td>
</tr>
<tr>
<td>What is the purpose of your trip today?</td>
</tr>
<tr>
<td>How many days a week do you work in this location and have to cross the border?</td>
</tr>
<tr>
<td>What factors do you consider in crossing the border? (asked based on the trip purpose)</td>
</tr>
</tbody>
</table>
### Questions Related to the Crossing Experience

- How long did it take you to cross the border today?
- If there was delay…
  - What do you perceive is the primary cause for delay in crossing at this bridge as a pedestrian?
- Before you got to the bridge today, how long did you think it would take to cross the border?
- For the portion of your trip that you were a pedestrian, were there sidewalks you could use?
- For the portion of your trip that you were a pedestrian, were there any areas where you had to cross auto or truck traffic?

### Questions Related to the Port of Entry Itself

- Did you use a SENTRI card to pass through the Port of Entry as a trusted traveler?
- Have you noticed the new electronic toll purchase machines?
- Have you noticed the recently completed pedestrian amenities (artwork and new canopies)?
- For the portion of your trip that you were a pedestrian, were there sidewalks you could use?

### Demographic Questions

- Year Born (age)
- City/Country Where Living and Working Currently
- Full- or Part-time Student
- Employment
- Latest grade or level of school completed
- Income level (in ranges)
- Profession (if work-related trip)
- Resident Status in Mexico

### PROPOSED SURVEY IMPLEMENTATION

The survey is designed as a simple, reliable, and relatively inexpensive method to account for pedestrians’ choices and demographic information at the PDN POE. This survey will assist local planners to optimize investments by collecting pedestrian trip behavior data. Additional benefits could be achieved by future data collections, which can help to track trends and prioritize investments. In general, the pedestrian survey provides the following benefits:

- Captures important information for local planning,
- Gives information regarding walking behavior for any given time period,
• Provides probably the most reliable source of pedestrian information, and
• Uses a sampling approach that will generate results that describe the walking behavior of an entire community or population group (202).

The first step of survey implementation is to determine population sample size, using statistical formulations and pedestrian survey related experience. Factors such as confidence intervals, expected response, and incidence rates (level of participation) directly influence the estimation as well. Creative Research Systems (203) provides a chart that can help researchers on determining sample sizes for different statistical conditions based on standard statistical formulas.

<table>
<thead>
<tr>
<th>Margin of error</th>
<th>Sample Size Needed (95% confidence level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>±3%</td>
</tr>
<tr>
<td>2,000</td>
<td>696</td>
</tr>
<tr>
<td>5,000</td>
<td>880</td>
</tr>
<tr>
<td>10,000</td>
<td>965</td>
</tr>
<tr>
<td>20,000</td>
<td>1,014</td>
</tr>
<tr>
<td>50,000</td>
<td>1,045</td>
</tr>
<tr>
<td>100,000</td>
<td>1,058</td>
</tr>
<tr>
<td>500,000</td>
<td>1,065</td>
</tr>
<tr>
<td>1,000,000</td>
<td>1,066</td>
</tr>
<tr>
<td>5,000,000</td>
<td>1,067</td>
</tr>
</tbody>
</table>

Figure 12 - Recommended Sample Size for Pedestrian Surveys


Student researchers and hired staff will need to be bilingual, both English and Spanish, since a high percentage of PDN users are Spanish-only or Spanish-preferred speakers. Researchers and supervisors will perform training for all surveyors that will participate in the survey. This training will provide step-by-step guidelines with information on how to proceed with the interview and strategies for getting the most accurate information from the survey respondents. As an example of the survey protocol to learn in the training process, surveyors have to identify themselves and explain the purpose of the survey before starting the questionnaire. The surveyor
dress requirement includes a name badge, safety vest, cap or hat, and comfortable walking shoes. The surveyor materials will include clipboard for support writing supplies, sun block if applicable, and drinking water.

Figure 13 shows the proposed area where the survey will be carried out. Before taking any action at the survey’s site, the researchers must obtain official approval (survey authorization) from the CBP office as well as complying with the Institutional Review Board (IRB) for Protection of Human Subjects requirements (certification and questionnaire approval).

For consistency, all surveys are considered to be conducted during local peak travel times, to be predetermined. According to data collected in 2012, the research team has identified the morning a week day peak period (6:30–9:30) as the maximum pedestrian influx (northbound) crossing the PDN Bridge. However, important influx at weekends has also been observed, particularly during holidays. The final decision on the exact period of time to be analyzed will be determined under Phase II of the study, and will be based on various factors such as the purpose of the survey, the survey’s budget, and the confidence level needed.

Following survey implementation, data will be input into a Microsoft Access template containing the entire questionnaire in electronic format. Data will be scrutinized and double-checked to avoid any data loss. Survey results will be analyzed and statistically validated prior to being input into the statistical pedestrian model.

CHAPTER SUMMARY

This chapter presents a general description of the primary data source that will be used for modeling travel behavior of pedestrians crossing the border bridge. Given that a local survey provides the best representation of the unique behavior in the region, this chapter mainly focuses on the steps of developing a survey instrument to gather pedestrian’s travel choices. In this respect, after presenting some example surveys that were conducted in practice, the chapter presented potential questions, including a sample survey for examining general walking behavior provided in Appendix A, and described a survey implementation process for Phase II of the project. To support the primary data obtained from a local survey, the next chapter will discuss secondary data sources that may affect individuals’ travel choice behavior in the context of the PDN bridge and that need to be included in the modeling efforts.
Figure 13 - Proposed Area for Survey Implementation
CHAPTER 5: SECONDARY DATA SOURCES

In addition to the primary data gathered from the local survey, it is important to gather various other secondary data variables to take into account other influences on an individual’s choice to walk across the border. That is, for each survey conducted, the pedestrian traveler will be asked various questions about their specific trip, such as questions concerning trip characteristics (e.g., trip purpose, origin, destination, intermediate stops to change travel mode along their trip) as well as demographic profile that only the traveler themselves can provide. In addition, it is important to explore various other dimensions that affect a person’s decision to cross the border as a pedestrian, which expand the explanatory setting for that decision but may be less (and/or indirectly) understood by the traveler or may not be gained directly from the individual traveler. Here we will label such variables as secondary data sources. Many of the secondary data sources are spatial variables—that is, they include a geographic location component. Spatial data are acquired and analyzed using Geographic Information Systems (GIS) tools, as described in the following sections.

Once gathered, variables in this secondary database will be appended to the primary dataset from the survey and used in the data analysis and/or model development. As part of this task, this section identifies potential secondary variables-based primarily on information gleaned from the literature synthesis. The actual collection of the data will be conducted in Phase II of this study, prior to the data analysis and/or model development.

IDENTIFICATION OF POTENTIAL VARIABLES

The identification of secondary variables to be tested for their influence on individual travel behavior is the result of:

- Variables cited in the literature synthesis and prior research efforts described in Chapter 2;

- Suitable and available datasets deemed to be possibly influence the decision to cross the PDN bridge as a pedestrian; and

- Professional judgment.

Potential variables to be tested are divided by the type of influence on travel behavior, for example activity generators, competing and complementary modes, built and surrounding environment factors, and regional, national, and international variables. The list is not intended to limit the research to only these variables as it proceeds into Phase II, merely to provide a substantial step toward that effort. Based on the specific purpose of the study, more detail on the list of variables and the corresponding data sources will be examined under Phase II of the study.
Activity Generators – Origins and Destinations

The activity motivating the trip—be it a daily trip, regular occurrence, or rare; non-recreational or recreational; planned or unplanned—is clearly related to the choice of travel. Variables related to activity origins and destinations, therefore, are of high interest in this examination. Many of these variables will be derived using GIS tools. A summary list of secondary variables that influence walking as a traffic behavior based on activity is presented in Table 7.

Table 7 - Examples of Secondary Variables: Activity Generators

<table>
<thead>
<tr>
<th>Type of Variable</th>
<th>Example Variable</th>
</tr>
</thead>
</table>
| Residential      | • Total population within a given radius  
                    • Total households within a given radius  
                    • Average household size within a given radius  
                    • Fraction of different household types within a given radius  
                    • Vehicles per household ratio within a given radius  
                    • Number of households in colonias within a given radius  
                    • Median household income within a given radius  
                    • Median housing value within a given radius  
                    • Proximity of origin or destination to public housing |
| Employment       | • Number of jobs within a given radius  
                    • Number of assembly and manufacturing jobs within a given radius |
| Retail/Shopping  | • Number of commercial retail establishments within a given radius  
                    • Number of supermarket retail establishments within a given radius  
                    • Number of convenience shopping retail establishments within a given radius |
| Education        | • Distance to Higher Education Destination  
                    • Distance to K-12 Education Destination  
                    • Distance to other child-attractive destinations |
| Other            | • Other community and personal business destinations  
                    • Pharmacy destinations within a given radius  
                    • Health-related destinations within a given radius  
                    • Open space recreational destinations within a given radius  
                    • General activity-center accessibility index |

Competing and Complementary Modes

The section above presented example variables related to the origin and destination of a trip, focusing upon the potential influences on trip generation. This section explores potential
influences upon the decision to travel by mode. That is, what factors influence an individual’s decision to walk versus travel by auto, bus, or other mode? These factors can be broken down into those that promote alternative mode use and those that complement the walking mode. Particularly at the border, the first variable listed is particularly pertinent: is there a significant differential in border crossing time by mode? This study proposes to explore these and other similar variables.

A summary of example variables related to competing and complementary modes includes:

- An average border crossing travel time by mode,
- Automobile parking spaces nearby,
- Bicycle Route,
- Bus Transit Stop Accessibility, and
- Proximity to a long-distance bus station.

**Built and Surrounding Environment Factors**

As demonstrated in Chapter 2, the choice of travel as a pedestrian can be highly dependent upon built and surrounding environment factors. Understandably, built environment variables related to these factors are typically spatially dependent. As explained in Chapter 2, built environment factors consider the hospitality of the local environment to the walking mode. Other surrounding environment factors are intended to capture less tangible influences, such as a person’s perception of personal safety.

A summary of example variables related to built environment and surrounding environment factors includes:

- Land use mix index,
- Sidewalk density,
- Proximity of origin or destination to a police station,
- Density of city blocks within a given radius,
- Density of street intersections within a given radius,
- Bikeway density,
- General index of pedestrian accessibility,
- Pedestrian safety index (accidents),
• Density of street miles by centerline within a given radius,
• Shade (by tree category), and
• Personal safety index (crime).

Regional, National, and International Variables to Explain Temporal Variation in Pedestrian Bridge Crossings

The above variables specifically augment the survey data to be conducted as part of this study under Phase II (the primary dataset) and relate directly to the trips documented in that survey. This section addresses regional and international variables that influence observed variation in the total number of pedestrian bridge crossings over time. Economic variables predominate in this discussion. As explored in literature on this topic, because of the dominance of the U.S. economy over that of Mexico (compared to many other international borders), economic variables from the U.S. are sufficient to explain variation in travel flows across the countries’ shared border. That is, the health (or not) of the U.S. and local economy is sufficient to explain much of the travel behavior, without the need for comparable statistics on the Mexican side. It is logical to expect that, for specific industries, this would not be the case, and yet what is sought here is the broadest picture influencing flows. Example regional and national variables include:

• Local Area Unemployment Statistics:
  o Texas,
  o El Paso Metro Area,
  o City of El Paso;

• Safety concerns (e.g., U.S. travel advisories);

• U.S. State and County Personal Income Per Capita, 1969–2010;

• U.S. State and County Population, 1969–2010;

• U.S. State and County Total Employment and Wage Breakdown Detail, 1969–2010;

• U.S. State and County Total Employment by SIC, 1969–2010;

• U.S. State and County Total Employment by NAICS, 1969–2010;

• Cost of living comparison; and

• Index of housing cost differential between the U.S. and Mexico.
Example international variables include:

- Value of the peso/exchange rate, and
- U.S.-Mexico trade balance.

As explained for the previous variables discussed, it is anticipated that this list will be further explored and expanded under Phase II of this study. It may also be determined under Phase II that this level of analysis is unnecessary to understand the pedestrian travel behavior, but this section is included because of its relevance at this time.

**ADDITIONAL DATA SETS NECESSARY FOR ANALYSIS**

Two additional datasets have been identified thus far as being necessary to the above analysis of variables, albeit for indirect application: a geography of traffic analysis zones (TAZs) and aerial imagery.

The TAZ layer is a product of the El Paso Metropolitan Transportation Planning Organization and represents zones typically larger than U.S. Census Block and smaller than U.S. Census Block Groups, that is, of a size typically quite suitable for transportation analysis at the regional level. TAZs may be helpful to aggregate certain variables. These geographies may be used to aggregate data, as appropriate. There are two potential resources for this dataset on the U.S. side, either the MPO directly or the U.S. Census Bureau TAZ layer. The latter may be more easily accessible and should differ only slightly, if at all, from the MPO product.

Aerial imagery is basically photographs taken from a plane. This type of imagery is quite useful for verifying specific data, for example examining the general reasonableness of housing density measures. TNRIS aerial imagery data will be used as needed. However, inquiries will be made to PdN Mapa and the Texas Department of Transportation if any more recent aerial imagery is available, and using online free aerial imagery, for the purpose of cross-checking data analysis results.

**IDENTIFICATION OF POTENTIAL DATA SOURCES BY ORGANIZATION**

Potential data resources were identified through the researchers’ prior knowledge or as a result of the literature review discussed in Chapter 2. An example list of resources for secondary data by organization is provided in Appendix B.

Three resources merit individual mention below; the remainder resources are described in the table in the Appendix B.

As an excellent general resource for data applicable to this current study, Tubridy and Pistilli in 2006 reviewed and summarized statistical data sources relevant to U.S.-Canada-Mexico cross-border retail activity: spending and sales tax revenues, travel patterns and models, and population, income, and other indicators (204). They describe each of the resources in detail, including specific reports and statistics.
Conducted out of an independent research unit of the University of Texas at El Paso, Department of Economics & Finance, the Border Regional Modeling Project (BRMP) applies the Borderplex Econometric Forecasting Model, a model encompassing El Paso and Las Cruces on the U.S. side and Ciudad Juárez and Ciudad Chihuahua on the Mexico side. This model is used to forecast short- and long-term trends affecting area policy and development issues. For the purpose of this current study, BRMP offers an extremely valuable resource: online availability of the model input data sets (205). These data sets are well documented, including source annotations, and assembled for long historical periods as available. The study team for this project will use these data sets for insight into the data available for use for this current study.

An additional resource of particular helpfulness for this current study is the Paso Del Norte Map for Public Access (PdN Mapa) coalition. PdN Mapa represents an effort by multiple agencies local to the tri-state, binational region of far-west Texas, southern New Mexico, and northern Chihuahua, Mexico, to share and disseminate geographical information system (GIS) data. In the research of available data comprising this chapter, numerous datasets have been downloaded during the course of this task for use in Phase II of the study.

CHAPTER SUMMARY

This chapter explores the wealth of secondary datasets available to support the primary data gathering instrument for this research: the survey of pedestrian travelers crossing the U.S.-Mexico border at the Paso del Norte Bridge in the downtown El Paso-Ciudad Juárez area. Potential variables to be tested are presented by their type of influence on travel behavior, for example activity generators, competing and complementary modes, and built and surrounding environment factors. Regional, national, and international variables are also discussed as they relate to broad trends in pedestrian flows between the countries. Finally, additional necessary data sets, and potential data sources by organization thus far are presented. The following chapter concludes this Phase I study report, positioning the work to be pursued under Phase II of the research effort.
CHAPTER 6: CONCLUSION

The broad objective of this research is to understand pedestrian travel on the Paso del Norte Bridge. This effort will result in the development of a pedestrian model to interpret and evaluate the factors influencing pedestrian’s travel behavior decisions in general and pedestrians crossing an international bridge in particular. This current report completes Phase I of the study, with a strategic focus on likely variables and available data. It started with a synthesis of existing literature relevant to the topic, definition of the study area, and identification of proposed primary and secondary data sources. As depicted in Figure 14, this research effort establishes the conceptual data inventory framework necessary to proceed with Phase II.

The City of El Paso’s mission statement for its international bridge operations is:

To provide safe, convenient, efficient and reliable cross-border mobility at an appropriate cost, while facilitating international commerce (206).

Supporting this mission, the results of this research will be used as the basis for a comprehensive analysis and a robust model to understand the travel choice decisions of PDN pedestrians. In particular, Phase II of the study will follow-up this effort by finalizing and implementing the survey as discussed in this report, gathering the secondary data sets, and formulating an analysis approach that best describes the travel choice decisions of PDN pedestrians. The spatial data set, once it is combined with the activity-travel dataset, will provide a more complete and accurate picture of border-crossing pedestrian travel behavior, which can eventually assist policy makers in improving the mobility at PDN and economic development of El Paso.
The main beneficiaries of this project include cross-border travelers; local, regional, and national constituencies dependent on commerce based upon cross-border travelers; and public agency authorities at all levels on both sides of the border whose mission it is to facilitate safe and efficient cross-border travel and commerce. Second, transportation research centers and economic research centers will also benefit from this analysis because it augments the body of knowledge on cross-border travel.

The importance of this research effort in a larger context cannot be overestimated. As shown in Figure 15, the work completed in this research will not only be applicable for the Paso del Norte Bridge (the central focus), but also be substantially beneficial to provide a basis for other border bridges in the Paso del Norte Region, such as the El Paso-Ciudad Juárez International Bridge of the Americas (BOTA carries over 50 percent of the traffic crossing the international border in El Paso). In addition, the improved understanding yielded from this research has potential application well beyond the geographic limits of this study. This research will be directly applicable to other cross-border bridges with pedestrian traffic along the U.S.-Mexico border and may be applicable indirectly to other international borders, as well.

![Figure 15 - Research Central Focus and Extended Benefits](source: Texas A&M Transportation Institute: Center for International Intelligent Transportation Research, 2012.)

Indeed, analysis to-date of the local impact of pedestrian cross-border travel barely scratches the surface of the issue of sustainable urban form for El Paso and Ciudad Juárez. Increasing attention is being paid to the importance of urban form for the health, wealth, and happiness of urban residents; connectivity at the streetscape and neighborhood level has been shown to have wide impacts to the community at large (see Jane Jacobs and Kevin Lynch). Recent research has explored the role of the New Urbanism movement, an urban design movement that employs physical connectivity as a place-making strategy, in Latino communities across the United States (207). The PDN bridge crossing, being located at the heart of the El Paso and Ciudad Juárez sister city conurbation, represents more opportunity than constraint for improved community connectivity. A pedestrian model such as the one proposed for development under Phase II of this study can play a critical role in quantifying increased pedestrian activity under various improved connectivity scenarios.
APPENDIX A:
SAMPLE SURVEY

DATE (FECHA): ______ NOVEMBER, 2012
Time (Hora): __________________________

La Universidad de Texas A&M está desarrollando un proyecto para evaluar las zonas peatonales en la zona centro de El Paso y la movilidad de peatones que cruzan la zona fronteriza. Esta encuesta es totalmente anónima y voluntaria.

The Texas A&M University is currently developing a project to assess pedestrian areas and mobility of pedestrian travelers between Ciudad Juárez, Chihuahua and El Paso, TX, at the International Bridge of Paso Del Norte. This survey is anonymous and voluntary.

### Background (Perfil)

<table>
<thead>
<tr>
<th>1. Place of residency (Lugar de residencia)</th>
<th>2. Origin of the trip? (¿Dónde comenzó su viaje?)</th>
<th>3. Final destination of the trip? (¿Dónde terminará su viaje?)</th>
<th>4. Which category better represents your average monthly income? (¿En qué rango situaría usted su ingreso mensual?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 □ El Paso</td>
<td></td>
<td></td>
<td>1- □ 0 – 5,000 pesos</td>
</tr>
<tr>
<td>2 □ Juárez</td>
<td></td>
<td></td>
<td>2- □ 5,001 – 10,000 pesos</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3- □ 10,001 – 15,000 pesos</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4- □ 15,001 – 20,000 pesos</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5- □ 20,001 – 25,000 pesos</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6- □ 25,001 – 30,000 pesos</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7- □ &gt;30,000 pesos</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. What is the main purpose of your trip? (¿Cuál es el principal propósito de su viaje?)</td>
<td>6. What is your employment status? (¿A qué se dedica?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 □ Work/Work-related business (Trabajo/Relacionado al Trabajo)</td>
<td>1 □ Full-time worker (Tiempo completo)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 □ School (Escuela)</td>
<td>2 □ Part-time worker (Medio tiempo)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 □ Shopping (Compras)</td>
<td>3 □ Student (Estudiante)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 □ Other (Otro)</td>
<td>4 □ Student and employed (Estudiante y trabajando)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 □ Other (otro)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7. Which category represents your age? (¿En qué intervalo de edad se encuentra?)

<table>
<thead>
<tr>
<th></th>
<th>Age Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18 - 24</td>
</tr>
<tr>
<td>2</td>
<td>25 - 34</td>
</tr>
<tr>
<td>3</td>
<td>35 - 44</td>
</tr>
<tr>
<td>4</td>
<td>45 - 54</td>
</tr>
<tr>
<td>5</td>
<td>55 – 64</td>
</tr>
<tr>
<td>6</td>
<td>65 or older (65 o más)</td>
</tr>
</tbody>
</table>

8. How often do you cross the border as a pedestrian? or first time? (¿Qué tan frecuentemente cruza? o ¿primera vez que cruza?)

- _______ per week (veces a la semana)
- _______ per month (veces al mes)
- _______ per year (veces al año)
- _______ first time (es la primera vez que cruza)

9. What other modes of travel (besides walking) have you or will you use on this trip between where you started and where you will end your trip? (¿Qué otros modos de transporte (aparte de caminar) ha usado o usará para completar su viaje?)

<table>
<thead>
<tr>
<th></th>
<th>Mode of Travel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Auto (Auto)</td>
</tr>
<tr>
<td>2</td>
<td>Transit (Transporte Público)</td>
</tr>
<tr>
<td>3</td>
<td>Bicycle (Bicicleta)</td>
</tr>
<tr>
<td>4</td>
<td>Other (Otro)</td>
</tr>
</tbody>
</table>

10. How often do you walk more than five minutes without stopping? (¿Con qué frecuencia camina más de cinco minutos sin parar?)

- _______ per week (veces a la semana)
- _______ per month (veces al mes)
- _______ per year (veces al año)

11. On average, how long do you walk per day? (¿En promedio, cuánto tiempo camina al día?)

- _______ hours _______ minutes

12. Average daily distance that you walk per day? (¿Distancia promedio diaria que camina al día?)

- _______ mi _______ km

13. Type of walking facilities frequently used? (¿Qué tipo de instalaciones peatonales utiliza con frecuencia?)

<table>
<thead>
<tr>
<th></th>
<th>Facility Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sidewalks (major)/ Banquetas (calles principales)</td>
</tr>
<tr>
<td>2</td>
<td>Sidewalks (residential)/ Banquetas (residencial)</td>
</tr>
<tr>
<td>3</td>
<td>Paved walkways/ Caminos pavimentados</td>
</tr>
<tr>
<td>4</td>
<td>Parks/ Parques</td>
</tr>
<tr>
<td>5</td>
<td>Trails/ Senderos</td>
</tr>
<tr>
<td>6</td>
<td>Road/ Carretera</td>
</tr>
<tr>
<td>7</td>
<td>Other / Otro</td>
</tr>
</tbody>
</table>

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14. For the portion of your trip today that you were a pedestrian, did you use any of these walking facilities? ¿De la porción de su viaje que ha caminado/caminará hoy, utilizó o utilizará alguna instalación peatonal?)

<table>
<thead>
<tr>
<th></th>
<th>Yes (Sí)</th>
<th>No (No)</th>
</tr>
</thead>
</table>

15. How do you rate present pedestrian conditions in the International Bridge (Santa Fe) and downtown El Paso? ¿Cómo valora usted las condiciones peatonales en el puente internacional (Santa Fe) y el centro de El Paso?)

<table>
<thead>
<tr>
<th></th>
<th>Excellent (Excelentes)</th>
<th>Good (Buenas)</th>
<th>Fair (Aceptarables)</th>
<th>Poor (Deficientes)</th>
</tr>
</thead>
</table>

16. Which of the following accessibility deficiencies are problems in the International Bridge and/or downtown El Paso? ¿Cuál de las siguientes deficiencias son problema en el puente internacional y la zona centro de El Paso?)

<table>
<thead>
<tr>
<th></th>
<th>Gaps/Uneven sidewalks (Banquetas con huecos o desnivel)</th>
<th>Missing curb ramps (faltan rampas de acceso a las banquetas)</th>
<th>Narrow sidewalks (Banquetas estrechas)</th>
<th>Sidewalk obstructions (Obstáculos en las banquetas)</th>
<th>Other / Otro ____________________________</th>
</tr>
</thead>
</table>

17. How long did it take you to cross the border today, from the time you got in line on the other side and got here? ¿Cuánto tiempo le tomó cruzar la frontera desde que se formó en la línea hasta que cruzó?)

_____ hours _____ minutes

18. If there was delay… (Si tuvo alguna demora..)

What do you perceive is the primary cause for delay in crossing at this bridge as a pedestrian? ¿Cual piensa que fue la razón principal de dicha demora?)

__________________________________________

19. Will you consider crossing the border again as a pedestrian? And why? (Consideraría volver a cruzar la frontera a pie? Porqué?)

<table>
<thead>
<tr>
<th></th>
<th>Yes (Sí)</th>
<th>No (No)</th>
</tr>
</thead>
</table>

__________________________________________
### APPENDIX B:
EXAMPLE RESOURCES BY SECONDARY DATA BY ORGANIZATION

<table>
<thead>
<tr>
<th>Data Source Name</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of El Paso Department of Public Health</td>
<td>For clinic sites. PnD Mapa Data Source (contributing partner agency).</td>
</tr>
<tr>
<td>City of El Paso Development Services</td>
<td>For zoning. PnD Mapa Data Source (contributing partner agency).</td>
</tr>
<tr>
<td>City of El Paso GIS Division</td>
<td>PnD Mapa Data Source (contributing partner agency). Data on-line for download at this location appears limited.</td>
</tr>
<tr>
<td>City of El Paso Planning &amp; Economic Development</td>
<td>PnD Mapa Data Source (contributing partner agency). Note: land use data</td>
</tr>
<tr>
<td>El Paso City/County Health District</td>
<td>For hospital locations. PnD Mapa Data Source (contributing partner agency).</td>
</tr>
<tr>
<td>El Paso County Central Appraisal District</td>
<td>PnD Mapa Data Source (contributing partner agency). Inquiries will be made if ELCAD is able to release database identifier information beyond current IDs (public agency owners, railroad owners, very few private property owners are identified).</td>
</tr>
<tr>
<td>El Paso County Public Works Department</td>
<td>AKA “Roads and Bridges” Department PnD Mapa Data Source (contributing partner agency).</td>
</tr>
<tr>
<td>El Paso Independent School District</td>
<td>PnD Mapa Data Source (includes school location dataset from City of El Paso).</td>
</tr>
<tr>
<td>El Paso Metropolitan Planning Organization</td>
<td>PnD Mapa Data Source (contributing partner agency).</td>
</tr>
<tr>
<td>PasodelNorteMapa (PdN Mapa)</td>
<td><a href="http://www.pdnmapa.org/index.html">http://www.pdnmapa.org/index.html</a></td>
</tr>
<tr>
<td>Paso Del Norte Map for Public Access (PdN Mapa) is a coalition of agencies that are responding to the need for a state of the art, trans-boundary geographical information system (GIS) in the tri-state, binational region of far-west Texas, southern New Mexico, and northern Chihuahua, Mexico.</td>
<td></td>
</tr>
<tr>
<td>Sun Metro</td>
<td>PnD Mapa Data Source (contributing partner agency).</td>
</tr>
<tr>
<td>Texas Natural Resources Information System (TNRIS)</td>
<td><a href="http://www.tnris.org/get-data?type=state&amp;name=Texas&amp;quicktabs_maps_data=1">http://www.tnris.org/get-data?type=state&amp;name=Texas&amp;quicktabs_maps_data=1</a></td>
</tr>
<tr>
<td>A “centralized information system incorporating all Texas natural resource data, socioeconomic data related to natural resources, and indexes related to that data that are collected by state agencies or other entities.”</td>
<td></td>
</tr>
<tr>
<td>Data Source Name</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Texas Workforce Commission</td>
<td>Data available through TxDOT under specific licensing agreement. TWC Data is frequently used for TxDOT modeling studies and may be available for this study upon request. A variety of information is available for each employer, provided as point data located by latitude/longitude and address. Data includes business type, number of employees, etc.</td>
</tr>
<tr>
<td>United States Census Bureau</td>
<td>Various entities maintain Census data as a convenience to their users, including TNRIS and the PasodelNorteMapa website. For the purpose of this analysis, the researchers will utilize datasets available directly from the U.S. Census Bureau to ensure that the latest, most correct datasets are used.</td>
</tr>
</tbody>
</table>
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2012.


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