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16. Abstract

The TRANSBORDER data base described in this report has been a major objective of the Texas-Mexico Toll Bridge Study. Designed to serve research and planning purposes, this data base compiles information and survey data gathered during the course of this project. The data are stored and organized in several files that can be linked by binational entry system, geographical location (such as city or municipality), and time. The selected data base language (SAS) is simultaneously a powerful relational data base software and one of the most comprehensive statistical packages available. TxDOT, as an SAS subscriber, has many personnel acquainted with this software.

Consisting of a comprehensive, binational overview of the border region, the TRANSBORDER data base has been designed to easily accommodate future updates as more data become available. It contains the traffic history associated with binational entry systems and with all major highway links; socioeconomic data useful in transportation planning is also included. In addition,the data base includes a complete inventory of all binational entry systems and all major routes to the border. Because data collection is usually the most expensive and time-consuming phase of any project, the TRANSBORDER data base can minimize both time and expense.

A library of formatted variables was specially designed to work in conjunction with the TRANSBORDER data base. The formats in this library decode all numeric codes and short abbreviations used as variable values. This library serves three purposes. First, it makes the data base output as self-explanatory as possible, minimizing the need for reviewing this guide. Second, it improves the self-documentation power of the data base, a feature that assures that the data base will be used even in those offices having frequent turnover. Finally, the library makes the data base more cost effective in that its use of shorter values for variables saves what would otherwise require a considerable amount of storage space. Whenever convenient or necessary, these customized formats can be removed by using a macro especially written for this purpose.

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OVERVIEW OF THE TEXAS-MEXICO BORDER: DATA BASE

Research Report Number 1976-2

Research Project 7-1976
Texas-Mexico Toll Bridge Study

conducted for the

Texas Department of Transportation
and the Texas Turnpike Authority

by the

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

December 1993

IMPLEMENTATION STATEMENT

Given that the North American Free Trade Agreement (NAFTA) will accelerate the already burgeoning international traffic flowing between Texas and Mexico, state transportation officials are understandably concerned about the adequacy of the current border infrastructure. As part of the ongoing research efforts focusing on that infrastructure, this report documents the development, contents, and uses of the data base dubbed the TRANSBORDER data base.

Following its installation at TxDOT, the TRANSBORDER data base, which consists of a comprehensive, binational overview of the border region, will be available for use by any SAS-PC subscriber. This data base can also be considered a first step toward the development of the proposed Border Information System, which, when completed, would combine the TRANSBORDER data base with all other data bases developed by organizations similarly interested in assessing and monitoring the U.S.-Mexico transportation infrastructure.

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

ACKNOWLEDGEMENTS

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Rob Harrison

DISCLAIMERS

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

NOT INTENDED FOR CONSTRUCTION,
BIDDING, OR PERMIT PURPOSES

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SUMMARY

The TRANSBORDER data base described in this report has been a major objective of the Texas-Mexico Toll Bridge Study. Designed to serve research and planning purposes, this data base compiles information and survey data gathered during the course of this project. The data are stored and organized in several files that can be linked by binational entry system, geographical location (such as city or municipality), and time. The selected data base language (SAS) is simultaneously a powerful relational data base software and one of the most comprehensive statistical packages available. TxDOT, as an SAS subscriber, has many personnel acquainted with this software.

Consisting of a comprehensive, binational overview of the border region, the TRANSBORDER data base has been designed to easily accommodate future updates as more data become available. It contains the traffic history associated with binational entry systems and with all major highway links; socioeconomic data useful in transportation planning is also included. In addition, the data base includes a complete inventory of all binational entry systems and all major routes to the border. Because data collection is usually the most expensive and time-consuming phase of any project, the TRANSBORDER data base can minimize both time and expense.

A library of formatted variables was specially designed to work in conjunction with the TRANSBORDER data base. The formats in this library decode all numeric codes and short abbreviations used as variable values. This library serves three purposes. First, it makes the data base output as self-explanatory as possible, minimizing the need for reviewing this guide. Second, it improves the self-documentation power of the data base, a feature that will especially benefit those offices having frequent turnover. Finally, the library makes the data base more cost effective in that its use of shorter values for variables saves what would otherwise require a considerable amount of storage space. Whenever convenient or necessary, these customized formats can be removed by using a macro especially written for this purpose.

CHAPTER 1. INTRODUCTION

BACKGROUND

Effective transportation planning requires extensive data drawn from a number of areas. For example, such planning requires both socioeconomic information (i.e., population, vehicle ownership, and employment) and traffic information (i.e., volumes, road network condition, and commodity flow). Since data collection, reduction, and storage are the most time-consuming phases of most projects, costly duplication of efforts can be avoided—and greater optimization of public funds can be achieved—if researchers had access to a centralized data base of transportation-related information.

In the case of the Texas-Mexico border area, however, data collection efforts aimed at establishing a transportation data base are considerably impeded by the binational nature of the subject area. Special requirements include a staff that is bilingual and, at the same time, familiar with both countries' official agencies and data collection procedures. These requirements are considered essential in developing the international networks needed to obtain relevant border data.

The recently approved North American Free Trade Agreement (NAFTA) has also heightened the need for border-related studies and information. In response, this project has undertaken to provide a comprehensive, easily accessible data base that stores current transportation information relating to both sides of the border.

OBJECTIVE

Project 1976, the Texas-Mexico Toll Bridge Study, was occasioned by the need for coordinated transportation planning across the Texas Mexico Border, and by the recognition that the increase in U.S.-Mexico trade and the implementation of the North American Free Trade Agreement would certainly increase the need for periodic investigation of the border region. Accordingly, an efficient, easily accessible and clearly documented data base that can be updated as needed with minimum coding effort was considered paramount for effectively monitoring the transportation demand and infrastructure condition in the border region.

This report documents the development, use, and management of the TRANSBORDER data base. It can also serve as the data base "User's Guide," as it was structured to meet the needs of the data base user, the data base manager, and the analyst responsible for the technical applications of the data.

REPORT ORGANIZATION

This report contains all hardware- and software-related information required by the users and managers of the TRANSBORDER data base. It includes descriptions of data collection procedures, comparisons of different data sources, and examples of practical data applications that illustrate actual data use.

This report is organized into eight chapters. Chapter 1 outlines the report scope and objective, the data base purpose, the software, hardware, and organization. Each subsequent chapter provides detailed explanations of each data category, describing the data collection procedures, the structure of the data sets, the variable internal formats, and some data applications. A PROC CONTENTS output and a sample PROC PRINT output are provided for each data set for additional clarification and for user's guidance.

Chapter 2 discusses the storage and organization of inventory data of the existing and proposed binational entry systems. Chapter 3 explains the northbound and southbound traffic histories of each binational entry system (these histories are stored in separate files, depending on the data source and on the traffic direction). Chapter 4 discusses the traffic history of all main highway links to the binational entry systems. Chapter 5 describes the highway condition data collected during this project. These data include highway condition and travel time inventories of all main routes to the border, both in Texas and in Mexico. Chapter 6 describes the socioeconomic data, which are also binational and which are stored in separate files, according to data type and source. Chapter 7 describes the origin and destination survey data collected during this study at eight different binational bridge entry systems. In addition, Chapters 2 through 7 present examples or case studies that illustrate possible practical applications of the TRANSBORDER data base. Chapter 8 summarizes the data base contents and makes recommendations for future improvements.

The report also contains two appendices. Appendix A is the glossary of border-related terminology that appears in all Study 1976 reports. Appendix B, a list of the data base variables, depicts each variable name by alphabetical order, followed by their respective labels, formats, and data sets in which they appear.

SELECTION OF THE DBMS LANGUAGE AND COMPUTER

Before selecting the DBMS (data base management system) language, and before designing the data base structure, the data base designer must identify the typical user of the data, as well as the types of analyses the data base will be called on to support. To be cost-effective, the data base must be designed so as to resist quick obsolescence; that is, it must provide useful service for as long as possible, without it having to be redesigned or loaded into a different computer. TxDOT's substantial mainframe computer resources represent the most inexpensive solution, offering at the same time such additional advantages as easy accessibility of the data base for simultaneous users, and compatibility with software used by most research agencies. (Use of the data base on a microcomputer can be achieved by choosing a language that is supported by both a mainframe and a microcomputer.)

The DBMS software was selected based on five criteria considered essential for the efficient use of the TRANSBORDER data base. These criteria include:

1. **TxDOT Compatibility**. The data base should use a software available at both UT and TxDOT, so that it can be transferred from UT to TxDOT without its having to be recoded into another software. In addition, data base users should be able to access

the desired data and produce reports, plots, and analyses with a minimum amount of time spent on training; accordingly, it should give priority to a software presently used by the client.

2. **Ease of access to statistical and graphical routines**. The language should provide immediate access to a powerful statistical and graphical package.
3. **Ease of output in standard file format.** The DBMS package should produce output in standard data file format that can be directly read by other applications.
4. **Self-documentation**. The DBMS must have inseparable and easily retrieved internal documentation. Such documentation would minimize disruptions caused by personnel turnovers and the time spent on manual consultations.
5. **Microcomputer compatibility**. The language should be available on at least one mainframe computer and on one microcomputer.

Three DBMS packages available at The University of Texas at Austin's IBM 3081 were considered: NOMAD™, SQL™ and SAS™ (Refs 1, 2, and 3). Languages running exclusively on the other mainframes were not considered because they fail to meet criteria 1, 2, and 5. NOMAD™ is a very powerful hierarchical and relational data base software, but it does not satisfactorily meet any of the above five criteria, especially the first. SQL™ is a powerful relational data base language, and its data retrieval instructions can be mastered with little training. It is the language used by the ORACLE™ data base, which in turn can be directly read by the geographic information system package INTERGRAPH™, as well as by SAS™. SQL™ was given serious consideration; however, it fails to meet criteria 1 and 2 and scores poorly with respect to criterion 3. Only SAS™ was able to satisfy all five criteria above, especially the first and the second. Its versatility is further underscored by the fact that TxDOT is a SAS™ subscriber and its personnel have been trained in its use. Consequently, the TRANSBORDER data base is written in SAS.

DATA BASE ORGANIZATION AND STRUCTURE

The TRANSBORDER data base structure and organization reflect both the variety of data subjects and the geographical organization of the study. Along with its space-saving fixed variable feature, the data base contains master files capable of storing long character variables (e.g., bridge names and codes for long character variables that appear in large data sets). This master-file feature is coupled with internally formatted variables that automatically decode all variable values stored as abbreviations and/or numerical codes.

Geographical Organization of this Study

For organizational purposes, and in accordance with the contract, this study is divided into two segments. Segment 1 begins at the Gulf of Mexico and ends west of Laredo just beyond the Colombia Bridge. Segment 2 begins immediately west of the Colombia Bridge and ends at

the Texas-New Mexico border west of El Paso. The two study segments are shown in Figure 1.1. Data base users and managers should be aware of this geographical organization because it was determined that, in some cases, the best way to organize the data was to separate the files by segment.

Data Base Structure

The data stored in the TRANSBORDER data base can be classified according to the following broad categories:

(1) inventory of binational entry system,

(2) socioeconomic data,

(3) traffic history of each bridge,

(4) traffic history of main network links,

(5) infrastructure inventory, and

(6) origin/destination.

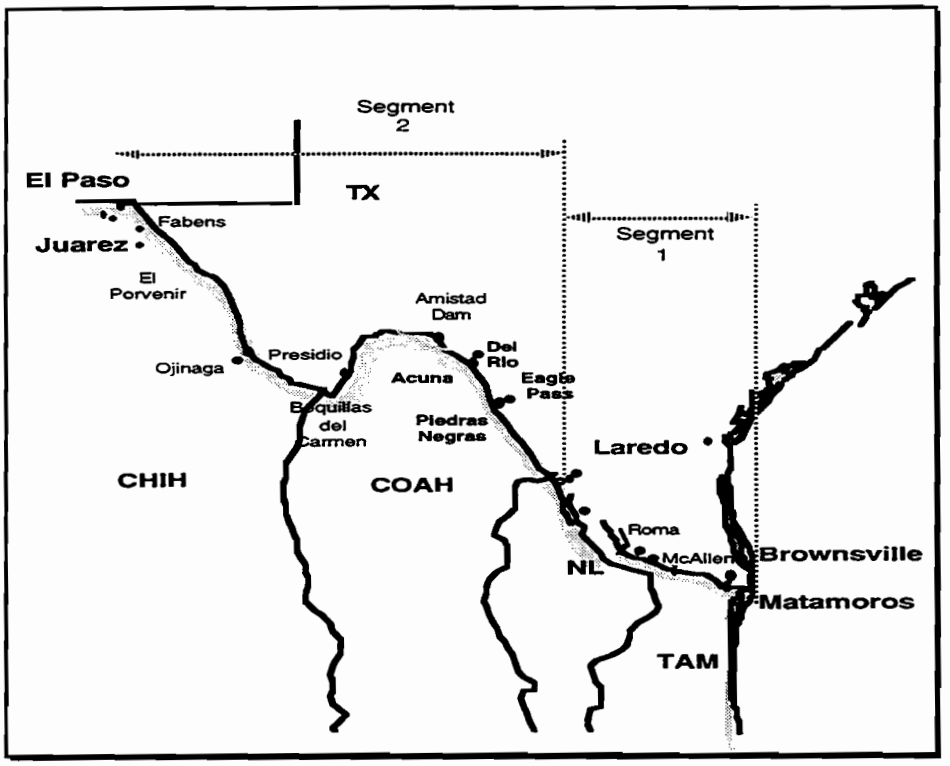

Figure 1.1. Geographical division of border into two segments

As shown in Figure 1.2, the data have a strong relational nature, a characteristic that must be reflected in the data base structure if the design is to save storage space and ensure easy

retrieval. Each data category is stored in one or more exclusive SAS™ data sets, with the main relational variables for merging files being geographical locations and codes that identify binational entry systems. When applicable, data sets can also be merged by other variables, such as year or other time variables. The list of variables provided in Appendix B facilitates the quick selection of relational link variables.

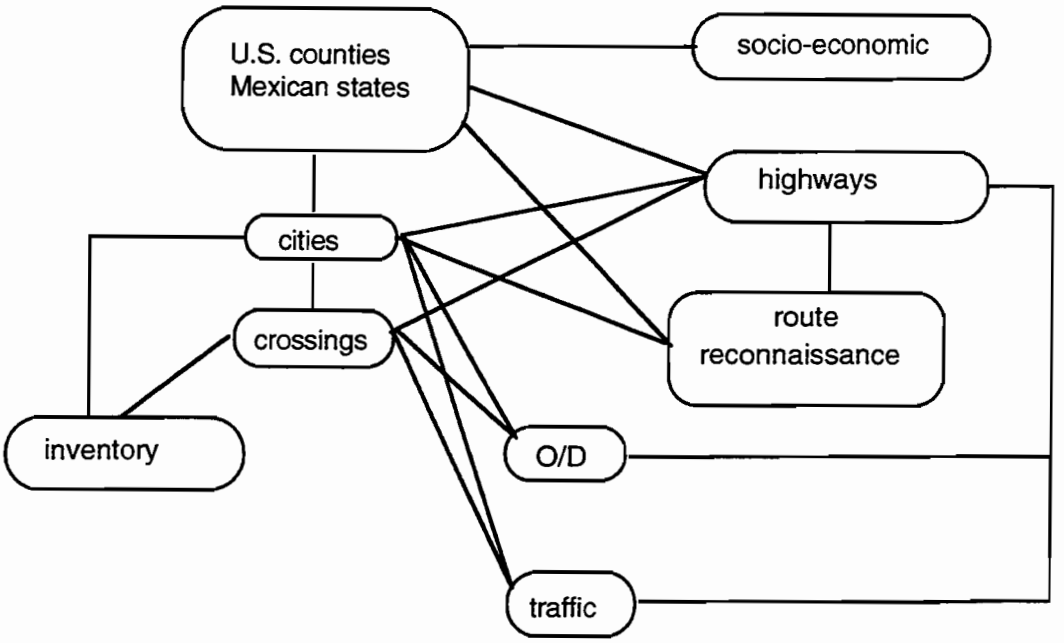

Figure 1.2. General data base structure

Data Base Organization

Each TRANSBORDER data base file is a SAS™ data set in a typical IBM-CMS virtual machine system. The file names of the data sets are acronyms of their contents, and the file modes are always SDS, which stands for SAS DATA SET. The data set labels explain in more detail the data set contents. All variables in the data sets have labels with the character '*' (star or uppercase 8) as the split character for the SPLIT option in PROC PRINT.

Several data sets contain internally formatted variables; these formats are stored in the format library "FORLIB DATABASE" discussed later in this chapter. In most cases, the format name is the same as the name of the variable it formats. Table 1.1 summarizes the three basic types of files that are part of the data base. The detailed contents of each data set are tabulated and explained in the other chapters of this manual.

Table 1.1. Three types of files in TRANSBORDER data base

File Category	File names	File Type	Example / Comments
SAS Data Set	Acronym of the data it contains	SDS	**ODSEG2.SDS**, for segment 2 origin and destination survey data set
Library of Formats	FORLIB	DATABASE	Formats have the same name as the variables they format
Format removal macro	UNFORLIB	DATABASE	Macro to remove customized formats

STORAGE SPACE OPTIMIZATION

The design of the TRANSBORDER data base includes two space-saving features that provide considerable economy in terms of storage space and which, at the same time, improve the self-documentation power of the data base. These features include the formats used to decode variable values and the fixed lengths of numeric and character variables. The former is complemented by a macro used to remove the customized internal formats and allow the user to work with unformatted variables when convenient.

Library of Formats

Being a comprehensive data base, TRANSBORDER compiles a large amount of information that is expected to continuously grow as more data are received. The binational nature of the information it contains, coupled with the various types of data from different engineering and socioeconomic sources, and the need for periodic data additions and updating create several data storage problems. One of these problems is the frequent occurrence of long names of Mexican cities and municipalities, which are too long to be stored as they are, but need to appear correctly printed in the data reports. Another problem are long values of character variables that are part of very large data sets. For example, the values "BUSINESS" or "SCHOOL" for variable PURP (trip purpose in the origin and destination files) require a considerable amount of storage space in a data set that contains several thousand records, and it is imperative that such variables be given values that do not exceed two bytes. On the other hand, efficiency in reporting the data requires that values of variables be as self-explanatory as possible. It was thus imperative to devise ways to save space, while at the same time keep the data reports as informative as possible.

SAS™ has the capability of allowing user-customized formats for decoding variable values. These formats can in turn be stored in a macro called for during any program execution. This design provides self-explanatory data reports and saves a considerable amount of space. Customized formats are created with PROC FORMAT statements that need to be either part of the program or part of an external file to be loaded in the beginning of the program. All the PROC FORMAT statements used to create the customized formats for the TRANSBORDER data base were stored in a macro file called "FORLIB.DATABASE;" all the user needs to do to obtain self-explanatory printouts is to run this macro in the program.

In some cases, it is either more convenient or necessary to work with unformatted variables, and to see their real values in the printout. File "UNFORLIB.DATABASE" removes internal formats and writes out the actual values for each variable (instead of the formatted values). While file "FORLIB.DATABASE" can be construed as a library of formats, "UNFORLIB.DATABASE" is a SAS macro used to remove the customized formats assigned to variables. Either file can be automatically added to any SAS program that uses the TRANSBORDER data base by including either one of the following statements at the beginning of the program:

```
%INCLUDE 'FORLIB DATABASE A'; or
%INCLUDE 'UNFORLIB DATABASE A'
```

where:

%INCLUDE = Command to load the file into the program as a macro, and compile the statements,

FORLIB = File name,

UNFORLIB = File name,

DATABASE = File type, and

A = File mode, or disk where the file resides.

File FORLIB.DATABASE automatically decodes all variable values coded acronyms, numeric codes, or short abbreviations, while file UNFORLIB.DATABASE automatically removes these internal formats and causes the program to work with actual values.

Fixed Variable Lengths

In the SAS™ system, all variables are stored by default in eight bytes. When using character variables that represent, for example, bridge names, it is necessary to use a longer length. Conversely, when using integers known not to exceed a certain value, shorter lengths are more than sufficient for storing all values without a loss of precision.

Changes in the default variable length were made using the LENGTH command in the DATA step. This command is a very powerful tool capable of saving space in the database, as well as securing longer lengths when necessary. The length statement overrides the default eight-byte variable length and defines new lengths that become the new default lengths for the associated variables of the data set being created or modified in that particular DATA step. These lengths, specified in the PROC CONTENTS output, can be modified using a different length statement in a DATA step. If shorter lengths are defined, the variable values are truncated in the new data set.

Real numbers cannot be stored in fewer than eight bytes without losing precision, because in most cases they must be multiples or submultiples of the potencies of 2 to be meaningfully stored in shorter lengths. Since real numbers were always stored using the default length of eight bytes, they were avoided as often as possible by using submultiples of units

whenever this practice yielded meaningful integer numbers that could be stored in less space.

Most long character variables were stored as short abbreviations decoded by customized internal formats, though sometimes it was necessary to store the character variable as the complete name, as in the case of binational entry system names in the main inventory file. Such variables require a length of 25 or more bytes, which were also defined in the DATA step that created the data set. These variables were used exclusively in small master files that can be merged with other files when necessary.

Integer variables, which, owing to the discrete nature of most data, occur often in the TRANSBORDER data base, seldom require the default length of eight bytes to be stored at full precision; shorter lengths were used in all files containing discrete data (e.g., traffic volumes). Since the LENGTH statement in the DATA step assigns a new permanent length to the variable in the data set, any new data set created by setting the old one will have these shorter lengths, which may not be sufficiently long to store new variables being created with calculations over the old ones. When in doubt, it is always advisable to redefine the lengths before performing the calculations or adding new data; a quick check of the variable magnitude helps determine the necessary lengths. An understanding of the internal representation of the integers in the IBM system is helpful in verifying if the predefined length is sufficient for storing the desired new variables, as well as to assign new lengths at the beginning of a program.

In order to maintain precision when the values become large, the IBM uses floating point representation to represent numeric values. The default storage space is eight bytes, and each byte has eight bits, or two half-bytes (also termed nibbles).

The first bit of the first byte is the sign of the number. It will take the values of 0 for positive numbers and 1 for negative numbers. The next seven bits of the first byte store the characteristic, or exponent. Instead of using another bit for the exponent sign, the system converts the exponent into its value plus a bias of 64 (decimal representation), which is always stored in binary. For example, an exponent of -2 is stored as 62, and an exponent of +2 is stored as 66, as shown in Equations 1.1 and 1.2 (both in decimal representation).

$$62 = 64+(-2) \tag{1.1}$$

$$66 = 64+2 \tag{1.2}$$

The mantissa is saved in the other seven bytes, in hexadecimal representation; although it is always less than 1, it is saved as an integer, as the system automatically assigns the floating point right before the first nibble of the first byte. For example, the integer 125 is stored as $0.125X10^3$ (decimal representation), as shown in Figure 1.3. In this figure, the representations used by the IBM system are shown in the bottom row of bytes and are translated into decimal representation on the top row. The top row is shown in Figure 1.3 for convenience, as no computer system stores numbers in decimal representation.

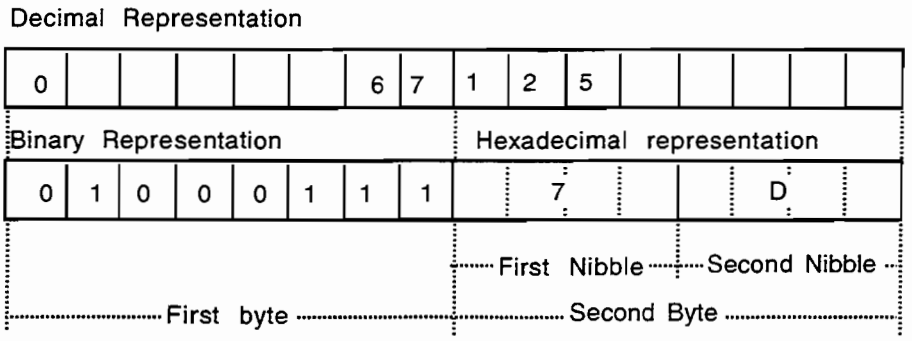

Figure 1.3. Storage of an integer

It is clear from Figure 1.3 that two bytes are sufficient for storing the number 125, or any other number that is not a perfect potency of 2, and is equal to or less than 255 (decimal representation), which corresponds to the maximum hexadecimal digit in both nibbles of the second byte. Since 255 takes a characteristic of 3, and the characteristic can go up to 240, very large numbers can be stored in two bytes, though even the first decimal digit could be wrong owing to truncation of the two-byte hexadecimal representation.

Considering that each hexadecimal byte cannot be larger than FF (hexadecimal representation), the maximum integers that can be represented by each length without losing precision are shown in Table 1.2.

Assuming that a variable in a 15,000-record data set is known to be an integer below 1,000 (decimal representation), this variable alone would require 120K bytes of storage space with the default length, while only 45K bytes are sufficient if a 3-byte length is defined. This can make difference between the possibility or impossibility of loading the data set into a convenient personal computer.

Table 1.2. Maximum integers for each length

Length	**Maximum Integer**	
(bytes)	**Decimal**	**Hexadecimal**
2	255	FF
3	65,535	FFFF
4	16,777,215	FFFFFF
5	4,294,967,295	FFFFFFFF
6	over 10^{11}	FFFFFFFFFF

The variable length is the default length every time a new data set is created by setting the old one in a DATA step. Before adding new numerical data to the data base, or before setting an existent data set to perform calculations that will redefine the existing variables as larger numbers, it is imperative that one check whether the new variable value overshoots its length.

Table 1.2 can be used as guidance to redefine the variable lengths before performing calculations that redefine variable values, or adding new data to the data set.

SUMMARY

The TRANSBORDER data base is written in SAS™, a powerful relational data base language and one of the most comprehensive statistical packages available. The SAS™ language was chosen because, in addition to serving the purposes of the data base, TxDOT is a SAS™ subscriber; consequently the data base can be implemented in its system and used immediately, obviating any further training. As the SAS system is available in a microcomputer version, the TRANSBORDER data base can be adapted for the personal computer with minimum recoding efforts. The TRANSBORDER data base consists of several SAS™ data sets, a library of formats to decode variable abbreviations into their unformatted values, and a macro to remove the internal formats whenever convenient or necessary.

Character variables and integer variables in each data set were compressed to the minimum acceptable length using the LENGTH statement in the DATA step, which overrides the default eight-byte length and permanently associates the new length to the variable. This saved the considerable amount of space that would otherwise be required to store the TRANSBORDER data base. However, the fixed lengths require special care to avoid truncation when updating the variables to larger values.

The TRANSBORDER data base can be used by any person familiar with the basics of the SAS™ language. However, use of any data base requires detailed knowledge of its contents. Thus, the next chapters describe the storage and the characteristics of all components of the TRANSBORDER data base.

CHAPTER 2. INVENTORY DATA

INTRODUCTION AND OBJECTIVE

The inventory files summarize the information pertinent to all existing and proposed bridge, dam, and ferry binational entry systems (including inspection facilities) along the Texas-Mexico border. The purpose of the inventory files is to permit easy access to basic information about the entry system, as well as to serve as a data base relational link by binational entry system (i.e., they are *not* intended to replace a comprehensive site description, such as found in Report 1976-1 of this study). This chapter describes in detail each inventory data set included in the TRANSBORDER data base.

INVENTORY DATA USER'S GUIDE

The three inventory files of the TRANSBORDER data base store basic information regarding existing, under-construction, and proposed binational entry systems. These files are the main relational link with all other files, which can be merged by site, by city, and/or by larger geographic region.

The MAIN INVENTORY data set (INVM.SDS) contains information common to existing and proposed binational entry systems, such as names, transportation modes carried, and number of lanes. The EXISTING CROSSINGS INVENTORY data set (INVEX.SDS) contains information pertaining only to existing entry systems, such as the structural features and characteristics of the inspection facilities. The PROPOSED CROSSINGS INVENTORY data set (INVPR.SDS) contains information pertaining exclusively to proposed entry systems (e.g., status of presidential permit). Toll information is supplemented by a TOLL SCHEDULES file (TOLL.SDS) that contains the current northbound and southbound toll prices for vehicular and pedestrian traffic in 1992 dollars. Table 2.1 summarizes the overall organization of the inventory data.

Table 2.1. Summary of the inventory data

SAS Data Set	Contents
INVM.SDS	Inventory information for existing, under-construction and proposed binational entry systems
INVEX.SDS	Inventory information for existing binational entry systems only
INVP.SDS	Inventory information for proposed binational entry systems only
TOLL.SDS	Toll schedules in 1992 dollars

MAIN INVENTORY FILE (INVM.SDS)

The purpose of the MAIN INVENTORY data set (INVM.SDS) is to identify and geographically locate all the crossings. There are 26 variables containing such information as bridge names in the U.S. and in Mexico, toll status, and road connections. Current information on this data set was obtained mainly from TxDOT, CAPUFE, U.S. and other Mexican bridge

owners and managers, and from direct information collected on field trips. Table 2.2 explains the contents of the main inventory file, depicting its variables by name, the possible values they may assume, and, when applicable, the name of the FORMAT that decodes their values.

Five variables identify the binational entry system in the INVM.SDS data set, namely, IBWC, USN1, USN2, MEXN1, and MEXN2. Numeric variable IBWC is a unique identification number used for all existing, under-construction, and proposed sites, from Brownsville to El Paso. It is the relational link between the three inventory data sets, as well as between all data sets pertaining to individual binational entry systems. The values of the IBWC variable are distances along the Rio Grande taken from the international boundary maps and approved by the IBWC Commission in Minute No. 253, September 23, 1976, in hectometers (tenths of kilometers). The distance, starting at the Gulf of Mexico, increases upstream toward El Paso, Texas. This identification setup allows additional information on the site location without having to use extra storage space. Hectometers were used instead of kilometers to keep all values as integers and to save five bytes of additional space. Some proposed sites either do not have a precise location or have not yet been identified by IBWC. These are indicated in the data base by a negative IBWC number, the absolute value of which is the best estimate of the distance from the proposed site location to the Gulf. The IBWC values are shown in Table 2.3 for segment 1 and 2, organized in ascending order from the Gulf of Mexico to El Paso. The character variables USN1, USN2, MEXN1, and MEXN2, respectively, store the two most common U.S. and Mexican names.

Traffic-related variables include TD, which refers to traffic direction; TF, which identifies the type of facility used by the traffic (i.e., bridge, dam, or ferry); and MODE, which specifies the transportation modes carried by the facility. Geometry variables are LANES, NB, and SB, which are the total number of lanes, number of northbound lanes, and number of southbound lanes, respectively.

Historical information about the system is given by the numeric variable OPEN, which indicates the year a binational entry system started operations. It assumes the value of -1 for sites under construction, a negative year if the opening date is unknown, and the value of -2 for proposed entry systems. These designations minimize the space that would otherwise be required to store a variable that distinguishes between proposed and existing binational entry systems. Such information can be printed as "EXISTING," "PROPOSED," and "UNDER CONSTRUCTION" using the internal format "$OPEN.," which is discussed later in this section.

In addition to the IBWC code, character variables COUNTY, MEXST, USCITY, and MEXCITY geographically locate the site. These are the U.S. county, the Mexican state, the nearest U.S. city, and the nearest Mexican city, respectively. AREAUS and AREAMEX identify the type of setting that encompasses the binational entry system in each country (i.e., rural, industrial, or urban).

The names of the approaching local facilities and the nearest main highway link on both sides of the border are given by character variables USFACM, USFACL, MEXFACM, and MEXFACL. Information about the toll status is provided by TOLLS and TOLLN for the

northbound and southbound traffic directions, respectively. Finally, the facility ownership is given in variables USAG and MEXAG for U.S. and Mexican sides, respectively.

Table 2.2. Contents of INVM.SDS

Variable	Type	Meaning	Format	Values
IBWC	Numeric (real)	Unique number identifying each binational entry system by its distance from the Gulf, as shown in Table 2.3. Negative if estimated.		Positive=distance in hectometers from Gulf to the binational entry system, according to IBWC. Negative=estimated distance.
USN1	Character	Name of binational entry system in the USA		Actual name
USN2	Character	Alternative US name		Actual name
MEXN1	Character	Name of binational entry system in Mexico		Actual name
MEXN2	Character	Alternative Mexican name		Actual name
TD	Character	Direction of traffic carried by facility.	$TD.	N=northbound traffic S=Southbound traffic 2=two-way traffic
TF	Character	Type of facility	$TF.	B=bridge F=ferry D=dam
MODE	Character	Type of transportation modes supported by the entry system	$MODE.	T=commercial vehicles C= private vehicles P=pedestrian R= Rail
LANES	Numeric	Total (two-way) number of lanes		
NB	Numeric	Number of lanes going into US (Northbound direction)		Integer number of vehicular lanes
SB	Numeric	Number of lanes going into Mexico (Southbound direction)		
OPEN	Numeric	year open to traffic	$OPEN.	Positive=actual year open Negative=best year estimate -1=under construction -2=proposed crossing
COUNTY	Character	US County name		Actual name
MEXST	Character	Mexican state name		Actual name
USCITY	Character	Name of nearest US city		City name
MEXCITY	Character	Name of nearest Mexican city		City name
AREAUS	Character	Type of area in US	$AREA.	R=rural I=industrial U=urban
AREAMEX	Character	Type of area in Mexico	$AREA.	
USFACM	Character	Name of main US approaching facility		Name of transportation artery (e.g., I-35).
USFACL	Character	Name of local US approaching facility		Street name
MEXFACM	Character	Name of main Mexican approaching facility		Name of transportation artery (e.g. MEX4)
MEXFACL	Character	Name of local Mexican approaching facility		Street name

Table 2.2. Continued

Variable	Type	Meaning	Format	Values
TOLLS	Character	Toll status, US southbound traffic	$TOLL.	T=toll F=free
TOLLN	Character	Toll status, Mexican northbound traffic	$TOLL.	T=toll F=free
USAG	Character	Names of US agencies operating or proposing the binational entry system.		Owner name, such as "CITY_OF_EL_PASO." For proposed bridges, it may assume value "NO_SUPPORT," if US does not support the Mexican proposal.
MEXAG	Character	Names of Mexican agencies operating or proposing the binational entry system.		Owner name, such as CAPUFE. For proposed bridges, it may assume value "NO_SUPPORT," if Mexico does not support the US proposal.

The INVM.SDS data set contains 45 observations and 26 variables, of which 8 have internal formats. Exhibit 2.1 shows a PROC CONTENTS output of data set INVM.SDS, while Exhibit 2.2 shows the PROC PRINT output of the first five observations in INVM.SDS. The PROC PRINT was run using the "SPLIT='*' " option, which prints variable labels rather than variable names.

Table 2.3. Values of IBWC variables

IBWC Distance	Segment 1	IBWC Distance	Segment 2
-200	Port_of Brownsville	7977	Eagle_Pass_rail
-200	Port_of Brownsville_rail	-7979	Eagle_Pass#2
844	Brownsville_Expressway	7987	Eagle_Pass#1
895	Gateway	9029	Del_Rio
896	Gateway	9236	Lake_Amistad
907	B&M	12501	La_Linda
-1000	Flor De Mayo	15405	Presidio/Ojinaga Rail
1585	Los_indios	15424	Presidio/Ojinaga
1985	B&P	19221	For_Hancock
2230	Donna	19586	Fabens/Caseta
2488	Pharr	19929	Ysleta/Zaragoza-Commercial
2565	Hidalgo	19930	Ysleta/Zaragoza-Noncommercial
2566	Hidalgo	20078	Bota
-2740	Anzalduas	20116	Good_Neighbour
-2741	Anzaldius_rail	20118	Mexican_Central_Railroad
-2787	Mission	20120	Paso_Del_Norte
3289	Los_Ebanos Ferry	20121	Mexican_Central_Railroad _II
-3293	Los_Ebanos		
3779	Rio_Grande		
4104	Roma		
4423	Lake_Falcom_dam		
5806	Juarez_Lincoln		
5808	Laredo#1		
5817	Laredo_Nuevo_Laredo_rail		
-5973	Laredo#3		
-5974	Union_Pacific_rail		
6318	Colombia		

Exhibit 2.1. PROC contents output for INVM.SDS

CONTENTS PROCEDURE

Data Set Name: SDS.INVM Observations: 44
Member Type: DATA Variables: 26
Engine: V608 Indexes: 0
Created: 14:35 Wednesday, December 15, 1993
Observation Length: 410
Last Modified: 14:35 Wednesday, December 15, 1993
Deleted Observations: 0
Protection: Compressed: NO
Data Set Type: Sorted: NO
Label: INVENTORY - MAIN FILE

-----Engine/Host Dependent Information-----
Data Set Page Size: 16384
Number of Data Set Pages: 2
File Format: 607
First Data Page: 1
Max Obs per Page: 39
Obs in First Data Page: 31
Userid : FTFD445
File : INVM SDS

-----Alphabetic List of Variables and Attributes-----

#	Variable	Type	Len	Pos	Format	Label
25	AREAMEX	Char	1	401	$AREA.	TYPE OF*AREA IN*MEXICO
18	AREAUS	Char	1	314	$AREA.	TYPE OF*AREA IN US
10	COUNTY	Char	10	135		
26	IBWC	Num	8	402		
8	LANES	Num	2	131		NO OF*LANES
22	MEXAG	Char	30	367		MEXICAN*AGENCY
13	MEXCITY	Char	15	164		
17	MEXFACL	Char	45	269		MEXICAN LOCAL*FACILITY
14	MEXFACM	Char	20	179		MEXICAN MAIN*FACILITY
3	MEXN1	Char	30	65		MEXICAN*NAME-1
4	MEXN2	Char	30	95		MEXICAN*NAME-II
11	MEXST	Char	4	145		MEXICAN*STATE
7	MODE	Char	4	127	$MODE.	TYPES OF*TRAFFIC
23	NB	Num	2	397		NO LANES*NORTHBOUND
9	OPEN	Num	2	133	$OPEN	YEAR OPENED*OR PROPOSED
24	SB	Num	2	399		NO LANES*SOUHTBOUND
6	TD	Char	1	126	$TD.	TRAFFIC*DIRECTION
5	TF	Char	1	125	$TF.	TYPE OF*FACILITY
19	TOLLN	Char	1	315	$TOLL.	TOLL*NORTHBOUND
20	TOLLS	Char	1	316	$TOLL.	TOLL*SOUTHBOUND
21	USAG	Char	50	317		US*AGENCY
12	USCITY	Char	15	149		
16	USFACL	Char	45	224		US LOCAL*FACILITY
15	USFACM	Char	25	199		US MAIN*FACILITY
1	USN1	Char	35	0		US NAME-I
2	USN2	Char	30	35		US NAME-II

Exhibit 2.2. PROC print output for INVM.SDS — sample

OBS	IBWC	USN1	USN2	MEXN1
1	-200	PORT_OF_BROWNSVILLE		
2	-200	PORT_OF_BROWNSVILLE_RAIL		
3	844	BROWNSVILLE_EXPRESSWAY	LOS_TOMATES	MATAMOROS3
4	895	GATEWAY		MATAMOROS
5	896	GATEWAY		MATAMOROS
6	907	B&M		BYM
7	-1000	FLOR_DE_MAYO		
8	1585	LOS_INDIOS	FREE_TRADE	LUCIO_BLANCO
9	1985	B&P	PROGRESO	LAS_FLORES
10	2230	DONNA		RIO_BRAVO

OBS	MEXN1	TD	TF	MODE
1		TWO WAY	BRIDGE	TRUCK,CAR,PED
2		TWO WAY	BRIDGE	RAIL
3		TWO WAY	BRIDGE	TRUCK,CAR,PED
4	NUEVO,PUERTA,MEXICO	NORTHBOUND	BRIDGE	TRUCK,CAR,PED
5	NUEVO,PUERTA,MEXICO	SOUTHBOUND	BRIDGE	TRUCK,CAR,PED
6		TWO WAY	BRIDGE	TRUCK,CAR,PED,RAIL
7		TWO WAY	BRIDGE	TRUCK,CAR,PED
8	LOS_INDIOS,LIBRE_COMERCIO	TWO WAY	BRIDGE	TRUCK,CAR,PED
9	NUEVO_PROGRESO	TWO WAY	BRIDGE	TRUCK,CAR,PED
10		TWO WAY	BRIDGE	TRUCK,CAR,PED

OBS	OPEN	COUNTY	MEXST	USCITY	MEXCITY
1	U/CONSTRUCTION	CAMERON	TAM	BROWNSVILLE	MATAMOROS
2	U/CONSTRUCTION	CAMERON	TAM	BROWNSVILLE	MATAMOROS
3	U/CONSTRUCTION	CAMERON	TAM	BROWNSVILLE	MATAMOROS
4	68	CAMERON	TAM	BROWNSVILLE	MATAMOROS
5	-50	CAMERON	TAM	BROWNSVILLE	MATAMOROS
6	-50	CAMERON	TAM	BROWNSVILLE	MATAMOROS
7	92	CAMERON	TAM	BROWNSVILLE	MATAMOROS
8	92	CAMERON	TAM	LOS_INDIOS	LUCIO_BLANCO
9	53	HIDALGO	TAM	PROGRESO	NUEVOPROGRESO
10	U/CONSTRUCTION	HIDALGO	TAM	DONNA	RIOBRAVO

OBS	NB	SB	LANES	AREUS	AREAMEX
1	2	2	4	INDUSTRIAL	RURAL
2	.	.	1	INDUSTRIAL	RURAL
3	2	2	4	URBAN	URBAN
4	2	0	2	URBAN	URBAN
5	0	2	2	URBAN	URBAN
6	1	1	2	URBAN	URBAN
7	.	.	.	URBAN	RURAL
8	2	2	4	RURAL	RURAL
9	1	1	2	RURAL	URBAN
10	2	2	4	RURAL	RURAL

Exhibit 2.2. Continued

OBS	USFACM	USFACL
1	SH4	NEW_ROAD_TO_SH4
2		
3	US83/77	EXTENTION_OF_US83
4	US83/77	INTERNATIONAL_BLVD.
5	US83/77	E_14TH_STREET,E_ELIZABETH_STREET
6	US83/77	MEXICO_STREET
7	US83,US281	EXTENTION_OF_FLOR_DE_MAYO
8	US83,US281	FM509
9	US83,US281	FM_1015
10	US83,US281	FM493

OBS	MEXFACM	MEXFACL	TOLLS	TOLLN
1	MEX2	NEW_ROAD_TO_MEX2	TOLL	
2			TOLL	
3	MEX101,MEX2	NEW_ROAD_TO_MEX2	TOLL	
4	MEX101,MEX2	ALVARO_OBREGON		TOLL
5	MEX101,MEX2	ALVARO_OBREGON	TOLL	
6	MEX101,MEX2	ALVARO_OBREGON,E_CARRANZA	TOLL	TOLL
7	MEX2	NEW_ROAD_TO_MEX2	TOLL	
8	MEX2	NEW_ROAD_TO_MEX2	TOLL	TOLL
9	MEX2	SH_NUEVO_PROGRESO	TOLL	TOLL
10	MEX2	NEW_ROAD_TO_MEX2	TOLL	

OBS	USAG	MEXAG
1	PORT_OF_BROWNSVILLE	NO_SUPPORT
2	PORT_OF_BROWNSVILLE	NO_SUPPORT
3	BROWNSVILLE_&_CAMERON_COUNTY	
4	GSA	CAPUFE
5	CAMERON_COUNTY	GOM
6	B&M_BRIDGE_COMPANY	B&M_BRIDGE_COMPANY
7	CITY_OF_BROWNSVILLE	
8	CAMERON_COUNTY,CITIES_OF_SAN-BENITO_&_HARLINGEN	UNDER_CONSESSION
9	B&P_BRIDGE_COMPANY	CAPUFE
10	CITY_OF_DONNA	

The six formats shown in Table 2.2 and in Exhibit 2.1 are part of the library of formats FORLIB.DATABASE, which must be called at the beginning of any SAS™ program using INVM.SDS. The PROC FORMATS that create these internal formats are shown in Exhibit 2.3.

Exhibit 2.3. PROC formats for INVM.SDS variables

```
PROC FORMAT; VALUE $TD
'N' = 'NORTHBOUND'
'S' = 'SOUTHBOUND'
'2' = 'TWO WAY';

VALUE $OPEN
'-1' = 'U/CONSTRUCTION'
'-2' = 'PROPOSED';

VALUE $MODE
'TCP' = 'TRUCK,CAR,PED'
'TCPR'  = 'TRUCK,CAR,PED,RAIL'
'R' = 'RAIL'
'CP' = 'CAR,PED'
'TP' = 'TRUCK,PED';

VALUE $TF
'F' = 'FERRY'
'D' = 'DAM'
'B' = 'BRIDGE';

VALUE $TOLL
'F' = 'FREE'
'T' = 'TOLL';
```

In the case of inventory files, the standard reports usually consist of PROC PRINT outputs of the desired variables. Partial printouts, such as a listing of all bridges in a certain county, can be easily produced from a temporary data set created by setting INVM.SDS with an appropriate IF statement that retrieves only the desired subset. Since this type of program requires only elementary SAS instructions, takes very little time to be written, and depends on the particular needs of the moment, no supplementary programs are included with INVM.SDS.

EXISTING BINATIONAL ENTRY SYSTEMS FILE (INVEX.SDS)

The existing binational entry system file, also called the INVEX.SDS (INV for inventory and EX for existing), contains technical and inventory data about each existing system. All types of existing binational entry systems are stored in the same data set for two reasons: the vast majority of them are vehicular, and little storage space would be saved by storing non-vehicular entry systems in a separate file. Consequently, some variables in INVEX.SAS pertain only to vehicular bridges and are not applicable to other types of entry systems. The following sections explain the contents, organization, and variables of this file.

Data Set Contents and Organization

The binational entry systems are identified by their IBWC number in this data set. Additional identification, such as the U.S. or Mexican name, can be obtained by merging

INVEX.SDS to INVM.SDS using the variable IBWC. The data stored in INVEX.SDS can be classified into three categories: bridge inspection variables, layout of inspection facilities, and other — i.e., information relating to bridge geometry and remodeling.

Bridge Inspection Variables

The bridge condition variables derive from the Bridge Inventory, Inspection, and Appraisal Program (BRINSAP) prepared for the National Bridge Inventory (NBI) data base. Bridges under the BRINSAP program are inspected at intervals of 2 years (±6 months) by an inspector with at least 5 years' experience in bridge inspections and who completed a training course based on the *Bridge Inspector's Training Manual 70* (Ref 2). Bridge inspections along the Texas-Mexico border began in 1991, with fifteen bridges having been inspected so far. These inspections were carried out under an agreement between Texas, Mexico, and the U.S., and they include both the U.S. and the Mexican side of the bridges. The inspection data are part of the NBI and BRINSAP data bases.

Each bridge in the BRINSAP data base is part of a record of 115 items that describe the bridge condition, history, geographical location, and other characteristics. These items are numbered and described in the BRINSAP manual by their item number. The TRANSBORDER data base contains twelve of these BRINSAP items, which consist of ratings given by TxDOT inspectors to the following items: deck, superstructure, substructure, channel, approaches condition, approach roadway alignment, waterway adequacy, signs and illumination, traffic safety features, and the overall ratings for structural evaluation and deck geometry. The inspection year is stored as integer variable YRINSP. Because some of the BRINSAP items consist of more than one variable, the TRANSBORDER data base actually contains 20 bridge inspection variables. The value of each of these variables is the actual rating stored in the BRINSAP data base. Format $B01N. decodes these ratings according to their actual meanings, which are described below based on the BRINSAP *Manual of Procedures* (Ref 3). Table 2.4 shows a summary of the bridge inspection variable names, meanings, values, and corresponding BRINSAP item numbers.

Variable YRINSP, corresponding to BRINSAP item 90, takes a four-digit value to indicate the latest inspection year. Variable POST, indicating whether the bridge is load-posted, takes the value of "NO" if not posted, and the four-digit year if posted. The other variables are ratings given to specific elements of the bridge according to inspection procedures normalized by the Federal Highway Administration. The TRANSBORDER data base contains the BRINSAP variables that can indicate to the transportation planner the overall condition of the bridge and/or whether it is in need of repair, rehabilitation, or replacement.

Traffic safety features are stored in character variables that correspond to BRINSAP item 36. These variables are abbreviated as GR, GREND, GRTR, and RAIL, indicating whether approach guardrails, approach guardrail ends, approach guardrail transitions, and bridge railings, respectively, meet current standards. Each of these features receives a code of "0" if it does not meet the standards, "1" if the feature meets standards, and "N" if the feature is not required.

Format $B01N. decodes such values according to their meaning. The name of the format indicates the values taken by the variables it formatted. Current safety feature standards are described in pages 3-4 through 3-6 of the BRINSAP *Manual of Procedures* (Ref 3).

Numeric variables DECKR, SUPR, SUBR, CHR, APPR, SER, DGR, WWAR, ALIGR, ILLUR, and SIGNR receive ratings on a scale of 0 to 9, or a rating of "N" when the component is not applicable, as in the case of item 58 for non-vehicular bridges (e.g., rail bridges). A rating of 9 indicates new condition, whereas a rating of 4 or lower indicates poor or critical condition. Table 2.5, taken from the BRINSAP *Manual of Procedures*, defines these codes.

Numeric variable DECKR, or BRINSAP roadway component item 58, is the deck portion of a bridge carrying vehicular traffic. The inspection rating takes into account the condition of the wearing surface (if it exists), the joints, the drainage system, and such other elements as curbs, sidewalks, and parapets.

Numeric variable SUPR, which corresponds to BRINSAP superstructure component item 59, is the portion of the structure that spans the substructure units and carries dead traffic loads. The *Manual for Maintenance Inspection of Bridges* (Ref 1), the *Bridge Inspector's Training Manual 70* (Ref 2), and the BRINSAP *Manual of Procedures* describe usual types of superstructure and substructure elements, including conditions that should be taken into account during inspection.

SUBR, or the substructure component (item 60), includes the abutments and the piers or bents that support the superstructure and transfer loads down into the ground. The BRINSAP *Manual of Procedures* discusses these elements, along with the conditions and elements to be inspected, in detail.

Rivers and other waterways are considered channels, and variable CHR (or BRINSAP item 61) rates the condition of the channel and the channel protection (e.g., channel banks and ripraps). Variable CHR stores the channel ratings in the TRANSBORDER data base.

Variable OPR, or operating rating, indicates the heaviest permissible load that may safely use the bridge for an indefinite period of time. Inspectors take into account the thickness of any existing overlays to rate this variable, which takes values according to the Manual for Maintenance Inspection of Bridges and BRINSAP Manual of Procedures. These values are the letter "H" followed by a number that indicates the maximum load in short tons. For example, a value of H15 indicates that the bridge is safe for a 15-ton truck.

Variable APPR, or approaches rating, is BRINSAP item 65. It indicates the condition of the roadway approach for vehicular bridges, taking as its values those listed in Table 2.5. The approach component includes the embankment near the abutments, the slope protection (e.g., riprap and vegetation), approach slabs or pavement, joints between the bridge, and the roadway pavement, drainage, delineation, and sight distance. A low rating indicates that its approaching structures are in poor condition (though the bridge structure itself may be in good condition).

Table 2.4. Bridge inspection variables

Variable Name	Variable Meaning	BRINSAP Item		Format	Variable Values and Corresponding Decoding
		Number	Name		
YRINSP	Year of inspection	90	Last in-spection date		2-digit year of recorded inspection
POST	Posted for load?	N/A	N/a	$POST.	N if not posted 2-digit year of posting if load-posted.
GR	Approach guardrail rating	36	Traffic Safety Features	$B01N.	0=feature does not meet standards 1=feature meets standards N=feature not required
GREND	Approach guardrail ends rating				
GRTR	Approach guardrail transitions rating				
RAIL	railings rating				
DECKR	Deck rating	58	Deck condition		Ratings from 0 to 9, or n if not applicable (see table 2.5)
SUPR	Superstructure rating	59	Super-structure condition		Ratings from 0 to 9, or n if not applicable (see table 2.5)
SUBR	Substructure rating	60	Sub-structure condition		Ratings from 0 to 9, or n if not applicable (see table 2.5)
CHR	Channel rating	61	Channel-protection		Ratings from 0 to 9, or n if not applicable (see table 2.5)
OPR	Maximum load that can safely use the bridge	64	Operating rating		"h" ratings according to reference 1
APPR	Approaches rating	65	Roadway approach condition		Ratings from 0 to 9, or n if not applicable (see table 2.5)
SER	Structural evaluation rating	67	Structure evaluation		Ratings from 0 to 9, or n if not applicable (see table 2.5)
DGR	Deck geometry rating	68	Deck geometry		Ratings from 0 to 9, or n if not applicable (see table 2.5)
LOAD	Safe load capacity	70	Safe load capacity		Ratings from 0 to 5 (see table 2.6)
WWAR	Waterway adequacy rating	71	Waterway adequacy		Ratings from 0 to 9, or n if not applicable (see table 2.5)
ALIGR	Approach roadway alignment rating	72	Approach roadway alignment		Ratings from 0 to 9, or n if not applicable (see table 2.5)
DMAT	Deck material	428-435	N/A		Description of deck material
ILLUR	Illumination rating	N/a	Misc.	$SIGN.	Ratings from 0 to 9, or n if not applicable (see table 2.5)
SIGNR	Signs rating	N/a	Misc.	$SIGN.	Ratings from 0 to 9, or n if not applicable (see table 2.5)

Table 2.5. Condition ratings (Ref 3)

Rating	Description	Condition with respect to desirable criteria	Condition of Element
9	New condition	Superior to present desirable criteria	GOOD: The component is new or in good condition. Preventative maintenance may be desirable
8	No repairs needed	Equal to present desirable criteria	
7	Generally good condition. Potential for minor maintenance	Better than present minimum criteria	
6	Fair condition. Potential for major maintenance	Equal to present minimum criteria	FAIR: The component is satisfactorily performing its function, but repair is necessary
5	Generally fair condition. Potential for minor rehabilitation	Somewhat better than minimum adequacy to tolerate leaving in place as it is	
4	Marginal condition. Potential for major rehabilitation	Meets minimum tolerable limits to be left in place as it is	POOR: The component is still performing its function but at minimum level. Repair work deserves immediate attention
3	Poor condition. Repair or rehabilitation required immediately	Basically intolerable condition requiring high priority of corrective action	
2	Critical condition. Bridge should be closed until repairs are complete	Basically intolerable condition requiring high priority of replacement	CRITICAL: The component is not performing its function. Traffic cannot safely use the bridge
1	Critical condition. Bridge closed but repairable	Bridge can be reopened with a complete rehabilitation (value not used for items 67,68,71, and 72)	
0	Critical condition. Bridge closed and beyond repair	Bridge closed	
N	Not applicable	Not applicable	Not applicable

Variable SER, the structural evaluation rating, is partially based on the condition ratings of the roadway, superstructure, and substructure. The rating system depicted in Table 2.5 is also used for this variable, which can be interpreted as a summary of the structural evaluation of the bridge.

Variable DGR, or deck geometry, is BRINSAP item 68. Applied to vehicular bridges, it measures the adequacy of the bridge width, vertical clearances to any existing overhead construction, and other geometric characteristics that affect the volume and/or size of vehicular traffic using the facility.

Variable LOAD, or safe load capacity, is very important in effective transportation planning, representing as it does the bridge capacity to carry the state legal load. This variable corresponds to BRINSAP item 70, and it takes the values depicted in Table 2.6.

Table 2.6. Ratings for Variable LOAD

Rating	Meaning
5	Operating rating equal to or above legal loading
4	Operating rating 0.1 to 9.9% below legal loading
3	Operating rating 10 to 19.9% below legal loading
2	Operating rating 20 to 29.9% below legal loading
1	Operating rating 30 to 39.9% below legal loading
0	Operating rating 39.9% or more below legal loading

Variable WWAR, or waterway adequacy, is BRINSAP item 71, which represents the adequacy of the waterway to carry peak water flows. The primary criterion is the frequency of the design flood. In the case of the Rio Grande, the IBWC requires that all bridges span the Rio Grande floodway. Ratings are given according to Table 2.5, with a rating of 3 or lower indicating that the bridge is not in accordance with the IBWC requirements.

Variable ALIGR, or approach roadway alignment, applies to vehicular bridges. Its value identifies bridges that do not function properly or safely owing to the alignment of the approaches. Elements considered in this rating include, but are not limited to, horizontal and vertical curves and headlight distances. While a bridge would rarely, if ever, be replaced owing to a poor rating in this variable, it should nonetheless be classified as obsolete (see ratings in Table 2.5).

Variable DMAT, or deck material, is a short description of the deck material, including the type of overlay, if any. Together with other variables, such as OPR, this variable helps in visualizing the overall deck status and the influence of the overlay on the maximum live load. The BRINSAP data base is more comprehensive than the TRANSBORDER data base, especially in that the former includes several items for describing fully all bridge component materials.

Miscellaneous items in BRINSAP, including signs and illumination, are rated according to Table 2.5. Variables ILLUR (illumination rating) and SIGNR (signs rating) store the condition of these elements in the TRANSBORDER data base. They are formatted internally by $Sign with a value 'N,' as in 'Not Applicable.'

Thorough understanding of bridge inspection procedures requires a familiarity with the *Manual for Maintenance Inspection of Bridges*, the *Bridge Inspector's Training Manual 70*, and the BRINSAP *Manual of Procedures*. The values of inspection variables, decoded according to Table 2.5, are usually sufficient for indicating the need for and/or urgency of repairs; this information is, in addition, sufficient for transportation planning studies.

Inspection Facilities Variables

Traffic at binational entry systems is stopped and interrupted several times for a number of inspection procedures that involve Customs, Immigration, and the Department of Agriculture. The information was obtained from the GSA manual and from information collected during the

field trips conducted by CTR. Transportation planning and capacity assessment are highly dependent on the geometric layout and on staffing capabilities of these different inspection facilities. Accordingly, the TRANSBORDER data base has nineteen variables for the inspection facilities and toll booth layout. These variables are explained in Table 2.7.

Table 2.7. Inspection facilities variables

Variable	Type	Meaning	Format	Values
USPRI	Numeric	Number of U.S. primary inspection booths for non commercial traffic		Number of primary inspection booths
USEC	Numeric	Number of U.S. secondary inspection booths for non commercial traffic		Number of secondary inspection booths.
EXUSPRI	Numeric	Total number of booths that the U.S. primary inspection facility can have or be expanded to	INSPL.	0 = No Room -1 = Under Study -2 = N/A to GSA -3 = Not Utilized
EXUSEC	Numeric	Total number of booths that the U.S. secondary inspection facility can have or be expanded to	INSPL.	0 = No Room -1 = Under Study -2 = N/A to GSA -3 = Not Utilized
MEXPRI	Numeric	Number of noncommerical Mexican primary inspection booths		Number of primary inspection booths.
MEXSEC	Numeric	Number of noncommercial Mexican secondary inspection booths		Number of secondary inspection booths.
CUSPRI	Numeric	Number of U.S. primary inspection booths for commercial traffic	COMINSP.	2 = N/A to GSA -3 = Not Utilized
CMEXPRI	Numeric	Number of Mexican primary inspection booths for commercial traffic	COMINSP.	2 = N/A to GSA -3 = Not Utilized
USISIZE	Numeric	Site size for the U.S. border station facility in acres		
USNUBU	Numeric	Number of buildings at the U.S. border station facility		
USDOWI	Numeric	Dock width for the U.S. import lot		
USNUDO	Numeric	Number of docks at the U.S. import lot		
MENUDO	Numeric	Number of docks at the Mexican import lot		
BRIDREM	Numeric	Year of major remodeling of the bridge		
USREM	Numeric	Year of last remodeling or major improvement in the U.S. inspection facilities		
MEXREM	Numeric	Year of last remodeling or major improvement in Mexican inspection facilities		Four digit year of remodeling;-1 if under consideration for remodeling zero if never remodeled missing if unknown or uncertain
TOLLNB	Number	Number of toll booths on the Mexican side in the northbound direction		Number of toll booths 0=if free
TOLLSB	Number	Number of toll booths on the U.S. side in the southbound direction		Number of toll booths

Numeric variables USPRI and USEC store the number of U.S. primary and secondary inspection booths, respectively, for noncommercial traffic. Numeric variables EXUSPRI and EXUSEC show the total number of inspection booths that the U.S. facilities can accommodate for primary and secondary inspections, respectively. Some of the bridges either lack room for further expansion or the process is under study. Codes given to these values are formatted internally by INSPL. MEXPRI and MEXSEC show the number of Mexican primary and secondary inspection booths for noncommercial traffic.

Numeric variables CUSPRI and CMEXPRI store the number of commercial primary inspection booths on the U.S. and Mexican sides, respectively. In some of the bridges the space is not utilized as a commercial inspection lane. The values for these variables are decoded by COMINSP. Numeric variable USISIZE stores the U.S. site size for the border inspection facility in acres. Variable USNUBU stores a numeric value for the number of the existing buildings at the U.S. border station facility.

Variable USDOWI represents the dock width in the U.S. import lot. Variables USNUDO and MENUDO store the number of docks at the U.S. and Mexican import lots, respectively. Numeric variables BRIDREM, USREM, and MEXREM represent the years of major remodeling for the bridge itself, the U.S. inspection facilities, and the Mexican inspection facilities, respectively. The year of the remodeled structure is stored as a four-digit number (e.g., "1990"). The four-digit number was used to accommodate and differentiate between 20th- and 21st-century remodeling. If the facility is under construction, the value is -1; if never remodeled, it is 0; and if the remodeling year is unknown or undetermined, the value is omitted.

TOLLSB and TOLLNB are numeric variables that identify the number of toll booths in the southbound and northbound directions, respectively. The value of 0 is given for free facilities.

Some of these variables' values, coded as short abbreviations or numeric codes, are always associated with an internal format from LIBFORM.DATABASE that decodes the variable values. Report 1976-1 describes in detail the border operations procedures and inspections on both the U.S. and Mexican sides.

Other Variables

The TRANSBORDER data base has five geometric layout variables that describe bridge or dam length, number of pedestrian lanes, and curb-to-curb width (stored in variable WIDTH). Variables USLEN, MEXLEN, and TOTLEN store the lengths of the U.S. part, the Mexican part, and the total length, respectively. While TOTLEN is always equal to USLEN+MEXLEN, it is stored as a separate variable because, in some cases, only the total length can be obtained. Variable PEDLN stores the number of pedestrian lanes on the bridge. Some bridges have only one sidewalk used by pedestrians crossing from one country into the other. Other bridges have two sidewalks — one used for southbound traffic and one used for northbound traffic. These self-explanatory variables are depicted in Table 2.8.

Table 2.8. Other variables in INVEX.SDS

Variable	Type	Meaning	Format	Values
WIDTH	Numeric	Curb-to-curb width length		Width length in centimeter
USLEN	Numeric	Length on U.S. side		length in meters
MEXLEN	Numeric	Length on Mexican side		length in meters
TOTLEN	Numeric	(USLEN+MEXLEN)		length in meters
PEDLN	Numeric	Pedestrian lanes		Number of pedestrian lanes

Summary

File INVEX.SDS contains variables that describe the layout and condition of existing binational entry systems across the Texas-Mexico border. These variables are internally formatted to decode ratings and other numeric codes that have specific meanings.

Exhibit 2.4 shows a PROC CONTENTS output of INVEX.SDS. The internal formats shown in this exhibit are further documented in Exhibit 2.5 (from FORLIB.DATABASE). Exhibit 2.6 shows a PROC PRINT output of the first ten observations of this data set.

PROPOSED CROSSINGS FILE (INVP.SDS)

The usual process by which a proposed binational entry system comes into existence consists of the following basic steps:

(1) Plan the new binational entry system
(2) Commit funds
(3) Select site
(4) Perform environmental assessment
(5) Get presidential or required permit
(6) Design
(7) Bid
(8) Construct
(9) Open to traffic

Steps (2) through (6) do not necessarily show the order of the steps — some could possibly be carried out simultaneously. The above is basically a list of procedures considered when a binational bridge entry system is proposed. Report 1976-1, "Overview of the Texas-Mexico Border: Background," fully describes all steps needed to plan and approve a new binational entry system, both in the U.S. and in Mexico. However, information on the nine steps above is sufficient to summarize the status of any proposed entry system. When the process reaches step (8), it must be deleted from the PROPOSED SITES file (INVP.SDS), and the INVENTORY FILE (INVM.SDS) must be updated to indicate the new facility under construction and (after construction) the year opened to traffic. When step (9) is reached, it must be added to the EXISTING SITES file (INVEX.SDS). As more data (e.g., traffic counts) become available for the new facility, appropriate files must be updated as well.

The PROPOSED SITES file is aimed at presenting the status of all proposed binational entry systems using as many self-explanatory variables as possible. Table 2.9 lists the contents of

this file, named INVPR.SDS (INV for inventory and PR for proposed).

Exhibit 2.4. PROC contents output for INVEX.SDS

```
CONTENTS PROCEDURE

Data Set Name: SDS.INVEX                    Observations:         26
Member Type:   DATA                         Variables:            44
Engine:        V608                         Indexes:              0
Created:       13:00 Wednesday, December 15, 1993
Observation Length:   126
Last Modified: 13:00 Wednesday, December 15, 1993
Deleted Observations: 0
Protection:                                 Compressed:           NO
Data Set Type:                              Sorted:               NO
Label:         INV DATA - EXISTING BRIDGES
              -----Engine/Host Dependent Information-----
Data Set Page Size:       7168
Number of Data Set Pages: 2
File Format:              607
First Data Page:          1
Max Obs per Page:         56
Obs in First Data Page:   10
Userid  :                 FTFD445
File    :                 INVEX    SDS

          -----Alphabetic List of Variables and Attributes-----
 #    Variable    Type    Len    Pos    Format      Label
-----------------------------------------------------------------------------
18    ALIGR       Num       2     36       APPROACH*ROADWAY*ALIGNMENT*RATING
13    APPR        Num       2     26              APPROACHES*RATING
33    BRIDREM     Num       3     92              YR-BRIDGE*REMOD
11    CHR         Num       2     20              CHANNEL*RATING
29    CMEXPRI     Num       2     84    COMINSP.  COMM - MEX*PRIMARY BOOTHS
28    CUSPRI      Num       2     82    COMINSP.  COMM - US*PRIMARY BOOTHS
 8    DECKR       Num       2     14              DECK*RATING
15    DGR         Num       2     30              DECK*GEOMETRY*RATING
19    DMAT        Char     30     38              DECK*MATERIAL
25    EXUSEC      Num       2     76    INSPL.    MAX BOOTHS*SEC - US
24    EXUSPRI     Num       2     74    INSPL.    MAX BOOTHS*PRIMARY - US
 4    GR          Char      1     10    $B01N.    APPROACH*GUARDRAIL*RATING
 5    GREND       Char     11           $B01N.    APPROACH*GUARDRAIL*
                                                              TRANSITION*RATING
 6    GRTR        Char      1     12    $B01N.    APPROACH*GUARDRAIL*ENDS
                                                              RATING
 1    IBWC        Num       3      0              CODES*FOR BRIDGES*BY IBWC
20    ILLUR       Char      1     68    $SIGN.    ILLUMINATION*RATING
16    LOAD        Num       2     32              SAFE*LOAD*CAPACITY
38    MENUDO      Num       2    104              NUMBER*OFDOCKS*
                                                              MEXIMPORT*LOT
41    MEXLEN      Num       2    112              MEX-SIDE*BR LEN
26    MEXPRI      Num       2     78              MEX PRIMARY*INSP BOOTHS
35    MEXREM      Num       2     98              YR-REM*MEX INSP FAC
27    MEXSEC      Num       2     80              MEX SEC*INSP BOOTHS
12    OPR         Char      4     22              MAX LOAD*ON THE*BRIDGE
43    PEDLN       Num       2    116              PEDESTRIAN*LANES
 3    POST        Char      4      6    $POST.    POSTED*FOR LOAD
 7    RAIL        Char      1     13              RAILINGS*RATING
14    SER         Num       2     28              STRUCTURAL*EVALUATION*
                                                              RATING
21    SIGNR       Char      1     69    $SIGN.    SIGNS*RATING
10    SUBR        Num       2     18              SUBSTRUCTURE*RATING
 9    SUPR        Num       2     16              SUPERSTRUCTURE*RATING
36    TOLLNB      Num       2    100              MEXSIDE*TOLLBOOTHS
37    TOLLSB      Num       2    102              US-SIDE*TOLLBOOTHS
```

Exhibit 2.5. PROC formats for variables in INVEX.SDS

```
PROC FORMAT; VALUE $POST
'N' =  'NOT POSTED';

VALUE $B01N
 '0' = 'BELOW STANDARDS'
 '1' = 'MEETS STANDARDS'
 'N' = 'FEATURE UNREQ';

VALUE $SIGN
'N' =  'NOT APPLICABLE';

VALUE  INSPL
 0 = 'NO ROOM'
-1 = 'UNDER STUDY'
-2 = 'N/A TO GSA'
-3 = 'NOT UTILIZED';

VALUE COMINSP
-3 = 'NOT UTILIZED'
-2 = 'N/A TO GSA';
```

Exhibit 2.6. Formatted PROC print output for INVEX.SDS

OBS	IBWC	YRINSP	POST	GR	GREND
1	895	1992	NOT POSTED	BELOW STANDARDS	BELOW STANDARDS
2	896	1992	NOT POSTED	BELOW STANDARDS	BELOW STANDARDS
3	907	.			
4	1585	.			
5	1985	1991	NOT POSTED	BELOW STANDARDS	BELOW STANDARDS
6	2565	1992	NOT POSTED	BELOW STANDARDS	BELOW STANDARDS
7	2566	1992	NOT POSTED	BELOW STANDARDS	BELOW STANDARDS
8	3289	.			
9	3779	1991	NOT POSTED	BELOW STANDARDS	BELOW STANDARDS
10	4104	.			

OBS	GRTR	RAIL	DECKR	SUPR	SUBR	CHR	OPR	APPR	SER	DGR
1	BELOW STANDARDS	0	7	7	8	8	HS20	7	6	2
2	BELOW STANDARDS	0	7	7	6	8	HS20	8	0	7
3			.	.	.	.		.	.	.
4			.	.	.	.		.	.	.
5	BELOW STANDARDS	8	8	8	8	8	HS20	8	0	7
6	BELOW STANDARDS	0	7	7	8	8	HS20	7	7	9
7	BELOW STANDARDS	0	7	8	7	8	HS20	7	7	2
8			.	.	.	.		.	.	.
9	BELOW STANDARDS	0	7	8	8	7	HS20	7	7	4
10			.	.	.	.		.	.	.

Exhibit 2.6. Continued

OBS	LOAD	WWAR	ALIGR	DMAT	ILLUR	SIGNR	USPRI	USSEC
1	5	9	3	REINF_CONC_W/AC_OVer	8	8	4	17
2	2	9	3	REINF_CONC_W/AC_OVer	8	8	.	.
3	.	.	.				4	12
4	.	.	.				4	12
5	4	7	7		8	8	4	16
6	5	9	3	REINF_CONC_W/AC_Over	8	8	12	45
7	5	9	3	REINF_CONC_W/AC_Over	8	8	.	.
8	.	.	.				1	1
9	5	7	5	REINF_CONC	8	8	1	4
10	.	.	.				4	14

OBS	EXUSPRI	EXUSEC	MEXPRI	MEXSEC	CUSPRI	CMEXPRI	USISIZE
1	6	NO ROOM	.	.	4	.	10.0
2	.	.	4	15	.	.	.
3	6	18	1	5	NOT UTILIZED	.	12.0
4	12	36	3	10	NOT UTILIZED	3	50.0
5	6	NO ROOM	2	.	NOT UTILIZED	.	4.0
6	N/A TO GSA	N/A TO GSA	.	.	2	.	28.0
7	.	.	5	.	.	1	.
8	N/A TO GSA	N/A TO GSA	1	.	0	0	1.0
9	3	6	1	1	0	.	2.5
10	NO ROOM	NO ROOM	5	20	0	1	4.0

OBS	USNUBU	USDOWI	USNUDO	MENUDO	USREM	MEXREM	TOLLNB	TOLLSB	WIDTH
1	3	25	20	.	1991	.	.	3	.
2	.	.	.	60	.	.	3	.	.
3	3	.	15	60	1992	.	3	2	.
4	6	50	50	.	.	.	4	2	.
5	3	25	14	.	1989	.	3	2	.
6	4	24	33	.	.	.	.	4	1220
7	.	.	.	.	.	.	6	.	1220
8	2	0	0	.	.	.	1	1	.
9	1	25	6	.	.	.	.	1	.
10	4	50	18	.	.	.	2	2	.

OBS	USLEN	MEXLEN	TOTLEN	PEDLN	BRIDREM
1	82	64	146	1	.
2	78	101	179	1	.
3	.	.	.	1	1941
4	.	.	.	2	.
5	.	.	.	2	1983
6	.	.	160	2	1988
7	.	.	153	2	.
8	.	.	.	0	.
9	.	.	.	1	.
10	.	.	.	2	.

Table 2.9. Contents of INVPR.SDS

Variable	Type	Meaning	Format	Values
IBWC	Numeric	Identification of crossing		Same unique number as in INVM.SDS
DATE	Numeric	Date information was compiled	DATE7.	Month/day/year
USP	Numeric	Status of U.S. presidential permit	USPP.	If granted=year granted If pending=negative year submitted If pending and year submitted not known= -1 If not yet applied for= 0
MEXOF	Character	Official application in Mexico		Y=finished and approved N=not done
MEXINT	Character	Intersecretariat agreement status		Y=finished and approved N=not done
USF	Numeric	Amount of funds committed by USA in millions of 1993 dollars		Positive #=approved Negative #=committed
MEXF	Numeric	Amount of funds committed by Mexico in millions of 1993 dollars		
USOURCE	Numeric	Source of U.S. funds	SOURCE.	1=federal 2=state 3=local 4=private 5=not known
MSOURCE	Numeric	Source of Mexican funds	SOURCE.	
USENV	Character	Environmental Analysis Status in the U.S.		S=submitted NS=not submitted A=approved Date=month/year
MENV	Character	Environmental Analysis Status in Mexico		
USITE	Character	U.S. final bridge location		Y=site location is known N=not known
MSITE	Character	Mexican final bridge location		
USDES	Numeric	U.S. bridge design status	$DES.	1=no design yet 2=preliminary bridge design 3=final bridge design
MEXDES	Numeric	Mexican bridge design status	$DES.	
MCONC	Character	Shows whether the bridge on the Mexican side will be put under concession or not		Y=concession N=not under concession

Variable IBWC is the same unique bridge identification number used in INVM.SDS and discussed earlier in this chapter. Variable DATE, indicating the date the information was collected, uses default format $DATE7. The data in this variable need to be updated every time new information is available. Variable USP depicts the status of the U.S. presidential permit approval. If the application has not been submitted, the variable takes the value of 0. If the application has been granted, the variable is the four-digit year (when granted). If the application is still pending, it takes the value of –1 times the year submitted. If the application is pending, but the year of submission is unknown, it takes the value of –1.

Mexico, on the other hand, has two permits: the official application MEXOF, and the Intersecretariat Agreement MEXINT. Variable MEXOF indicates whether the official application was approved. The official application is obtained by having preliminary approval from the Government of Mexico (i.e., diplomatic notes have been exchanged, positive preliminary discussions have been held). Variable MEXINT, or the Intersecretariat Agreement, stores information on the status of the final approval from the Government of Mexico.

Variables USF and MEXF depict the amount of funds committed or approved by U.S. and Mexico, respectively, in millions of 1992 dollars. A positive number means funds are approved, while a negative number indicates funds are committed. Variables USOURCE and MSOURCE show the source of U.S. and Mexican committed or approved funds. The funds could come from federal, state, local, or private sources.

USINV and MINV show the status of the environmental analysis in the U.S. and in Mexico. The environmental analysis is mandated in the U.S. for every proposed bridge. In Mexico there is no official requirement for an environmental impact study to be undertaken prior to approving a bridge proposal. However, the federal government, through SEDESOL, is working to include an environmental impact analysis as a requirement to the approval process. The variable MINV was included at this time to accommodate SEDESOL future plans. The information in the data base indicates whether the environmental analysis has been submitted, not submitted, or approved. The date of submittal or approval is also added whenever available.

USITE and MSITE show whether the site location is known on both sides of the border. The character (Y) is given if the final site location is known, and (N) when the exact site is not known. Numeric variables USDES and MEXDES give information about the design stage status in the U.S. and Mexico, respectively. The information indicates whether the design is in progress and if the design is in its preliminary or final stages. Finally, MCONC indicates whether the bridge on the Mexican side will be put up for concession. (Bridges are put up for concession when the government does not have the funds needed for construction.)

A PROC CONTENTS output for INVPR.SDS is included in Exhibit 2.7, and a PROC FORMATS corresponding to the formats depicted in Exhibit 2.7 is included in Exhibit 2.8. Exhibits 2.9 and 2.10 present a formatted PROC PRINT and an unformatted PROC PRINT of this data set, respectively.

Exhibit 2.7. PROC contents output of INVP.SDS

CONTENTS PROCEDURE

Data Set Name: SDS.INVP Observations: 10
Member Type: DATA Variables: 16
Engine: V608 Indexes: 0
Created: 13:58 Wednesday, December 15, 1993
Observation Length: 52
Last Modified: 13:58 Wednesday, December 15, 1993
Deleted Observations: 0
Protection: Compressed: NO
Data Set Type: Sorted: NO
Label: INV - PROPOSED BRIDGES

-----Engine/Host Dependent Information-----

Data Set Page Size: 3072
Number of Data Set Pages: 1
File Format: 607
First Data Page: 1
Max Obs per Page: 58
Obs in First Data Page: 10
Userid : FTFD445
File : INVP SDS

-----Alphabetic List of Variables and Attributes-----

#	Variable	Type	Len	Pos	Format	Label
15	DATE	Num	8	36		DATE*INFORMATION*COMPILED
1	IBWC	Num	3	0		CODES*FOR BRIDGES*BY IBWC
14	MCONC	Char	1	35	$MCONC.	WHETHER BR*ON MEX*SIDE*UNDER CONCESSION
9	MENV	Char	8	21	$ENV.	ENVIRONMENTAL*ANALYSIS* STATUS - MEX
13	MEXDES	Num	2	33	DES.	MEX BRIDGE*DESIGN*STATUS
5	MEXF	Num	2	7		FUNDS*COMMITTED*BY MEX*IN MILL$
4	MEXINT	Char	1	6	$MEXOFAP.	INTERSECRETARIAT*AGREEMENT STATUS
3	MEXOFAP	Char	1	5	$MEXOFAP.	OFFICIAL*APPLICATION*IN MEXICO
11	MSITE	Char	1	30	$SITE.	MEX FINAL*BRIDGE*LOCATION
7	MSOURCE	Num	2	11	SOURCE.	SOURCE*OF MEX*FUNDS
12	USDES	Num	2	31	DES.	US BRIDGE*DESIGN*STATUS
8	USENV	Char	8	13	$ENV.	ENVIRONMENTAL*ANALYSIS* STATUS - US
16	USF	Num	8	44		FUNDS*COMMITTED*BY US* IN MILL $
10	USITE	Char	1	29	$SITE.	US FINAL*BRIDGE*LOCATION
6	USOURCE	Num	2	9	SOURCE.	SOURCE*OF US *FUNDS
2	USP	Num	2	3	USPP.	STATUS*OF US*PRESIDENTIAL* PERMIT

Exhibit 2.8. FORMATS used in INVP.SDS.

```
PROC FORMAT ; VALUE SOURCE
1 = 'FEDERAL'
2 = 'STATE'
3 = 'LOCAL'
4 = 'PRIVATE'
5 = 'NOTKNOWN';

VALUE DES
1 = 'NO DESIGN'
2 = 'PRELIM DESIGN'
3 = 'FINAL DESIGN';

VALUE $ENV
'S' = 'SUBMITTED'
'NS' ='NOT SUBMITTED'
'A' = 'APPROVED';

VALUE $SITE
'Y' = 'LOC KNOWN'
'N' = 'LOC UNKNOWN';

VALUE $MCONC
'Y' = 'CONCESSION'
'N' = 'NO CONCESSION';

VALUE USPP
-91 = 'PENDING/YR 1991'
-92 = 'PENDING/YR 1992'
  0 = 'NOT APPLIED'
 -1 = 'PENDING';

VALUE $MEXOFAP
'Y' = 'APPROVED'
'N' = 'NOT DONE';
```

Exhibit 2.9. Formatted PROC PRINT output of INVP.SDS

OBS	IBWC	DATE	USP	MEXOFAP	MEXINT	USF
1	-200	10/30/93	PENDING/YR 1991	NOT DONE	NOT DONE	
2	-200	10/30/93	PENDING/YR 1991	NOT DONE	NOT DONE	-16.526
3	-844	10/30/93	PENDING/YR 1991	APPROVED	APPROVED	-16.526
4	-1000	10/30/93	NOT APPLIED	NOT DONE	NOT DONE	-24.000
5	-2230	10/30/93	79	NOT DONE	NOT DONE	.
6	-2740	10/30/93	PENDING/YR 1992	NOT DONE	NOT DONE	.
7	-2787	10/30/93	78	NOT DONE	NOT DONE	18.800
8	-3293	10/30/93	NOT APPLIED	APPROVED	APPROVED	.
9	-5973	10/30/93	PENDING/YR 1991	APPROVED	APPROVED	-6.500
10	-7979	10/30/93	PENDING/YR 1991	APPROVED	APPROVED	-2.400

Exhibit 2.9. Continued

OBS	MEXF	USOURCE	MSOURCE	USENV	MENV
1	-30	PRIVATE	NOTKNOWN	S/10/92	
2	-30	PRIVATE	NOTKNOWN	S/10/92	
3	.	FEDERAL	FEDERAL	S/12/91	
4	.	NOTKNOWN	NOTKNOWN	NOT SUBMITTED	
5	.	NOTKNOWN	NOTKNOWN	NOT SUBMITTED	
6	37	PRIVATE	PRIVATE	SUBMITTED	
7	.	NOTKNOWN	NOTKNOWN	NOT SUBMITTED	
8	.	NOTKNOWN	NOTKNOWN	SUBMITTED	
9	.	LOCAL	NOTKNOWN	SUBMITTED	
10	.	PRIVATE	NOTKNOWN	S/3/92	

OBS	USITE	MSITE	USDES	MEXDES	MCON
1	LOC KNOWN	LOC UNKNOWN	PRELIM DESIGN	NO DESIGN	
2	LOC KNOWN	LOC UNKNOWN	PRELIM DESIGN	FINAL DESIGN	
3	LOC KNOWN	LOC KNOWN	PRELIM DESIGN	NO DESIGN	
4	LOC KNOWN	LOC UNKNOWN	PRELIM DESIGN	NO DESIGN	
5	LOC KNOWN	LOC UNKNOWN	.	NO DESIGN	
6	LOC UNKNOWN	LOC UNKNOWN	PRELIM DESIGN	NO DESIGN	
7	LOC KNOWN	LOC UNKNOWN	.	NO DESIGN	
8	LOC KNOWN	LOC KNOWN	.	NO DESIGN	
9					
10					

Exhibit 2.10. Unformatted PROC PRINT output of INVP.SDS

OBS	IBWC	DATE	USP	MEXOFAP	MEXINT	USF
1	-200	10/30/93	-91	N	N	.
2	-200	10/30/93	-91	N	N	-16.526
3	-844	10/30/93	-91	Y	Y	-16.526
4	-1000	10/30/93	0	N	N	-24.000
5	-2230	10/30/93	79	N	N	.
6	-2740	10/30/93	-92	N	N	.
7	-2787	10/30/93	78	N	N	18.800
8	-3293	10/30/93	0	Y	Y	.
9	-5973	10/30/93	-91	Y	Y	-6.500
10	-7979	10/30/93	-91	Y	Y	-2.400

OBS	MEXF	USOURCE	MSOURCE	USENV	MENV
1	-30	4	5	S/10/92	
2	-30	4	5	S/10/92	
3	.	1	1	S/12/91	
4	.	5	5	NS	
5	.	5	5	NS	
6	37	4	4	S	
7	.	5	5	NS	
8	.	5	5	S	
9	.	3	5	S	
10	.	4	5	S/3/92	

Exhibit 2.10. Continued

OBS	USITE	MSITE	USDES	MEXDES	MCON
1	N	Y	2	1	
2	N	Y	2	3	
3	N	N	2	1	
4	N	Y	2	1	
5	N	Y	.	1	
6	Y	Y	2	1	
7	N	Y	.	1	
8	N	N	.	1	
9					
10					

TOLLS AND REVENUES FILE (TOLL.SDS)

The data set dubbed "TOLL.SDS" contains 1992 northbound and southbound toll prices and 1992 southbound revenues. Thus, TOLL.SDS includes the basic toll data needed for economic analysis. All values included are in 1992 dollar values. Table 2.10 presents the variables and the associated meaning and values in this data set. All variables are numeric and self-explanatory. Exhibit 2.11 presents a PROC CONTENTS of TOLLL.SDS.

Toll prices usually vary with vehicle type. For example, noncommercial traffic pays less toll than commercial traffic. Commercial traffic toll prices vary by axle: the greater the number of axles, the greater the toll. Prices also vary in the country where tolls are collected. Tolls in Mexico are usually double the tolls collected in the U.S.

SUMMARY AND RECOMMENDATIONS FOR FUTURE UPDATING

All binational entry systems spaning the Texas-Mexico border (including rail bridges and ferries) are inventoried in three data sets: INVM.SDS, INVEX.SDS, and INVPR.SDS. The letters INV stand for "inventory," while the letters M, EX, and PR stand for Main, EXisting, and PRoposed, respectively. The first data set includes basic information on all binational entry systems; the second summarizes the layout and condition of existing binational entry systems; the third data set summarizes the status of the proposed systems.

Data set INVEX.SDS covers bridge inspection, inspection facilities, and bridge geometry. CAPUFE has recently been developing a bridge inspection program for the binational entry systems they manage. It is recommended that these data be obtained and added to the inventory file INVEX.SDS.

Data set INVPR.SDS has variable DATE, which indicates the date the information was collected. Inventory information is supplemented by data set TOLL.SDS, which currently has 1992 tolls schedules and yearly revenue data.

The information in INVPR.SDS should be periodically updated. Moreover, as bridges

are constructed and begin operation, they should be removed from INVPR.SDS and added to INVEX.SDS. Information in other inventory files also needs updating, insofar as bridges and their respective inspection facilities can be remodeled, closed, rehabilitated, and expanded, causing changes in the TRANSBORDER data base. Chapter 8 proposes that an ongoing study be set up to continuously update and operate the TRANSBORDER data base.

Exhibit 2.11. PROC contents output for TOLL.SDS

```
CONTENTS PROCEDURE

 Data Set Name: SDS.TOLL                              Observations:      10
 Member Type:   DATA                                  Variables:         21
 Engine:    V608
 Indexes:        0
 Created:     14:42 Monday, September 6, 1993
 Observation Length:   163
 Last Modified: 14:42 Monday, September 6, 1993
 Deleted Observations: 0
 Protection:                                          Compressed:        NO
 Data Set Type:                                       Sorted:            NO
 Label:     TOLL RATES FOR SOUTHBOUND TRAFFIC

 -----Engine/Host Dependent Information-----

 Data Set Page Size:     8192
 Number of Data Set Pages: 1
 File Format:        607
 First Data Page:      1
 Max Obs per Page:     50
 Obs in First Data Page:   10
 Userid  :         FTFD445
 File  :         TOLL   SDS

     -----Alphabetic List of Variables and Attributes-----

  #  Variable  Type  Len  Pos  Label
-----------------------------------------------------------------
  4  AUTOEM    Num     8   19  AUTOS& EMPTY PICKUPS
  6  BICY      Num     8   35  BICYCLES
  2  BUS       Char    5    6
 13  EIGHTAXE  Num     8   91  TRUCKS/8AXLES-EMPTY
 20  EIGHTAXL  Num     8  147  TRUCKS/8AXLES-LOADED
 10  FIVEAXE   Num     8   67  TRUCKS/5AXLES-EMPTY
 17  FIVEAXL   Num     8  123  TRUCKS/2AXLES-LOADED
  9  FOURAXE   Num     8   59  TRUCKS/4AXLES-EMPTY
 16  FOURAXL   Num     8  115  TRUCKS/4AXLES-LOADED
  3  IBWC      Num     8   11  CODES FOR BRIDGES BY IBWC
 21  MTR       Num     8  155  MOTORCYCLES
  5  PEDS      Num     8   27  PEDESTRIANS
  1  RECVEH    Char    6    0  RECREATION VEHICLES
 12  SEVENAXE  Num     8   83  TRUCKS/7AXLES-EMPTY
 19  SEVENAXL  Num     8  139  TRUCKS/7AXLES-LOADED
 11  SIXAXE    Num     8   75  TRUCKS/6AXLES-EMPTY
 18  SIXAXL    Num     8  131  TRUCKS/6AXLES-LOADED
  8  THREEAXE  Num     8   51  TRUCKS/3AXLES-EMPTY
 15  THREEAXL  Num     8  107  TRUCKS/3AXLES-LOADED
  7  TWOAXE    Num     8   43  TRUCKS/2AXLES-EMPTY
 14  TWOAXL    Num     8   99  TRUCKS/2AXLES-LOADED
```

CHAPTER 3. BINATIONAL ENTRY SYSTEMS TRAFFIC DATA

INTRODUCTION

During the early phases of this project, the study team visited all binational entry systems and discussed border crossing procedures with relevant agencies (GSA, U.S. Customs, Mexican Customs, CAPUFE) and with bridge managers on both sides of the border. As a result, considerable data on northbound and southbound traffic counts were collected and, after appropriate reduction and manipulation, were stored in the TRANSBORDER data base.

Northbound data come from three sources: CAPUFE, GSA, and U.S. Customs. GSA data are aggregated by ports of entry, which may include more than one binational entry system under the same customs jurisdiction. A list of all ports of entry and their respective binational entry systems is shown in Table 3.1.

Table 3.1. U.S. ports of entry

Port of Entry	Binational Entry System
Brownsville	Gateway / B&M / Los Indios
Progresso	Progreso
Hidalgo	Hidalgo-Reynosa
Rio Grande City	Los Ebanos Ferry / Rio Grande City - Camargo
Roma	Roma-Miguel Alemán / Lake Falcon Dam
Laredo	Bridge #1, Bridge #2, Colombia
Eagle Pass	Eagle Pass
Del Rio	Del Rio Bridge / Lake Amistad Dam
Presidio	Presidio
Fabens	Fabens / Fort Hancock
El Paso	Ysleta / BOTA / PDN / GNB

Data aggregated by port of entry must be used in conjunction with disaggregated data in site-specific analysis. CAPUFE data supplements the data by port of entry, but care must be taken with the calendar year versus fiscal year data reporting systems. CAPUFE data are broken down by year, by month, and by mode (i.e., autos, trucks, and pedestrians). Although the data provide a very thorough site-specific traffic history, they are available only for the international bridges under CAPUFE.

Southbound traffic counts were provided by bridge owners and managers during the visits to each site. These data, collected primarily for toll bridge accounting purposes, have levels of aggregation that vary according to system used by the bridge owners and managers. For example, while El Paso disaggregated the data by bridge, Laredo aggregated the data for the entire Laredo Bridge System, which comprises Laredo 1, Laredo 2, and Colombia.

The length of traffic history varies from file to file, as do the procedures to break the traffic into vehicle types. Storage of a single consistent northbound and a single consistent

southbound traffic history would require either losing a considerable amount of interesting information that is available only for some binational entry systems, or storing a mixture of actual data and estimates based on available data. Since the TRANSBORDER data base is supposed to serve future studies whose needs have not yet been determined, all available information was stored, with statistical estimates of unavailable data avoided.

The organization of the data sets, which reflects the diversity of sources, purposes, and levels of aggregation, was designed to minimize storage space, while at the same time keeping the information as self-explanatory as possible. The latter required some data sets to have customized formats, which are stored in FORLIB.DATABASE.

Table 3.2 shows a summary of all data sets that contain traffic data at binational entry systems. The first two letters of each data set indicate the traffic direction (NB or SB), with the following characters indicating either the data source (as in NBGSA) or the binational entry system (as in SBGATWAY). Each binational entry system is identified by the IBWC code described in Chapter 2. More informative printouts can be made by merging the traffic data sets with data set INVM.SDS (Chapter 2) by variable IBWC, and using the names of the binational entry systems in the data reports. Data set INVM.SDS is described in Chapter 2.

Table 3.2. Summary of the traffic data sets

Data Set	Source	Contents
NBGSA.SDS	GSA	Northbound counts by fiscal year at each port of entry
NBRAIL.SDS	US Customs	Northbound counts by fiscal year at bridges with a facility to accommodate rail traffic
NBCOUNT.SDS	US Customs	Northbound counts by fiscal year at bridges without a facility to accommodate rail traffic
NBELPASO.SDS	US Customs-El Paso District	Northbound counts by calender year for the bridges in El Paso
NBCAP.SDS	CAPUFE	Northbound counts by calender year at each bridge
NBCAPMA.SDS	CAPUFE	Northbound monthly auto traffic counts at each bridge
NBCAPMT.SDS	CAPUFE	Northbound monthly truck traffic counts by axle at each bridge
NBCAPMP.SDS	CAPUFE	Northbound monthly pedestrian traffic counts at each bridge
SBDELRIO.SDS	Bridge manager	Southbound counts by calender year at Del Rio Bridge
SBGATWAY.SDS	Bridge manager	Southbound counts by calender year at Gateway Bridge
SBHIDAL.SDS	Bridge manager	Southbound counts by calender year at Hidalgo Bridge
SBEGPASS.SDS	Bridge manager	Southbound counts by calender year at Eagle Pass Bridge
SBROMA.SDS	Bridge manager	Southbound counts by calender year at Roma Bridge
SBGRANDE.SDS	Bridge owner	Southbound counts by calender year at Rio Grande Bridge
SBLOSIND.SDS	Bridge manager	Southbound counts at the Los Indios Bridge.
SBLAREDO.SDS	Laredo bridge system	Southbound counts by calender year at the three Laredo Bridges (#1, #2, and Colombia)
SBPROGSO.SDS	Bridge owner	Southbound counts by calender year at Progreso Bridge
SBPDN.SDS	City of El Paso	Southboundcounts by calender year at Paso Del Norte Bridge
SBSTANTN.SDS	City of El Paso	Southbound counts by calender year at Stanton Street Bridge
SBYSLETA.SDS	City of El Paso	Southbound counts by calender year at Ysleta Bridge

NORTHBOUND TRAFFIC DATA USER'S GUIDE

Traffic in the northbound direction usually passes through Mexican toll booths administered by CAPUFE and through inspection booths administered by U.S. Customs. Traffic data were collected from GSA, CAPUFE, and U.S. Customs as discussed below.

General Services Administration (GSA) Data

Because traffic and merchandise release data have been provided by the General Services Administration (GSA) by port of entry, GSA traffic data are aggregated as shown in Table 3.1. The contents of the GSA file are described in Table 3.3.

Table 3.3. Contents of GSA.SDS

Variable	Type	Values
PORT	Character	Names of crossings included in port of entrys
YEAR	Numeric	Fiscal year (starts in September) of data collection
CAR	Numeric	Total number of cars and pickups
PED	Numeric	Number of pedestrians
TRUCK	Numeric	Number of trucks
TOTM	Numeric	Total number of merchandise releases
FE	Numeric	Formal entries (value over $1000)
IE	Numeric	Informal entries (value under $1000)
OTHER	Numeric	Other merchandise releases, including merchandise leaving Mexico by one port and returning to Mexico by another port

This data set contains 120 observations and 9 variables. Since this is a very small data set, the variable PORT was given a length of 27 bytes; it contains the actual names of each port of entry, eliminating the need for formatted variables. Variables FE (formal entries), IE (informal entries), and OTHER supplement the traffic data with some commodity data (the values of these variables represent the number of merchandise releases over $1,000, under $1,000, and other types, including merchandise entering the U.S. by one port and then returning to Mexico). Exhibit 3.1 shows the PROC CONTENTS output for this data set, while Exhibit 3.2 shows the printout of the first ten observations of this data set.

Exhibit 3.1. PROC CONTENTS output of GSA.SDS

```
CONTENTS PROCEDURE

Data Set Name: SDS.GSA                          Observations:      120
Member Type:   DATA                             Variables:           9
Engine:    V608                                 Indexes:             0
Created:     8:35 Monday, August 30, 1993
Observation Length:   71
Last Modified: 8:35 Monday, August 30, 1993
Deleted Observations: 0
Protection:                                     Compressed:         NO
Data Set Type:                                  Sorted:             NO
Label:     TRAFFIC COUNT NORTH BOUND

-----Engine/Host Dependent Information-----

Data Set Page Size:     4096
Number of Data Set Pages: 3
File Format:         607
First Data Page:       1
Max Obs per Page:      57
Obs in First Data Page:   37
Userid  :          FTFD445
File  :          GSA    SDS

    -----Alphabetic List of Variables and Attributes-----

#  Variable   Type   Len  Pos   Label
-----------------------------------------------------------------
9   AUTO       Num     7   64   NO OF*AUTOS
2   FE         Num     5   27   FORMAL*ENTRIES
3   IE         Num     6   32   INFORMAL*ENTRIES
4   OTHER      Num     5   38   OTHER*ENTRIES
5   PEDS       Num     6   43   PEDESTRIANS
1   PORT       Char   27    0   PORT OF*ENTRY
6   TOTM       Num     6   49   TOTAL*MERCHANDISE*RELEASE
7   TRUCK      Num     6   55   NO. OF*TRUCKS
8   YEAR       Num     3   61   FISCAL YEAR*OCT-SEP
```

Exhibit 3.2. Sample PROC PRINT of SDS.GSA

OBS	PORT	FE	IE	OTHER	PEDS	TOTM	TRUCK	YEAR	AUTO
1	BROWNSVILLE-GATEWAY-B&M	21543	34328	4090	2750409	59961	144752	1983	4614220
2	BROWNSVILLE-GATEWAY-B&M	18689	26606	2588	3139307	47883	148344	1984	4551635
3	BROWNSVILLE-GATEWAY-B&M	20915	27309	4012	3244330	52236	141235	1985	4644333
4	BROWNSVILLE-GATEWAY-B&M	22956	25764	6028	3290286	54730	152669	1986	4614074
5	BROWNSVILLE-GATEWAY-B&M	25173	28748	6720	3443771	60641	143482	1987	4367440
6	BROWNSVILLE-GATEWAY-B&M	28200	21067	8336	3464634	57603	160927	1988	4175500
7	BROWNSVILLE-GATEWAY-B&M	31259	15972	9989	4274202	57220	142492	1989	4501269
8	BROWNSVILLE-GATEWAY-B&M	32960	22311	12014	4345466	67285	180084	1990	4905246
9	BROWNSVILLE-GATEWAY-B&M	33313	21526	11639	4976562	66478	182715	1991	4990401
10	BROWNSVILLE-GATEWAY-B&M	36647	18115	12629	4518555	67391	203116	1992	4939722

CAPUFE Data

The Mexican federal agency CAPUFE (Caminos y Puentes Federales) is responsible for federal toll facilities (the international bridges fall under federal jurisdiction in Mexico). CAPUFE records traffic data for budget calculation and other accounting purposes related to toll collection. During the earlier phases of this project, bilingual CTR engineers visited CAPUFE and obtained these data, which provide a very comprehensive traffic history disaggregated by bridge and by vehicle type in all fourteen international bridges under CAPUFE jurisdiction. The U.S. Customs data and GSA data can be used to supplement CAPUFE's northbound traffic data as needed for other bridges. A summary of the bridges under CAPUFE jurisdiction, together with the availability of monthly and yearly traffic history, is shown in Table 3.4.

Table 3.4. Summary of northbound CAPUFE data

Bridge Name	**IBWC code**	**Yearly Data**	**Monthly Data**		
			Autos	**Trucks**	**Pedestrians**
Gateway	895	1964 -1992	1986-1992	1989-1992	1990-1992
Los Indios	1585	1992	n/a	n/a	n/a
Progreso	1985	1971-1992	1986-1992	1989-1992	1990-1992
Hidalgo (NB)	2565	1967 -1992	1986-1992	1989-1992	1990-1992
Rio Grande	3779	1966 -1992	1986-1992	1989-1992	1990-1992
Roma	4104	1967 -1992	1986-1992	1989-1992	1990-1992
Laredo II	5806	1979, 1980, 1991, 1992	1986-1992, except 1990	1989,1991,1992	n/a
Laredo I	5808	1979 -1992	1986-1992	1989-1992	1990-1992
Colombia	6318	1992	n/a	n/a	n/a
Eagle Pass	7987	1975 -1992	1986-1992	1989-1992	1990-1992
Del Rio	9029	1979 -1992	1986-1991	1989-1992	1990-1992
Presidio	15424	1973 -1992	1986-1992, except 1990	1989,1990,1992	1991,1992
Zaragoza (commercial)	19929	1991 -1992		1991,1992	1992
Zaragoza (non-commercial)	19930	1991 -1992	1991-1992		
Paso del Norte	20120	1973 -1992	1986-1992	1989-1992	1990-1992

The data from the bridges under CAPUFE jurisdiction are organized into four data sets, one containing the yearly traffic history for all fourteen bridges, and the other three containing monthly counts, respectively, for pedestrians, autos, and trucks. These data sets are summarized in Table 3.5.

Table 3.5. Summary of CAPUFE data sets

Data Set Name	Data Set Contents
NBCAP.SDS	Yearly history by vehicle type and pedestrians.
NBCAPMA.SDS	Monthly auto traffic history
NBCAPMT.SDS	Monthly truck traffic history
NBCAPMP.SDS	Monthly pedestrian traffic history

The yearly northbound traffic history for the CAPUFE bridges is organized into data set NBCAP.SDS, which contains 224 observations and 8 variables. All data are numeric and self-explanatory, with the possible exception of the IBWC code, which was described in Chapter 2. Exhibits 3.3 and 3.4a represent a PROC CONTENTS output and a PROC PRINT, respectively, of the first ten observations of this data set. The data set is comprehensive and has the yearly counts of trucks, autos, and pedestrians.

Exhibit 3.3. PROC CONTENTS output of CAPUFE.SDS

```
CONTENTS PROCEDURE

Data Set Name: SDS.CAPUFE                          Observations:     224
Member Type:   DATA                                Variables:          8
Engine:    V608                                    Indexes:            0
Created:     15:48 Monday, August 30, 1993
Observation Length:   39
Last Modified: 15:48 Monday, August 30, 1993
Deleted Observations: 0
Protection:                                        Compressed:        NO
Data Set Type:                                     Sorted:            NO
Label:     YEARLY TRAFFIC HISTORY - CAPUFE

-----Engine/Host Dependent Information-----

Data Set Page Size:       2048
Number of Data Set Pages: 6
File Format:              607
First Data Page:          1
Max Obs per Page:         51
Obs in First Data Page:   18
Userid  :          FTFD445
File  :          CAPUFE   SDS

     -----Alphabetic List of Variables and Attributes-----

#  Variable  Type   Len  Pos  Label
-------------------------------------------------------------------------
2  AUTO      Num      6    3  NO OF*AUTOS
6  BIKE      Num      4   23  NO OF*MOTORBIKES
3  BUS       Num      4    9  NO OF*BUSES
8  IBWC      Num      4   35  CODE FOR*BRIDGES BY*WATER*COMMISSION
5  PEDS      Num      6   17  NO OF*PEDESTRIANS
7  TOTAL     Num      8   27  TOTAL*VEHICLES
4  TRUCK     Num      4   13  NO OF*TRUCKS
1  YEAR      Num      3    0  CALENDAR*YEAR
```

Exhibit 3.4. Sample PROC PRINT of CAPUFE.SDS

OBS	CALENDAR YEAR	NO OF AUTOS	NO OF BUSES	NO OF TRUCKS	NO OF PEDESTRIANS	NO OF MOTORBIKES	TOTAL VEHICLES	IBWC
1	1966	11120	51	272	.	13	11456	3779
2	1967	41828	1963	1536	.	109	45436	3779
3	1968	55622	3049	2202	.	159	61032	3779
4	1969	71035	1686	2834	.	148	75703	3779
5	1970	97641	1221	2839	.	177	101878	3779
6	1971	115775	1775	3133	308	131	120814	3779
7	1972	136937	2766	4118	7774	282	144103	3779
8	1973	146682	2798	4511	7984	304	154295	3779
9	1974	163886	2778	4666	8833	211	171541	3779
10	1975	181215	2846	4754	6790	340	189155	3779

CAPUFE monthly traffic history is stored in data sets NBCAPMA.SDS, NBCAPMP.SDS, and NBCAPMT.SDS, respectively, for autos (A), pedestrians (P), and trucks (T). The first two data sets contain three variables: the bridge identification (IBWC code), the number of autos (variable AUTO) or pedestrians (variable PEDS), and variable DATE, formatted as MONYY5., one of the several SAS predefined date formats. Separate variables for month and year can be created using approapriate SAS date functions, as shown in Exhibit 3.5. For example, if DATE has a formatted value of SEP90, then YR has the value of 1990 and MON has the value of 9.

Exhibit 3.5. Separating year and month from variable DATE

```
DATA TEMP; SET SDS.NBCAPMT; /* OR NBCAPMP, OR NBCAPMA */
YR=YEAR(DATE);
MON=MONTH(DATE);
```

Data set NBCAPMT.SDS contains monthly truck traffic history, which is disaggregated by number of axles. Accordingly, this data set has eight variables: DATE and IBWC, as described above, and variables TWOAX, THREEAX, FOURAX, FIVEAX, SIXAX, and MSIXAX, respectively for two, three, four, five, six, and more than six axles.

These data sets contain only self-explanatory, numeric variables that require no customized formats. They can be explained with Exhibits 3.6 through 3.11, a PROC CONTENTS output and a PROC PRINT output of the first ten observations, respectively, for NBCAPMA, NBCAPMP, and NBCAPMT data sets.

Exhibit 3.6. PROC CONTENTS output of CAPUFEMA.SDS

```
CONTENTS PROCEDURE

 Data Set Name: SDS.NBCAPMA                          Observations:     996
 Member Type:   DATA                                  Variables:          3
 Engine:    V608                                      Indexes:            0
 Created:     15:49 Monday, August 30, 1993
 Observation Length:   17
 Last Modified: 15:49 Monday, August 30, 1993
 Deleted Observations: 0
 Protection:                                          Compressed:       NO
 Data Set Type:                                       Sorted:           NO
 Label:     MONTHLY COUNT AUTOS- CAPUFE

 -----Engine/Host Dependent Information-----

 Data Set Page Size:       2048
 Number of Data Set Pages: 9
 File Format:              607
 First Data Page:          1
 Max Obs per Page:         118
 Obs in First Data Page:   78
 Userid  :          FTFD445
 File    :         NBCAPMA SDS

          -----Alphabetic List of Variables and Attributes-----

 #  Variable  Type  Len  Pos  Format   Label
 ------------------------------------------------------------------------
 2  AUTO      Num     5    8            NO OF*AUTOS
 1  DATE      Num     8    0    MONYY5.
 3  IBWC      Num     4   13            CODE FOR*BRIDGES BY*WATER*COMMISSION
```

Exhibit 3.7. Sample PROC PRINT of NBCAPMA.SDS

OBS	DATE	AUTO	IBWC
1	JAN86	33022	3779
2	FEB86	29411	3779
3	MAR86	36288	3779
4	APR86	30876	3779
5	MAY86	32428	3779
6	JUN86	29847	3779
7	JUL86	28841	3779
8	AUG86	30655	3779
9	SEP86	29641	3779
10	OCT86	30180	3779

Exhibit 3.8. PROC CONTENTS Output of CAPUFEMP.SDS

```
Data Set Name: SDS.NBCAPMP                          Observations:     360
Member Type:   DATA                                 Variables:          3
Engine:    V608                                     Indexes:            0
Created:       15:51 Monday, August 30, 1993
Observation Length:   17
Last Modified: 15:51 Monday, August 30, 1993
Deleted Observations: 0
Protection:                                         Compressed:       NO
Data Set Type:                                      Sorted:           NO
Label:     MONTHLY COUNT PEDESTRIANS-CAPUFE

-----Engine/Host Dependent Information-----

Data Set Page Size:       2048
Number of Data Set Pages: 4
File Format:              607
First Data Page:          1
Max Obs per Page:         118
Obs in First Data Page:   78
Userid  :          FTFD445
File  :          NBCAPMP SDS

          -----Alphabetic List of Variables and Attributes-----

#  Variable  Type  Len  Pos  Format   Label
-----------------------------------------------------------------------------
2  DATE      Num     8    5  MONYY5
3  IBWC      Num     4   13            CODE FOR*BRIDGES BY*WATER*COMMISSION
1  PEDS      Num     5    0            NO OF*PEDESTRIANS
```

Exhibit 3.9. Sample PROC PRINT of NBCAPMP.SDS

OBS	PEDS	DATE	IBWC
1	664	JAN90	3779
2	633	FEB90	3779
3	733	MAR90	3779
4	804	APR90	3779
5	684	MAY90	3779
6	653	JUN90	3779
7	786	JUL90	3779
8	1101	AUG90	3779
9	709	SEP90	3779
10	626	OCT90	3779

Exhibit 3.10. PROC CONTENTS Output of NBCAPMP.SDS

```
Data Set Name: SDS.NBCAPMT                Observations:     573
Member Type:   DATA                       Variables:          8
Engine:    V608                           Indexes:            0
Created:     15:52 Monday, August 30, 1993       Observation Length:   36
Last Modified: 15:52 Monday, August 30, 1993     Deleted Observations:  0
Protection:                               Compressed:       NO
Data Set Type:                            Sorted:           NO
Label:     MONTHLY COUNT TRUCKS-CAPUFE

-----Engine/Host Dependent Information-----

Data Set Page Size:        2048
Number of Data Set Pages:  11
File Format:               607
First Data Page:           1
Max Obs per Page:           56
Obs in First Data Page:     19
Userid  :         FTFD445
File  :         NBCAPMT SDS

         -----Alphabetic List of Variables and Attributes-----

#  Variable  Type  Len  Pos  Format   Label
-----------------------------------------------------------------------
7  DATE      Num     8   24  MONYY5.
5  FIVEAX    Num     4   16          FIVE*AXLES
4  FOURAX    Num     4   12          FOUR*AXLES
8  IBWC      Num     4   32          CODE FOR*BRIDGES BY*WATER*COMMISSION
3  MSIXAX    Num     4    8          MORE THAN*SIX AXLES
6  SIXAX     Num     4   20          SIX*AXLES
2  THREEAX   Num     4    4          THREE*AXLES
1  TWOAX     Num     4    0          TWO*AXLES
```

Exhibit 3.11. Sample PROC PRINT of CAPUFEMP.SDS

OBS	TWOAX	THREEAX	MSIXAX	FOURAX	FIVEAX	SIXAX	DATE	IBWC
1	84	111	1	2	250	121	JAN89	3779
2	61	116	0	17	281	526	FEB89	3779
3	65	154	0	.	551	838	MAR89	3779
4	71	222	2	.	698	1078	APR89	3779
5	52	147	0	16	528	1160	MAY89	3779
6	60	68	4	3	126	138	JUN89	3779
7	50	66	0	5	175	96	JUL89	3779
8	45	84	1	1	298	485	AUG89	3779
9	59	118	1	7	379	819	SEP89	3779
10	65	147	5	22	327	818	OCT89	3779

U.S. Customs Data

The U.S. Customs data, aggregated by port of entry in many cases, are the only source of northbound traffic data for the free and rail bridges. Data are organized by fiscal years, which run from October through September. A convenient data set organization requires the three data sets summarized in Table 3.6.

Table 3.6. General Organization of the US Customs Data Sets

Data Set name	**Data Set Contents**	**Binational Entry Systems**
NBRAIL.SDS	Bridges with rail facilities	B&M, Laredo Rail, Eagle Pass Rail
NBCUST.SDS	Bridges without rail facilities	Gateway, Los Indios, B&P, Hidalgo, Los Ebanos Ferry, Rio Grande, Roma, Lake Falcon, Laredo 1 and 2, Colombia, Del Rio, Lake Amistad, Presidio, Fabens
NBELPASO.SDS	El Paso bridges	Ysleta, Bridge of the Americas, Paso del Norte

The variables in the three data sets were kept as consistent as possible. Variables PEDS (pedestrian traffic) and IBWC (binational entry system code) are common to all three data sets. Variables AUTO (auto traffic), TRUCK (truck traffic), YEAR (fiscal year) and BUS (bus traffic) are common to NBRAIL.SDS and NBCUST.SDS. Specific variables are discussed within each data set explanation.

Data set NBRAIL.SDS contains northbound traffic histories for the border bridges that carry both vehicular and rail traffic. The IBWC code identifies the bridge and functions as the relational link to merge this data set with others. The data set, depicted in Exhibits 3.12 and 3.13, shows a PROC CONTENTS and a sample PROC PRINT output, respectively. The B&M bridge located between Brownsville and Matamoros is depicted in Exhibit 3.13.

Variables ECARTS and LOCARTS store the yearly number of empty and loaded rail carts, respectively. The other, self-explanatory variables store the vehicular traffic.

Exhibit 3.12. PROC CONTENTS Output of NBRAIL.SDS

```
 CONTENTS PROCEDURE
Data Set Name: SDS.NBRAIL                          Observations:         30
Member Type:   DATA                                Variables:             8
Engine:        V608                                Indexes:               0
Created:       17:56 Friday, November 5, 1993
Observation Length:   30
Last Modified: 17:56 Friday, November 5, 1993
Deleted Observations: 0
Protection:                                        Compressed:           NO
 Data Set Type:                                    Sorted:               NO
 Label:         NORTH BOUND COUNTS FOR BRIDGES WITH RAIL

 -----Engine/Host Dependent Information-----

 Data Set Page Size:       2048
 Number of Data Set Pages: 2
 File Format:              607
 First Data Page:          1
 Max Obs per Page:         67
 Obs in First Data Page:   23
 Userid  :                 FTFD445
 File    :                 NBRAIL   SDS

          -----Alphabetic List of Variables and Attributes-----

#    Variable    Type    Len    Pos    Label
-----------------------------------------------------------------------
3    AUTO        Num       5      6    NUMBER OF*PRIVATELY*OWNED VEHS
5    BUS         Num       4     15    NUMBER OF*BUSES
7    EMCARTS     Num       3     24    NUMBER OF*EMPTY CARTS
2     YEAR       Num       3      3    FISCAL*YEAR
1    IBWC        Num       3      0    CODES FOR*BRIDGES BY*IBWC
8    LOCARTS     Num       3     27    NUMBER OF*LOADED CARTS
6    PEDS        Num       5     19    NUMBER OF*PEDESTRIANS
4    TRUCK       Num       4     11    NUMBER OF*TRUCKS
```

Exhibit 3.13. Sample PROC PRINT of NBRAIL.SDS

OBS	IBWC	YEAR	AUTO	TRUCK	BUS	PEDS	EMCARTS	LOCARTS
1	907	1983	1593440	45593	88	37499	10117	6913
2	907	1984	1656667	43693	14	39938	9811	9451
3	907	1985	1772132	42059	0	45673	11225	9219
4	907	1986	1863588	44375	0	45424	7222	9306
5	907	1987	1691439	41835	0	66384	15428	8774
6	907	1988	1604916	36600	0	92498	15243	11102
7	907	1989	1749025	15235	0	105493	19100	10963
8	907	1990	2041625	19623	0	122088	12937	7938
9	907	1991	2354471	34404	0	184984	12795	6201
10	907	1992	2383342	50979	0	251544	17332	8103

Data set NBCUST.SDS contains the northbound yearly volumes for the vehicular international bridges that do not carry rail traffic. Exhibits 3.14 and 3.15 show a PROC CONTENTS and a PROC PRINT output of the data set, respectively.

Exhibit 3.14. PROC CONTENTS Output of NBCUST.SDS

CONTENTS PROCEDURE

Data Set Name:	SDS.NBCUST	Observations:	105
Member Type:	DATA	Variables:	6
Engine:	V608	Indexes:	0
Created:	17:55 Friday, November 5, 1993		
Observation Length:	24		
Last Modified:	17:55 Friday, November 5, 1993		
Deleted Observations:	0		
Protection:		Compressed:	NO
Data Set Type:		Sorted:	NO
Label:	NORTH BOUND COUNTS FOR BRIDGES		

-----Engine/Host Dependent Information-----

Data Set Page Size:	2048
Number of Data Set Pages:	2
File Format:	607
First Data Page:	1
Max Obs per Page:	84
Obs in First Data Page:	40
Userid :	FTFD445
File :	NBCUST SDS

-----Alphabetic List of Variables and Attributes-----

#	Variable	Type	Len	Pos	Label
3	AUTO	Num	6	6	NUMBER OF*THE PRIVATELY*OWNED VEHS
5	BUS	Num	3	15	NUMBER OF*BUSES
2	YEAR	Num	3	3	FISCAL*YEAR
1	IBWC	Num	3	0	CODES*FOR BRIDGES*BY IBWC
6	PEDS	Num	6	18	NUMBER OF*PEDESTRIANS
4	TRUCK	Num	3	12	NUMBER OF*TRUCKS

Exhibit 3.15. Sample PROC PRINT of NBCUST.SDS

OBS	IBWC	YEAR	AUTO	TRUCK	BUS	PEDS
1	6318	1991	1923	28	1	0
2	6318	1992	55341	20263	16	0
3	6318	1993	48675	30914	18	0
4	9029	1983	1361644	6248	5545	44497
5	9029	1984	1266970	5411	7012	90786
6	9029	1985	1155073	5904	7070	114305
7	9029	1986	1135774	8622	7197	66065
8	9029	1987	943450	14675	6273	126779
9	9029	1988	1126914	16318	6956	169969
10	9029	1989	1245091	18063	6985	177600

Data set NBELPASO.SDS contains the U.S. Customs traffic volumes for BOTA, PDN, and the Ysleta Bridges. It is the only source of traffic data for BOTA, a free bridge. These data were stored in a separate data set to optimize the storage space and the organization, since the data recording system is different from the other northbound data sets. Exhibits 3.16 and 3.17 show a PROC CONTENTS and a PROC PRINT output of this data set, respectively. Variables PEDS and VEH have the yearly volumes of pedestrians and total vehicles. The variable TYPEYR was created to denote whether the data are recorded by fiscal or calendar year. This variable takes the customized format $TYPEYR., which decodes the values of this variables as 'FISCAL YEAR' and 'CALENDAR YEAR,' instead of codes 'F' and 'C.'

Exhibit 3.16. PROC CONTENTS Output of NBELPASO.SDS

CONTENTS PROCEDURE

Data Set Name:	SDS.NBELPASO	Observations:	24
Member Type:	DATA	Variables:	5
Engine:	V608	Indexes:	0
Created:	13:04 Thursday, November 11, 1993		
Observation Length:	17		
Last Modified:	13:04 Thursday, November 11, 1993		
Deleted Observations:	0		
Protection:		Compressed:	NO
Data Set Type:		Sorted:	NO
Label:	NORTH BOUND COUNT FOR EL PASO BRIDGES		

-----Engine/Host Dependent Information-----

Data Set Page Size:	2048
Number of Data Set Pages:	1
File Format:	607
First Data Page:	1
Max Obs per Page:	118
Obs in First Data Page:	24
Userid :	FTFD445
File :	NBELPASO SDS

-----Alphabetic List of Variables and Attributes-----

#	Variable	Type	Len	Pos	Format	Label
1	IBWC	Num	3	0		CODES FOR BRIDGES BY IBWC
4	PEDS	Num	5	7		# OF PEDESTRIANS
3	TYPEYR	Char	1	6	$TYPEYR.	CALENDAR OR FISCAL YEAR
5	VEH	Num	5	12		TOTAL*VEHICLES
2	YEAR	Num	3	3		

Exhibit 3.17. Sample PROC PRINT of NBELPASO.SDS

OBS	IBWC	YEAR	TYPEYR	PEDS	VEH
1	20078	1985	FISCAL YEAR	6380982	442114
2	20078	1986	FISCAL YEAR	6052749	490868
3	20078	1987	FISCAL YEAR	6729969	524303
4	20078	1988	FISCAL YEAR	7643072	641040
5	20078	1989	FISCAL YEAR	7668133	752982
6	20078	1990	FISCAL YEAR	7692663	888386
7	20078	1991	FISCAL YEAR	7117937	649686
8	20078	1992	FISCAL YEAR	7051967	506455
9	20120	1985	CALENDAR YEAR	4348569	4934560
10	20120	1986	CALENDAR YEAR	4314259	5270628

SOUTHBOUND TRAFFIC DATA USER'S GUIDE

General Data Organization

Southbound traffic volumes were obtained mostly from bridge owners and managers, and are recorded for accounting and managerial purposes in the binational entry systems that charge toll. The volumes are broken down by vehicle categories according to the toll structure of each management system or bridge; file TOLL.SDS will clarify any questions regarding the data recording procedure. Consequently, the available southbound traffic volumes are not consistent throughout the border. In addition, southbound volumes are not available for the free binational entry systems. Table 3.7 shows a summary of the available southbound data counts.

Table 3.7. Summary of southbound traffic volumes

Bridge Name	IBWC code	Yearly Data		
		Autos	Trucks	Pedestrians
Gateway (SB)	896	1980-1991	1980-1991	1980-1991
Los Indios	1585	1992-1993	1992-1993	1992-1993
Progreso	1986	1961-1992	1961-1992	1961-1992
Hidalgo (SB)	2566	1983-1992	1983-1992	1991-1992
Rio Grande	3779			
Roma	4104	1989-1992	1989-1992	1989-1992
Laredo II	5806	1977-1992	1977-1992	1977-1992
Laredo I	5808			
Colombia	6318			
Eagle Pass	7987	1988-1992	1988-1992	1988-1992
Del Rio	9029			
Presidio	15424			
Zaragoza (commercial)	19929		1991-1992	
Zaragoza (non-commercial)	19930	1991-1992		1991-1992
GNB	20116	1989-1992		1989-1992
Paso del Norte	20120			1989-1992

In terms of data storage, this inconsistency can be handled in three different ways:

1. Store only the data consistently available for all or most binational entry systems. This implies losing some information.
2. Develop estimates for unavailable data and store a consistent data set with a combination of actual and estimated data. This implies a data set with different levels of data reliability.
3. Store all available information in as many data sets as needed for data organization.

Because a comprehensive data base is a project deliverable, and since its future uses are not known at this point, option 3 was selected.

All data sets contain variable IBWC, which takes the corresponding value for the bridge. This variable was included to ease the use of these data sets in conjunction with others. The years of the traffic counts are either calendar or fiscal and are indicated in the labels of variable YEAR.

This required twelve separate data sets, each prefixed with "SB" followed by either the corresponding name of the binational entry system or an abbreviation. These data sets are described below.

Southbound Traffic — Gateway Bridge

Data set SBGATWAY.SDS contains traffic history from 1980 through 1991 for the Gateway Bridge, located between Brownsville and Matamoros. The data set's seven numeric variables are shown in Exhibits 3.18 and 3.19, which represent a PROC CONTENTS and a sample PROC PRINT output of this data set, respectively.

Exhibit 3.18. PROC CONTENTS output of SBGATWAY.SDS

```
Data Set Name: SDS.SBGATWAY                Observations:          12
Member Type:   DATA                        Variables:             7
Engine:        V608                        Indexes:               0
Created:       16:14 Sunday, November 14, 1993
Observation Length:   26
Last Modified: 16:14 Sunday, November 14, 1993
Deleted Observations: 0
Protection:                                Compressed:            NO
Data Set Type:                             Sorted:                NO
Label:         SOUTHBOUND COUNTS - GATEWAY BRIDGE

-----Engine/Host Dependent Information-----

Data Set Page Size:       2048
Number of Data Set Pages: 1
File Format:              607
First Data Page:          1
Max Obs per Page:         77
Obs in First Data Page:   12
Userid  :                 FTFD445
File    :                 SBGATWAY SDS

        -----Alphabetic List of Variables and Attributes-----

#    Variable    Type    Len    Pos    Label
-----------------------------------------------------------------
3    AUTOPICK    Num       5      6    NUMBER OF*AUTOS &*PICKUPS
6    BIKEMTR     Num       3     20    NUMBER OF*BIKES AND*MOTORCYCLES
1    IBWC        Num       3      0    CODES FOR*BRIDGES BY*IBWC
7    OTHER       Num       3     23    NUMBER OF*BUSES AND OTHER*VEHICLES
5    PEDS        Num       5     15    NUMBER OF*PEDESTRIANS
4    TWOSIXAX    Num       4     11    NUMBER OF*2- 6 AXLED*TRUCKS
2    YEAR        Num       3      3    CALENDAR*YEAR
```

Exhibit 3.19. Sample PROC PRINT of SBGATWAY.SDS

OBS	IBWC	YEAR	AUTOPICK	TWOSIXAX	PEDS	BIKEMTR	OTHER
1	896	1980	3821157	51044	2138693	25616	23139
2	896	1981	4151417	64276	2332750	24665	25244
3	896	1982	3929727	57445	2013938	24964	20080
4	896	1983	3603134	47130	1948193	22439	22462
5	896	1984	3621983	54098	2278026	27301	26513
6	896	1985	3492662	62363	2399488	24006	20597
7	896	1986	3406581	52733	2484637	27221	10771
8	896	1987	3246270	83399	2729307	27264	3192
9	896	1988	3595613	99850	3117297	33078	1
10	896	1989	3581021	97741	3073500	21991	52

Variable IBWC takes the value of 896, with variable year represented by the calendar year. The other variables are total yearly number of each vehicle category or mode. These categories are based on the toll structure used in this bridge, and they aggregate categories according to managerial purposes.

Variable AUTOPICK is the total yearly number of autos and pickups. Variable PEDS is the total yearly number of pedestrians. Variable BIKEMTR is the total yearly number of bicycles and motorcycles. Variable TWOSIXAX is the total number of vehicles having two, three, four, five, or six rear axles, empty or loaded. Between 1980 and 1985, this variable includes buses. From 1986 on, buses are included in variable OTHER, which also includes any vehicle having more than six rear axles, as well as all vehicles using courtesy passes.

A consistent traffic history for southbound commercial traffic can be obtained only by using a variable that is the sum of TWOSIXAX and OTHER. Since variable OTHER includes all free passes, TWOSIXAX + OTHER overestimates the total commercial traffic by an unknown margin.

Southbound Traffic — Los Indios Bridge

Data set SBLOSIND.SDS contains traffic volumes at the Los Indios Bridge for the 2 months it has been in operation (1992 and early 1993). The information was obtained from the Los Indios Bridge Management. The variables are as self explanatory as possible, and are shown in Exhibit 3.20, a PROC CONTENTS output of this data set. Year 1992 includes only November and December, while year 1993 includes only January and February. The label for variable YEAR is a reminder that the traffic volumes are available for only 2 months. This data set has only two observations, with Exhibit 3.21 representing its complete PROC PRINT output.

Exhibit 3.20. PROC CONTENTS Ouput of SBLOSIND.SDS

```
Data Set Name: SDS.SBLOSIND                    Observations:          2
Member Type:   DATA                            Variables:             6
Engine:        V608                            Indexes:               0
Created:       16:30 Sunday, November 14, 1993
Observation Length:   19
Last Modified: 16:30 Sunday, November 14, 1993
Deleted Observations: 0
Protection:                                    Compressed:            NO
Data Set Type:                                 Sorted:                NO
Label:         SOUTHBOUND VOLUMES LOS INDIOS BRIDGE

-----Engine/Host Dependent Information-----

Data Set Page Size:       2048
Number of Data Set Pages: 1
File Format:              607
First Data Page:          1
Max Obs per Page:         106
Obs in First Data Page:   2
Userid  :                 FTFD445
File    :                 SBLOSIND SDS

      -----Alphabetic List of Variables and Attributes-----

#    Variable    Type    Len    Pos    Label
------------------------------------------------------------
3    AUTOPICK    Num       3      6    NUMBER OF*AUTOS&*PICKUPS
1    IBWC        Num       3      0    CODES FOR*BRIDGES BY IBWC
6    OTHER       Num       2     17    NUMBER OF OTHER*MISC VEHS
5    PEDS        Num       5     12    NUMBER OF*PEDESTRIANS
4    TWOSIXAX    Num       3      9    NUMBER OF* 2 -6 AXLED*TRAILERS
2    YEAR        Num       3      3    2 MONTHS*ONLY
```

Exhibit 3.21. Sample PROC PRINT of SBLOSIND.SDS

OBS	IBWC	YEAR	AUTOPICK	TWOSIXAX	PEDS	OTHER
1	1585	1992	35585	2104	47	0
2	1585	1993	34789	1979	14	105

Southbound Traffic — Progreso Bridge

Data set SBPROGSO.SDS contains southbound traffic volumes at the Progreso Bridge, from the B&P Bridge Company, and from Laredo State University for calendar years 1961 through 1992. The data set is shown in Exhibits 3.22 and 3.23, a PROC CONTENTS and a sample PROC PRINT output of this data set.

Variable AUTOPICK has the volumes for both the autos and pickups. The variable AUTOC gives the total occupancy of the autos that crossed the bridge during the year. The rest of the variables are self- explanatory.

Exhibit 3.22. PROC CONTENTS output of SBPROGSO.SDS

```
Data Set Name: SDS.SBPROGSO                    Observations:          32
 Member Type:   DATA                           Variables:             6
 Engine:        V608                           Indexes:               0
 Created:       16:06 Sunday, November 14, 1993
 Observation Length:   24
 Last Modified: 16:06 Sunday, November 14, 1993
 Deleted Observations: 0
 Protection:                                   Compressed:           NO
 Data Set Type:                                Sorted:               NO
 Label:         SOUTHBOUND COUNTS  - PROGRESO BRIDGE

 -----Engine/Host Dependent Information-----

 Data Set Page Size:       2048
 Number of Data Set Pages: 1
 File Format:              607
 First Data Page:          1
 Max Obs per Page:         84
 Obs in First Data Page:   32
 Userid  :                 FTFD445
 File    :                 SBPROGSO SDS

             -----Alphabetic List of Variables and Attributes-----

 #    Variable    Type    Len    Pos     Label
 ------------------------------------------------------------------------
 4    AUTOC       Num       5    11     NUMBER OF*AUTO OCCUPANTS
 3    AUTOPICK    Num       5     6     NUMBER OF AUTOS*& PICKUPS
 1    IBWC        Num       3     0     CODES FOR*BRIDGES BY*IBWC
 5    PEDS        Num       5    16     NUMBER OF*PEDESTRIANS
 6    TRUCK       Num       3    21     NUMBER OF *TRUCKS
 2    YEAR        Num       3     3     CALENDAR*YEAR
```

Exhibit 3.23. Sample PROC PRINT of SBPROGSO.SDS

OBS	IBWC	YEAR	AUTOPICK	AUTOC	PEDS	TRUCK
1	1985	1961	173841	442433	126761	3901
2	1985	1962	195010	514374	114893	4388
3	1985	1963	205298	522776	147492	4421
4	1985	1964	231806	559024	140449	5440
5	1985	1965	264264	625396	190379	4612
6	1985	1966	272982	678731	188488	4393
7	1985	1967	292775	810404	209220	3893
8	1985	1968	330598	821596	222470	4779
9	1985	1969	388387	956765	249695	5814
10	1985	1970	438606	1041170	234404	6883

Southbound Traffic — Hidalgo Bridge

Data set SBHIDAL.SDS has the southbound volumes at the Hidalgo Bridge for the years 1983–1992 (the information was obtained from the bridge managers). This data set is self-explanatory, with Exhibits 3.24 showing its PROC CONTENTS output and Exhibit 3.25 showing a PROC PRINT output of its first ten observations. The variable AUTOPICK has the yearly volumes of autos and pickups. Variable HTRAIL (House Trailers) was added to this data set because this vehicle category was a considerable percentage of the total vehicles that crossed the Hidalgo Bridge. The other variables are self-explanatory.

Exhibit 3.24. PROC CONTENTS output of SBHIDAL.SDS

```
Data Set Name: SDS.SBHIDAL                    Observations:          10
Member Type:   DATA                           Variables:             7
Engine:        V608                           Indexes:               0
Created:       16:23 Sunday, November 14, 1993
Observation Length:   26
Last Modified: 16:23 Sunday, November 14, 1993
Deleted Observations: 0
Protection:                                   Compressed:           NO
Data Set Type:                                Sorted:               NO
Label:         SOUTHBOUND COUNTS HIDALGO BRIDGE

-----Engine/Host Dependent Information-----

Data Set Page Size:        2048
Number of Data Set Pages:  1
File Format:               607
First Data Page:           1
Max Obs per Page:          77
Obs in First Data Page:    10
Userid  :                  FTFD445
File    :                  SBHIDAL  SDS

      -----Alphabetic List of Variables and Attributes-----

#    Variable    Type    Len    Pos    Label
-----------------------------------------------------------------------
3    AUTOPICK    Num       5      6    NUMBER OF*AUTOS & PICKUPS
7    BUS         Num       3     23    NUMBER OF*BUSES
6    HTRAIL      Num       3     20    NUMBER OF HOUSE*TRAILERS
1    IBWC        Num       3      0    CODES FOR*BRIDGES BY IBWC
5    PEDS        Num       5     15    NUMBER OF*PEDESTRIANS
4    TWOSIXAX    Num       4     11    NUMBER OF* 2-6 AXLE*TRUCKS
2    YEAR        Num       3      3
```

Exhibit 3.25. Sample PROC PRINT of SBHIDAL.SDS

OBS	IBWC	YEAR	AUTOPICK	TWOSIXAX	PEDS	HITRAIL	BUS
1	2566	1983	3476472	50643	1023908	9604	20180
2	2566	1984	3601729	64415	989253	12287	22055
3	2566	1985	3618578	65139	956686	12770	24788
4	2566	1986	3840826	73250	1018361	12124	23451
5	2566	1987	3783555	95102	1057128	10453	24932
6	2566	1988	4104210	110516	1263847	10939	28273
7	2566	1989	4523909	129393	1127361	13817	38648
8	2566	1990	4558909	130574	1139986	16381	26254
9	2566	1991	4537927	131393	1181505	17440	27730
10	2566	1992	4802548	123859	1251840	9510	28200

Southbound Traffic — Roma Bridge

Data set SBROMA.SDS compiles traffic data obtained from Laredo State University for the calendar years 1989 through 1992. The variables are self-explanatory, with Exhibits 3.26 and 3.27, a PROC CONTENTS and sample PROC PRINT outputs of this data set, sufficient for explaining the data set contents.

Exhibit 3.26. PROC CONTENTS output of SBROMA.SDS

```
Data Set Name: SDS.SBROMA                          Observations:          4
Member Type:   DATA                                Variables:             7
Engine:        V608                                Indexes:               0
Created:       11:43 Monday, November 15, 1993
Observation Length:   24
Last Modified: 11:43 Monday, November 15, 1993
Deleted Observations: 0
Protection:                                        Compressed:            NO
Data Set Type:                                     Sorted:                NO
Label:         SOUTHBOUND COUNTS - ROMA BRIDGE

-----Engine/Host Dependent Information-----

Data Set Page Size:       2048
Number of Data Set Pages: 1
File Format:              607
First Data Page:          1
Max Obs per Page:         84
Obs in First Data Page:   4
Userid  :                 FTFD445
File    :                 SBROMA   SDS

      -----Alphabetic List of Variables and Attributes-----

#    Variable    Type    Len    Pos    Label
-----------------------------------------------------------------
3    AUTO        Num       5      6    NUMBER OF*AUTOS
7    BUS         Num       3     21    NUMBER OF*BUSES
1    IBWC        Num       3      0    CODES*FOR BRIDGES*BY IBWC
5    PEDS        Num       4     14    NUMBER OF*PEDESTRIANS
6    TRAILERS    Num       3     18    NUMBER OF*TRAILERS
4    TWOSIXAX    Num       3     11    NUMBER OF 2 - 6*AXLED TRUCKS
2    YEAR        Num       3      3    CALENDAR*YEAR
```

Exhibit 3.27. Sample PROC PRINT of SBROMA.SDS

OBS	IBWC	YEAR	AUTO	TWOSIXAX	PEDS	TRAILERS	BUS
1	4104	1989	366696	4105	104053	733	71
2	4104	1990	755121	8548	216641	1528	83
3	4104	1991	763933	8049	210311	1390	294
4	4104	1992	711705	5829	206694	1485	585

Southbound Traffic — Rio Grande Bridge

Data set SBGRANDE.SDS contains the yearly southbound traffic volumes for the Rio Grande Bridge; the information was obtained from the Starr-Camargo Bridge Company for fiscal years 1983 through 1992. The data set is depicted in Exhibits 3.28 and 3.29, which show a PROC CONTENTS and a sample PROC PRINT output of this data set, respectively.

Variable AUTOPICK includes autos, pickups, courtesy vehicles, and the vehicles not included in other variables. Variable AUTOC is the number of auto occupants in the year, including the number of courtesy passengers. The rest of the variables are self-explanatory.

Exhibit 3.28. PROC CONTENTS output of SBRGRANDE.SDS

```
Data Set Name: SDS.SBGRANDE                Observations:          10
 Member Type:   DATA                       Variables:             6
 Engine:        V608                       Indexes:               0
 Created:       11:41 Monday, November 15, 1993
 Observation Length:   22
 Last Modified: 11:41 Monday, November 15, 1993
 Deleted Observations: 0
 Protection:                               Compressed:            NO
 Data Set Type:                            Sorted:                NO
 Label:         SOUTHBOUND COUNTS - RIOGRANDE BRIDGE

 -----Engine/Host Dependent Information-----

 Data Set Page Size:       2048
 Number of Data Set Pages: 1
 File Format:              607
 First Data Page:          1
 Max Obs per Page:         91
 Obs in First Data Page:   10
 Userid  :                 FTFD445
 File    :                 SBGRANDE SDS

       -----Alphabetic List of Variables and Attributes-----
 #    Variable    Type    Len    Pos    Label
 ------------------------------------------------------------------
 3    AUTOPICK    Num       5      6    NUMBER OF AUTOS*& PICKUPS
 2    YEAR        Num       3      3    FISCAL*YEAR
 1    IBWC        Num       3      0    CODES FOR*BRIDGES BY*IBWC
 6    AUTOC       Num       5     17    NUMBER OF*AUTO OCCUPANTS
 5    PEDS        Num       3     14    NUMBER OF*PEDESTRIANS
 4    TWOSIXAX    Num       3     11    NUMBER OF 2-6*AXLES TRUCKS
```

Exhibit 3.29. Sample PROC PRINT of SBGRANDE.SDS

OBS	IBWC	YEAR	AUTOPICK	TWOSIXAX	PEDS	PASS
1	3779	1983	314582	5653	.	637609
2	3779	1984	344267	7032	.	692721
3	3779	1985	366213	9363	.	644821
4	3779	1986	370665	5355	.	687726
5	3779	1987	372269	6636	.	779470
6	3779	1988	405752	8095	.	788400
7	3779	1989	418940	12394	.	741504
8	3779	1990	412275	7595	.	698861
9	3779	1991	390180	8825	7851	611902
10	3779	1992	410285	11882	8871	642270

Southbound Traffic — Laredo Bridges

Data set SBLAREDO.SDS compiles yearly southbound traffic volumes for the three international bridges at Laredo (Laredo 1, Laredo 2, and Colombia, respectively) with IBWC codes 5806, 5808, and 6318. The data were obtained from the Laredo Bridge System. This agency does not disaggregate data by bridge, and the data are the sum of the traffic in all three bridges for calendar years 1977 through 1992.

This data set does not contain variable IBWC because the data are aggregated and cannot be associated with any individual bridge. The relational link with other data sets can be obtained by creating such variables as USCITY='LAREDO.'

Exhibits 3.30 and 3.31 show a PROC CONTENTS and a sample PROC PRINT output of this data set, respectively. Variable AUTOPICK has yearly volumes of autos, pickups, and other two-axle vehicles, empty and loaded. Variable TRUCK has the yearly volumes for trailers with three to five axles, empty and loaded. Variable BUS includes the counts for both local and through buses (the former are buses with origins and destinations in Laredo and Nuevo Laredo, and the latter are long-haul buses that use the Laredo Bridges). Separate counts are available for through and local buses for some years; but since they show that local buses are always less than 0.5 percent buses, additional space for this information was not provided. A separate variable, FRTVEH, was used to store information about the loaded vehicles, because the toll for these vehicles are higher and their counts are provided separately. This variable double counts the loaded vehicles already counted in variables AUTOPICK and TRUCK. Total number of empty vehicles is shown in Equation 3.1, and total traffic can be obtained according to Equation 3.2.

$$\text{EMPTY} = \text{AUTOPICK}+\text{TRUCK}-\text{FRTVEH} \tag{3.1}$$

$$\text{TOTAL} = \text{AUTOPICK}+\text{TRUCKS}+\text{BUS} \tag{3.2}$$

Exhibit 3.30. PROC CONTENTS output of SBLAREDO.SDS

```
Data Set Name: SDS.SBLAREDO                    Observations:        16
Member Type:   DATA                            Variables:           6
Engine:        V608                            Indexes:             0
Created:       12:09 Monday, November 15, 1993
Observation Length:   42
Last Modified: 12:09 Monday, November 15, 1993
Deleted Observations: 0
Protection:                                    Compressed:          NO
Data Set Type:                                 Sorted:              NO
Label:         SOUTHBOUND COUNTS-LAREDO BRIDGES

-----Engine/Host Dependent Information-----

Data Set Page Size:       3072
Number of Data Set Pages: 1
File Format:              607
First Data Page:          1
Max Obs per Page:         72
Obs in First Data Page:   16
Userid  :                 FTFD445
File    :                 SBLAREDO SDS

      -----Alphabetic List of Variables and Attributes-----

#    Variable    Type    Len    Pos    Label
-----------------------------------------------------------------
4    AUTOPICK    Num       5     25 NUMBER OF*AUTOS&*PICKUPS
6    BUS         Num       3     34 NUMBER OF LOCAL&*THRU BUSES
1    FRTVEH      Num       5     37 NUMBER OF FREIGHT VEHICLES
3    PEDS        Num       5     20 NUMBER OF*PEDESTRIANS
5    TRUCK       Num       4     30 NUMBER OF* 3-5 AXLE*TRAILERS
2    YEAR        Num       3     17
```

Exhibit 3.31. Sample PROC PRINT of SBLAREDO.SDS

OBS	YEAR	PEDS	AUTOPICK	TRUCK	BUS	FRTVEH
1	1977	3186451	.	.	.	58227
2	1978	3160340	.	.	.	72966
3	1979	3165194	.	.	.	79816
4	1980	3217267	5162832	146059	30485	99358
5	1981	3459890	5534787	168271	29177	122314
6	1982	2846744	5397380	110434	20463	72258
7	1983	2692894	5130493	103181	12096	49811
8	1984	2932308	5259457	138502	13600	77589
9	1985	3072734	5162832	146059	30485	98589
10	1986	3118586	5501961	148694	8568	90632

Southbound Traffic — Eagle Pass Bridge

Data set SBEGPASS.SDS stores the southbound volume history for fiscal years 1988 through 1992 for the Eagle Pass Bridge. This self-explanatory data set is depicted in Exhibits 3.32 and 3.33, which show its PROC CONTENTS and a PROC PRINT output of its first ten observations, respectively.

Exhibit 3.32. PROC CONTENTS Output of SBEGPASS.SDS

```
Data Set Name: SDS.SBEGPASS                    Observations:         5
Member Type:   DATA                            Variables:            6
Engine:        V608                            Indexes:              0
Created:       16:19 Sunday, November 14, 1993
Observation Length:   22
Last Modified: 16:19 Sunday, November 14, 1993
Deleted Observations: 0
Protection:                                    Compressed:           NO
Data Set Type:                                 Sorted:               NO
Label:         NORTHBOUND COUNTS - EAGLEPASS BRIDGE

-----Engine/Host Dependent Information-----

Data Set Page Size:       2048
Number of Data Set Pages: 1
File Format:              607
First Data Page:          1
Max Obs per Page:         91
Obs in First Data Page:   5
Userid  :                 FTFD445
File    :                 SBEGPASS SDS

      -----Alphabetic List of Variables and Attributes-----

#    Variable    Type    Len    Pos    Label
-----------------------------------------------------------------------
3    AUTO        Num       5      6    NUMBER OF*AUTOS
6    BUS         Num       3     19    NUMBER OF*BUSES
1    IBWC        Num       3      0    CODES FOR*BRIDGES BY IBWC
4    PEDS        Num       5     11    NUMBER OF*PEDESTRIANS
5    TRUCK       Num       3     16    NUMBER OF*TRUCKS
2    YEAR        Num       3      3    FISCAL*YEAR
```

Exhibit 3.33. Sample PROC PRINT of SBEGPASS.SDS

OBS	IBWC	YEAR	AUTO	PEDS	TRUCK	BUS
1	7987	1988	2358442	486672	40335	1068
2	7987	1989	2430531	475445	40940	1117
3	7987	1990	2419838	470562	39805	1405
4	7987	1991	2409809	374359	38157	5805
5	7987	1992	2507973	383046	46052	5268

Southbound Traffic — Del Rio Bridge

Data set SBDELRIO.SDS contains southbound traffic history for the Del Rio Bridge, for which IBWC=9029. Variable YEAR is fiscal year (October through September), and the other variables store the yearly volumes of each vehicle category. Exhibits 3.34 and 3.35 show a PROC CONTENTS output and a sample PROC PRINT output of this data set, respectively.

Exhibit 3.34. PROC CONTENTS output of SBDELRIO.SDS

```
 Data Set Name: SDS.SBDELRIO                    Observations:          13
Member Type:    DATA                            Variables:             6
Engine:         V608                            Indexes:               0
Created:        16:05 Sunday, November 14, 1993
Observation Length:   22
Last Modified: 16:05 Sunday, November 14, 1993
Deleted Observations: 0
Protection:                                     Compressed:            NO
Data Set Type:                                  Sorted:                NO
Label:          SOUTHBOUND COUNTS DELRIO BRIDGE

-----Engine/Host Dependent Information-----

Data Set Page Size:       2048
Number of Data Set Pages: 1
File Format:              607
First Data Page:          1
Max Obs per Page:         91
Obs in First Data Page:   13
Userid  :                 FTFD445
File    :                 SBDELRIO SDS

          -----Alphabetic List of Variables and Attributes-----

#    Variable    Type    Len    Pos    Label
-----------------------------------------------------------------------
3    AUTO        Num       5      6    NUMBER OF*AUTOS 2 - AXLED
6    BUS         Num       3     19    NUMBER OF BUSES
2    YEAR        Num       3      3    FISCAL*YEAR
1    IBWC        Num       3      0    CODES FOR*BRIDGES BY IBWC
4    PEDS        Num       5     11    NUMBER OF*PEDESTRIANS
5    TRUCK       Num       3     16    NUMBER OF* TRUCKS& 3-5 AXLED*TRAILERS
```

Exhibit 3.35. Sample PROC PRINT of SBDELRIO.SDS

OBS	IBWC	FYEAR	AUTO	PEDS	TRUCK	BUS
1	9029	1980	1234856	77408	7149	8002
2	9029	1981	1381572	66438	6655	5780
3	9029	1982	963357	37205	3293	3690
4	9029	1983	1233608	44660	4387	6084
5	9029	1984	975295	49513	5881	5959
6	9029	1985	1054780	59483	6727	7039
7	9029	1986	961803	61784	8181	7157
8	9029	1987	804206	71134	11673	7094
9	9029	1988	892297	79809	19558	7354
10	9029	1989	1072873	80130	26034	7786

Variables PEDS and BUSES store the yearly volumes of pedestrians and buses, respectively. Variable AUTO includes pickups and two-axle trucks, and variable TRUCK stores all trucks and any trailers having three to five axles.

Southbound Traffic — El Paso Bridges

There are four vehicular bridges linking El Paso, Texas, to Ciudad Juarez, Chihuahua: Paso del Norte (IBWC=20120), Good Neighbor or Stanton Street (IBWC=20116), Ysleta-Zaragoza (IBWC=19929) and the Bridge of the Americas (IBWC=20078). The Bridge of the Americas is a free bridge, and as such there are no agencies or organizations monitoring its traffic. The other three bridges are monitored for accounting purposes; their yearly traffic volume histories, available for the southbound direction, are stored in the three data sets described below.

Data Set SBPDN.SDS: Since Paso Del Norte is a northbound bridge, southbound data consist only of the number of pedestrians. Data are available for calendar years 1989–1992 from the City of El Paso and from Laredo State University. The data set is simple and self-explanatory. Its PROC CONTENTS and sample PROC PRINT outputs are shown in Exhibits 3.36 and 3.37.

Exhibit 3.36. PROC CONTENTS output of SBPDN.SDS

```
Data Set Name: SDS.SBPDN                    Observations:          4
Member Type:   DATA                         Variables:             3
Engine:        V608                         Indexes:               0
Created:       13:21 Monday, November 15, 1993
Observation Length:   11
Last Modified: 13:21 Monday, November 15, 1993
Deleted Observations: 0
Protection:                                 Compressed:            NO
Data Set Type:                              Sorted:                NO
Label:         SOUTHBOUND COUNTS PDN BRIDGE

-----Engine/Host Dependent Information-----

Data Set Page Size:        2048
Number of Data Set Pages:  1
File Format:               607
First Data Page:           1
Max Obs per Page:          182
Obs in First Data Page:    4
Userid  :                  FTFD445
File    :                  SBPDN    SDS

      -----Alphabetic List of Variables and Attributes-----

#    Variable    Type    Len    Pos    Label
------------------------------------------------------------------
1    IBWC        Num       3      0    CODES FOR*BRIDGES BY IBWC
3    PEDS        Num       5      6    NUMBER OF*PEDESTRIANS
2    YEAR        Num       3      3    CALENDAR*YEAR
```

Exhibit 3.37. Sample PROC PRINT of SBPDN.SDS

OBS	IBWC	YEAR	PEDS
1	20120	1989	3107835
2	20120	1990	3253511
3	20120	1991	3328393
4	20120	1992	3423025

Data Set SBGNB.SDS: This bridge, also called the Stanton Street Bridge, carries only noncommercial southbound traffic. Data Set SBGNB.SDS has auto and pedestrian yearly volumes for calendar years 1989 through 1992. The self-explanatory variables are depicted in Exhibits 3.38 and 3.39, which show a PROC CONTENTS and a sample PROC PRINT output of this data set, respectively.

Exhibit 3.38. PROC CONTENTS output of SBPGNB.SDS

```
Data Set Name: SDS.SBGNB                          Observations:          4
 Member Type:   DATA                              Variables:             4
 Engine:        V608                              Indexes:               0
 Created:       13:28 Monday, November 15, 1993
 Observation Length:   16
 Last Modified: 13:28 Monday, November 15, 1993
 Deleted Observations: 0
 Protection:                                      Compressed:            NO
 Data Set Type:                                   Sorted:                NO
 Label:         SOUTHBOUND COUNTS STANTON BRIDGE

 -----Engine/Host Dependent Information-----

 Data Set Page Size:       2048
 Number of Data Set Pages: 1
 File Format:              607
 First Data Page:          1
 Max Obs per Page:         126
 Obs in First Data Page:   4
 Userid  :                 FIFD445
 File    :                 SBGNB SDS

       -----Alphabetic List of Variables and Attributes-----

 #    Variable    Type    Len    Pos    Label
 ------------------------------------------------------------
 1    IBWC        Num       3      0    CODES FOR*BRIDGES BY IBWC
 3    PEDS        Num       5      6    NUMBER OF*PEDESTRIANS
 4    VEH         Num       5     11    NUMBER OF AUTOS
 2    YEAR        Num       3      3    CALENDAR*YEAR
```

Exhibit 3.39. Sample PROC PRINT of SBGNB.SDS

OBS	IBWC	YEAR	PEDS	VEH
1	20116	1989	1829106	2898534
2	20116	1990	1927471	2646213
3	20116	1991	1944499	2268324
4	20116	1992	1640292	2757868

Data Set SBYSLETA.SDS: The Ysleta Zaragoza Binational Entry System comprises two bridges, one for commercial traffic and the other for noncommercial traffic. Their IBWC codes are 19929 and 19930, respectively. Data Set SBYSLETA.SDS has the traffic volumes counts for the vehicles at both the commercial and the noncommercial bridge. Exhibits 3.40 and 3.41 show a PROC CONTENTS and PROC PRINT output of this data set. Data for this recently remodeled bridge are available only for calendar years 1991 and 1992.

Exhibit 3.40. PROC CONTENTS of SBYSLETA.SDS

```
Data Set Name: SDS.SBYSLETA                    Observations:          2
Member Type:   DATA                            Variables:             4
Engine:        V608                            Indexes:               0
Created:       13:18 Monday, November 15, 1993
Observation Length:   21
Last Modified: 13:18 Monday, November 15, 1993
Deleted Observations: 0
Protection:                                    Compressed:            NO
Data Set Type:                                 Sorted:                NO
Label:         SOUTHBOUND COUNTS YSLETA BRIDGE

-----Engine/Host Dependent Information-----

Data Set Page Size:       2048
Number of Data Set Pages: 1
File Format:              607
First Data Page:          1
Max Obs per Page:         96
Obs in First Data Page:   2
Userid  :                 FTFD445
File    :                 SBYSLETA SDS

              -----Alphabetic List of Variables and Attributes-----

#    Variable    Type    Len  Pos    Label
-------------------------------------------------------------------------
5    COMM        Num       5   16  COMMERCIAL*VEHICLES
4    NONCOMM     Num       5   11  NON-COMMERCIAL*VEHICLES
3    PEDS        Num       5    6  NUMBER OF*PEDESTRIANS
2    YEAR        Num       3    3  CALENDAR*YEAR
```

Exhibit 3.41. Sample PROC PRINT of SBYSLETA.SDS

OBS	YEAR	PEDS	NONCOMM	COMM
1	1991	198516	1874669	82527
2	1992	142833	2159393	182599

Because each data set observation refers to two different bridges, this data set does not include variables IBWC. However, a temporary data set can be created that separates both bridges. This data set arrives at variable IBWC, the relational link, by using the SAS statements in Exhibit 3.42, which in turn create the data set shown in Exhibit 3.43. Total vehicles at this binational entry system can be obtained by adding variables COMM and NONCOMM.

Exhibit 3.42. SAS statements to create IBWC relational link

```
DATA COMMA;
SET SDS. SBYSLETA;
KEEP YEAR COMM;
IBWC=19929;
DATA NCOM;
SET SDS. SBYSLETA;
KEEP YEAR NONCOMM;
IBWC=19930;
DATA YSLETA; SET COM NCOM;
PROC SORT; BY IBCW YEAR;
PROC PRINT;
```

Exhibit 3.43. Temporary data set with IBWC relational link

OBS	IBWC	YEAR	NONCOMM	COMM
1	19929	1991	.	82527
2	19929	1992	.	182599
3	19930	1991	1874669	.
4	19930	1992	2159393	.

CHAPTER 4. HIGHWAY TRAFFIC DATA

INTRODUCTION

Forecasting future traffic trends — an essential part of effective transportation planning and highway design — depends on analyses of traffic histories. Accordingly, this study identified all major highway links to the Texas-Mexico binational entry systems and collected traffic histories in Texas and in Mexico from TxDOT traffic reports and from the Secretaría de Comunicaciones y Transportes (SCT), respectively. This chapter describes the U.S. and Mexican data and explains the data collection procedures, the type of information available in each country, and the data sets that store the data. It also presents examples of data reports extracted from the data base.

The data, organized in a format that is convenient for research purposes, always takes into account the need for economy of storage space. This required five separate data sets, one for Mexican traffic history and four for Texas traffic history. These data sets are summarized in Table 4.1.

Table 4.1. General organization of highway traffic data

Basic Data Type	Data Set	General Contents
Mexican border highways	MEXHWY.SDS	Annual average daily traffic of main Mexican routes to the border, by vehicle type when available.
Texas border highways	TXADT.SDS	Average daily traffic of main Texas routes to the border, by month and by weekday.
	TXHIGH.SDS	High hour volumes of main Texas routes to the border.
	TXHOUR.SDS	Average hourly volumes of main Texas routes to the border, by weekday.
	TXSTAT.SDS	Locations of automatic traffic recorder (ATR) stations used in data collection.

Because binational transportation planning studies use data from both sides of the border, it is important that these data be consistent. The next section discusses and compares the procedures used in Texas and in Mexico to record and reduce the raw traffic counts and to estimate average daily traffic (ADT).

PROCEDURES TO CALCULATE AVERAGE DAILY TRAFFIC FROM TRAFFIC RECORDS

Raw data from field traffic recorders usually consist of a very large series of counts that must be reduced for meaningful use. One of the most widely used figures obtained from raw traffic counts is the average daily traffic (ADT), which represents the average daily number of vehicles using the highway section during a certain period of time. It is possible to define ADT for any desired period, such as a typical day of the week, a certain month or season in a given

year, or a certain year, with the data reduction requirements depending on the objectives of each study. The ideal ADT figure is obtained by averaging uninterrupted traffic counts for the entire period of interest. Economic reasons, however, limit the feasibility of such comprehensive coverage, and most ADT data are obtained from samples of the period of interest, which are corrected based on the continuous counts from a permanent station having similar traffic fluctuations.

The TRANSBORDER data base includes ADT data obtained from two different sources — TxDOT and SCT — and are used together in border transportation planning studies. Both sources report only reduced data (their raw data are not publicly available). Therefore, it is important to first discuss and compare the procedures used by both agencies to record the traffic counts and to compute the ADT figures stored in the data base.

Procedure for Monitoring Traffic and Estimating ADT — Texas

This section presents an overview of the methodology for collecting and reducing traffic data in Texas, based on the Highway Performance Monitoring System and the Federal Traffic Monitoring Guide.

There are three categories of traffic data collected in the Texas Traffic Monitoring Program: vehicular volume data, vehicular classification data, and weight in motion data. Vehicular volume data are collected either by automatic traffic recorders (ATR) operating continuously at permanent stations, or by 24-hour portable short-term-coverage counters. The TRANSBORDER data base concentrates on permanent ATR data, because they provide a consistent traffic history and the most reliable ADT figures available. There are 155 ATR sites in Texas; the TRANSBORDER data base contains the 24 sites that are either at the border region or at main routes to the border region.

An ATR site consists of an embedded inductance loop connected to a box on the roadside which contains the recorder and the telemetry equipment. TXDOT utilizes a Streeter Amet model 241 classification device, which is programmed to count vehicle passes. Data from all ATR stations are compiled daily at midnight and recorded in terms of vehicles per hour for the 24 one-hour time intervals in the day.

Short-term counts are taken for 24 hours once per year, at about 60,000 rural sites and 15,000 urban sites, using Automatic Cumulative Recorders (ACR), which consist of rubber tubes connected to a pneumatic counter device that counts axle passes. At the end of the 24-hour period, the ACR data are recorded in terms of site location, date, and cumulative axle counts. These data are sent to TxDOT for analysis and compilation; ultimately, they are used to produce yearly flow-band maps of the entire state highway system. While these maps are far more extensive and precise than federally recommended, they do not provide the same accuracy as the permanent ATR stations, which continuously record the traffic volumes. Data collected using 24-hour recorders are corrected using the ratio between the same 24-hour counts and the AADT from the nearest permanent station.

Vehicle classification data can be collected either automatically or manually by a crew of

three or four data collection technicians who take three or four consecutive 8-hour or 6-hour shifts over a 24-hour period. There are two procedures used in Texas to collect vehicular classification data: the continuous and the short-term. Both procedures utilize the Streeter Amet model 241 Automatic Vehicle Classification (AVC) device. Vehicle characteristics in terms of number of axles and spacing are preprogrammed in the computer for the 13 vehicle categories standardized by FHWA. In addition, two other categories are programmed, one for user customization and the other for vehicles not recognized under any other category. The data are recorded in terms of lane, vehicle type, speed, length, gap, and headway, and they are compiled daily at midnight. There are 24 proposed continuous classification sites at the Texas-Mexico border, 12 of which were activated in September 1992. It is recommended that these data be added to the TRANSBORDER data base as soon as they become publicly available.

Truck weight data are collected by weigh-in-motion (WIM) devices at selected sites each year. Data are collected using either permanent or portable equipment. These data are very important for transportation planning, highway and bridge design, and for pavement design. It is recommended that truck weight data be added to the TRANSBORDER data base when border coverage is expanded.

Permanent ATR stations provide the ideal ADT figures because they are averaged for the entire period of interest, rather than extrapolated from smaller samples. ADT figures from permanent stations are used to develop seasonal factors to correct the ADT from 24-hour counts (ACR). There are 24 permanent ATR stations located on main routes to the border, providing very good coverage of the Texas side of the border (comparable to that of the Mexican side of the border). Therefore, the TRANSBORDER data base contains only data from ATR stations, and the ADT data in it consist of the most reliable figures available in Texas.

Procedure for Monitoring Traffic and Estimating ADT — Mexico

This section discusses the procedure currently used by SCT to determine the Annual Average Daily Traffic (AADT) on Mexican highways. The procedures are similar to those used in Texas, with the data comparable as stored. Like TxDOT, SCT also relies on both temporary and permanent traffic recording stations. Permanent stations are located on highway sections considered representative of a certain part of the highway network; the continuous, uninterrupted traffic counts from these stations are used to correct the AADTs from temporary stations.

In temporary stations, a 7-day sample is continuously taken each year using traffic recorders of the same type used by TxDOT. In some of these stations, manual vehicle classification data are also obtained to determine traffic composition.

The ADTs obtained from the temporary station 7-day sample are corrected to annual ADTs using the same period average from the nearest permanent station with similar traffic characteristics, as shown in Eq. 4.1.

$$AADT_{temp} = ADT_{7\text{-day}} \times \frac{AADT_p}{ADT_{7\text{-day p}}} \qquad (4.1)$$

where:

AADTtemp = annual average daily traffic at the temporary station,

$ADT_{7\text{-day}}$ = average of the seven-day counts in the temporary station,

$AADT_p$ = annual average daily traffic obtained from continuous counts at the nearest permanent station, and

ADT7-day p = average of all counts obtained for the same week, at the nearest permanent station.

The basic assumption in the AADT calculation is that the rate between the overall annual average and the weekly average is constant for nearby highway sections with similar traffic characteristics and can be construed as a correction factor for seasonal fluctuations. Correction factors used by the FHWA and by TxDOT are based on the same assumption, so Mexican and Texas ADT estimates are consistent. The main difference is that, in Mexico, the temporary stations record traffic for a full week, while in Texas these temporary stations are active for only 24 hours. On the one hand, Mexican estimates are better than Texas estimates on that account; on the other hand, the correction factors for Texas are better because Texas ATR coverage is the best in the U.S. and, thus, more comprehensive than that available in Mexico.

Conclusions

The state of Texas has the most comprehensive traffic monitoring program in the United States, covering 35 percent more sites than Oregon covers (the second most comprehensive program in the U.S.). Consequently, the amount of Texas data in the TRANSBORDER data base exceeds the amount of Mexican data and provides more comprehensive information, because hourly volumes and high hours are reported by TxDOT but not by SCT. At the same time, however, all main U.S. routes to the border could only be covered using permanent stations, while the Mexican data include both permanent stations and estimates obtained from temporary stations. Nevertheless, the TRANSBORDER data base contains the best available highway traffic histories relating to both sides of the border.

MEXICAN TRAFFIC DATA — USER'S GUIDE

Traffic histories at major Mexican border routes are stored in data set MEXHWY.SDS, which contains annual average daily traffic data. A thorough understanding of the contents of this data set requires a brief explanation of the data collection procedures used for the Mexican roads. This explanation is given in the next section, together with a description of the data set.

Data Set Description

Mexican traffic data are collected and stored by highway sections, which are usually identified by their starting and ending points. For example, the Cd. Victoria-Matamoros section of Highway MEX101/180 indicates that the traffic data are applicable to the MEX 101/180

highway section starting at Cd. Victoria and ending in Matamoros, while MEX 101/180 means that highways MEX101 and MEX180 are superimposed on this particular segment.

Each highway section has a traffic counting station physically identified by a kilometer-post. These stations are also assigned a code, which is required by SCT if there are questions about the data. The first two digits of the station code correspond to the state codes, and the other digits identify the section within the state. State codes of the Mexican states that have a border with Texas are listed in Table 4.2.

Table 4.2. Mexican border states codes

State	Code
Nuevo León	19
Tamaulipas	28
Chihuahua	08
Coahuila	05

The actual traffic counting can be performed at locations in advance of the kilometer post, exactly at the kilometer post, and beyond the kilometer post. This is termed "station type" by SCT, and it is stored in variable STYPE, which takes the values 1, 2, and 3, respectively, for before, exactly at, and after the kilometer post. The traffic direction (variable DIR) can be the same as increasing kilometer posts, (traffic direction=0), decreasing kilometer posts (traffic direction=1), or both ways (traffic direction=2). If the volumes were recorded in the frontage roads, the traffic direction is 3 when the direction is the same as increasing kilometer posts, and 4 for decreasing kilometer posts. Figure 4.1 schematically shows a highway section, with frontage roads at each side, where the traffic counts were taken around km 175. The circles in the main road represent the station type, i.e., its location with respect to the km post. The directions at which the traffic can be recorded are depicted in the main and the frontage roads.

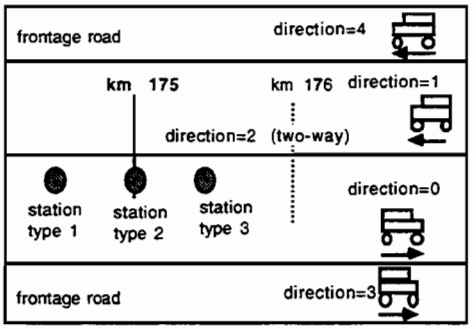

Figure 4.1. Scheme of station type and direction for MEXHWY.SDS

In some stations, only total traffic volumes are available, while in others they are broken down into the following vehicle types: autos, buses, two-axle trucks, three-axle trucks, four-axle trucks, and six or more axle trucks. No five-axle trucks were observed in any highway, and the data set does not have a "T5" variable. Every station in this data set has an AADT value for total traffic; whenever available, the percentages of AADT for each vehicle type are also stored. The contents of this data set are summarized in Table 4.3. Table 4.4 shows a summary of the values of the variables STYPE and DIR and their respective decoded values.

Table 4.3. Contents of MEXHWY.SDS

Variable	Meaning	Type	Format
HWY	Highway name	Character	
SECTION	Geographical identification of the highway section by starting and ending points	Character	
STATION	Station Code Number	Numeric	
LOCATION	Closest city or point of interest to station	Character	
KM	Kilometer-post	Numeric	
STYPE	Station type, i.e., position of the actual counts with respect to the kilometer-post	Numeric	STYPE.
DIR	Direction of traffic counts	Numeric	DIR.
YEAR	year of traffic counts	Numeric	
ADT	Total ADT for that year and traffic direction	Numeric	
AUTO	percent autos in ADT	Numeric	
BUS	percent buses in ADT	Numeric	
T2	percent 2-axle trucks in ADT	Numeric	
T3	percent 3-axle trucks in ADT	Numeric	
T4	percent 4-axle trucks in ADT	Numeric	
T6	percent 6 of more-axle trucks in ADT	Numeric	

Table 4.4. Decoded values of variable DIR and STYPE

Variable	Format	Actual Value	Decoded Value
STYPE	STYPE.	1	Before km-post
		2	At km-post
		3	After km-post
DIR	DIR.	0	Increasing km-post, main road
		1	Decreasing km-post, main road
		2	Two-way, main road
		3	Increasing km-post, frontage
		4	Decreasing km-post, frontage

Exhibit 4.1 depicts a PROC CONTENTS output from the MEXHWY.SDS data set, while Exhibit 4.2 shows PROC PRINT of the first ten observations. The formats STYPE. and DIR., shown in Table 4.3, decode the variables STYPE and DIR according to Figure 4.1 and Table 4.4.

Exhibit 4.1. PROC contents output for data set MEXHWY.SDS

CONTENTS PROCEDURE

Data Set Name:	SDS.MEXHWY	Observations:	415
Member Type:	DATA	Variables:	15
Engine:	V608	Indexes:	0
Created:	16:17 Monday, August 23, 1993	Observation Length:	166
Last Modified:	16:17 Monday, November 15, 1993	Deleted Observations:	0
Protection:		Compressed:	NO
Data Set Type:		Sorted:	NO
Label:	ADT HISTORY AT MEXICAN HWYS		

-----Engine/Host Dependent Information-----

Data Set Page Size:	9216
Number of Data Set Pages:	8
File Format:	607
First Data Page:	1
Max Obs per Page:	55
Obs in First Data Page:	42
Userid :	FTFD441
File :	MEXHWY SDS

-----Alphabetic List of Variables and Attributes-----

#	Variable	Type	Len	Pos	Format	Label
4	ADT	Num	4	102		AVERAGE*DAILY*TRAFFIC
14	AUTO	Num	7	152		PERCENT*AUTOS
15	BUS	Num	7	159		PERCENT*BUSES
5	DIR	Num	2	106	DIR.	TRAFFIC*DIRECTION
3	HWY	Char	12	90		
6	KM	Num	7	108		KM-POST
2	LOCATION	Char	30	60		STATION*LOCATION
1	SECTION	Char	60	0		
7	STATION	Num	4	115		STATION*CODE
8	STYPE	Num	2	119	STYPE.	STATION*TYPE
9	T2	Num	7	121		PERCENT OF*TWO AXLE*TRUCKS
10	T3	Num	7	128		PERCENT OF*THREE AXLE*TRUCK
11	T4	Num	7	135		PERCENT OF*FOUR AXLE*TRUCK
12	T6	Num	7	142		PERCENT OF*SIX AXLE*TRUCKS
13	YEAR	Num	3	149		

Exhibit 4.2. PROC print output for data set MEXHWY.SDS — sample

OBS	STATION CODE	STATION LOCATION	HWY	SECTION	KM-POST
1	28025	SAN_FERNANDO	MEX101/180	CD.VICTORIA-MATAMOROS	175
2	28398	SAN_FERNANDO	MEX101/180	CD.VICTORIA-MATAMOROS	175
3	28025	SAN_FERNANDO	MEX101/180	CD.VICTORIA-MATAMOROS	175
4	28025	SAN_FERNANDO	MEX101/180	CD.VICTORIA-MATAMOROS	175
5	28025	SAN_FERNANDO	MEX101/180	CD.VICTORIA-MATAMOROS	175
6	28025	SAN_FERNANDO	MEX101/180	CD.VICTORIA-MATAMOROS	175
7	28026	JCT_REYNOSA	MEX101/180	CD.VICTORIA-MATAMOROS	202
8	28326	JCT_REYNOSA	MEX101/180	CD.VICTORIA-MATAMOROS	202
9	28026	JCT_REYNOSA	MEX101/180	CD.VICTORIA-MATAMOROS	202
10	28326	JCT_REYNOSA	MEX101/180	CD.VICTORIA-MATAMOROS	202

OBS	STATION CODE	STATION TYPE	TRAFFIC DIRECTION	YEAR	AVERAGE DAILY TRAFFIC
1	28025	BEFORE KM-POST	INCREASING KM-POST MAIN ROAD	1990	3978
2	28398	AFTER KM-POST	INCREASING KM-POST MAIN ROAD	1990	4524
3	28025	BEFORE KM-POST	INCREASING KM-POST MAIN ROAD	1989	3864
4	28025	BEFORE KM-POST	INCREASING KM-POST MAIN ROAD	1988	3606
5	28025	BEFORE KM-POST	INCREASING KM-POST MAIN ROAD	1987	3370
6	28025	BEFORE KM-POST	INCREASING KM-POST MAIN ROAD	1986	3100
7	28026	BEFORE KM-POST	INCREASING KM-POST MAIN ROAD	1990	4562
8	28326	AFTER KM-POST	INCREASING KM-POST MAIN ROAD	1990	3152
9	28026	BEFORE KM-POST	INCREASING KM-POST MAIN ROAD	1989	4429
10	28326	AFTER KM-POST	INCREASING KM-POST MAIN ROAD	1989	2929

OBS	STATION CODE	PERCENT AUTOS	PERCENT BUSES	PERCENT OF TWO AXLE TRUCKS	PERCENT OF THREE AXLE TRUCK	PERCENT OF FOUR AXLE TRUCK	PERCENT OF SIX AXLE TRUCKS
1	28025	.	.	.	.	.	.
2	28398	79.5	4.6	5.2	3.3	0.5	3.4
3	28025	.	.	.	.	.	.
4	28025	.	.	.	.	.	.
5	28025	63.8	8.9	9.6	10.0	0.4	2.3
6	28025	59.6	3.2	15.8	10.0	0.5	5.3
7	28026	.	.	.	.	.	.
8	28326	.	.	.	.	.	.
9	28026	.	.	.	.	.	.
10	28326	.	.	.	.	.	.

Summary and Recommendations

Data set MEXHWY contains annual ADT histories for all major highway links to the Texas-Mexico border. The stations are located in different positions with respect to km post and main or frontage roads, and the variables storing this information are decoded using internal formats stored in FORLIB.DATABASE, as shown in Table 4.4. AADT figures come from both permanent and temporary stations, with the procedure used to estimate AADT from temporary stations similar to that used in Texas, though based on 7-day temporary counts, rather than on

24-hour as used in Texas.

Mexican traffic data are continuously collected and published annually by SCT in "Datos Viales." Each issue of "Datos Viales" contains data from the year before issuance, i.e., the "Datos Viales 1990" contains 1989 traffic data, and so on. It is recommended that the TRANSBORDER data base be updated every year, as new publications are issued.

TEXAS TRAFFIC DATA — USER'S GUIDE

General Information

The traffic counts stored in the TRANSBORDER data base summarize information obtained from permanently located Automatic Traffic Recorders (ATR), owned and operated by TxDOT. The AT recorders are installed on several highway systems throughout the state, with the stations selected to be part of the TRANSBORDER data base located either in the border region or on main routes leading to the border (these represent a total of 24 sections and 14 years of history).

ATR stations are identified by a letter and a number, such as A308. There have been changes in the station identification code in some cases, and the TRANSBORDER Data Base uses the most recent section identification in all files. All traffic is counted in both directions of traffic, and a percent directional distribution factor is available when there are separate ATR devices for each traffic direction.

The raw data are reduced and published in three different ways: ADT by month and day of the week, high hour volumes for each year, and average hourly volumes by typical day of the week. This required three separate data sets, one for each type of traffic information. The station code is the only variable identifying the section location in these three data sets; a fourth data set was created which contains the station codes and their respective geographical location. These data sets are listed in Table 4.5. The next four sections of this chapter describe these four data sets in detail.

Table 4.5. Summary of traffic data of Texas highways

Data Set	Contents
TXSTAT.SDS	Station codes and locations.
TXHIGH.SDS	Hourly Volumes by days of the week, 1979 to 1992
TXHOUR.SDS	High Hours, 1979 to1992.
TXADT.SDS	Average daily traffic (ADT) by month, and day of the week, 1979 to 1992

Description of Data Set TXSTAT.SDS

Each ATR station included in the TRANSBORDER data base is assigned a code and is geographically identified by its position on the highway with respect to nearest intersection or point of interest, in addition to the name of the nearest city. This data set contains three self-explanatory character variables, which are depicted in Table 4.6.

Table 4.6. Contents of TXSTAT.SDS

Variable	Values	Example
STATION	ATR station code	A308
LOCATION	Description of station location	IH35 0.7 Miles FM 1472 IH35, 0.7 miles north of FM 1472.
USCITY	Nearest US City	LAREDO

The main purpose of this data set is to save the storage space that would otherwise be required to store variables LOCATION and USCITY in the other data sets containing Texas ATR data. The latter contain only the station code, and more elaborate and informative printouts can be obtained by merging any one of the traffic data sets with TXSTAT.SDS by variable STATION, which is the relational link between the four data sets.

A PROC CONTENTS of TXSTAT.SDS is shown in Exhibit 4.3, with its complete PROC PRINT output shown is Exhibit 4.4. There are no variable labels or internal formats, since the data set is self-explanatory.

Exhibit 4.3. PROC contents output of TXSTAT.SDS

```
Data Set Name: SDS.TXSTAT                          Observations:      24
 Member Type:   DATA                                Variables:         3
 Engine:    V608                                    Indexes:           0
 Created:     11:50 Monday, August 23, 1993
 Observation Length:   49
 Last Modified: 11:50 Monday, August 23, 1993
 Deleted Observations: 0
 Protection:                                        Compressed:        NO
 Data Set Type:                                     Sorted:            NO
 Label:     LOCATION OF THE STATIONS

 -----Engine/Host Dependent Information-----

 Data Set Page Size:     3072
 Number of Data Set Pages: 1
 File Format:        607
 First Data Page:      1
 Max Obs per Page:     62
 Obs in First Data Page:   22
 Userid  :         FTFD445
 File  :         TXSTAT   SDS

 -----Alphabetic List of Variables and Attributes-----

 #  Variable  Type  Len  Pos
 ---------------------------------
 2  LOCATION  Char   25    4
 1  STATION   Char    4    0
 3  USCITY    Char   20   29
```

Exhibit 4.4. PROC print output of TXSTAT.SDS

OBS	STATION	LOCATION	USCITY
1	A308	IH35_0.7_MI_N_FM1472	LAREDO
2	A027	LP374_1.3_MI_E_US281	PHARR
3	S028	SH359_4.9_MI_E_US83	LAREDO
4	S029	US277_7.1_MI_S_SH131	EAGLEPASS
5	S051	US277_0.6_MI_S_US87	SANANGELO
6	S069	SH336_3.5_MI_S_SH107	MCALLEN
7	S070	FM258_5.4_MI_SW_SH20	YSLETA
8	S071	SH16_1.1_MI_S_SH72	TILDEN
9	S072	US285_2.0_MI_S_IH10	FT_STOCKTON
10	S074	US77_0.1_MI_N_SARITA	FT_STOCKTON
11	S097	US281_1.9MI_S_SH285	FALFURRIAS
12	S102	US90_4.3_MI_NE_US83	UVALDE
13	S103	US90_0.5_MI_NW_US377	DELRIO
14	S123	IH10_1.2_MI_S_LP375	ELPASO
15	S143	US83_0.4_MI_W_FM1426	PHARR
16	S152	IH10_10.3_MI_W_SH54	VANHORN
17	S159	US83_2.8_MI_W_FM492	MISSION
18	S162	IH10_0.6_MI_W_US54	ELPASO
19	S163	SH100_W_END_OF_CAUSEWAY	PT_ISABEL
20	S173	US281_7.5_MI_S_US83	PHARR
21	S181	SH48_0.2_MI_NE_FM511	BROWNSVILLE
22	S189	US54_0.3_MI_N_IH10	ELPASO
23	S201	US83_0.6_MI_N_SH100	SANBENITO
24	S214	SH18_0.2MI_S_FM1233	MONAHANS

Description of Data Set TXHOUR.SDS

Hourly volumes and weekly fluctuations are very important information to transportation planning and even pavement design in some cases. For example, they help determine the busiest day of the week for planning purposes. Hourly volumes are needed for studying congestion and for estimating the peak hours and overall demand throughout the day. The TRANSBORDER data base meets these and other needs with data set TXHOUR.SDS, which has the annual average hourly volumes by weekday, from 1979 to 1992, for the selected stations depicted in Exhibit 4.4. The data set contents are depicted in Table 4.7.

Table 4.7. Contents of data set TXHOUR.SDS

Variable	Type	Meaning
HVMON	Numeric	Average hourly volumes on Monday (two-way).
HVTUE	Numeric	Average hourly volumes on Tuesday (two-way).
HVWED	Numeric	Average hourly volumes on Wednesday (two-way).
HVTHR	Numeric	Average hourly volumes on Thursday (two-way).
HVFRI	Numeric	Average hourly volumes on Friday (two-way).
HVSAT	Numeric	Average hourly volumes on Saturday (two-way).
HVSUN	Numeric	Average hourly volumes on Sunday (two-way).
STATION	Character	ATR station code
TIME	Numeric	Starting hour of time interval, in 24-hour clock.
YEAR	Numeric	Year of data collection.

Variable STATION, the station code, identifies the station where the data were collected and serves as the relational link between the four Texas traffic data sets. Variable YEAR is the two-digit year of data collection. Variable TIME indicates the starting hour of each 1-hour time interval. Using the 24-hour clock, this variable takes values from 0 (midnight) to 23 (11 PM). For example, TIME= 1 indicates that the traffic data were averaged for the time interval between 1 AM and 2 AM. TIME=12 is the time interval between noon and 1 PM, and so on.

The other variable names are as self explanatory as possible. The first two letters of the variable names are HV, which stand for Hourly Volumes. The other letters are the weekday abbreviation. For example, HVSUN is the average traffic volume of all Sundays for the entire year for each particular time interval. These variables are labeled according to their meanings, as shown in Exhibit 4.5, which shows a PROC CONTENTS output for TXHOUR.SDS.

Exhibit 4.5. PROC contents output of TXHOUR.SDS

```
Data Set Name: SDS.TXHOUR                    Observations:     7152
Member Type:   DATA                             Variables:       10
Engine:    V608                                   Indexes:        0
Created:     11:50 Monday, August 23, 1993
Observation Length:   29
Last Modified: 11:50 Monday, August 23, 1993
Deleted Observations: 0
Protection:                                     Compressed:       NO
Data Set Type:                                  Sorted:           NO
Label:     HOURLY VOLUMES BY WEEKDAY

-----Engine/Host Dependent Information-----

Data Set Page Size:     2048
Number of Data Set Pages: 105
File Format:         607
First Data Page:       1
Max Obs per Page:      69
Obs in First Data Page:   16
Userid  :          FTFD445
File  :          TXHOUR   SDS

    -----Alphabetic List of Variables and Attributes-----

 #  Variable  Type  Len  Pos  Label
-----------------------------------------------------------
 8  HVFRI     Num     3   21  FRIDAY*HOURLY*VOLUMES
 4  HVMON     Num     3    9  MONDAY*HOURLY*VOLUMES
 9  HVSAT     Num     3   24  SATURDAY*HOURLY*VOLUMES
 3  HVSUN     Num     3    6  SUNDAY*HOURLY*VOLUMES
 7  HVTHR     Num     3   18  THURSDAY*HOURLY*VOLUMES
 5  HVTUE     Num     3   12  TUESDAY*HOURLY*VOLUMES
 6  HVWED     Num     3   15  WEDNESDAY*HOURLY*VOLUMES
 2  STATION   Char    4    2  STATI0N*CODE
 1  TIME      Num     2    0  STARTING*HOUR
10  YEAR      Num     2   27
```

A sample of the variable values can be seen in Exhibit 4.6, a PROC PRINT output of the first ten observations of TXHOUR.SDS.

Exhibit 4.6. PROC print output of TXHOUR.SDS — sample

OBS	TIME	STATION	HVSUN	HVMON	HVTUE	HVWED	HVTHR	HVFRI	HVSAT	YEAR
1	0	A308	87	82	69	70	73	72	125	79
2	1	A308	65	58	49	51	52	57	101	79
3	2	A308	56	46	39	43	44	46	87	79
4	3	A308	48	53	50	47	51	51	83	79
5	4	A308	48	61	56	54	62	61	84	79
6	5	A308	60	75	68	73	75	77	100	79
7	6	A308	81	119	112	117	117	117	134	79
8	7	A308	116	171	171	178	176	176	186	79
9	8	A308	156	197	193	204	198	212	229	79
10	9	A308	204	224	225	231	222	231	274	79

Description of Data Set TXHIGH.SDS

High hour volumes represent important data for transportation planning, since they are used to analyze traffic congestion and levels of service at peak hours. Data set TXHIGH.SDS has the date and time when the traffic volumes were at their peak, for years 1979–1992. For each year there are 24 observations, selected between the first highest volume and the 200th highest. The traffic volumes are always two-way, with a percent directional distribution factor indicating the percentages of the traffic volume going one way as opposed to another. The data set contents is best explained with the aid of Exhibit 4.7, a PROC PRINT of the first 24 observations of TXHIGH.SDS, in conjunction with Table 4.8, which summarizes the contents of TXHIGH.SDS.

Table 4.8. Contents of TXHIGH.SDS

Variable	Type	Meaning
STATION	Character	Station Code
HIHOUR	Numeric	Ranking of the high hour in the year
DATE	Numeric	Date when high hour was observed
TIME	Numeric	Starting hour of the high-hour time interval (24-hour clock).
HIVOL	Numeric	Traffic volume at each high hour (two-way)
PDIST	Numeric	Percent directional distribution

Variable STATION identifies the ATR station where the traffic was counted. Variable DATE shows the exact DATE when the high hour was observed; it can also be used to determine at which day of the week the specific high hour occurred. Variable TIME is the starting time of the 1-hour time interval where the specific high-hour was observed. Variable HIHOUR is the ranking of the high hour in ordinal number. For example, HIHOUR=10 indicates the 10th

highest hourly volume of the year. All stations have the 24 values of variable HIHOUR depicted in Exhibit 4.7. Variable HCOUNT is the two-way hourly volume of the corresponding high hour, while variable PDIST gives the percent directional distribution associated with that particular high hour.

The variables in TXHIGH.SDS are labeled according to their meanings, as shown in Exhibit 4.8, a PROC CONTENTS output of the data set. This data set does not require customized formats because all variable values are self-explanatory.

Exhibit 4.7. PROC print output of TXHIGH.SDS — Sample

OBS	STATION CODE	HIGH HOUR DATE	HIGH HOUR TIME	ORDINAL HIGH HOUR	HIGH HOUR VOLUME	PERCENT DIRECTIONAL DISTRIBUTION
1	A308	22DEC79	16	1	600	62
2	A308	22DEC79	15	2	580	60
3	A308	25NOV79	14	3	570	68
4	A308	22DEC79	13	4	570	67
5	A308	22DEC79	14	5	560	64
6	A308	25NOV79	16	6	550	67
7	A308	29DEC79	15	7	530	51
8	A308	25NOV79	13	8	520	71
9	A308	29DEC79	12	9	510	57
10	A308	25NOV79	11	10	500	72
11	A308	22DEC79	17	15	490	59
12	A308	26DEC79	16	20	480	50
13	A308	29DEC79	16	25	470	51
14	A308	23NOV79	16	30	460	54
15	A308	15APR79	16	35	450	53
16	A308	23DEC79	13	40	450	58
17	A308	28DEC79	17	45	450	51
18	A308	13APR79	15	50	440	52
19	A308	04MAR79	14	75	420	67
20	A308	15APR79	13	100	410	54
21	A308	13APR79	13	125	400	60
22	A308	10MAR79	15	150	390	51
23	A308	21DEC79	17	175	390	59
24	A308	27JUL79	17	200	380	55

Description of Data Set TXADT.SDS

Average daily traffic (ADT) history, along with ADT weekly, monthly, and seasonal fluctuations, is important in transportation planning and highway design. Accordingly, the TRANSBORDER data base contains these data for the main routes to the border in data set TXADT.SDS. This data set has fourteen years (1979-1992) of ADT data, broken down by day of the week and by month. All ADT values in this data set are from permanent ATR stations, which means they are actual observed averages, rather than estimates from temporary stations corrected with seasonal factors. The variable names are self-explanatory, and Table 4.9 depicts a summary of the contents of this data set, while Exhibit 4.9 shows a PROC CONTENTS output of

this data set. Exhibit 4.10 shows a PROC PRINT output of the first ten observations in TXADT.SDS. The latter is helpful in explaining the contents of this data set.

Exhibit 4.8. PROC contents output of TXHIGH.SDS

```
CONTENTS PROCEDURE

Data Set Name: SDS.TXHIGH                          Observations:          71
Member Type:   DATA                                Variables:             6
Engine:        V608                                Indexes:               0
Created:       18:32 Tuesday, August 24, 1993      Observation Length:    22
Last Modified: 17:42 Monday, November 8, 1993      Deleted Observations:  0
Protection:                                        Compressed:            NO
Data Set Type:                                     Sorted:                NO
Label:         ORDINAL HIGH HOURS FOR YRS 1979-1992

-----Engine/Host Dependent Information-----

Data Set Page Size:       2048
Number of Data Set Pages: 80
File Format:              607
First Data Page:          1
Max Obs per Page:         91
Obs in First Data Page:   43
Userid  :                 FTFD445
File    :                 TXHIGH   SDS

              -----Alphabetic List of Variables and Attributes-----

#    Variable    Type    Len    Pos    Format    Label
-------------------------------------------------------------------------------
2    DATE        Num       8      2    DATE7.    HIGH*HOUR*DATE
1    HIHOUR      Num       2      0              ORDINAL*HIGH*HOUR
5    HIVOL       Num       4     16              HIGH*HOUR*VOLUME
6    PDIST       Num       2     20              PERCENT*DIRECTIONAL*DISTRIB
3    STATION     Char      4     10              STATION*CODE
4    TIME        Num       2     14              STARTING*HOUR
```

Table 4.9. Contents of TXADT.SDS

Variable	Type	Meaning
STATION	Character	Station code
YEAR	Numeric	Year of data collection
MONTH	Character	Month of data collection
ADTMON	Numeric	Average Daily Traffic on all Mondays of each month
ADTTUE	Numeric	Average Daily Traffic on all Tuesdays of each month
ADTWED	Numeric	Average Daily Traffic on all Wednesdays of each month
ADTTHR	Numeric	Average Daily Traffic on all Thursdays of each month
ADTFRI	Numeric	Average Daily Traffic on all Fridays of each month
ADTSAT	Numeric	Average Daily Traffic on all Saturdays of each month
ADTSUN	Numeric	Average Daily Traffic on all Sundays of each month

Exhibit 4.9. PROC contents output of TXADT.SDS

```
Data Set Name: SDS.TXADT                  Observations:         3600
Member Type:   DATA                          Variables:           10
Engine:    V608                              Indexes:              0
Created:     11:50 Monday, August 23, 1993
Observation Length:   30
Last Modified: 11:50 Monday, August 23, 1993
Deleted Observations: 0
Protection:                               Compressed:           NO
Data Set Type:                               Sorted:            NO
Label:     ADT BY MONTH AND WEEKDAY

-----Engine/Host Dependent Information-----

Data Set Page Size:          2048
Number of Data Set Pages:      55
File Format:                  607
First Data Page:                1
Max Obs per Page:              67
Obs in First Data Page:        15
Userid  :                 FTFD445
File  :                TXADT  SDS

-----Alphabetic List of Variables and Attributes-----

 #  Variable  Type  Len  Pos  Label
-----------------------------------------------------
 8  ADTFRI    Num     3   22  FRIDAY*ADT
 4  ADTMON    Num     3   10  MONDAY*ADT
 9  ADTSAT    Num     3   25  SATURDAY*ADT
 3  ADTSUN    Num     3    7  SUNDAY*ADT
 7  ADTTHR    Num     3   19  THURSDAY*ADT
 5  ADTTUE    Num     3   13  TUESDAY*ADT
 6  ADTWED    Num     3   16  WEDNESDAY*ADT
 1  MONTH     Char    3    0
 2  STATION   Char    4    3  STATION*CODE
10  YEAR      Num     2   28
```

Variables YEAR and STATION duplicate the functions of the similarly named variables associated with the other data sets of this series; they can be used to merge TXADT.SDS with other Texas traffic data sets as needed in future studies. Variable MONTH represents the month for which the data were averaged.

The permanent ATR stations continuously record traffic counts at each date and time, with the data then averaged to obtain weekly, monthly, and early ADT. Variables ADTMON through ADTSUN represent the average daily traffic for each month at that particular day of the week. The procedures used to average the traffic counts are discussed below.

The first observation in TXADT.SDS has ADTMON through ADTSUN for the month of December 1979. For example, the value of ADTMON=4202 in the first observation of Exhibit 4.10 indicates that the average volume of all Mondays for December 1979 was 4202. ADTTUE through ADTSUN have an analogous meaning.

Exhibit 4.10. PROC print output of TXADT.SDS — sample

OBS	MONTH	STATION	ADTSUN	ADTMON	ADTTUE	ADTWED	ADTTHR	ADTFRI	ADTSAT	YEAR
1	DEC	A308	5088	4202	4287	4717	4707	5520	6240	79
2	JAN	A308	3892	4168	4068	3976	3980	4650	4617	79
3	FEB	A308	4705	4280	3992	4080	4087	5045	5012	79
4	MAR	A308	5127	4337	4195	4242	4204	5098	5418	79
5	APR	A308	5064	4422	4187	4277	4447	5267	5342	79
6	MAY	A308	4352	4185	4022	4014	4018	4717	5042	79
7	JUN	A308	4450	4332	4160	4090	4100	4822	5028	79
8	JUL	A308	4884	4558	4308	4245	4372	5200	5355	79
9	AUG	A308	5142	4690	4515	4432	4458	5446	5777	79
10	SEP	A308	4434	4220	3660	3707	3690	4537	5182	79

Overall weekday ADT is the average of the twelve ADTs for that particular day in that particular year, as shown in Eq. 4.2. Annual ADT for any given year, say, 1980, can be obtained by averaging all weekdays in all months of that year, as shown in Eq. 4.3. Monthly ADT is obtained by averaging all data for that particular month of that particular year, as shown in Eq. 4.4. Seasonal ADT is obtained by averaging the three monthly ADTs for the months comprising that particular season, as shown in Eqs. 4.5 to 4.8.

$$ADTMON_{80} = \frac{\sum_{12\ \text{months}} ADTMON}{12} \tag{4.2}$$

$$AADT_{80} = \frac{ADTMON_{80} + ADTTUE_{80} + \ldots\ldots + ADTSAT_{80} + ADTSUN_{80}}{7} \tag{4.3}$$

$$ADTDEC_{80} = \frac{ADTMON+ADTTUE+ADTWED+ADTTHR+ADTFRI+ADTSAT+ADTSUN}{7} \tag{4.4}$$

$$ADTwin_{80} = \frac{ADTDEC_{79} + ADTJAN_{80} + ADTFEB_{80}}{3} \tag{4.5}$$

$$ADTspr_{80} = \frac{ADTMAR_{80} + ADTAPR_{80} + ADTMAY_{80}}{3} \tag{4.6}$$

$$ADTsum_{80} = \frac{ADTJUN_{80} + ADTJUL_{80} + ADTAUG_{80}}{3} \tag{4.7}$$

$$ADTfal_{80} = \frac{ADTSEP_{80} + ADTOCT_{80} + ADTNOV_{80}}{3} \tag{4.8}$$

where:

$ADTMON$ = value of variable ADTMON for all months of 1980

$ADTTUE$ = value of variable ADTTUE for all months of 1980

$ADTWED$ = value of variable ADTWED for all months of 1980

$ADTTHR$ = value of variable ADTTHR for all months of 1980

$ADTFRI$ = value of variable ADTFRI for all months of 1980

$ADTSAT$ = value of variable ADTSAT for all months of 1980

$ADTSUN$ = value of variable ADTSUN for all months of 1980

$AADT_{80}$ = annual average daily traffic for 1980

$ADTMON_{80}$ = annual average daily traffic for typical Monday of 1980 (see Eq. 4.2)

$ADTTUE_{80}$ = annual average daily traffic for the typical Tuesday of 1980

$ADTWED_{80}$ = annual average daily traffic for the typical Wednesday of 1980

$ADTTHR_{80}$ = annual average daily traffic for the typical Thursday of 1980

$ADTFRI_{80}$ = annual average daily traffic for the typical Friday of 1980

$ADTSAT_{80}$ = annual average daily traffic for the typical Saturday of 1980

$ADTSUN_{80}$ = annual average daily traffic for the typical Sunday of 1980

$ADTJAN_{80}$ = monthly average daily traffic for January 1980

$ADTFEB_{80}$ = monthly average daily traffic for February 1980

$ADTMAR_{80}$ = monthly average daily traffic for March 1980

$ADTAPR_{80}$ = monthly average daily traffic for April 1980

$ADTMAY_{80}$ = monthly average daily traffic for May 1980

$ADTJUN_{80}$ = monthly average daily traffic for June 1980

$ADTJUL_{80}$ = monthly average daily traffic for July 1980

$ADTAUG_{80}$ = monthly average daily traffic for August 1980

$ADTSEP_{80}$ = monthly average daily traffic for September 1980

$ADTOCT_{80}$ = monthly average daily traffic for October 1980

$ADTNOV_{80}$ = monthly average daily traffic for November 1980

$ADTDEC_{80}$ = monthly average daily traffic for December 1980

$ADTwin_{80}$ = average daily traffic for winter 1980

$ADTspr_{80}$ = average daily traffic for spring 1980

$ADTsum_{80}$ = average daily traffic for summer 1980

$ADTfal_{80}$ = average daily traffic for fall 1980

Standard reports of ATR counts usually show the data in Eqs. 4.2 through 4.8. These figures can be obtained from the TRANSBORDER data base by applying the above equations to TXADT.SDS. If convenient, these summary reports can be stored as a permanent SAS data set; but when storage space is a consideration, TXADT.SDS provides the most information using the least space.

APPLICATIONS AND CASE STUDIES

Specific applications and uses of traffic data are numerous and depend on the study objectives. For example, histories of annual average daily traffic can be used to estimate future traffic, which in turn is used for purposes that range from pavement design to transportation planning and policies. Since annual average daily traffic have to be calculated from the TXADT.SDS, this data set was chosen as an example of data set applications. A section of IH-35 near Laredo was selected for a case study, with its Mexican counterpart—MEX085—presented as a comparison. These examples are for illustrative purposes only and should be construed neither as traffic analysis nor as recommendations for extrapolations and predictions of future traffic.

Texas Data

As discussed in the previous sections of this chapter, the data set with Texas ADT data contains only the ADT for the typical day of the week at each month. Monthly, seasonal, and yearly ADT can be obtained by successive averages, as shown in Equations 4.2 through 4.8. Out of the various possible examples of data use, this section will present the AADT history and the trends, as well as a study of the high hour volumes for station A308 at IH-35 near Laredo, Texas.

Successive runs of SAS PROC MEANS on TXADT.SDS automatically give the averages depicted in Equations 4.2 through 4.8. A temporary data set with the annual average daily traffic history was created this way (see Figure 4.2). Trends in traffic growth rates can be seen in Figure 4.3. Figures 4.2 and 4.3 suggest an exponential trend in the AADT volumes for this section. Using SAS PROC REG produces the output shown in Exhibit 4.11, which indicates a very good exponential curve fit for this particular ATR station. The model given by Exhibit 4.11 is:

$$\log_{10}(ADT) = 0.04429*year \tag{4.9}$$

which can also be written as:

$$ADT = 1.107^{year} \tag{4.10}$$

where:

ADT = annual average daily traffic (two-way), and

year = two-digit year, or actual year minus 1900.

The goodness-of-fit measures, such as r-square, and the significance tests for the coefficient of YEAR are very good. This brief analysis was made for illustrative purposes only, and further statistical analyses are needed before any working model can be recommended for traffic forecasts.

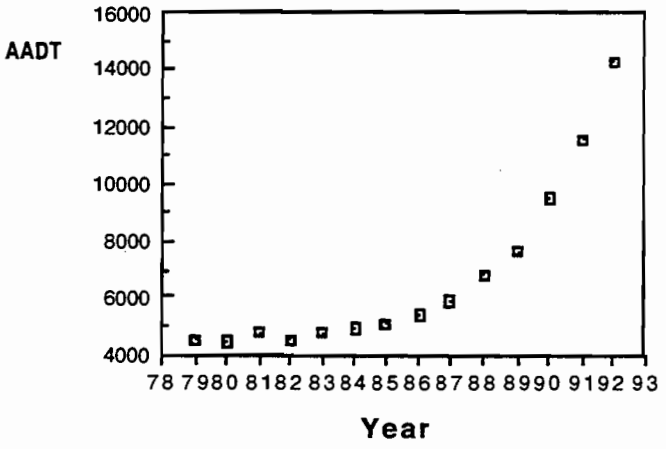

Figure 4.2. AADT history for IH-35 near Laredo

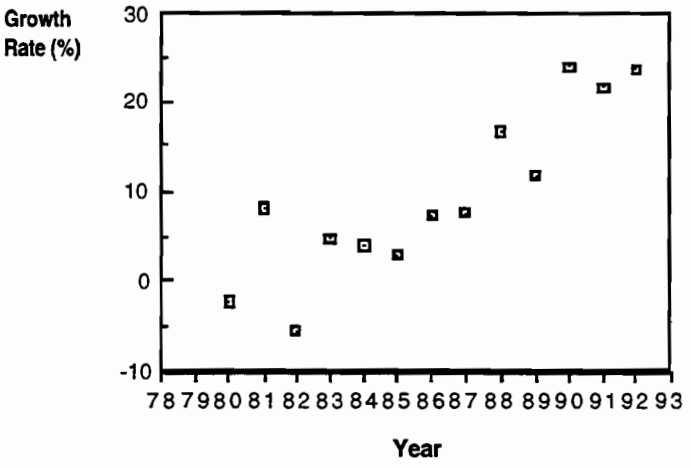

Figure 4.3. Traffic growth trends for IH-35 near Laredo

Exhibit 4.11. Curve fit for AADT history — Station A308

```
Model: log10(ADT) = B*YEAR

Analysis of Variance
                          Sum of          Mean
Source          DF       Squares        Square      F Value       Prob>F
Model            1     188.60654     188.60654     34080.164       0.0001
Error           12       0.06641       0.00553
U Total         13     188.67295

    Root MSE          0.07439     R-square          0.9996
    Dep Mean          3.80632     Adj R-sq          0.9996
    C.V.              1.95444

Parameter Estimates
                    Parameter      Standard       T for H0:
Variable  DF        Estimate       Error        Parameter=0    Prob > |T|
YEAR       1       0.044285    0.00023989          184.608        0.0001
```

High hour volumes provide interesting information on levels of service and potential congestion of highway sections. A commonly used measurement of traffic levels is the K-factor, which is the percentage of the AADT corresponding to each hourly volume. This measurement can be obtained by the following steps:

1. Calculate AADT using TXADT.SDS and equations 4.2 and 4.3.
2. Create a data set with variables YEAR, AADT, and STATION.
3. Merge this data set with TXHIGH.SDS, by STATION YEAR. Variable YEAR can be created in TXHIGH.SDS by applying SAS function YEAR to variable DATE.
4. Steps 1, 2, and 3 create a new data set with high hour volumes and AADT history. In this new data set, create variable K according to Equation 4.11.

$$K = \frac{HIHOUR}{AADT} \times 100 \qquad (4.11)$$

where:

K = K-factor,

HIHOUR = high hour volume, or variable high hour, as shown in Table 4.8 and Exhibits 4.7 and 4.8, and

AADT = Annual average daily traffic.

Station A308 near Laredo was again selected as a case study to illustrate a possible application of TXHIGH.SDS in conjunction with other data sets of the same category. The procedure outlined above was applied to temporary data sets containing only station A308.

Figure 4.4 depicts a plot of the ordinal high hours versus the K-factors, for years 1992 and 1982 (a period that shows the changes in traffic circulation observed over 10 years). AADT in 1982 was about 4,800, while the 1992 AADT was over 14,000—an increase which in itself may indicate a potential need for additional lanes in this section of IH-35. An analysis of the K-factors gives additional indication that, while for the two most crowded hours the K-factor was higher in 1982 than it was in 1992, after the 10th hour the1992 K-factor steadily increases with respect to that of 1982. This is showing a constant trend for a more congested highway at non-peak hours, since it is now carrying a higher AADT percentage (which is also higher than it was 10 years before). This analysis was made only to illustrate the data base uses, as actual traffic circulation improves if more lanes are added.

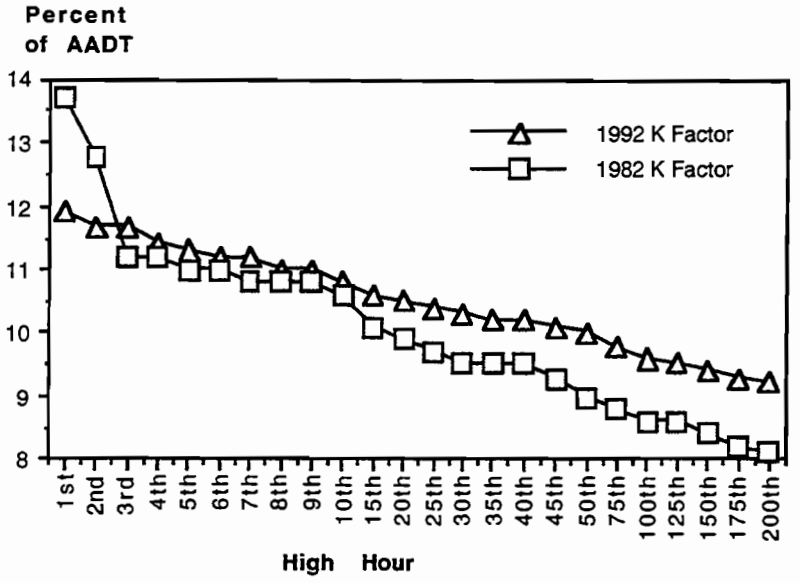

Figure 4.4. Changes in K-factor for IH-35 near Laredo

Mexican Data

The highway section just analyzed on the U.S. side is on an Interstate highway near Laredo. Because traffic recording station 28048 on km 228 of MEX 085 is very close to Nuevo Laredo, it can be regarded as the Mexican counterpart of ATR station A308, which was analyzed in the previous section. Figure 4.5 shows an estimate of the two-way AADT obtained by duplicating the available one-way AADT to permit comparison with the two-way AADT data from IH-35. Figure 4.5 shows years 1986, 1987, 1989, and 1990—the only available years for the Mexican station under study. Figure 4.5 shows that, before 1988, AADTs for MEX085 were approximately three times the ADTs for IH-35, despite the fact that the U.S. has the highest rate of vehicle ownership per capita in the world. After 1988, a sudden increase in traffic in MEX085 created an almost fourfold AADT difference. Comparison of these data support the conclusion

that the Texas highway network is superior to its Mexican counterpart, which in turn helps explain the strong preference given to U.S. roads by the border region population.

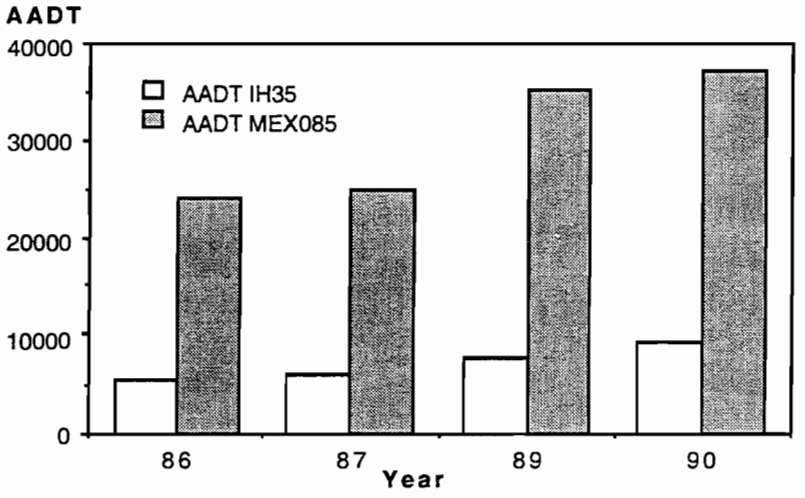

Figure 4.5. AADT histories at MEX085 and IH-35 near Laredo/Nuevo Laredo

Summary

This section presented some applications of the data sets containing traffic data on Mexican and Texas highways. The two highway sections presented as case studies, selected at random, illustrate some of the possible uses of the TRANSBORDER data base in transportation planning. The analyses presented in this section, along with the conclusions drawn from the data, are preliminary and should not therefore be understood as representing a recommendation for transportation planning policies and decisions. Further analyses of the data and, in some cases, additional data are required to make such recommendations.

SUMMARY OF RECOMMENDATIONS FOR FUTURE UPDATING

Traffic monitoring on Texas highways is the most comprehensive in the U.S. Consequently, the Texas portion of highway traffic data is more comprehensive than the Mexican portion. In addition, the references used to obtain reduced data in Texas report hourly volumes and high hours (in addition to ADT), while the Mexico references report only annual ADTs. The procedures used in Texas and in Mexico to estimate AADT from temporary stations are similar; they consist of correcting the temporary counts with the ratio between the AADT and the ADT in the same period, at the nearest permanent station. Mexican temporary stations function for 7 days (168 hours), while in Texas they function for only 24 hours. This apparent difference in accuracy is possibly compensated for by the availability of more permanent stations in Texas.

The TRANSBORDER data base comprises traffic data selected according to accuracy,

geographical location with respect to the Texas-Mexico border, and consistency of binational traffic history available. Because Texas ATR coverage is very comprehensive, it was possible to cover the main routes to the border using exclusively permanent stations, which means that the TRANSBORDER data base contains the most accurate traffic data available in Texas.

It is recommended that the data base be annually updated as more TxDOT and SCT publications are released. In addition, it is recommended that geographical locations of new ATR, WIM, and vehicle classification stations be checked, and that these data be included in the TRANSBORDER data base as soon as a sufficient amount of border data is available.

CHAPTER 5. HIGHWAY CONDITION DATA

INTRODUCTION

Route reconnaissance, or highway condition data, provide important route preference information for transportation planners. This project surveyed a total of 4,900 miles (7,969 km) of border routes, out of which 2,000 miles (3,329 km) are in Mexico. Tables 5.1 and 5.2 list the roads surveyed in the U.S. and in Mexico.

The information collected includes, but is not limited to, road lengths, travel times and delays, lanes and shoulder widths, speed limits, and a subjective rating of the pavement condition. The latter provides a categorical variable describing the pavement condition in a consistent way. Only three categories were used (poor, fair, good) to avoid biases created by the frequently encountered tendency to avoid extreme ratings in any subjective survey.

These data, providing a very comprehensive summary of the current infrastructure links and main routes to and from the Texas-Mexico border, can be used to assess current needs, estimate route choices, compare the condition of different highways, and calculate percentiles to use in trip assignment models.

Table 5.1. Roads surveyed in the U.S.

ROUTE	FROM/TO (CITY)	ROUTE	FROM/TO (CITY)
US 77	Robstown / Brownsville	IH 10	San Antonio / Sonora
US 83	Harlingen / Laredo	IH 10	Fort Stockton / Ozona
SH 359	Laredo / San Diego	US 67	Presidio / Fort Stockton
SH 285	Hebbronville / Riviera	US 277	Carrizo Springs / Del Rio
SH 44	Encinal / Corpus Christi	US 277	Del Rio / Sonora
US 281	Alice / Pharr	US 377	Junction / Del Rio
US 281	Brownsville / Hidalgo	SH 57	Eagle Pass / Moore
SH 16	Hebbronville / Freer	SH 163	Ozona / Comstock
FM 1472	Laredo / Colombia-Solidarity Bridge	US 285	Fort Stockton / Sanderson
US 59	Laredo / Freer	US 385	Fort Stockton / Big Bend H.Q.
IH 35	San Antonio / Laredo	Rt 12 & 13	Big Bend Roads
US 83	Laredo / Junction	FM 170	Presidio / Study Butte
US 90	San Antonio / Del Rio	US 118	Study Butte / Fort Davis
US 90	Comstock / Van Horn	SH 17	Marfa / Balmorhea

In addition to the Mexican road survey, other information was collected regarding the length of rail and road infrastructures from INEGI. The road data cover paved, unpaved, and surface stabilized infrastructure.

Table 5.2. Roads surveyed in Mexico

ROUTE	FROM/TO (CITY)	ROUTE	FROM/TO (CITY)
MEX 54	Monterrey / Cd. Mier	MEX 85	Cd. Victoria / Monterrey
MEX 85	Monterrey / Nuevo Laredo (Libre)		Diaz Ordaz / Jct MEX 40
MEX 40	Monterrey / Reynosa	MEX 40	Monterrey / Saltillo
MEX 2	Nuevo Laredo / Reynosa	MEX 57	Saltillo / Monclova
MEX 2	Reynosa / Matamoros	MEX 57	Monclova / Piedras Negras
TAM 3	Rio Bravo / Jct MEX 101	MEX 2	Piedras Negras / Ciudad Acuña
TAM 6	Jct MEX 2 / Nuevo Progreso	MEX 2	Piedras Negras / Nuevo Laredo
TAM 5	Matamoros / Jct TAM 4	MEX 29	Morelos / Ciudad Acuña
MEX 101/180	Matamoros / Cd. Victoria	MEX 85	Monterrey / Nuevo Laredo (Toll)
TAM 4	Jct MEX 101 / Jct MEX 2-Empalme	MEX 16	Chihuahua / Ojinaga
MEX 97	Jct MEX 101 / Jct MEX 002	MEX 45	Chihuahua / Ciudad Juárez

HIGHWAY CONDITION DATA USER'S GUIDE

Highway condition data are compiled in the data set titled HWYCOND.SDS, which includes U.S. and Mexican data. Exhibits 5.1 and 5.2 show PROC CONTENTS and a sample PROC PRINT output of this data set, respectively, with the variables explained below.

AREAT: The area type of the road surveyed. This could be urban, residential, commercial, central business district, rural, or industrial.
CHECKP: Checkpoint, which could be the place, intersection, town, elapsed mile or kilometer road posting, or any other geographical marker where the reading is taken.
COND: Road condition, which could be poor, fair, good, construction, or no construction.
DELAY: Includes the type of delay in that section of the road, which could be signal, stop sign, railroad crossing, toll, construction, school bus, bump, school zone, animal crossing, left turn, computer setup, sharp curve, filling gas, detour, and traffic jam.
ELTIME: The difference between the new time reading and the previous one.
FROM: The starting point of the surveyed road section.
FROMST: The state in which the starting point is located.
HWY: The highway name or number, such as I-35 or MEX 2.
LANET: The layout of lanes, such as divided or undivided.
LANEW: The width of each travel lane in decimeters.
DIST: The difference between the new odometer reading and the previous one.
NLANES: The number of road lanes, which could be two, four, six, or eight lanes.
ODREAD: The car odometer reading in kilometer.
OTHER: Includes any other observations or comments on the road.
SHW: The width of the roadway shoulder in decimeters.
SL: The posted speed limit for a segment of the road measured in kilometers per hour.
TIME: The time recorded whenever a change in the road occurs at a specific point.
TO: The ending point of the surveyed road section.
TOST: The state in which the ending point is located.
YEAR: The year of conducting the survey.

Exhibit 5.1. PROC contents of HWYCOND.SDS

CONTENTS PROCEDURE

Data Set Name:SDS.HWYCOND — Observations: 993
Member Type:DATA — Variables: 19
Engine:V608 — Indexes: 0
Created: 13:59 Monday, December 6, 1993 — Observation Length: 229
Last Modified: 13:59 Monday, December 6, 1993 — Deleted Observations: 0
Sorted: NO
Label: HIGHWAY CONDITION DATA - US AND MEXICO

-----Engine/Host Dependent Information-----

Data Set Page Size: 12288
Number of Data Set Pages: 19
File Format: 607
First Data Page: 1
Max Obs per Page: 53
Obs in First Data Page: 41
Userid : FTFD445
File : HWYCOND SDS

-----Alphabetic List of Variables and Attributes-----

#	Variable	Type	Len	Pos	Format	Label
9	AREAT	Char	5	169	$AREA.	AREA*TYPE
7	CHECKP	Char	40	125		CHECKPOINT
15	COND	Char	10	187	$COND.	ROAD*CONDITION
8	DEL	Char	4	165	$DELAY.	DELAY*CAUSE
18	ELTIME	Num	8	213		ELAPSED*TIME
3	FROM	Char	20	65		STARTING*POINT
5	FROMST	Char	10	105		STATE OF*STARTING*POINT
2	HWY	Char	20	45		HIGHWAY
11	LANET	Char	5	176	$LANET.	DIVIDED*OR UNDIVIDED
12	LANEW	Num	2	181		LANE*WIDTH*(DM)
17	DIST	Num	8	205		ELAPSED*DISTANCE(KM)
10	NLANES	Num	2	174		NUMBER*OF LANES
16	ODREAD	Num	8	197		ODOMETER*READING(KM)
1	OTHER	Char	45	0		OTHER*OBSERVATIONS
14	SW	Char	3	31		SHOULDER*WIDTH*(DM)
13	SL	Num	2	183		SPEED*LIMIT(KM/H)
4	TO	Char	20	85		ENDING*POINT
6	TOST	Char	10	115		STATE OF*ENDING*POINT
19	YEAR	Num	8	221		

Exhibit 5.2. Formatted PROC print of HWYCOND.SDS

OBS	YEAR	HIGHWAY	CHECKPOINT	STARTING POINT	ENDING POINT
1	1993	MEX54	Airport_&_54	MONTERREY	CD._MIER
2	1993	MEX54	INT._NL113	MONTERREY	CD._MIER
3	1993	MEX54		MONTERREY	CD._MIER
4	1993	MEX54		MONTERREY	CD._MIER
5	1993	MEX54	INT._NL163	MONTERREY	CD._MIER
6	1993	MEX54		MONTERREY	CD._MIER
7	1993	MEX54		MONTERREY	CD._MIER
8	1993	MEX54		MONTERREY	CD._MIER
9	1993	MEX54		MONTERREY	CD._MIER
10	1993	MEX54	INT._NVO._REPUEBLO	MONTERREY	CD._MIER
11	1993	MEX54	INT._LA_VENADERA	MONTERREY	CD._MIER
12	1993	MEX54		MONTERREY	CD._MIER
13	1993	MEX54		MONTERREY	CD._MIER
14	1993	MEX54	INT._WITH_NL141	MONTERREY	CD._MIER
15	1993	MEX54		MONTERREY	CD._MIER
16	1993	MEX54		MONTERREY	CD._MIER
17	1993	MEX54		MONTERREY	CD._MIER
18	1993	MEX54	GRAL._TREVINO	MONTERREY	CD._MIER
19	1993	MEX54	AGUALEGUAS_NL2	MONTERREY	CD._MIER
20	1993	MEX54		MONTERREY	CD._MIER
21	1993	MEX54		MONTERREY	CD._MIER
22	1993	MEX54	BORDER_CHECK_POINT	MONTERREY	CD._MIER
23	1993	MEX54	INT._WITH_MEX2	MONTERREY	CD._MIER
24	1993	MEX54	INT._WITH_MEX2	MONTERREY	CD._MIER

Exhibit 5.2. Continued

OBS	STATE OF STARTING POINT	STATE OF ENDING POINT	ODOMETER READING	ELAPSED DISTANCE (KM)
1	NUEVO_LEON	TAMAULIPAS	12459.3	0
2	NUEVO_LEON	TAMAULIPAS	12474.0	14.7
3	NUEVO_LEON	TAMAULIPAS	12474.7	0.7
4	NUEVO_LEON	TAMAULIPAS	12481.4	6.7
5	NUEVO_LEON	TAMAULIPAS	12482.7	1.3
6	NUEVO_LEON	TAMAULIPAS	12483.4	0.7
7	NUEVO_LEON	TAMAULIPAS	12487.1	3.7
8	NUEVO_LEON	TAMAULIPAS	12487.9	0.8
9	NUEVO_LEON	TAMAULIPAS	12493.0	5.1
10	NUEVO_LEON	TAMAULIPAS	12500.8	7.8
11	NUEVO_LEON	TAMAULIPAS	12503.5	2.7
12	NUEVO_LEON	TAMAULIPAS	12512.2	8.7
13	NUEVO_LEON	TAMAULIPAS	12515.6	3.4
14	NUEVO_LEON	TAMAULIPAS	12527.1	11.5
15	NUEVO_LEON	TAMAULIPAS	12532.7	5.6
16	NUEVO_LEON	TAMAULIPAS	12541.9	9.2
17	NUEVO_LEON	TAMAULIPAS	12542.6	0.7
18	NUEVO_LEON	TAMAULIPAS	12549.6	7.0
19	NUEVO_LEON	TAMAULIPAS	12551.8	2.2
20	NUEVO_LEON	TAMAULIPAS	12558.1	6.3
21	NUEVO_LEON	TAMAULIPAS	12562.8	4.7
22	NUEVO_LEON	TAMAULIPAS	12581.1	18.3
23	NUEVO_LEON	TAMAULIPAS	12589.8	8.7
24	NUEVO_LEON	TAMAULIPAS	12590.0	0.2

Exhibit 5.2. Continued

OBS	ELAPSED TIME	DIVIDED OR UNDIVIDED	NUMBER OF LANES	LANE WIDTH (DM)	SHOULDER WIDTH (DM)	SPEED LIMIT(KM/H)
1	0	L	2	40	0	80
2	1200	L	2	40	0	60
3	60	L	2	40	0	80
4	300	LD	4	40	0	80
5	120	L	2	40	0	30
6	120	L	2	40	0	80
7	300	L	2	40	0	60
8	60	L	2	40	0	80
9	240	L	2	40	0	80
10	300	L	2	40	0	80
11	240	L	2	40	0	80
12	420	L	2	40	0	60
13	240	L	2	40	0	80
14	480	L	2	40	0	60
15	840	L	2	40	0	80
16	480	L	2	40	0	60
17	60	L	2	40	0	80
18	240	L	2	40	0	80
19	300	L	2	40	0	80
20	180	L	2	40	0	60
21	180	L	2	40	0	60
22	840	L	2	40	0	60
23	420	L	2	40	0	30
24	120	L	2	40	0	30

Exhibit 5.2. Continued

OBS	DELAY CAUSE	ROAD CONDITION	AREA TYPE	OTHER OBSERVATIONS
1		FAIR	RURAL	UNPAVED_SHOU.
2		FAIR	RURAL	EVERY.5_KILO
3		FAIR	RURAL	
4		GOOD	RESIDENTIAL	
5		FAIR	RESIDENTIAL	
6		FAIR	RURAL	
7		GOOD	RURAL	
8		GOOD	RURAL	
9		FAIR	RURAL	
10		FAIR	RURAL	
11		FAIR	RURAL	
12		FAIR	RURAL	
13		FAIR	RURAL	
14		FAIR	RURAL	
15		FAIR	RURAL	
16		FAIR	RURAL	
17		FAIR	RURAL	
18		FAIR	RURAL	
19		FAIR	RURAL	
20		FAIR	RURAL	
21		FAIR	RURAL	SL_NOT_POSTED
22		FAIR	RURAL	
23		FAIR	URBAN	MIER_CITY_LIMIT
24		FAIR	URBAN	

Further information about the roads and rail in Mexico are included in the data set MEXSUR.SDS. Exhibits 5.3 and 5.4 present a PROC CONTENTS and a PROC PRINT of the first ten observations in this data set. The variables PAVED, STSURF, and UNPAVED refer to the roads that are paved, surface stabilized (i.e., roads with a base layer only), and unpaved, respectively.

Exhibit 5.3. PROC contents of MEXSUR.SDS

CONTENTS PROCEDURE

Data Set Name:	SDS.MEXSUR	Observations:	35
Member Type:	DATA	Variables:	9
Engine:	V608	Indexes:	0
Created:	12:33 Monday, August 30, 1993	Observation Length:	48
Last Modified:	12:33 Monday, August 30, 1993	Deleted Observations:	0
Protection:		Compressed:	NO
Data Set Type:		Sorted:	NO
Label:	MEXICAN HIGHWAY SURFACE DATA		

-----Engine/Host Dependent Information-----

Data Set Page Size:	3072
Number of Data Set Pages:	2
File Format:	607
First Data Page:	1
Max Obs per Page:	63
Obs in First Data Page:	33
Userid :	FTFD445
File :	MEXSUR SDS

-----Alphabetic List of Variables and Attributes-----

#	Variable	Type	Len	Pos	Label
4	PAVED	Num	5	19	TOTAL*LENGTH OF*PAVED*HIGHWAY(KM)
7	RAIL	Num	5	35	TOTAL*RAILROAD*LENGTH(KM)
1	STATE	Char	8	0	
8	STSURF	Num	5	40	TOTAL*LENGTH*STAB SURFACE*HIGHWAY(KM)
5	UNPAVED	Num	5	24	TOTAL*LENGTH OF*UNPAVED*HIGHWAY(KM)
9	YEAR	Num	3	45	

Exhibit 5.4. PROC print of MEXSUR.SDS

OBS	STATE	TOTAL LENGTH OF PAVED HIGHWAY(KM)	TOTAL LENGTH OF UNPAVED HIGHWAY(KM)	TOTAL RAILROAD LENGTH(KM)	TOTAL LENGTH STAB SURFACE HIGHWAY(KM)	YEAR
1	COAH	2954	2750	2148	4018	1981
2	CHIH	3200	2497	2594	3861	1981
3	NL	3149	423	1038	2388	1981
4	TAM	2948	4548	930	3093	1981
5	MEX	68412	56098	25498	88728	1981
6	COAH	.	.	2160	.	1982
7	CHIH	3233	2440	2626	3940	1982
8	NL	3211	297	1052	2507	1982
9	TAM	2974	4436	917	3166	1982
10	MEX	70234	50975	25476	92493	1982
11	COAH	.	.	2148	.	1983
12	CHIH	.	.	2594	.	1983
13	NL	.	.	1038	.	1983
14	TAM	.	.	930	.	1983
15	MEX	.	.	25498	.	1983
16	COAH	2998	2092	2184	4991	1985
17	CHIH	3307	2329	2642	3817	1985
18	NL	3383	146	1096	2972	1985
19	TAM	3212	3919	938	4680	1985
20	MEX	72525	45804	25908	104606	1985
21	COAH	3133	535	2184	5381	1986
22	CHIH	3706	2917	2638	4376	1986
23	NL	3377	2087	1096	3164	1986
24	TAM	3246	4448	938	4857	1986
25	MEX	76948	36869	26241	117174	1986
26	COAH	.	.	2183	.	1987
27	CHIH	.	.	2643	.	1987
28	NL	.	.	1111	.	1987
29	TAM	.	.	938	.	1987
30	MEX	.	.	26287	.	1987
31	COAH	.	.	2183	.	1988
32	CHIH	.	.	2641	.	1988
33	NL	.	.	1111	.	1988
34	TAM	.	.	938	.	1988
35	MEX	.	.	26399	.	1988

APPLICATIONS

The highway condition data can indicate the percentages of good, fair, poor, or under-construction roads in either country. Table 5.3 presents the percentages of road conditions in Texas and in Mexico, compared with the total length of roads surveyed. Figure 5.1 is a graphical representation of the data presented in Table 5.3.

These data indicate that roads in the U.S. are in better condition than those in Mexico, based on the criteria used in the highway condition survey conducted by CTR and WSA. The

percentage of roads under construction (rehabilitation) is comparable (though a little higher in Mexico).

Table 5.3. Road condition in the U.S. and in Mexico

CONDITION	MEXICO	US
Construction or rehabilitation	3.1%	2.5%
Fair	40.8%	9.7%
Good	48.1%	87.1%
Poor	8%	0.7%

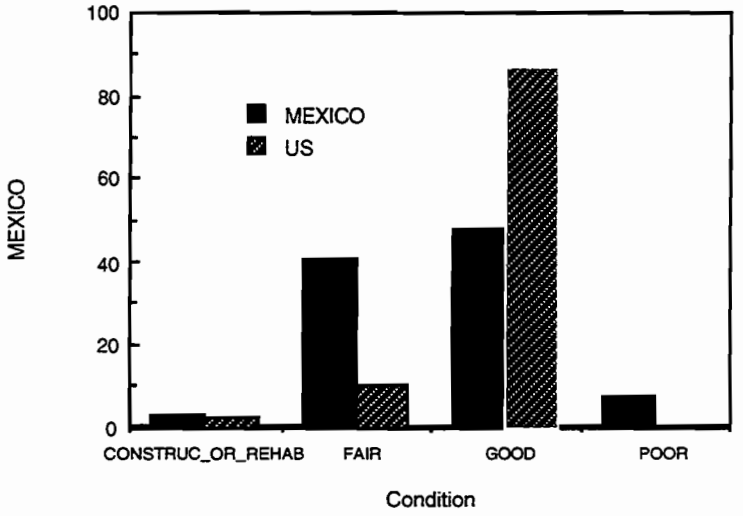

Figure 5.1. Road condition in the U.S. and in Mexico

The percentages of roads surveyed that have a certain number of lanes and are divided or undivided can also be compared using route reconnaissance data. Figure 5.2 shows a chart comparing the occurrences of each number of lanes in each category in Mexico and in the U.S. The percentages are obtained from the ratio of the surveyed length in each category and the total length surveyed in the country.

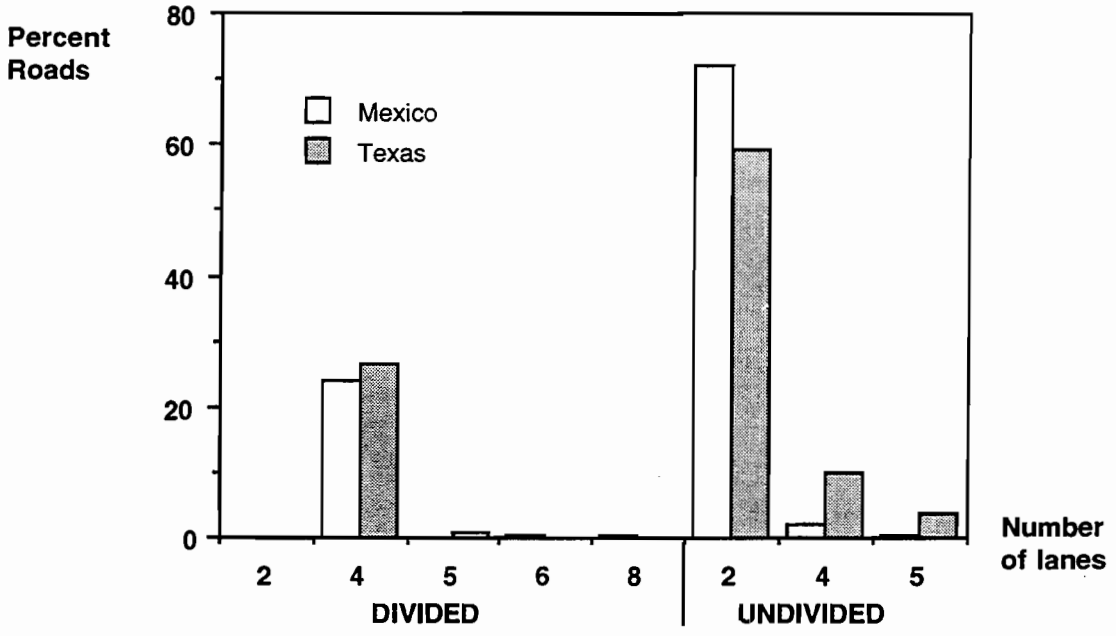

Figure 5.2. Number of lanes in the U.S. and in Mexico

Figure 5.2 shows that the percentages of roads at each lane category are comparable in the U.S. and in Mexico. This figure, coupled with Figure 5.1, suggests that, given the appropriate maintenance, the Mexican border network can be more comparable with the Texas network.

SUMMARY AND RECOMMENDATIONS

Adequate highway condition data covering the road networks provide information about traffic circulation to and from binational entry systems, an indication of the current needs, the penalties to be used in a trip assignment model, and other important information. Roads and highway infrastructure on both sides of the border were surveyed, and the information collected includes road lengths, travel times, delays, area type, number of lanes, lanes and shoulder widths, speed limits, road condition, and other necessary data. A total of 2,900 miles (4,640 kms) of major U.S. highways and roads were surveyed. On the Mexican side, a total of 2,000 miles (3,329 kms) were surveyed.

As discussed above, this survey identified several sections undergoing rehabilitation and/or new construction. These are candidates for a "good" condition in the near future. In addition, the project's field trips and networking efforts identified several planned highways on both sides of the border, some of them already approved and budgeted for construction. It is imperative that these data be periodically updated to reflect these dynamic changes in the border highway network.

CHAPTER 6. SOCIOECONOMIC DATA

INTRODUCTION

Effective transportation planning and policy making require extensive socioeconomic data. Fortunately, a wealth of such information exists, both in the U.S. and in Mexico. Sources of U.S. data include, but are not limited to, the U.S. Census Bureau, Texas State Comptroller data base, the Border Base at UTEP, city councils and chambers of commerce, several private organizations, and numerous reports, theses, and dissertations about the border region. In Mexico, the situation is analogous, albeit less prolific; data sources there include primarily state and federal organizations, such as the Instituto Nacional de Estadística Geografía e Informatica (INEGI).

Clearly, the amount of socioeconomic information available precluded an exhaustive compilation, given the timeframe and resources of this study. Accordingly, the TRANSBORDER data base socioeconomic information was limited to data that have obvious use in transportation planning studies, especially those related to traffic generation and demand.

Relevant socioeconomic information includes border population, employment, and revenues. Vehicle ownership or registration data were also collected on both sides of the border to provide an indication of traffic activity in the area (useful for traffic growth and traffic demand forecasting). Data sets compiling information about the U.S. are assigned names having the letters "US" or "TX," while those relating to Mexican data include the letters "MEX." Variables that serve as relational links among the different data sets are kept as consistent as possible to facilitate the merging of Mexican and U.S. data sets for this and future studies of the border region. The user guides for these data, which are presented in the next sections, are divided by country and data category. Table 6.1 summarizes the socioeconomic data sets and their contents.

U.S. SOCIOECONOMIC DATA USER'S GUIDE

Socioeconomic data, such as sales and population, are stored by category. These different data sets can be linked by U.S. city and/or year of data collection. A DATE or YEAR variable is present in all U.S. data sets. The format of DATE varies with the method by which the data are broken down, and may consist of a year, a year and a quarter, or a particular date. SAS functions that work in conjunction with SAS date formats can be used to retrieve the year of each particular DATE and to create a temporary variable that provides the relational time link between data sets of differing times.

Sales Data

Texas' quarterly sales data from 1984 to 1992 is found in the TXSALES.SDS data set available in the State Comptroller's Office. The contents of TXSALES.SDS, summarized in Table 6.2, cover all border cities found in the Comptroller's data base. These cities, stored in character variable USCITY, include Alamo, Brownsville, Del Rio, Donna, Eagle Pass, Edinburg,

El Paso, Harlingen, Hidalgo, La Feria, La Grulla, La Joya, Laredo, Los Fresnos, McAllen, Mercedes, Mission, Palmview, Pharr, Progreso, Roma, San Benito, San Juan, Socorro, and Weslaco.

Table 6.1. Summary of the socioeconomic data sets

Data Set	Contents
TXSALES.SDS	History of whole and retail sales data by border city
USPOP.SDS	History of US population data by Texas border city
VOTXTOT.SDS	History of vehicle ownership data by border county
VOTXMST.SDS	History of vehicle ownership data by border county and vehicle type
MEXMUNI.SDS	Geographical information by Mexican municipality
MEXEMP.SDS	Employment data in Mexico by municipality and area of activity
MEXPOP.SDS	Mexican population data by municipality in the four border states
MAQHIST.SDS	Maquiladora indicators history by municipality and state
MAQEC.SDS	Maquiladora indicators history by area of economic activity
VOMEXY.SDS	Annual vehicle ownership data by vehicle category and state
VOMEX91.SDS	1991 Mexican vehicle ownership data by municipality

Variable DATE stores the year and quarter of the sales figures. It is the only formatted variable using SAS default format YYQQ4, which decodes the date values as year and quarter. For example, a DATE value of 89Q1 represents the first quarter of 1989.

Sales data are broken down by total sales and retail sales. Variables OUTR and OUTT store the number of retail outlets and the total number of outlets, respectively. Variables RETS92 and TOTS92 store the values of retail and total sales for each DATE in thousands of 1992 dollars, respectively. Values for wholesales can be obtained by subtraction.

The State Comptroller's data base reports sales in nominal dollars of each year. Because this did not serve present research purposes, all sales values in TXSALES.SDS were converted to 1992 dollars. The Consumer Price Index (CPI) was used to convert the nominal dollars of each reported year to the baseline year of 1992. The values of CPI were obtained from the Economic Indicators Handbook and are based on the average of all U.S. urban consumers in the period from 1982 to 1984.[1] Variables PTAXRET and PTAXTOT store the percentages of retail and total sales that are subject to sales tax. These variables give a general indication of the nature of the goods traded in the border area.

Exhibit 6.1 shows a PROC CONTENTS output of TXSALES.SDS, while Exhibit 6.2 shows a PROC PRINT output of the first ten observations. There are no customized formats for this data set, since all numeric variable values are self-explanatory and because the values of the only character variable, USCITY, are also self-explanatory.

[1] Economic Indicators Handbook.

Table 6.2. Contents of TXSALES.SDS

Variable	Meaning	Format	Type
USCITY	City name		Character
DATE	Year and quarter	YYQQ4.	Numeric
OUTR	Number of retail outlets		Numeric
OUTT	Number of total outlets		Numeric
RETS92	Retail sales in 1000 dollars (1992 dollars)		Numeric
TOTS92	Total sales in 1000 dollars (1992 dollars)		Numeric
CPI	Consumer Price Index (base year = Ave. 1982 / 1984)		Numeric
PTAXRET	Percent taxable of retail sales		Numeric
PTAXTOT	Percent taxable of total sales		Numeric

Exhibit 6.1. PROC CONTENTS output of TXSALES.SDS

```
CONTENTS PROCEDURE
Data Set Name: SDS.TXSALES                          Observations:     936
Member Type:   DATA                                 Variables:          9
Engine:    V608                                     Indexes:            0
Created:       11:50 Monday, August 23, 1993
Observation Length:   42
Last Modified: 11:50 Monday, August 23, 1993
Deleted Observations: 0
Protection:                                         Compressed:       NO
Data Set Type:                                      Sorted:           NO
Label:     TOTAL AND RETAIL SALES IN 92

          -----Engine/Host Dependent Information-----
Data Set Page Size:       3072
Number of Data Set Pages:   14
File Format:               607
First Data Page:             1
Max Obs per Page:           72
Obs in First Data Page:     38
Userid  :              FTFD445
File  :             TXSALES  SDS

        -----Alphabetic List of Variables and Attributes-----
#  Variable  Type  Len  Pos  Format  Label
-----------------------------------------------------------------------
3  CPI       Num     3   11          CONSUMER*PRICE*INDEX*AVG82/84
1  DATE      Num     8    0   YYQ4.  YEAR*QUARTER
2  OUTR      Num     3    8          NUMBER*OF RETAIL*OUTLETS
6  OUTT      Num     3   21          NUMBER OF*SALES*OUTLETS
5  PTAXRET   Num     3   18          PERCENT*TAXABLE*RETAIL*SALES
8  PTAXTOT   Num     3   28          PERCENT*TAXABLE*TOTAL*SALES
4  RETS92    Num     4   14          RETAIL*SALES IN*1000 92-DOLLARS
7  TOTS92    Num     4   24          TOTAL*SALES*IN 1000* 92 DOLLARS
9  USCITY    Char   11   31
```

Exhibit 6.2. Sample PROC PRINT output of TXSALES.SDS by variable names

OBS	DATE	OUTR	CPI	RETS92	PTAXRET	OUTT	TOTS92	PTAXTOT	USCITY
1	84Q1	53	1.02588	5730	37.1563	78	12564	21.5469	ALAMO
2	84Q2	51	1.03687	4767	37.9180	75	11092	22.3789	ALAMO
3	84Q3	49	1.04980	4457	35.8672	74	8707	25.0664	ALAMO
4	84Q4	79	1.05298	6135	33.8477	116	20140	13.9700	ALAMO
5	85Q1	50	1.06396	7053	36.2969	70	15085	19.9297	ALAMO
6	85Q2	59	1.07593	6815	38.9063	80	15615	20.4570	ALAMO
7	85Q3	52	1.08276	4953	50.5586	74	11946	25.5898	ALAMO
8	85Q4	89	1.09277	6471	45.3086	133	21115	17.2266	ALAMO
9	86Q1	57	1.08789	6000	49.7266	77	13757	24.8164	ALAMO
10	86Q2	60	1.09497	10373	25.8477	79	17438	17.7070	ALAMO

U.S. Population Data

Population data for the U.S. are stored in the data set "USPOP.SDS," which contains population by city for the past 3 census years, namely, 1970, 1980, and 1990. The PROC CONTENTS output of this self-explanatory data set is shown in Exhibit 6.3. Exhibit 6.4 shows a formatted printout of the first ten observations of these data sets. In Exhibits 6.4 and 6.6, the numeric variables P70, P80, and P90 are the border city populations for the 3 census years of 1970, 1980, and 1990, respectively. Variable USCITY provides the relational link with other data sets by geographical site. A relational time link can easily be obtained by splitting USPOP.SDS into three separate data sets (one for each year) and creating new variables according to the SAS statements shown in Exhibit 6.8. These statements create a temporary data set with variables USCITY, YEAR, and USPOP, which can be used to link population data to other data by year.

Exhibit 6.3. PROC CONTENTS output of USPOP.SDS

```
CONTENTS PROCEDURE

 Data Set Name: SDS.USPOP                                  Observations:      27
 Member Type:   DATA                                       Variables:          4
 Engine:    V608                                           Indexes:            0
 Created:     11:58 Monday, August 23, 1993
 Observation Length:   24
 Last Modified: 11:58 Monday, August 23, 1993
 Deleted Observations: 0
 Protection:                                               Compressed:        NO
 Data Set Type:                                            Sorted:            NO
 Label:
           -----Engine/Host Dependent Information-----
 Data Set Page Size:     2048
 Number of Data Set Pages: 1
 File Format:        607
 First Data Page:      1
 Max Obs per Page:     84
 Obs in First Data Page:   27
 Userid  :         FTFD445
 File  :         USPOP  SDS

       -----Alphabetic List of Variables and Attributes-----
 #  Variable  Type   Len  Pos  Label
 ------------------------------------------------------------
 2   P70      Num     4   12   POPULATION*IN 1970
 3   P80      Num     4   16   POPULATION*IN 1980
 4   P90      Num     4   20   POPULATION*IN 1990
 1   USCITY   Char   12    0
```

Data in TXPOP.SDS come from the *Texas Almanac*, a publication whose population data include the 1950 census. SAS statements analogous to these shown in Exhibit 6.8 can be used to reorganize this data set and to create a YEAR variable to serve as a relational link.

Exhibit 6.6. Sample PROC PRINT output of USPOP.SDS

OBS	USCITY	P70	P80	P90
1	ALAMO	5200	5831	8210
2	BROWNSVILLE	68000	84977	98962
3	DELRIO	21865	30034	30705
4	DONNA	8600	9952	12652
5	EAGLEPASS	16890	21407	20651
6	EDINBURG	19100	24075	29885
7	ELPASO	360725	425259	515342
8	FABENS	3400	3400	5599
9	HARLINGEN	40000	43543	48735
10	HIDALGO	1980	2288	3292

Exhibit 6.7. Sample PROC PRINT output of TXPOP.SDS

OBS	BORDER COUNTIES	TOTAL NO OF VEHICLES	YEAR
1	CAMERON	129821	1982
2	HIDALGO	182706	1982
3	STARR	15461	1982
4	ZAPATA	5677	1982
5	WEBB	62559	1982
6	DIMMIT	7855	1982
7	MAVERICK	16078	1982
8	KINNEY	1987	1982
9	VALVERDE	27072	1982
10	TERRELL	1616	1982
11	BREWSTER	5826	1982
12	PRESIDIO	3848	1982
13	JEFF_DAVIS	1618	1982
14	CULBERSON	2628	1982
15	HUDSPETH	2038	1982
16	ELPASO	314625	1982

Exhibit 6.8. SAS statements to create relational time link for USPOP.SDS

```
DATA P70;   SET SDS. USPOP; KEEP USCITY P70; RENAME P70=USPOP; YEAR=1970;
DATA P80;   SET SDS. USPOP; KEEP USCITY P80; RENAME P80=USPOP; YEAR=1980;
DATA P90;   SET SDS. USPOP; KEEP USCITY P90; RENAME P90=USPOP; YEAR=1990;
DATA USPOP; SET P70 P80 P90;
```

U.S. Vehicle Ownership Data

The Texas Department of Transportation's Division of Motor Vehicle Titles and Registration provided the number of registered vehicles in each Texas-Mexico border county during the calendar years 1982 through 1992. This information is based on the number of vehicles registered and paying a registration fee. The data, compiled into the VOTXTOT.SDS data set, cover the following border counties: Cameron, Hidalgo, Starr, Zapata, Webb, Dimmit, Maverick, Kinney, Val Verde, Terrell, Brewster, Presidio, Jeff Davis, Culberson, Hudspeth, and El Paso. As mentioned earlier, these numbers are based on the number of vehicles registered in each county, i.e., the number of vehicles that bought a license sticker during that year. However, the fact that some vehicles operate without registration, or with invalid or forged license stickers, reduces the accuracy of these data as an indication of the number of vehicles operating in each county. This data set is self-explanatory and contains only three variables: YEAR, COUNTY and VEH. Exhibit 6.9 is a PROC CONTENTS of VOTXTOT.SDS, and Exhibit 6.10 is a PROC PRINT of the same data set showing the total number of vehicles registered during 1982 in each Texas border county.

Exhibit 6.9. PROC CONTENTS output of VOTXTOT.SDS

CONTENTS PROCEDURE

Data Set Name:	SDS.VOTXTOT	Observations:	176
Member Type:	DATA	Variables:	3
Engine:	V608	Indexes:	0
Created:	21:25 Sunday, August 29, 1993	Observation Length:	20
Last Modified:	21:25 Sunday, August 29, 1993	Deleted Observations:	0
Protection:		Compressed:	NO
Data Set Type:		Sorted:	NO
Label:	TOTAL VEH IN TEXAS BORDER COUNTIES		

-----Engine/Host Dependent Information-----

Data Set Page Size:	2048
Number of Data Set Pages:	3
File Format:	607
First Data Page:	1
Max Obs per Page:	100
Obs in First Data Page:	66
Userid :	FTFD445
File :	VOTXTOT SDS

-----Alphabetic List of Variables and Attributes-----

#	Variable	Type	Len	Pos	Label
1	COUNTY	Char	11	0	BORDER*COUNTIES
2	VEH	Num	6	11	TOTAL NO* OF VEHICLES
3	YEAR	Num	3	17	

Exhibit 6.10. Formatted sample PROC PRINT output of VOTXTOT.SDS

OBS	BORDER COUNTIES	TOTAL NO OF VEHICLES	YEAR
1	CAMERON	129821	1982
2	HIDALGO	182706	1982
3	STARR	15461	1982
4	ZAPATA	5677	1982
5	WEBB	62559	1982
6	DIMMIT	7855	1982
7	MAVERICK	16078	1982
8	KINNEY	1987	1982
9	VALVERDE	27072	1982
10	TERRELL	1616	1982
11	BREWSTER	5826	1982
12	PRESIDIO	3848	1982
13	JEFF_DAVIS	1618	1982
14	CULBERSON	2628	1982
15	HUDSPETH	2038	1982
16	ELPASO	314625	1982

Another source of vehicle ownership data is the master file retained by TxDOT's Division of Motor Vehicles. This comprehensive master file provides the number of vehicles in each class at a certain date. The major drawbacks of the master file counts are due to faults in the run and human errors. In the past, county numbers were out of order, however this problem is now eliminated. The sixteen border counties included in this file are the same border counties discussed earlier.

Data set VOTXMST includes the number of vehicles in each class per border county at the dates of run, which are: September 24, 1988; June 9, 1989; September 1, 1990; December 30, 1991; and December 3, 1992. Examples of this self-explanatory data set are shown in Exhibit 6.11, a PROC CONTENTS of VOTXMST, and in Exhibit 6.12, a PROC PRINT of the same data set. The sample contains September 24, 1988, data on all sixteen border counties. The only variable that may warrant further explanation is APPR (apportioned interstate vehicles). This variable indicates commercial vehicles that work in more than one state and which must be registered accordingly. The errors that might result when this variable is added to other commercial vehicles to estimate the totals are here regarded as negligible.

MEXICAN SOCIOECONOMIC DATA USER'S GUIDE

Mexican socioeconomic data include population, employment statistics, vehicle ownership, and maquiladora indicators. As found in the U.S. data, the two main relational links found among the Mexican data sets are geographical location and time. Some Mexican data are available by city, while others are available by municipality. It is important to note that a Mexican Municipality usually comprises more than one city. The data sets in the TRANSBORDER data base make this distinction by labeling these variables MUNI or MEXCITY, as appropriate. The most recent geographical description of Mexican Municipalities is found in a special data set described in the next section.

Mexican Municipalities Information

The data set MEXMUNI.SDS provides a basic geographical description of Mexican municipalities in all four states sharing a border with Texas. Usually, the name of the municipality corresponds to the name of the most important city it encompasses. This can be used to create the variable MEXCITY, which is then used as a relational link to other files when appropriate. The data reports, however, must take into account the difference between municipality and city, which is more or less equivalent to the difference between county and city in the U.S. Variable NLOC, the number of localities in the municipality, helps identify the size of the municipality. Variables MUNI and STATE are also present in other data sets and can be used as relational links. Variable AREA, the municipality area in square kilometers, can provide population densities when merged with the Mexican population file discussed below. The self-explanatory data set's PROC CONTENTS output is depicted in Exhibit 6.13. Exhibit 6.14 shows a PROC PRINT of the first five observations of this data set.

Exhibit 6.11. PROC CONTENTS output of VOTXMST.SDS.

CONTENTS PROCEDURE

Data Set Name:	SDS.VOTXMST	Observations:	80
Member Type:	DATA	Variables:	22
Engine:	V608	Indexes:	0
Created:	15:58 Monday, November 22, 1993	Observation Length:	82
Last Modified:	15:58 Monday, November 22, 1993	Deleted Observations:	0
Protection:		Compressed:	NO
Data Set Type:		Sorted:	NO
Label:	VEH OWNERSHIP-MASTER FILE		

-----Engine/Host Dependent Information-----

Data Set Page Size:	5120
Number of Data Set Pages:	2
File Format:	607
First Data Page:	1
Max Obs per Page:	62
Obs in First Data Page:	25
Userid :	FTFD445
File :	VOTXMST SDS

-----Alphabetic List of Variables and Attributes-----

#	Variable	Type	Len	Pos	Format	Label
19	APPR	Num	4	70		APPORTIONED*INTERSTATE*VEHICLES
3	AUTO	Num	6	19		AUTOS
6	COMB	Num	4	34		COMBINATION
1	COUNTY	Char	11	0		BORDER*COUNTIES
9	CTYBUS	Num	2	44		CITY BUS
2	DATE	Num	8	11	DATE7.	DATE*OF RUN
17	DISRLF	Num	2	66		DISASTER RELIEF
5	FMTR	Num	4	30		FARM_TRUCK
16	FMTRL	Num	3	63		FARM*TRAILER
15	FMTRLTRC	Num	2	61		FARM_TRAILER_TRACTOR
11	FRTR	Num	2	50		FERTILIZER*TRUCK
12	MACH	Num	3	52		MACHINERY
8	MTRBUS	Num	2	42		MOTOR BUS
10	MTRMO	Num	4	46		MOTORCYCLES*MOPEDS
20	PPLATE	Num	2	74		PERMIT*PLATE
22	PRVBUS	Num	2	80		PRIVATE*BUS
14	RDTRC	Num	2	59		ROAD*TRACTOR
18	SOLCOSRV	Num	2	68		SOIL*CONSERVATION
13	TKNTRL	Num	4	55		TOKEN*TRAILER
7	TRAILER	Num	4	38		TRAILER
4	TRUCK	Num	5	25		TRUCKS
21	TRVLTRL	Num	4	76		TRAVEL*TRAILERS

Exhibit 6.12. Formatted sample PROC PRINT output of VOTXMST.SDS

OBS	BORDER COUNTIES	DATE OF RUN	AUTOS	TRUCKS	FARM_TRUCK	COMBINATION	TRAILER
1	BREWSTER	24SEP88	3311	2250	283	32	312
2	CAMERON	24SEP88	97509	34359	674	766	3113
3	CULBERSON	24SEP88	1188	935	199	43	55
4	DIMMIT	24SEP88	3652	2117	189	79	162
5	ELPASO	24SEP88	266835	87023	620	1146	5119
6	HIDALGO	24SEP88	135698	58060	1499	1941	4080
7	HUDSPETH	24SEP88	808	666	237	25	63
8	JEFF_DAVIS	24SEP88	711	742	128	11	73
9	KINNEY	24SEP88	1088	735	155	15	86
10	MAVERICK	24SEP88	11935	5940	234	121	227
11	PRESIDIO	24SEP88	1855	1513	302	26	97
12	STARR	24SEP88	10016	8255	580	157	223
13	TERRELL	24SEP88	650	468	163	15	75
14	VALVERDE	24SEP88	17270	8198	434	150	1339
15	WEBB	24SEP88	45427	19183	658	1330	1036
16	ZAPATA	24SEP88	2981	2113	205	41	417

OBS	BORDER COUNTIES	DATE OF RUN	MOTOR BUS	CITY BUS	MOTORCYCLES MOPEDS	FERTILIZER TRUCK	MACHINERY
1	BREWSTER	24SEP88	0	0	138	0	11
2	CAMERON	24SEP88	79	4	2156	1	165
3	CULBERSON	24SEP88	0	0	35	0	3
4	DIMMIT	24SEP88	0	0	72	0	24
5	ELPASO	24SEP88	15	19	7176	0	656
6	HIDALGO	24SEP88	8	1	3052	0	433
7	HUDSPETH	24SEP88	0	0	13	0	20
8	JEFF_DAVIS	24SEP88	0	0	21	0	25
9	KINNEY	24SEP88	0	0	66	0	0
10	MAVERICK	24SEP88	16	6	145	3	19
11	PRESIDIO	24SEP88	0	0	28	0	3
12	STARR	24SEP88	2	0	103	3	1
13	TERRELL	24SEP88	0	0	20	0	3
14	VALVERDE	24SEP88	3	2	655	0	31
15	WEBB	24SEP88	1	1	990	0	248
16	ZAPATA	24SEP88	1	0	85	0	1

Exhibit 6.12. Continued

OBS	BORDER COUNTIES	DATE OF RUN	TOKEN TRAILER	ROAD TRACTOR	FARM_TRAILER_TRACTOR	FARM TRAILER
1	BREWSTER	24SEP88	38	0	2	138
2	CAMERON	24SEP88	1019	3	20	720
3	CULBERSON	24SEP88	34	0	0	91
4	DIMMIT	24SEP88	98	0	5	198
5	ELPASO	24SEP88	3703	0	6	454
6	HIDALGO	24SEP88	2333	6	21	1708
7	HUDSPETH	24SEP88	34	0	3	171
8	JEFF_DAVIS	24SEP88	27	0	0	80
9	KINNEY	24SEP88	21	0	3	54
10	MAVERICK	24SEP88	168	0	2	72
11	PRESIDIO	24SEP88	28	0	2	196
12	STARR	24SEP88	161	0	1	414
13	TERRELL	24SEP88	21	0	1	75
14	VALVERDE	24SEP88	213	0	3	234
15	WEBB	24SEP88	2592	0	10	314
16	ZAPATA	24SEP88	56	0	1	136

OBS	BORDER COUNTIES	DATE OF RUN	DISASTER RELIEF	SOIL CONSERVATION	APPORTIONED INTERSTATE VEHICLES
1	BREWSTER	24SEP88	0	0	.
2	CAMERON	24SEP88	1	0	.
3	CULBERSON	24SEP88	0	0	.
4	DIMMIT	24SEP88	0	0	.
5	ELPASO	24SEP88	0	0	.
6	HIDALGO	24SEP88	0	3	.
7	HUDSPETH	24SEP88	0	0	.
8	JEFF_DAVIS	24SEP88	0	0	.
9	KINNEY	24SEP88	0	0	.
10	MAVERICK	24SEP88	0	2	.
11	PRESIDIO	24SEP88	0	3	.
12	STARR	24SEP88	0	0	.
13	TERRELL	24SEP88	0	0	.
14	VALVERDE	24SEP88	0	0	.
15	WEBB	24SEP88	0	2	.
16	ZAPATA	24SEP88	0	2	.

Exhibit 6.12. Continued

OBS	BORDER COUNTIES	DATE OF RUN	PERMIT PLATE	TRAVEL TRAILERS	PRIVATE BUS
1	BREWSTER	24SEP88	0	142	7
2	CAMERON	24SEP88	0	1930	115
3	CULBERSON	24SEP88	0	41	3
4	DIMMIT	24SEP88	0	35	4
5	ELPASO	24SEP88	0	3479	198
6	HIDALGO	24SEP88	4	4104	242
7	HUDSPETH	24SEP88	0	34	1
8	JEFF_DAVIS	24SEP88	0	41	2
9	KINNEY	24SEP88	0	43	2
10	MAVERICK	24SEP88	0	56	13
11	PRESIDIO	24SEP88	0	54	0
12	STARR	24SEP88	0	70	17
13	TERRELL	24SEP88	0	25	0
14	VALVERDE	24SEP88	0	294	20
15	WEBB	24SEP88	1	167	137
16	ZAPATA	24SEP88	0	240	2

Exhibit 6.13. PROC CONTENTS output of MEXMUNI.SDS

```
 CONTENTS PROCEDURE
Data Set Name: SDS.MEXMUNI                              Observations:   199
Member Type:   DATA                                     Variables:       5
Engine:    V608                                         Indexes:         0
Created:     11:50 Monday, September 20, 1993
Observation Length:   39
Last Modified: 11:50 Monday, September 20, 1993
Deleted Observations: 0
Protection:                                             Compressed:      NO
Data Set Type:                                          Sorted:          NO
Label:     MEXICAN MUNICIPALITY INFORMATION

            -----Engine/Host Dependent Information-----
Data Set Page Size:     2048
Number of Data Set Pages: 5
File Format:        607
First Data Page:      1
Max Obs per Page:     51
Obs in First Data Page:   18
Userid  :         FTFD445
File  :         MEXMUNI   SDS
        -----Alphabetic List of Variables and Attributes-----
#  Variable  Type   Len  Pos  Format    Label
-----------------------------------------------------------------------------
1  AREA      Num     8    0             MUNICIPALITY* AREA IN* SQRT KM
5  MUNI      Char   25   27             MUNICIPALITY
3  NLOC      Num     4   12             NUMBER OF*LOCALITIES
4  STATE     Char    3   36
```

Exhibit 6.14. PROC PRINT output of MEXMUNI.SDS — Sample

OBS	AREA	NLOC	MUNI	STATE
1	645.9	84	ABASOLO	TAMP
2	11487.7	294	ALDAMA	TAMP
3	198.7	246	ALTAMIRA	TAMP
4	1818.6	129	ANTIGUO_MORELOS	TAMP
5	2305.5	167	BURGOS	TAMP

Employment Data

Employment data for all four Mexican border states for 1992 are included in the SAS data set "MEXEMP.SDS." The data are broken down by area of economic activity and by municipality. Exhibit 6.15 shows a printout of the PROC CONTENTS of this data set, and Exhibit 6.16 shows a formatted printout of the first ten observations of the same data set.

The two character variables in this data set are border state (STATE) and municipality name (MUNI). These provide the geographical relational links between this data set and other Mexican data sets. Each numeric variable reflects the number of persons employed in the economic sector indicated by variable name and label. The variable values are all self-

explanatory, requiring no customized formats. Since all data are for 1992, there is no need to secure additional storage space for this information, which can be easily added to the data set as needed to provide a relational time link to other data sets.

Mexican Population Data

The data set labeled "MEXPOP.SDS" contains Mexican population data by municipality in all four border states for the past 3 census years, i.e., 1970, 1980, and 1990. This data set is self-explanatory, with a PROC CONTENTS output shown in Exhibit 6.17. Exhibit 6.18 shows a formatted printout of the first ten observations in this data set. The character variables are STATE and the municipality names (MUNI), which have the same values as found in all data sets as they appear, and which serve as relational links by location. As in the case of USPOP.SDS and TXPOP.SDS, the numeric variables P70, P80, and P90 are the municipality populations in the 3 census years of 1970, 1980, 1990, respectively. Variables EMP90 and UNEMP90 store the number of employed and unemployed individuals reported in the most recent census.

Maquiladora Indicators

Because the maquiladora industry generates considerable traffic demand within the Texas-Mexico border region, the TRANSBORDER data base contains a history of maquiladora indicators that can be merged with additional socioeconomic data to provide input for traffic and socioeconomic forecasts. Data sets MAQHIST.SDS and MAQEC.SDS store this information.

Exhibit 6.15. PROC CONTENTS output of MEXEMP.SDS

```
CONTENTS PROCEDURE

Data Set Name: SDS.MEXEMP                      Observations:      40
Member Type:   DATA                            Variables:         17
Engine:    V608                                Indexes:            0
Created:     11:50 Monday, August 23, 1993
Observation Length:   72
Last Modified: 11:50 Monday, August 23, 1993
Deleted Observations: 0
Protection:                                    Compressed:        NO
Data Set Type:                                 Sorted:            NO
Label:     EMPLOYMENT STATISTICS IN MEXICO

             -----Engine/Host Dependent Information-----

Data Set Page Size:     4096
Number of Data Set Pages: 2
File Format:        607
First Data Page:      1
Max Obs per Page:     56
Obs in First Data Page:   22
Userid  :         FTFD445
File  :         MEXEMP92 SDS

          -----Alphabetic List of Variables and Attributes-----

 #  Variable  Type   Len  Pos  Format    Label
-----------------------------------------------------------------------
 1  AGR       Num      4    0            AGRICULTURE*& LIVESTOCK
 7  COM       Num      4   24            COMMERCE
 6  CON       Num      4   20            CONSTRUCTION
 9  FIN       Num      4   32            FINANCIAL*SERVICES
10  GOV       Num      4   36            GOVERNMENT*& DEFENSE
 4  MAN       Num      4   12            MANUFACTURING
 2  MIN       Num      4    4            MINING
16  MUNI      Char    25   60            MUNICIPALITY
15  NS        Num      4   56            UNSPECIFIED*JOBS
14  PER       Num      4   52            PERSONAL*SERVICES &*MAINTENANCE
 3  PET       Num      4    8            PETROLEUM
12  PRO       Num      4   44            PROFESSIONAL*& TECHNICAL* SERVICES
13  RES       Num      4   48            RESTAURANT &* HOTEL SERVICES
11  SOC       Num      4   40            SOCIAL SERVICES
17  STATE     Char     3   69
 8  TRA       Num      4   28            TRANSPORTATION*& COMMUNICATION
 5  WAT       Num      4   16            WATER &*ELECTRICITY
```

Exhibit 6.16. PROC PRINT output of MEXEMP.SDS

OBS	AGR	MIN	PET	MAN	WAT	CON	COM	TRA	FIN
1	71137	15362	960	150288	6136	47998	78003	26003	8800
2	7015	521	134	42095	859	12643	17771	6639	2301
3	5652	606	304	32089	1628	12207	27868	8418	3868
4	802	212	217	18301	366	4785	6889	2310	692
5	1268	264	11	8743	147	1286	1881	448	135
6	1076	1108	39	9606	982	2615	4511	1256	459
7	131610	9641	988	203938	4487	58608	100845	31172	10541
8	7217	1130	324	46308	1309	17266	27836	10270	4218
9	3894	173	289	117007	1380	20967	41419	10365	3431
10	8450	59	27	5062	218	3022	5211	1430	476

OBS	GOV	SOC	PRO	RES	PER	NS	MUNI	STATE
1	18807	60325	14378	16272	54442	17247	TOTAL	COAH
2	6230	18108	3178	3531	13202	2630	SALTILLO	COAH
3	4983	17432	3816	5638	17536	5708	TORREON	COAH
4	1322	5222	1050	1258	4754	1861	MONCLOVA	COAH
5	482	1266	1751	800	1388	595	ACUNA	COAH
6	1283	3057	618	1312	3127	1046	PIEDRAS_NEGRAS	COAH
7	24346	58600	18083	25561	65228	29452	TOTAL	CHIH
8	8914	20578	4644	6219	16929	7603	JUAREZ	CHIH
9	7008	17235	7968	12355	27491	12200	CUAUHTEMOC	CHIH
10	1021	2461	1020	1078	2919	760	DELICIAS	CHIH

Exhibit 6.17. PROC CONTENTS output of MEXPOP.SDS

```
 CONTENTS PROCEDURE
Data Set Name: SDS.MEXPOP                          Observations:     199
Member Type:   DATA                                Variables:          8
Engine:    V608                                    Indexes:            0
Created:     11:50 Monday, August 23, 1993
Observation Length:   39
Last Modified: 11:50 Monday, August 23, 1993
Deleted Observations: 0
Protection:                                         Compressed:       NO
Data Set Type:                                      Sorted:           NO
Label:     POPULATION AND EMPLOYMENT STATISTICS

           -----Engine/Host Dependent Information-----
Data Set Page Size:     2048
Number of Data Set Pages: 5
File Format:        607
First Data Page:      1
Max Obs per Page:     51
Obs in First Data Page:   18
Userid  :         FTFD445
File  :          MEXPOP   SDS
        -----Alphabetic List of Variables and Attributes-----
#  Variable  Type   Len  Pos  Format    Label
-----------------------------------------------------------------------------
1  AREA      Num     8    0             MUNICIPALITY* AREA IN* SQRT KM
6  EMP90     Num     4   23             NO OF*PEOPLE* EMPLOYED IN 90
7  MUNI      Char   25   27             MUNICIPALITY
2  P70       Num     4    8             POPULATION*IN 1970
3  P80       Num     4   12             POPULATION*IN 1980
4  P90       Num     4   16             POPULATION*IN 1990
8  STATE     Char    3   36
5  UNEMP     Num     3   20             NO OF * PEOPLE*UNEMPLOYED IN 90
```

Exhibit 6.18. Sample PROC PRINT output of MEXPOP.SDS

OBS	AREA	P70	P80	P90	UNEMP90	EMP90	MUNI	STATE
1	645.9	1523	1195	1409	19	405	ABASOLO	COAH
2	11487.7	32500	41948	56336	359	20465	ACUNA	COAH
3	198.7	12707	15864	18486	161	5818	ALLENDE	COAH
4	1818.6	15763	18345	17414	213	5261	ARTEAGA	COAH
5	2305.5	2209	2093	1888	10	553	CANDELA	COAH
6	2921.6	13641	15690	21356	256	5463	CASTANOS	COAH
7	7860.6	9443	10850	12302	138	3378	CUATRICIENEGAS	COAH
8	973.9	2988	2533	2966	9	745	ESCOBEDO	COAH
9	4933.9	37343	47511	50981	728	12160	FRANCISCO_I._MADERO	COAH
10	506.8	27979	35179	61450	707	15901	FRONTERA	COAH

The first data set, MAQHIST.SDS, has annual maquiladora indicators from 1982 through 1992, by state (STATE) and municipality (MUNI). The compiled information includes number of maquiladora plants, number of employees, value added, imported input, and exported output

(with the latter three reported per $100,000).

In this data set, variable MUNI also takes the values "TOTAL," "BORDER," and "OTHER." The corresponding values of STATE are, respectively, "NAT," for the first two MUNI values, and a state code for the latter. MUNI='TOTAL,' coupled with STATE='NAT,' shows the totals for the entire country. MUNI='OTHER,' coupled with a state code, shows the totals for the rest of the state not specified in the other values of MUNI. MUNI='BORDER,' coupled with STATE='NAT,' shows the totals for all U.S.-Mexico border states. Other than that, the data set is self-explanatory and can be easily understood by considering Exhibit 6.19, a PROC CONTENTS output of this data set, and Exhibit 6.20, a PROC PRINT of its first six observations.

Exhibit 6.19. PROC CONTENTS output of MAQHIST.SDS

```
 CONTENTS PROCEDURE
Data Set Name: SDS.MAQHIST                          Observations:     310
Member Type:   DATA                                 Variables:          8
Engine:    V608                                     Indexes:            0
Created:     10:50 Tuesday, August 24, 1993
Observation Length:   39
Last Modified: 10:50 Tuesday, August 24, 1993
Deleted Observations: 0
Protection:                                         Compressed:        NO
Data Set Type:                                      Sorted:            NO
Label:     MAQUILADORA HISTORY

            -----Engine/Host Dependent Information-----
Data Set Page Size:     2048
Number of Data Set Pages: 5
File Format:        607
First Data Page:      1
Max Obs per Page:     51
Obs in First Data Page:   18
Userid  :          FTFD445
File  :          MAQHIST   SDS
        -----Alphabetic List of Variables and Attributes-----
#  Variable  Type   Len  Pos  Format    Label
-----------------------------------------------------------------------------
1  YEAR      Num     3    0
6  EMPL      Num     4   23             NO OF*EMPLOYEES
5  MUNI      Char   25   27             MUNICIPALITY
2  VAD       Num     4    8             VALUE ADDED*(US 100,000)
3  PLANTS    Num     4   12             NUMBER OF*PLANTS
4  IMP       Num     4   16             IMPORTED INPUT*(US 100,000)
7  EXP       Num     4   36             EXPORTED OUTPUT*(US 100,000)
8  STATE     Char    4   15             MEXICAN*STATE
```

Exhibit 6.20. PROC PRINT output of MAQHIST.SDS

OBS	YEAR	VAD	PLANTS	IMP	EXP	EMPL		MUNI	STATE
1	1986	12945	.	1195	43513	56459	.	TOTAL	NAT
2	1986	11196	.	41948	41919	53915	.	BORDER	NAT
3	1986	291	26	1006	1298	.		CIUDAD_ACUNA	COAH
4	1986	145	21	352	497	.		PIEDRAS_NEGRAS	COAH
5	1986	0	.	0	591	.		TORREON	COAH
6	1986	142	.	449	0	.		OTHER	COAH

The second data set, MAQEC.SDS, contains data on number of maquiladora employees, imported input, exported output, and value added, disaggregated by area of both economic activity from 1986 through 1991 (data for the latter three are per $100,000). The data set is for the entire country, since no data disaggregated by economic activity and municipality were found. This data set is self-explanatory; its PROC CONTENTS and sample PROC PRINT outputs are depicted in Exhibits 6.21 and 6.22, respectively.

Exhibit 6.21. PROC CONTENTS output of MAQEC.SDS

```
 CONTENTS PROCEDURE
Data Set Name: SDS.MAQEC                          Observations:    78
Member Type:   DATA                               Variables:        6
Engine:    V608                                   Indexes:          0
Created:     7:30 Sunday, August 22, 1993
Observation Length:   39
Last Modified: 7:30 Sunday, August 22, 1993
Deleted Observations: 0
Protection:                                       Compressed:      NO
Data Set Type:                                    Sorted:          NO
Label:     MAQUILADORA HISTORY BY ECONOMIC ACTIVITY

           -----Engine/Host Dependent Information-----
Data Set Page Size:     2048
Number of Data Set Pages: 5
File Format:        607
First Data Page:      1
Max Obs per Page:     51
Obs in First Data Page:   18
Userid  :         FTFD445
File  :         MAQEC   SDS
        -----Alphabetic List of Variables and Attributes-----
#  Variable  Type   Len  Pos  Format    Label
-----------------------------------------------------------------------------
5  ECACT     Char   25   27             AREA OF*ECONOMIC*ACTIVITY
1  VAD       Num     4    8             VALUE ADDED*(US 100,000)
3  EMPL      Num     4   12             NUMBER OF*EMPLOYEES
4  IMP       Num     4   16             IMPORTED INPUT*(US 100,000)
2  EXP       Num     4   36             EXPORTED OUTPUT*(US 100,000)
6  YEAR      Num     3   20
```

Exhibit 6.22. PROC PRINT output of MAQEC.SDS

OBS	YEAR	ECACT	VAD	IMP	EXP	EMPL
1	1991	TOTAL	41339	116943	158282	486723
2	1991	FOOD	879	699	1578	8507
3	1991	TEXTILES	2499	5952	8441	49377
4	1991	LEATHER_PRODUCTS	529	846	1370	7712
5	1991	FURNITURE	2439	5142	7581	28256
6	1991	CHEMICAL_PRODUCTS	792	1076	1868	7947

Mexican Vehicle Ownership Data

Vehicle ownership data are provided on the Mexican side for the years 1982 through 1991 in each of the Texas-Mexico border states (Tamaulipas, Nuevo Leon, Coahuila, and Chihuahua) and classified by autos, buses, and trucks. These data are compiled in the data set labeled "VOMEXY.SDS" and are provided by INEGI. Exhibits 6.23 and 6.24 depict the PROC CONTENTS of VOMEXY.SDS and the PROC PRINT of the state of Chihuahua from 1982 through 1991 in this data set, respectively.

Exhibit 6.23. PROC CONTENTS output of VOMEXY.SDS

```
CONTENTS PROCEDURE

Data Set Name: SDS.VOMEXY                          Observations:          40
Member Type:   DATA                                Variables:              5
Engine:        V608                                Indexes:                0
Created:       17:22 Thursday, November 18, 1993   Observation Length:    19
Last Modified: 17:22 Thursday, November 18, 1993   Deleted Observations:   0
Protection:                                        Compressed:            NO
Data Set Type:                                     Sorted:                NO
Label:         VEH.OWN.IN MEX BORDER STATES

        -----Engine/Host Dependent Information-----

Data Set Page Size:        2048
Number of Data Set Pages:  1
File Format:               607
First Data Page:           1
Max Obs per Page:          106
Obs in First Data Page:    40
Userid  :                  FTFD445
File    :                  VOMEXY   SDS

    -----Alphabetic List of Variables and Attributes-----

#    Variable    Type    Len    Pos    Label
------------------------------------------------------------
3    AUTO        Num       5      7    # OF REGISTERED AUTOS
4    BUS         Num       3     12    # OF REGISTERED BUSES
1    STATE       Char      4      0
5    TRUCK       Num       4     15    # OF REGISTERED TRUCKS
2    YEAR        Num       3      4
```

Exhibit 6.24. Formatted sample PROC PRINT output of VOMEXY.SDS

OBS	STATE	YEAR	# OF REGISTERED AUTOS	# OF REGISTERED BUSES	# OF REGISTERED TRUCKS
1	CHIH	1982	242416	4123	89041
2	CHIH	1983	276179	4664	110752
3	CHIH	1984	292967	5113	127040
4	CHIH	1985	307200	5706	135961
5	CHIH	1986	309656	5920	141638
6	CHIH	1987	311993	5981	144753
7	CHIH	1988	316352	6167	149664
8	CHIH	1989	326457	5948	157323
9	CHIH	1990	349464	5960	187460
10	CHIH	1991	351763	2400	274184

As a further step into disaggregating the state vehicle ownership data, data set VOMEX91 provides the number of autos, buses, and trucks during 1991 in certain municipalities located in Tamaulipas, Nuevo Leon, Coahuila, and Chihuahua. These selected municipalities are those encompassing either major cities (such as Monterrey) or border municipalities. Exhibit 6.25 includes the PROC CONTENTS, while Exhibit 6.26 includes the PROC PRINT of the first fifteen observations, which depict the data for the state of Chihuahua in this data set.

APPLICATIONS AND CASE STUDIES OF SOCIOECONOMIC DATA

Applications of socioeconomic data are numerous and depend on the particular needs of each study. This section provides a few samples and case studies that illustrate the potential and importance of the socioeconomic data stored in the TRANSBORDER data base. They include simple data retrievals from a single data set, as well as compound retrievals obtained by merging the data by location and/or by such time variables as MUNI, US CITY, and DATE.

Comparison Between Population and Vehicle Ownership Levels

The ratio of number of people to the total number of registered vehicles in a certain area is one of the indicators of the traffic demand per capita in that area, as well as of the region's wealth. However, this ratio does not always indicate the wealth of a region, i.e., higher ratios do not always mean wealthier communities. These comparisons can be made through simultaneous use of data sets TXPOP.SDS, VOTXTOT.SDS, VOMEX.SDS, and MEXPOP.SDS.

The 1990 population data in Mexico and in Texas are compared with the most recent total registered vehicular counts in each region. Figures 6.1 through 6.4 show the 1990 population in the municipalities of each Mexican border state, and the total number of vehicles in 1991 in these respective municipalities for each Mexican state. Figure 6.5 plots the 1990 population of each Texas border county and the 1992 total number of vehicles registered in those counties. These figures indicate that the lower the population, the higher the ratio of total number of registered vehicles to population. In some cases, the ratio is closer to 1, i.e., one vehicle per inhabitant. On the other hand, the ratio of total vehicles to population decreases as the population increases.

Exhibit 6.25. PROC CONTENTS output of VOMEX91.SDS

```
CONTENTS PROCEDURE

Data Set Name: SDS.VOMEX91                          Observations:          91
Member Type:   DATA                                 Variables:             5
Engine:        V608                                 Indexes:               0
Created:       17:35 Thursday, November 18, 1993    Observation Length:    46
Last Modified: 17:35 Thursday, November 18, 1993    Deleted Observations:  0
Protection:                                         Compressed:            NO
Data Set Type:                                      Sorted:                NO
Label:         91 MEX.VEH.OWNERSHIP BY MUNI

            -----Engine/Host Dependent Information-----

Data Set Page Size:       3072
Number of Data Set Pages: 2
File Format:              607
First Data Page:          1
Max Obs per Page:         66
Obs in First Data Page:   45
Userid  :                 FTFD445
File    :                 VOMEX91  SDS

       -----Alphabetic List of Variables and Attributes-----

#    Variable    Type    Len    Pos    Label
-----------------------------------------------
3    AUTO        Num       6     32    NO OF*AUTOS
4    BUS         Num       4     38    NO OF*BUSES
1    MUNI        Char     24      0    MUNICIPALITY
2    STATE       Char      8     24
5    TRUCK       Num       4     42    NO OF*TRUCKS
```

Exhibit 6.26. Formatted sample PROC PRINT output of VOMEX91.SDS

OBS	MUNICIPALITY	STATE	NO OF AUTOS	NO OF BUSES	NO OF TRUCKS
1	AHUMADA	CHIH	3344	1	6018
2	ALDAMA	CHIH	1166	1	2672
3	ASCENSION	CHIH	2008	0	3560
4	BOCOYNA	CHIH	550	0	2223
5	BUENAVENTURA	CHIH	451	0	1967
6	CAMARGO	CHIH	3621	28	5164
7	CASAS_GRANDES	CHIH	376	8	1925
8	CUAUHTEMOC	CHIH	9537	45	18160
9	CHIHUAHUA	CHIH	82113	679	59769
10	DELICIAS	CHIH	10898	120	11533
11	GENERAL_TRIAS	CHIH	504	38	1368
12	GOMEZ_FARIAS	CHIH	291	2	1092
13	GRAN_MORELOS	CHIH	537	10	1923
14	GUADALUPE	CHIH	13138	0	8990
15	GUERRERO	CHIH	2374	36	5683

The magnitudes of the difference vary. They are more pronounced for Tamaulipas than for any other state, and they are less pronounced for Texas; but the trend is very consistent for the entire Texas-Mexico border. Data in Figures 6.5 and 6.6 show that the ratio of total vehicles to population is not a reliable indicator of the magnitude of the per capita income of a certain region. Figure 6.6 shows approximately the same per capita income for the El Paso and Val Verde counties, while the difference between number of vehicles and number of inhabitants is over 20 times higher for El Paso (Fig 6.5).

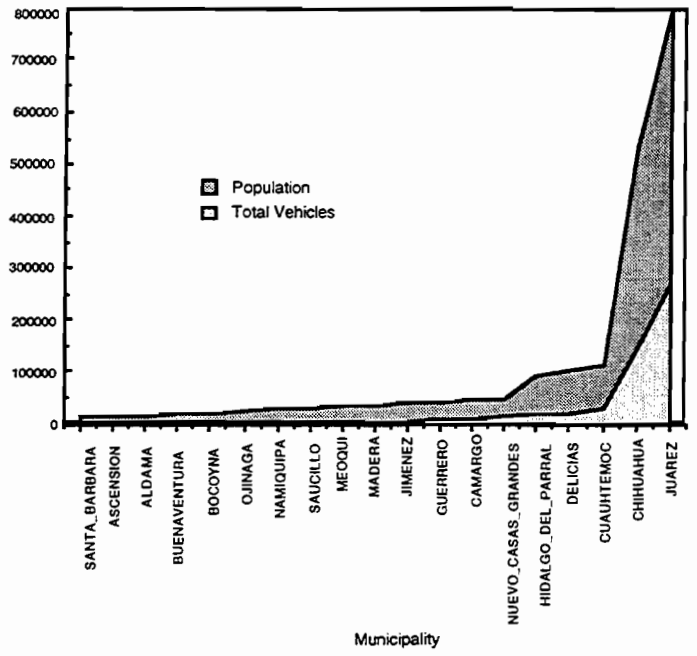

Figure 6.1. Population and vehicle registration levels in the state of Chihuahua

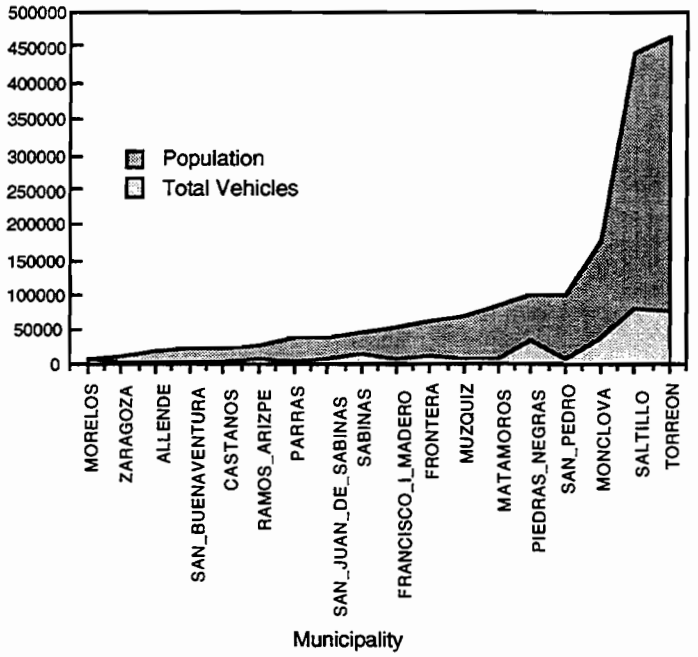

Figure 6.2. Population and vehicle registration levels in the state of Coahuila

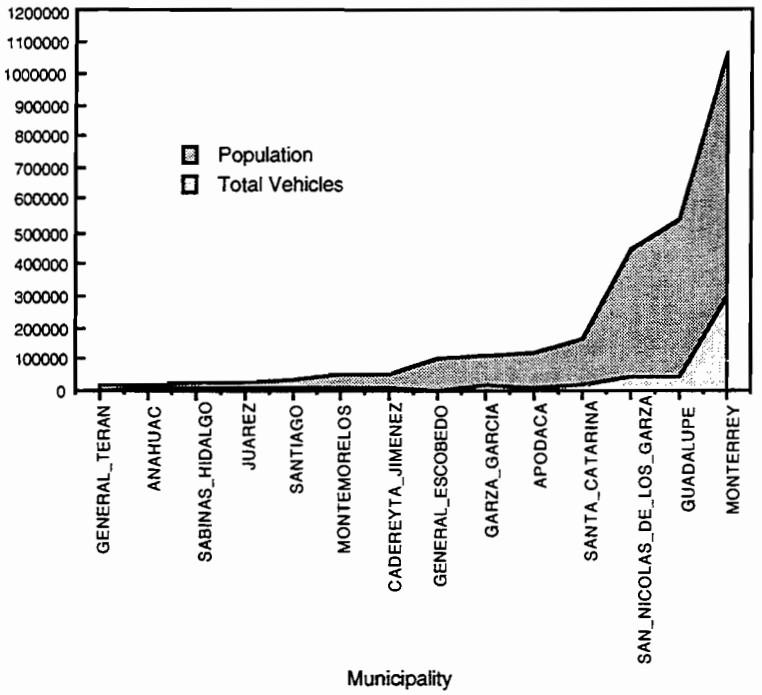

Figure 6.3. Population and vehicle registration levels in the state of Nuevo Leon

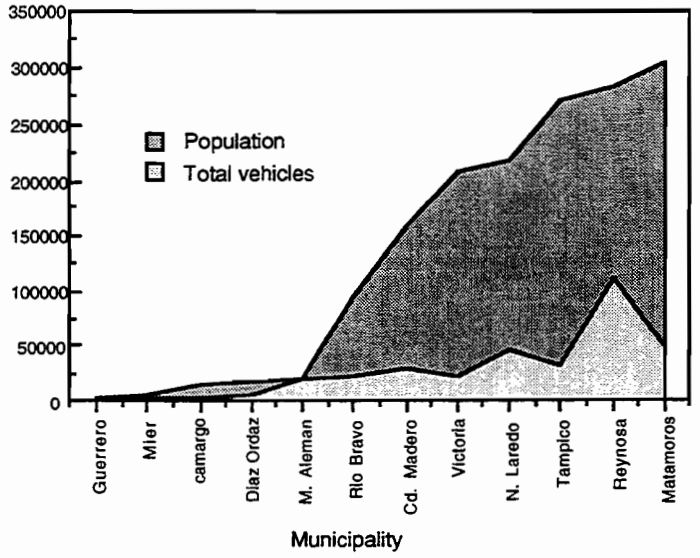

Figure 6.4. Population and vehicle registration levels in the state of Tamaulipas

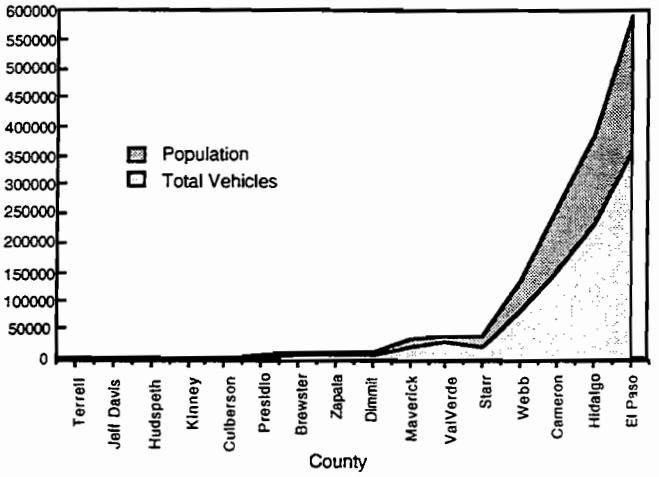

Figure 6.5. Population and vehicle registration levels in Texas

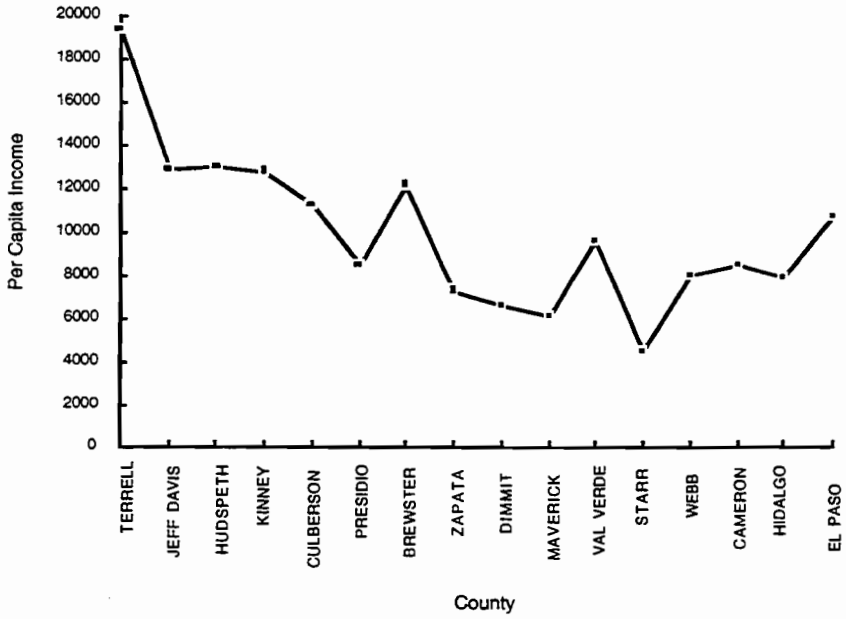

Figure 6.6. 1989 per capita income figures of the Texas border counties [2]

Vehicular Composition: A Case Study

Table 6.3 presents the 1991 vehicular composition of autos, trucks, and buses found in the Texas border counties and in the Mexican border states. The counts in Texas are based on the master file December 30, 1991, run. The vehicular classes in the master file were combined

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[2] Texas Almanac and State Industrial Guide, 1992-1993 based on the Census of Business, April 1991, by the U.S. Census Bureau.

to meet the categories in Table 6.3 according to the criteria discussed below.

Autos: includes passenger counts only.

Trucks: includes truck, farm truck, combination, farm trailer/tractor, trailer, road tractor, farm trailer, fertilize truck, apportioned, token trailer, and travel trailers.

Buses: includes motor bus, city bus, and private bus.

The master file classes that were not combined under any of the above three categories (autos, trucks, and buses) were machinery, disaster relief, soil conservation, permit plate, and invalid. Because these classes made up only 4,156 vehicles in 1991 (less than 0.4 percent of the total shown in Table 6.3), they can be ignored for the purposes of this illustrative analysis.

The U.S. and Mexico vehicular category distribution shows similarities for the percentages of autos and trucks. Looking at total vehicles in the Texas-Mexico border region, the percentage of autos reported for Texas border counties is slightly higher than that reported for the Mexican border states (the opposite is true for trucks). In addition, though the percentages of buses is less than 1 percent in both countries, that percentage in Mexico is 8 times higher than that reported for the U.S. (0.8 percent versus 0.1 percent).

Table 6.3. Number and percentages of 1991 vehicle ownership counts in Texas and Mexico

		Autos	Trucks	Buses	Totals
Texas Border Counties	Counts	707,013	349,936	955	1,057,904
	Percentages	66.8%	33.1%	0.1%	100%
Mexico Border States	Counts	1,219,498	752,900	15,070	1,987,468
	Percentages	61.4%	37.9%	0.8%	100%

Maquiladora Surplus

Data from file MAQHIST.SDS provide an interesting case study for analyzing the development of maquiladora activity and its profits and balance for Mexico. Figure 6.7 shows the exported output and imported input from the maquiladora industry, and their difference, which is the surplus. These three lines in the figure show a consistent ascending trend, which indicates that the maquiladora activity is growing. However, when the surplus is expressed as a percent of the imported input, the figure shows no growth. These data indicate that, while Mexico has interest in the maquiladora industry only to the extent that it yields a positive balance, maquiladora activity, historically, shows a consistent rate between surplus and imported input.

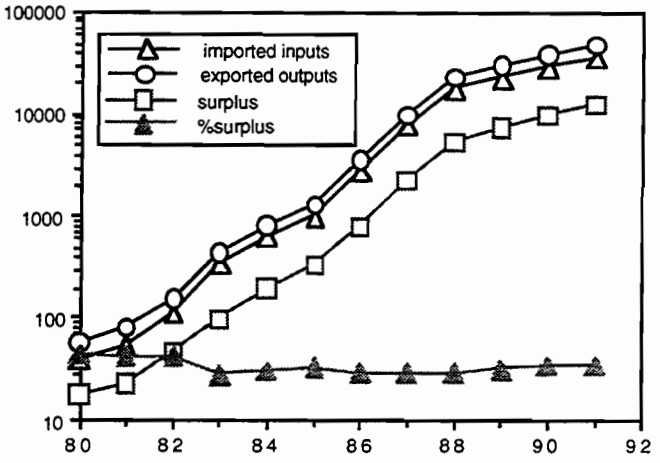

Figure 6.7. Maquiladora surplus

RECOMMENDATIONS FOR FUTURE UPDATING

Like any other type of data, socioeconomic data in the TRANSBORDER data base must be updated to be useful. Periodic contacts with such Mexican agencies as INEGI, and with such U.S. agencies as the Bureau of Census and TxDOT's Motor Vehicle Registration, are recommended for obtaining new and updated data for each category. Additional data categories (including Mexican per capita income and land use in border cities of both countries) should also be added to the data base as needed and/or as they become available.

The North American Free Trade Agreement may mandate changes in maquiladora industry operations. Such changes, if they occur, will in turn affect the population, employment, and other socioeconomic indicators. It is especially important that transportation planners closely monitor the maquiladora and industrial activity indicators. The concentration of such efforts in a single data base can save considerable resources that would otherwise be duplicated in collecting and storing these data for each study that requires socioeconomic indicators.

CHAPTER 7. ORIGIN AND DESTINATION SURVEY DATA

INTRODUCTION

The origin and destination information collected for this study is based on a comprehensive and critical inventory of recent origin and destination surveys, supplemented by new origin and destination surveys conducted specifically for this study when appropriate. While these two parts of the origin and destination investigation are interrelated (a complete discussion of the survey procedures and the transborder traffic flow patterns can be found in Chapter 5 of Report 1976-3), this report concentrates on the explanations necessary to understand the data sets and to obtain the standard origin and destination data summaries and reports from these sets.

The extensive revisions that characterize existing surveys indicated a need to undertake additional surveys at eight binational bridge entry systems. The data sets contain the origin and destination data collected during this project only. Table 7.1 shows a summary of the origin and destination data stored in the TRANSBORDER data base.

Table 7.1. Summary of origin and destination surveys

Bridge	US. City / Mexican City	Survey Dates	ADT		Number of Surveys	
			Autos	Trucks	Autos	Trucks
Gateway	Brownsville / Matamoros	6-28-93/6-29-93	9,955 (1)	718 (1)	4258	185
B&M	Brownsville / Matamoros	6-30-93 / 7-1-93	4,611 (1)	11 (1)	2407	3
Progreso	Progreso/ Nuevo Progreso	6-30-93 / 7-1-93	2,138 (1)	46 (1)	1548	29
Hidalgo	Hidalgo / Reynosa	6-1-93	14,467 (2)	572 (2)	4003	137
Eagle Pass	Eagle Pass/Piedras Negras	4-22-93	6,244 (2)	207 (2)	483	15
Del Rio	Del Rio / Ciudad Acuña	4-29-93	3,205 (3)	65 (3)	824	33
Presidio	Presidio / Ojinaga	4-29-93	1,560 (4)	20 (4)	594	5
Fabens	Fabens / La Caseta	4-27-93	840 (5)	n.a.	563	1

(1) Average 24-hour counts on dates of survey
(2) 24-hour count on date of survey
(3) Monday-Friday average, March 1993
(4) Estimate based on monthly counts
(5) Monday-Friday average, June 1993
NOTE: The lower number of trucks at B&M bridge during the dates of the survey was due to construction work on the highway infrastructure on the Mexican side.

Although the questionnaires used to collect data were basically the same in all surveys, they underwent three adjustments throughout the project. Consequently, there are three origin and destination data sets, one for each survey questionnaire. These are termed ODSGG2.SDS, ODVALL.SDS, and ODHIDAL.SDS. The file names always start with the letters "OD" to facilitate identification of each file. The next section discusses the survey methodology and the three forms used in the field, to help better understand the structure and organization of the three origin and destination data sets.

ORIGIN AND DESTINATION SURVEY METHODOLOGY

The origin and destination surveys used the direct interview methodology, with the devised questionnaires addressing the following issues:

(1) Determination of traffic patterns in terms of origin and destination pairs.

(2) Identification of auto trip purpose and their quantification with respect to the total number of auto trips (the main focus being the identification of number of business as opposed to non-business trips).

(3) Quantification of the number and frequencies of trips between each origin and destination pair.

(4) Quantification of auto occupancy rate.

(5) Quantification of number of truck axles.

As mentioned earlier, the survey forms were modified to facilitate the surveyors' jobs and to improve the quality and quantity of information collected during the interviews. Exhibit 7.1 shows the basic survey form used in all segment 2 sites (Eagle Pass, Del Rio, Presidio, and Fabens). Following the reduction and analysis of the survey field data, it was decided that the trip purpose categories would be expanded to include recreation, school, and shopping, and that this new form would be tested at Hidalgo bridge. The test was successful, and in the rest of the surveys the trip purpose categories were further expanded to include more categories. In addition, a more detailed truck questionnaire was devised, one which included the commercial destination and origin of the cargo (port, manufacturing plant, etc.) and which identified whether the trucks were empty or loaded. The latter information is very useful for transportation planning, because it gives an idea of the potential for improving traffic circulation by encouraging loaded trucks. An attempt to identify whether the trip purpose was associated with the origin or the destination was unsuccessful, primarily because the corresponding question was too long for a direct interview survey.

The three survey questionnaires and related field work are discussed in detail in Chapter 5 of Report 1976-3. The next section discusses the organization of these questionnaires in data base format, with the last section of this chapter including some practical applications of the origin and destination data. These examples will help the data base operator understand the standard tabulations of these data.

ORIGIN AND DESTINATION DATA USER'S GUIDE

General Data Description

The basic survey questionnaire underwent some modification throughout the process; these modifications are reflected in the organization of the three data sets containing origin and destination data, as shown in Table 7.2. Most variables are common to the three data sets and reflect the questionnaire shown in Exhibit 7.1. These variables are listed in Table 7.3.

Exhibit 7.1. Basic survey form used by CTR

AUTO

RECORD

Number of persons in the auto (including driver) 1 2 3 4 5 6 7 8+
(circle one)

ASK

In which US. city or town did you start your trip today?
¿En que ciudad de Estados Unidos comenzó usted su viaje?

Del Rio	Eagle Pass
Comstock	Loma Alta
Carta Valley	Bracketville
Uvalde	San Antonio
Laughlin	San Angelo

(write city name or circle one)

Which Mexican city or town is your destination?
¿A que ciudad en Mexico se dirige?

Ciudad Acuña	Sabinas
Piedras Negras	Monclova
Jimenez	Saltillo
Allende	Monterrey

(write city name or circle one)

TRUCK

RECORD

Number of axles: 2 3 4 5 6 7 8+
(circle one)

ASK

Where was the last US. city or town in which you picked up or dropped off cargo?
¿En que ciudad de Estados Unidos recogió o entregó usted su carga por última vez?

Del Rio	Eagle Pass
Comstock	Loma Alta
Carta Valley	Bracketville
Uvalde	San Antonio
Laughlin	San Angelo

(write city name or circle one)

In which Mexican city or town will you make your first delivery or first pick up cargo?
¿Cual va ser la primer ciudad de Mexico donde entregará o recogerá usted su carga?

Ciudad Acuña	Sabinas
Piedras Negras	Monclova
Jimenez	Saltillo
Allende	Monterrey

(write city name or circle one)

Is this a business trip? yes no
¿Es esto un viaje de trabajo o negocio?

ASK ALL

How often do you make this trip_____per day week month year
¿Quantas veces por dia o por semana o por mes.. realiza usted este viaje?

RECORD

License Plate: State_____ USA Mexico Other /Unknown
(circle one)

Table 7.2. Summary of origin and destination data sets

Data Set	Region	Binational Bridge Entry Systems
ODSEG2.SDS	Segment 2	Eagle Pass, Del Rio, Presidio, and Fabens Bridges
ODHIDAL.SDS	Hidalgo	Hidalgo Bridge
ODVALL.SDS	Lower Valley	Gateway, B&M, and Progreso Bridges.

Table 7.3. Common variables for all origin and destination data sets

Variable	Format	Meaning	Values
IBWC		A unique bridge identification number as in INVM.SDS	Distance to the gulf in hm
DATE	DATE7.	Survey date	day/mon/year
TIME		One-hour interval in which data was taken	Lower boundary of interval (6 to 18)
DEST		Destination of trip	Names of places; mostly cities
ORI		Origin of trip	
VEH	$VEH.	Type of vehicle (mode)	A=auto, t=truck, b=bus.
PA		Number of passengers for cars, number of axles for trucks, missing for buses.	Integers
PLATE		State code of the vehicle license plate	State codes
FQ1		Number of times the trip is taken in every day, week, etc.	Integers
FQ2	$FQ.	Unit fq1 refers to	D=day, w=week, etc.
PURP	$PURP.	Trip purpose for autos or load status for trucks	See Table 7.3

Variable IBWC identifies the binational entry system. Identical to the numeric code described in Chapter 2, it represents the distance along the river between the Gulf and the binational entry system. The distance values are in hectometers (100 m) to allow the use of integer codes that require shorter variable lengths. This variable provides the relational link between the origin and destination files and other files containing data on individual binational entry systems.

Variable DATE shows the survey date. It was formatted as DATE7 default format for dates.

Variable time indicates the lower limits of the pre-hour time interval associated with the specific interview. A 24-hour clock was used to ensure a numeric variable and to avoid confusion between times such as 6 PM and 6 AM.

Variables ORI and DEST store the name of declared origins and destinations of the trip, respectively. Most variable values are names of Texas or Mexican cities, though in some cases these value names refer to countries or to U.S. or Mexican states.

Variable PA is either the number of passengers in the auto, or the number of axles in the truck. It assumes missing values for buses.

Variable PLATE shows the state of origin of the license plates for all vehicle types. This information can be supplemented by the vehicle ownership discussed in the previous chapter.

Variable VEH indicates the mode, or vehicle type. It takes values A, T, or B, which are respectively decoded as AUTO, TRUCK and BUS by customized format $VEH., stored in library FORLIB.DATABASE.

Two variables were assigned to store information about the frequency of trips. FQ1 is a numeric variable that stores information about the number of times a person takes the trip. FQ2, a character variable, has information about the time interval in which the person takes the number of stored trips in FQ1. For example, if FQ1 has a value "5" and FQ2 the value "week," then the person takes the trip five times a week. Small programs can be written to merge the information in FQ1, FQ2, and trip purpose to produce standard trip frequency tables, which are illustrated later in this chapter.

Character variable PURP (TRIP*PURPOSE), with customized format $PURP., is also present in all three data sets, but its possible values changed as the survey methodology evolved. In data set ODSEG2.SDS, the variable takes only two values: "W" for business or work-related trips, and "NB" (non-business) for any other trip purpose. In ODHIDAL.SDS, this variable can take more values, and in ODVALL.SDS the values of PURP were further expanded. Table 7.4 shows a summary of the trip purpose values in the three origin and destination data sets. These values are decoded by customized format $PURP., and the formatted values are also shown in Table 7.4.

*Table 7.4. Values of variable PURP (TRIP*PURPOSE)*

	TRUCKS		**AUTOS**	
DATA SET	**Actual Value**	**Formatted Value**	**Actual Value**	**Formatted Value**
ODSEG2.SDS	W	WORK	W NB	WORK NON-BUSINESS
ODHIDAL.SDS	W	WORK	W SH SC OT R	WORK SHOPPING SCHOOL OTHER RECREATION
ODVALL.SDS	E L T	EMPTY LOADED TRACTOR	W SH SC OT R TA D	WORK SHOPPING SCHOOL OTHER RECREATION TAXI DOCTOR

During the surveys conducted at the Lower Rio Grande Valley, an attempt was made to identify the commercial origin and destination of the cargo. This information is stored in variables TRF and TRT, which stand for TRuck To and TRuck From, respectively. Both

variables have customized format $TRF., and their values indicate whether the cargo was coming from (TRF) or going to (TRT) a warehouse, a seaport, an airport, or to other possible commercial origins and destinations. In addition to identifying the traffic flow patterns, this information is important for multimodal transportation planning, insofar as it gives an indication of the interaction among the several transportation modes used to haul the cargo from the U.S. into Mexico. Table 7.5 explains the possible values of variables TRT and TRF.

In the Lower Valley surveys, an attempt was made to link the trip purpose to the origin or destination using variable FROMTO, which takes only two values: "F" (from) and "T" (to). A FROMTO value of "T" associated with a business trip purpose means that the vehicle leaving the U.S. was going to Mexico for business purposes, while a FROMTO value of "F" indicates that the vehicle was coming back to Mexico from a business trip in the U.S. This identification helps determine the value of time associated with the trip, but the extra time required to ask this additional question discouraged many drivers from responding.

Table 7.5. Values of variables TRT and TRF

Values	Decoded Values
A	Airport
P	Port
W	Warehouse
M	Manufacturing Plant

Exhibits 7.2 through 7.4 show the PROC CONTENTS output of the three origin and destination data sets. Exhibit 7.5 shows the program that created the customized formats mentioned in Exhibits 7.2 through 7.4. Finally, Exhibits 7.6 through 7.8 show samples from PROC PRINT outputs of each origin and destination data set.

Exhibit 7.2. PROC CONTENTS output of ODSEG2.SDS

CONTENTS PROCEDURE

Data Set Name:	SDS.ODSEG2	Observations:	2520
Member Type:	DATA	Variables:	11
Engine:	V608	Indexes:	0
Created:	15:35 Monday, August 30, 1993	Observation Length:	91
Last Modified:	15:35 Monday, August 30, 1993	Deleted Observations:	0
Protection:		Compressed:	NO
Data Set Type:		Sorted:	NO
Label:	O&D DATA FOR SEGMENT-II		

-----Engine/Host Dependent Information-----

Data Set Page Size:	5120
Number of Data Set Pages:	46
File Format:	607
First Data Page:	1
Max Obs per Page:	56
Obs in First Data Page:	37
Userid :	FTFD445
File :	ODSEG2 SDS

-----Alphabetic List of Variables and Attributes-----

#	Variable	Type	Len	Pos	Format	Label
5	DATE	Num	8	45	DATE7.	
2	DEST	Char	20	20		DESTINATION
8	FQ1	Num	8	69		REPORTED*FREQUENCY
4	FQ2	Char	4	41	$FQ.	FREQUENCY*UNIT
11	IBWC	Num	4	87		CODE FOR*BRIDGES
1	ORI	Char	20	0		ORIGIN
7	PA	Num	8	61		# AXLES(TRUCKS)* OR PASS(CARS)
10	PLATE	Char	8	79		
9	PURP	Char	2	77	$PURP.	TRIP* PURPOSE
6	TIME	Num	8	53		MILITARY*TIME
3	VEH	Char	1	40	$VEH.	MODE

Exhibit 7.3. PROC CONTENTS output of ODHIDAL.SDS

```
CONTENTS PROCEDURE

Data Set Name: SDS.ODHIDAL                          Observations:          4140
Member Type:   DATA                                 Variables:             11
Engine:        V608                                 Indexes:               0
Created:       15:28 Monday, August 30, 1993        Observation Length:    77
Last Modified: 15:28 Monday, August 30, 1993        Deleted Observations:  0
Protection:                                         Compressed:            NO
Data Set Type:                                      Sorted:                NO
Label:         O&D DATA FOR HIDALGO

-----Engine/Host Dependent Information-----

Data Set Page Size:       4096
Number of Data Set Pages: 81
File Format:              607
First Data Page:          1
Max Obs per Page:         52
Obs in First Data Page:   31
Userid  :                 FTFD445
File    :                 ODHIDAL SDS

          -----Alphabetic List of Variables and Attributes-----
 #    Variable    Type    Len    Pos    Format    Label
-----------------------------------------------------------------------------
 9    DATE        Num       8     57    DATE7.
 2    DEST        Char     20     20               DESTINATION
 6    FQ1         Num       2     51               REPORTED*FREQUENCY
 7    FQ2         Char      2     53    $FQ.       FREQUENCY*UNIT
11    IBWC        Num       4     73               CODE FOR*BRIDGES
 1    ORI         Char     20      0               ORIGIN
10    PA          Num       8     65           # AXLES(TRUCKS)* OR PASS(CARS)
 5    PLATE       Char      8     43               LICENSE*PLATE
 3    PURP        Char      2     40    $PURP.     TRIP* PURPOSE
 8    TIME        Num       2     55               MILITARY*TIME
 4    VEH         Char      1     42    $VEH.      MODE
```

Exhibit 7.4. PROC CONTENTS output of ODVALL.SDS

CONTENTS PROCEDURE

Data Set Name:	SDS.ODVALL	Observations:	8430
Member Type:	DATA	Variables:	14
Engine:	V608	Indexes:	0
Created:	15:33 Monday, August 30, 1993	Observation Length:	105
Last Modified:	15:33 Monday, August 30, 1993	Deleted Observations:	0
Protection:		Compressed:	NO
Data Set Type:		Sorted:	NO
Label:	O&D DATA FOR VALLEY		

-----Engine/Host Dependent Information-----

Data Set Page Size:	6144
Number of Data Set Pages:	146
File Format:	607
First Data Page:	1
Max Obs per Page:	58
Obs in First Data Page:	38
Userid :	FTFD445
File :	ODVALL SDS

-----Alphabetic List of Variables and Attributes-----

#	Variable	Type	Len	Pos	Format	Label
8	DATE	Num	8	51	DATE7.	
2	DEST	Char	20	20		DESTINATION
4	FQ1	Num	2	41		REPORTED*FREQUENCY
5	FQ2	Char	2	43	$FQ.	FREQUENCY*UNIT
7	FROMTO	Char	4	47	$FROMTO.	TO OR FROM*PURPOSE
14	IBWC	Num	4	101		CODE FOR*BRIDGES
1	ORI	Char	20	0		ORIGIN
9	PA	Num	8	59		PASS(CARS)*AXLES(TRUCKS)
13	PLATE	Char	10	91		
12	PURP	Char	8	83	$PURP.	TRIP PURPOSE(CARS)*LOAD STATUS(TRUCKS)
6	TIME	Num	2	45		MILITARY*TIME
10	TRF	Char	8	67	$TRF.	ORIGIN*FOR THE*TRUCK
11	TRT	Char	8	75	$TRF.	DESTINATION*FOR THE*TRUCK
3	VEH	Char	1	40	$VEH.	MODE

Exhibit 7.5. Customized formats for the origin and destination data sets

```
PROC FORMAT;
VALUE $PURP
'W' = 'WORK'
'NB' = 'NO BUSINESS'
'SC'='SCHOOL'
'SH'='SHOPPING'
'D'='DOCTOR'
'OT'='OTHER'
'E' = 'EMPTY'
'L' = 'LOADED'
'T' = 'TRACTOR'
'R'='RECREATION'
'TA'='TAXI';

 VALUE $VEH
'A' = 'AUTO'
'T' = 'TRUCK'
'B' = 'BUS';

VALUE $FQ
'D' = 'DAY'
'W' = 'WEEK'
'Y' = 'YEAR'
'M' = 'MONTH';

 VALUE $TRT
'MP' = 'MANUFACTURING PLANT'
'WH'  = 'WAREHOUSE'
'PT' = 'PORT';

VALUE $FROMTO
'F' = 'FROM'
'T' = 'TO';
```

Exhibit 7.6. PROC PRINT output of ODSEG2.SDS

OBS	DATE	CODE FOR BRIDGES BY WATER COMMISSION	ORIGIN	DESTINATION	MODE
1	27APR93	19586	FABENS	PORFIRIOPARRA	AUTO
2	27APR93	19586	FABENS	PRAXEDIS	AUTO
3	27APR93	19586	FABENS	PORFIRIOPARRA	AUTO
4	27APR93	19586	FABENS	GUADALUPE	AUTO
5	27APR93	19586	FABENS	GUADALUPE	AUTO
6	27APR93	19586	FABENS	PORFIRIOPARRA	AUTO
7	27APR93	19586	ELPASO	PRAXEDIS	AUTO
8	27APR93	19586	FABENS	PORFIRIOPARRA	AUTO
9	27APR93	19586	ELPASO	PORFIRIOPARRA	AUTO
10	27APR93	19586	FABENS	PORFIRIOPARRA	AUTO

Exhibit 7.6. Continued

OBS	MILITARY TIME	REPORTED FREQUENCY	FREQUENCY UNIT	AXLES(TRUCKS) OR PASS(CARS)	TRIP PURPOSE	PLATE
1	7	5	WEEK	1	NO BUSINESS	TX
2	17	1	DAY	1	WORK	CHIH_MEX
3	7	5	WEEK	1	WORK	TX
4	17	2	WEEK	3	NO BUSINESS	TX
5	7	1	WEEK	1	NO BUSINESS	TX
6	17	3	WEEK	1	NO BUSINESS	TX
7	7	1	DAY	1	WORK	TX
8	17	1	WEEK	5	NO BUSINESS	TX
9	7	1	DAY	2	WORK	TX
10	17	1	WEEK	4	NO BUSINESS	TX

Exhibit 7.7. PROC PRINT of ODHIDAL.SDS

OBS	DATE	CODE FOR BRIDGES BY WATER COMMISSION	ORIGIN	DESTINATION	MODE
1	08JUN93	2566	ALAMO	MONTERREY	AUTO
2	08JUN93	2566	ALAMO	NUEVOLEON	AUTO
3	08JUN93	2566	ALAMO	REYNOSA	AUTO
4	08JUN93	2566	ALAMO	REYNOSA	AUTO
5	08JUN93	2566	ALAMO	REYNOSA	AUTO
6	08JUN93	2566	ALAMO	REYNOSA	AUTO
7	08JUN93	2566	ALAMO	REYNOSA	AUTO
8	08JUN93	2566	ALAMO	REYNOSA	AUTO
9	08JUN93	2566	ALAMO	REYNOSA	AUTO
10	08JUN93	2566	ALAMO	REYNOSA	AUTO

OBS	MILITARY TIME	REPORTED FREQUENCY	FREQUENCY UNIT	# AXLES(TRUCKS) OR PASS(CARS)	TRIP PURPOSE	LICENSE PLATE
1	11	3.0	MONTH	2	RECREATION	TX
2	10	2.0	MONTH	4	OTHER	TX
3	9	1.0	YEAR	2	OTHER	TX
4	10	2.0	WEEK	5	OTHER	TX
5	10	3.0	MONTH	4	OTHER	TX
6	11	2.0	MONTH	2	OTHER	TX
7	13	10.0	MONTH	1	OTHER	TAMPS
8	9	1.0	MONTH	4	RECREATION	TAMPS
9	11	2.0	DAY	1	WORK	TAMPS
10	10	1.5	WEEK	2	OTHER	TAMPS

Exhibit 7.8. PROC PRINT output of ODVALL.SDS

OBS	DATE	CODE FOR BRIDGES BY WATER COMMISSION	ORIGIN	DESTINATION	MODE
1	29JUN93	896	BROWNSVILLE	MATAMOROS	TRUCK
2	29JUN93	896	MISSION	MATAMOROS	TRUCK
3	29JUN93	896	BROWNSVILLE	CADEREYTA	TRUCK
4	29JUN93	896	BROWNSVILLE	MEXICO_DF	TRUCK
5	28JUN93	896	BROWNSVILLE	MATAMOROS	TRUCK
6	28JUN93	896	BROWNSVILLE	MATAMOROS	TRUCK
7	28JUN93	896	BROWNSVILLE	MONTERREY	TRUCK
8	28JUN93	896	BROWNSVILLE	MEXICO_DF	TRUCK
9	28JUN93	896	BROWNSVILLE	MATAMOROS	TRUCK
10	28JUN93	896	BROWNSVILLE	MATAMOROS	TRUCK
11	29JUN93	896	BROWNSVILLE	MATAMOROS	AUTO
12	29JUN93	896	BROWNSVILLE	MATAMOROS	AUTO
13	29JUN93	896	BROWNSVILLE	MATAMOROS	AUTO
14	29JUN93	896	BROWNSVILLE	MATAMOROS	AUTO
15	29JUN93	896	BROWNSVILLE	MATAMOROS	AUTO
16	29JUN93	896	BROWNSVILLE	MATAMOROS	AUTO
17	28JUN93	896	BROWNSVILLE	MATAMOROS	AUTO
18	28JUN93	896	BROWNSVILLE	MATAMOROS	AUTO
19	28JUN93	896	BROWNSVILLE	MATAMOROS	AUTO
20	28JUN93	896	BROWNSVILLE	MATAMOROS	AUTO
21	28JUN93	896	BROWNSVILLE	MATAMOROS	AUTO
22	28JUN93	896	BROWNSVILLE	MATAMOROS	AUTO

Exhibit 7.8. Continued

OBS	MILITARY TIME	REPORTED FREQUENCY	FREQUENCY UNIT	PASSENGERS(CARS) AXLES(TRUCKS)	TRIP PURPOSE(CARS) OR LOAD STATUS(TRUCKS)	PLATE
1	9	12.0	WEEK	3	EMPTY	TAMPS_MEX
2	10	3.0	WEEK	5	EMPTY	TAMPS_
3	11	1.0	DAY	5	LOADED	SPF_MEX
4	12	1.0	DAY	6	LOADED	SPF_MEX
5	13	2.0	DAY	5	LOADED	TN
6	14	2.0	WEEK	5	LOADED	
7	15	4.0	WEEK	6	LOADED	SPF_MEX
8	16	1.0	WEEK	6	LOADED	SPF_MEX
9	17	2.0	DAY	5	LOADED	SAF_MEX
10	18	6.5	WEEK	2	LOADED	TAMPS_MEX
11	7	5.0	WEEK	1	WORK	TX
12	8	5.0	WEEK	1	SHOPPING	TAMPS_MEX
13	9	4.0	WEEK	1	RECREATION	TX
14	10	1.5	WEEK	2	SHOPPING	TAMPS_MEX
15	11	1.0	WEEK	1	RECREATION	TX
16	12	2.0	WEEK	1	SHOPPING	TAMPS_MEX
17	13	2.5	DAY	1	WORK	TX
18	14	2.0	WEEK	1	SHOPPING	TAMPS_MEX
19	15	1.0	WEEK	2	RECREATION	TX
20	16	1.0	MONTH	2	RECREATION	TAMPS_MEX
21	17	1.0	MONTH	1	DOCTOR	TX
22	18	5.0	WEEK	1	WORK	TX

Exhibit 7.8. Continued

OBS	DESTINATION FOR THE TRUCK	ORIGIN FOR THE TRUCK	GOING TO COMING FROM (PURPOSE)
1	MANUFACTURING PLANT	WAREHOUSE	
2	MANUFACTURING PLANT	MANUFACTURING PLANT	
3		PORT	
4	WAREHOUSE	WAREHOUSE	
5	MANUFACTURING PLANT	WAREHOUSE	
6	WAREHOUSE	WAREHOUSE	
7		PORT	
8		PORT	
9	WAREHOUSE	WAREHOUSE	
10	WAREHOUSE	WAREHOUSE	
11			TO
12			FROM
13			TO
14			FROM
15			TO
16			FROM
17			FROM
18			FROM
19			TO
20			FROM
21			TO
22			FROM

APPLICATIONS AND CASE STUDIES OF ORIGIN AND DESTINATION DATA

Origin and destination data not only provide useful information about the traffic flow patterns within a certain region of interest, they also are widely used in a variety of transportation planning studies—especially those involving predictions of route choice, trip production, and trip assignment to a certain network. This section briefly reports the findings of origin and destination surveys of some selected bridges. The purpose of these randomly selected case studies is to illustrate the typical data reductions and immediate applications of the origin and destination data sets. More comprehensive technical discussions of these data are documented in Report 1976-3, "Comprehensive Overview of the Texas-Mexico Border: Traffic Patterns Assessment," while Report 1976-4, "Comprehensive Overview of the Texas-Mexico Border: Revenue and Capacity Analysis," discusses the applications of such data in revenue forecasts.

Origin and Destination Matrices

Origin and destination data are typically reported using the origin and destination matrices. These matrices are two-way tables in which rows represent the destinations (i), columns represent the origins (j), and each cell (i,j) shows the number of trips going from origin (i) to destination (j). Because of the binational nature of trips investigated by this study, the surveys identified origins and destinations all over North and South America. This consequently

created a complete origin and destination matrix that is very cumbersome and full of cells showing few trips or, in some cases, no trips. Data can be better reduced in terms of a summary origin and destination matrix, in which each cell contains origin or destination frequencies of 5 percent or more, while all origins and destinations that appear less than 5 percent are grouped in the "OTHER" category. Tables 7.6 and 7.7 show the summary origin and destination matrices for the Southbound Hidalgo Bridge for autos and trucks, respectively. In these tables each cell consists of two rows. The top row shows the number of trips with each origin, while the second row shows the percentage with respect to all origins. Totals for origins and destinations are shown in the bottom row and rightmost column.

Table 7.6. Auto origin and destination matrix — Hidalgo Bridge

	Destination		
Origin	**Reynosa**	**Other**	**Total (Origin)**
HIDALGO	310	20	330
	7.74%	0.50%	8.24%
McALLEN	2134	288	2422
	53.31%	7.19%	60.50%
MISSION	315	27	342
	7.87%	0.67%	8.54%
PHARR	211	13	224
	5.27%	0.32%	5.60%
OTHER	560	125	685
	13.99%	3.12%	17.11%
Total (destination)	3530	473	4003
	88.18%	11.82 %	100%

Table 7.7. Truck origin and destination matrix — Hidalgo Bridge

	Destination		
Origin	**Reynosa**	**Other**	**Total (Origin)**
HIDALGO	18	18	36
	13.14%	13.14%	26.28%
McALLEN	47	13	60
	34.31%	9.49%	43.80%
PHARR	21	1	22
	15.33%	0.73%	16.03%
OTHER	0	14	35
	0.00%	10.22%	25.55%
Total (destination)	90	47	137
	65.69%	34.31%	100.00%

These matrices can easily be obtained by two successive runs of SAS PROC FREQ. This program, shown in Exhibit 7.9, can be run in any origin and destination data set. The program can also be modified to run by IBWC code when data sets contain more than one bridge.

Exhibit 7.9. SAS Program to generate a summary origin and destination matrix

```
CMS FI SDS DISK DUMMY DUMMY D;
%INCLUDE 'LIBRARY DATABASE D';
TITLE1 'FABENS IBWC=1959';
DATA VAL; SET SDS.SEG2; IF IBWC=1959;
/*
PROC SORT DATA=VAL          OUT=VAL; BY  VEH;
*/
PROC FREQ DATA=VAL           NOPRINT;  /*   BY  VEH;  */
TABLES ORI / OUT=ORI;
PROC SORT DATA=ORI OUT=ORI; BY  /* VEH*/  ORI;
PROC SORT DATA=VAL           OUT=VAL     ; BY /* VEH*/  ORI;
DATA VAL;      MERGE VAL     ORI; BY/*  VEH*/ ORI;
ORI1=ORI;
IF PERCENT<4.8 THEN ORI='OTHER';
RENAME PERCENT=PCORI;
PROC SORT DATA=VAL           OUT=VAL     ; BY/* VEH*/ ORI;
DATA OTHER; SET VAL; BY/*  VEH*/  ORI;
 IF ORI='OTHER';
TITLE2 'OTHER ORIGINS';
PROC FREQ  DATA=OTHER; TABLES ORI1/NOCUM; TITLE2;
PROC FREQ DATA=VAL NOPRINT; /*  BY  VEH;*/
TABLES DEST / OUT=DEST;
PROC SORT DATA=DEST OUT=DEST; BY/*  VEH*/ DEST;
PROC SORT DATA=VAL      OUT=VAL     ; BY /* VEH*/ DEST;
DATA VAL     ; MERGE VAL     DEST; BY /* VEH*/ DEST;
DEST1=DEST;
IF PERCENT<5 THEN DEST='OTHER';
RENAME PERCENT=PCDEST;
PROC SORT DATA=VAL      OUT=VAL     ; BY/*  VEH*/ DEST;
DATA OTHER; SET VAL     ; IF DEST='OTHER';
TITLE2 'OTHER DESTINATIONS';
PROC FREQ  DATA=OTHER; TABLES DEST1/NOCUM; TITLE2;
                                  /*
PROC SORT DATA=VAL OUT=VAL; BY  VEH;  */
PROC FREQ DATA=VAL     ; TABLES ORI*DEST/NOROW NOCOL;/* BY  VEH;
FORMAT VEH $VEH.;                                     */
```

Both the auto and truck matrices (Tables 7.6 and 7.7) indicate a predominance of local origins spread over the Hidalgo-McAllen-Mission-Pharr area in Texas, which accounts for over 80 percent of all auto origins and 75 percent of all truck origins. Destinations are also predominantly local, as Reynosa is the only urban concentration found in the Tamaulipas area immediately opposed to the predominant Texas origins. This trip pattern indicates that these bridges serve primarily local, urban traffic. As for trucks, the matrices are reflecting the current international trade regulations requiring trucks to remain within each country's commercial zone— that is, a narrow strip along the border that usually includes only the sister cities and their immediate neighborhoods.

Trip Frequency and Purpose

Origin and destination matrices are traditionally supplemented by trip frequency tables, which are ideally broken down by trip purpose. This information can easily be retrieved from the TRANSBORDER data base using any SAS routine to perform data tabulation. Observed trip frequencies in the Southbound Gateway Bridge are shown in Table 7.8 to illustrate this type of data application. The library of formats allows informative outputs, showing actual trip purposes rather than a two-character code.

Table 7.8. Auto trip frequencies by purpose — Gateway Bridge

Weekly Frequency	Recorded Trips (Percentage of Category)						
	Shopping	**Recreation**	**Doctor**	**School**	**Business**	**Other**	**Total**
<1	180 (14.4%)	330 (23.6%)	60 (47.2%)	3 (3.1%)	82 (7.1%)	47 (24.7%)	707 (16.6%)
1-2	328 (26.2%)	356 (25.5%)	30 (23.6%)	6 (6.3%)	94 (8.1%)	33 (17.4%)	849 (19.9%)
2-3	285 (22.8%)	265 (19.0%)	19 (15.0%)	8 (8.3%)	73 (6.3%)	36 (18.9%)	686 (16.1%)
3-4	197 (15.7%)	151 (10.8%)	8 (6.3%)	2 (2.1%)	88 (7.6%)	17 (8.9%)	467 (11.0%)
4-5	47 (3.8%)	52 (3.7%)	1 (0.8%)	4 (4.2%)	47 (4.0%)	7 (3.7%)	162 (3.8%)
5-6	29 (2.3%)	35 (2.5%)	3 (2.4%)	28 (29.2%)	305 (26.3%)	7 (3.7%)	409 (9.6%)
6-7	15 (1.2%)	7 (0.5%)	0	2 (2.1%)	76 (6.5%)	2 (1.1%)	102 (2.4%)
>=7	164 (13.1%)	186 (13.3%)	5 (3.9%)	43 (44.8%)	393 (33.9%)	40 (21.1%)	846 (19.9%)
n/a	6 (0.5%)	15 (1.1%)	1 (0.8%)	0	3 (0.3%)	1 (0.5%)	30 (0.7%)

In addition to the number of recorded trips shown above, there are 21 cases that did not declare any purpose and 15 cases of Taxi crossings that are not categorized above.

The same type of tabulation can be made for trucks to analyze the weekly occurrence of loaded and empty trucks. An overall summary of truck-load status, easily obtained with a one-way tabulation of the data, are also informative and are illustrated in Table 7.9.

Table 7.9. Truck load status — Gateway Bridge

Load status	Recorded trips	Percentage
Empty	48	28.1%
Loaded	109	63.7%
Tractor	14	8.2%

There are 46 cases of missing frequency, i.e., no load status is available.

Data in Table 7.8 indicate a potential for improving traffic circulation by discouraging empty trucks and encouraging loaded trucks. The high percentage of empty trucks is partly due to the requirement that foreign trucks remain in the commercial zones of both countries. NAFTA and the subsequent removal of such restrictions may improve this situation.

RECOMMENDATIONS FOR FUTURE UPDATING

Origin and destination data, such as found in the TRANSBORDER data base, have numerous applications in transportation planning studies. The three data sets stored in the

TRANSBORDER data base provide up-to-date information on transborder traffic flow patterns, trip purposes and frequencies, and truck-load status. These data, collected before NAFTA was ratified, reflect a situation that is about to change. Truck data reflect regulations that will be gradually lifted and replaced by free cargo hauling anywhere within the three NAFTA countries. It would be highly desirable to periodically update the truck information; above all, it is paramount that these surveys be repeated after the old restrictions are lifted. If this is done, a very interesting case study of truck traffic under different regulations can be performed using the historical information stored in the TRANSBORDER data base.

The typically urban, local nature of the auto trips suggest less dramatic changes owing to NAFTA, especially in the first few years. Nevertheless, changes in land use, industrial activity, and migration patterns eventually generated by NAFTA may affect the nature of the trips, necessitating further investigation. It is highly recommended that an up-to-date source of origin-and-destination surveys be kept for use in transportation planning studies.

CHAPTER 8. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

This report, the second for Project 1976, documents the development and use of the TRANSBORDER data base (summarized in Table 8.1). Being a binational data base, it contains as much Mexican data as U.S. data.

This chapter concludes the report by providing a summary and recommendations. Appendix A, included in all Project 1976 reports, consists of a bilingual glossary of border-related terminology, some of which was developed in this project. Appendix B lists all variables in the data base by alphabetical order and shows the data sets in which they appear. It is useful as a quick reference for writing programs that merge two or more data sets.

Any data base, if it is to be useful, requires continuous updating. Accordingly, the next section discusses recommendations for updating the TRANSBORDER data base.

Table 8.1. Summary of TRANSBORDER data base

Data Category	Availability	Data Sets
Inventory	US, Mexico	3
Traffic at Binational Entry Systems	North and Southbound	20
Traffic at Highways	US, Mexico	5
Highway Condition	US, Mexico	1
Population	US, Mexico	3
Sales	US	1
Vehicle Ownership	US, Mexico	4
Per-capita Income	US	1
Maquiladora Indicators	Mexico (US not applicable)	2
Employment	Mexico	1
Origin and Destination	Southbound	3

DATA BASE UPDATING

The TRANSBORDER data base contains historical traffic and socioeconomic data, as well as inventory data regarding existing and proposed binational entry systems and highways. Some data were obtained from such sources as Customs, Immigration, TxDOT, and SCT, while other data were collected in field surveys conducted during this project.

The usefulness of historical data depends on data accuracy, data consistency, and series continuity. These factors are not independent. For example, the levels of data accuracy must be the same in all periods to allow a consistent historical series; ideally, there should be no periods with missing data. The recommendations in this section, based on these three factors, have two objectives: to facilitate the updating process and to guarantee consistency, continuity, and accuracy. The next six sections discuss these recommendations.

Inventory Data

There are four basic files having inventory data: (1) a main file, (2) a file for existing binational entry systems, (3) a file for the proposed binational entry systems, and (4) a file for toll prices. Because all these data are subject to changes and modifications, it is imperative that periodic contact be maintained with the following agencies:

(1) Bridge owners and managers
(2) TxDOT
(3) CAPUFE
(4) IBWC
(5) City planners, councils, and managers
(6) County authorities
(7) All organizations listed under variables USAG and MEXAG in the main inventory file (INVM.SDS)
(8) GSA
(9) U.S. Customs
(10) Mexican Customs

Before contacting these agencies, it is helpful to prepare a checklist containing all information needed, based on the variables in the four inventory files. It is also useful to check the current information and latest changes in the inventory data sets.

CAPUFE is now developing a bridge management system that includes inspection procedures that summarize the structural and functional conditions of bridges. It is recommended that these results be added to the TRANSBORDER data base as soon as they are published.

Binational Entry Systems Traffic Data

Updating historical traffic data at binational entry systems requires periodic contacts with the following agencies:

(1) U.S. owners, managers, and operators of the binational entry systems
(2) IBWC
(3) U.S. Customs
(4) CAPUFE
(5) GSA
(6) City Planners and managers, especially in the case of city-owned binational entry systems
(7) Mexican Customs

Data requests should always be forwarded to these agencies. Whenever possible, meetings and other discussions should be arranged with persons responsible for data collection and reduction in these agencies. Once all data are collected, any differences found among data collection and reduction procedures should be documented.

Both U.S. and Mexican Customs possess commodity flow information that could be very useful for transportation planning. While these data are confidential (i.e., they may be used for advantage by rival trucking companies), they can nonetheless be obtained from customs of both countries (once legal issues are resolved). Transportation planners should encourage both customs agencies to prepare these data in a format ready for publishing.

Highway Traffic Data

The TRANSBORDER data base includes traffic histories of major border routes. On the U.S. side, these are entirely based on permanent stations and include hourly volumes and high hours (but do not include vehicle classifications). On the Mexican side, the data are based on a combination of permanent and temporary stations and include some vehicle classifications. These histories must be updated yearly as TxDOT and SCT publish more data. In addition, the network must be checked for new projects, with data on these new roads added to expand the current coverage of the TRANSBORDER data base.

NAFTA is expected to change the traffic patterns across the border and beyond. These changes will be reflected in the traffic composition and volumes, which must be recorded in the TRANSBORDER data base. Truck traffic is expected to undergo more substantial changes after NAFTA lifts the current regulations that prohibit foreign truck circulation beyond the commercial zone of both countries. The removal of such restrictions is causing concerns about Mexican truck weight limits, which are about twice those valid in Texas. This issue will require weight data to be adequately studied. TxDOT is now expanding their border traffic monitoring efforts to include more weigh-in-motion and vehicle classification stations. It is recommended that these data be added to the TRANSBORDER data base as soon as border-wide coverage becomes available.

Highway Condition Data

Highway condition data were obtained during the so-called route reconnaissance surveys, which required trained crews to drive along all routes of interest. In the case of the border, this reconnaissance currently comprises of 5,000 miles (8,050km), a distance which is expected to increase as new roads and highways are built on both sides of the border. Sections currently undergoing rehabilitation will shortly become "GOOD" sections, and sections currently rated "GOOD" and "FAIR" may or may not deteriorate to a point where they become part of a worse category.

All this suggests a somewhat short "shelf-life" for the route reconnaissance data. It is recommended that these surveys, although expensive, be undertaken every year to ensure accuracy and quality. Moreover, personnel should be adequately trained to ensure consistency of

the collected data over the years and over the surveyed networks. Another, albeit less accurate, data collection method involves contacting agencies responsible for maintenance, rehabilitation, and new construction, and then performing the procedure outlined below:

(1) Determine the status of sections currently listed as undergoing rehabilitation and/or maintenance; update the roads currently rated as such to "GOOD" whenever appropriate.

(2) Obtain information about new roads and add that information to the data base as "GOOD" whenever appropriate. Although other variables will be left as missing, at least the overall data will reflect the current network.

(3) Obtain qualitative opinions as to the status of roads in the network; update the categories as appropriate.

(4) Obtain new construction, rehabilitation, and other maintenance schedules; list all these sections as such whenever appropriate.

While the above procedure should be conducted on a monthly or bi-monthly basis, it should not be used as a basis for updating data each year.

New data added to the TRANSBORDER data base should not substitute for the old values. The overall objective is to create a historical series of highway condition data. These series are extremely useful for studies ranging from transportation planning to pavement management. The cost of periodic surveys may be justified if these are designed to suit all these purposes, rather than only one; the goal is to develop a border-wide periodic survey that is jointly sponsored and coordinated by all agencies and divisions interested in highway condition data.

Socioeconomic Data

The socioeconomic data sets in the TRANSBORDER data base should be updated every year as more data are published. The procedure consists of contacting all agencies responsible for data collection, and consulting with them about data availability and about procedures for collecting and reducing the data. Any changes in this process should be documented for reference. Agencies to contact and/or publications to review include:

(1) Texas State Comptroller's Office

(2) Texas Almanac

(3) Chambers of commerce

(4) U.S. Bureau of Census

(5) TxDOT

(6) Border Base SEIS

(7) Nuevo Leon Department of Transportation

(8) Coahuila Department of Transportation

(9) Chihuahua Department of Transportation

(10) Tamaulipas Department of Transportation

(11) INEGI

Agencies and publications do not release data simultaneously. For example, the U.S. and Mexican census surveys are undertaken every 10 years, while the State Comptroller's sales data are updated quarterly. It is recommended that an effective schedule be developed for contacting all agencies. This schedule would attempt to alternate agency contacts with data base work, so that the overall data base can be updated quickly.

Origin and Destination Data

Origin and destination data in the TRANSBORDER data base were collected before NAFTA took effect. Consequently, they reflect travel behavior and traffic flow patterns that may change under the new regulations. A specific example: Truck traffic is expected to change in 3 years, when the current regulation prohibiting foreign truck traffic beyond the commercial zones of the two countries is lifted. This relaxation of an existing regulation is expected to cause changes in truck traffic flow—changes which need to be investigated.

Construction of new binational entry systems and/or new infrastructure links to binational entry systems will also modify traffic patterns. Ideally, the origin and destination surveys should be repeated every time a change in traffic pattern is expected (or suspected to have already occurred). However, origin and destination surveys are expensive, especially at the border area, where a good response rate requires direct interview (which in turn requires bilingual crews). This may be a cause for concern, especially if the data have no immediate use for the sponsoring agency. On the other hand, origin and destination data have numerous applications in transportation studies, and a coordinated effort of several agencies interested in such information may be the most cost-effective solution as regards the Texas-Mexico border area and its data base. This fact, along with previously discussed facts, indicates that there is a pressing need for coordination among agencies involved in Texas-Mexico border area transportation provision. Below we suggest a way of expanding the TRANSBORDER data base to include most information needed for transportation studies.

Additional Recommendations

Because SAS mapping capabilities are very cumbersome, the TRANSBORDER data base cannot easily display data on maps. There are more user-friendly softwares, usually designated GIS (Geographic Information Systems), specifically designed to display data on maps. While the SAS company has already developed interfaces between SAS and some GIS softwares, additional work is required to develop a workable, user-friendly interface between the TRANSBORDER data base and a GIS package. This would expand the data report capabilities to display data sets (such as road condition data) directly on a Texas-Mexico roadmap.

The interface described above could work extremely well in conjunction with an SAS

user-friendly interface. It could, for example, produce standard data reports for those having no background in data base language. By contrast, operation of the TRANSBORDER data base requires some basic knowledge of SAS. SAS allows the development of a series of user-friendly screens that prompt the user to enter appropriate information and output the desired data reports. It is recommended that a user-friendly interface be developed for the TRANSBORDER data base.

A CENTRALIZED BORDER INFORMATION SYSTEM

The previous sections discussed ways to improve and update the TRANSBORDER data base (keeping its current basic design, language, and features). While these recommendations are pertinent and will, if carried through, help save considerable time and money in future studies, the concept of a binational, public data base for the Texas-Mexico border is worth exploring.

The TRANSBORDER data base is currently designed to be housed and managed by a single agency, with other participating agencies continuing their own data collection efforts (an example of which is The University of Texas at El Paso's Border Base SEIS, which focuses primarily on macroeconomic and maquiladora data). Because it is imperative that each agency keep an individual data base to serve its immediate requirements, a third party in need of socioeconomic and traffic data must still spend time and effort in reviewing several different data bases having overlapping contents. Thus, the management, updating, and maintenance of a data base is another example of a duplication of effort among agencies. The current study urges optimization of data base management and data base usage.

The development and availability of the TRANSBORDER data base can be considered a first step towards the implementation of a coordinated BORDER INFORMATION SYSTEM, which ideally would be a broader data base encompassing the TRANSBORDER data base, data bases from other organizations interested in combining efforts, and additional data as needed. The language for the Border Information System should suit the typical user and have an interface with a GIS package. This means that the data base contents could be automatically displayed on maps, in addition to being displayed on such traditional formats as graphs, tables, and summary reports. There are several commercial GIS packages, each emphasizing a different set of attributes. For example, some systems sacrifice functionality and emphasize data storage capabilities and quickness of response to query, while others do the opposite. Selection of the best GIS package would be one of the major tasks in developing a Border Information System.

Considerable benefits would accrue from the implementation of a coordinated Border Information System. First, data collection redundancies among agencies would be eliminated. Second, the time required to complete contracted studies would be significantly reduced. And third, cooperation among agencies, which is necessary to implement such a data base and to complete any planning study, would automatically be fostered.

Ideally, the development of this information system would be a binational effort undertaken by all organizations involved in planning, operating, managing, providing, and

approving border infrastructure along the entire U.S.-Mexico border. Once such an information system is operational, any third party in need of data pertaining to the U.S.-Mexico border area could subscribe to the Border Information System by paying a fee that covers part of the ongoing costs of housing, managing, updating, and operating the system. This fee would be significantly less than the data collection costs of an average engineering or socioeconomic study, and would expedite the study by the amount of time required to collect, organize, and reduce the data. This system could benefit sponsoring agencies by providing organized information storage and by reducing the time currently spent by their staff in meeting numerous and often redundant data requests.

CONCLUSION

The signing of the North American Free Trade Agreement prompts a need for periodic monitoring of the Texas-Mexico border area, as well as a need for studies that investigate a wide range of socioeconomic NAFTA impacts, including transportation needs, population migration, land use, urban planning, and environmental protection. Because data requirements for these studies usually overlap, a considerable amount of effort duplication is currently taking place among different agencies interested in the Texas-Mexico border area.

It was observed during this study that the concept of a centralized border-related data base could be further expanded in two areas: data reporting capabilities and scope. The former would be achieved with the development of a GIS interface that allows data display on maps, along with a user-friendly interface to obtain other standard reports. The latter suggests the implementation of a centralized Border Information System—one that would optimize the currently observed duplication of efforts among different agencies housing data bases of border-related information. The TRANSBORDER data base can be regarded as a specific data base and as the foundation for the suggested Border Information System.

REFERENCES

1. American Association of State Highway and Transportation Officials (AASHTO), *Manual for Maintenance Inspection of Bridges*, 1983.
2. Federal Highway Administration (FHWA), *Bridge Inspector's Training Manual 70*, 1971.
3. State Department of Highways and Public Transportation, *Bridge Inventory, Inspection and Appraisal Program (BRINSAP), Manual of Procedures*, Safety and Maintenance Operations Division, September 1984.

APPENDIX A:

GLOSSARY

AADT: Annual Average Daily Traffic

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

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

ACR: Automatic Cumulative Recorders

ADT: Average Daily Traffic

Aduana Fronteriza: Mexican Customs

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

AMS: Automated Manifest System (Sistema Automatizado de Manifestos)

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

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

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

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

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

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

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

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

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

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

Caseta: Booth

Cd.: Ciudad (city)

CES: Centralized Inspection Station (Estación Centralizada de Inspección)

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

Chih.: Chihuahua

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

CIS: Central Index System (Sistema Central de Información)

Coah.: Coahuila

CRA: Charles Rivers Associates

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

DBMS: Data Base Management System

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

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

DOT: Department of Transportation (Departamento del Transporte)

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

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

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

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

EPA: Environmental Protection Agency (Agencia de Protección Ambiental)

ETZ: Extra-territorial Zone (Zona Extraterritorial)

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

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

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

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

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

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

Garita: Checkpoint

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

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

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

GSA: General Services Administration (Departamento de Servicios Generales)

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

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

ICC: Interstate Commerce Commission (Comisión Interestatal de Comercio)

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

INEGI: Instituto Nacional de Geografía y Estadistica

Ing.: Ingeniero (Engineer)

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

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

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

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

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

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

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

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

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

N.L.: Nuevo León

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

PHS: Public Health Service (Servicio Público de Salud)

PDN: Paso Del Norte Bridge, El Paso, Texas

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

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

POV: Privately Owned Vehicle (vehículo particular)

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

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

Presa: Dam

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

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

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

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

SDS: SAS data set

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

Sectur: Secretaría de Turismo (Department of Tourism)

SED: Shippers Export Declaration (Declaracíon de Exportación)

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

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

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

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

SP: Southern Pacific Railroad (Ferrocarril del Pacífico Sur)

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

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

TAM.: Tamaulipas/Road in Tamaulipas

TAMP: Tamaulipas

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

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

TLC: Tratado de Libre Comercio Norteamericano (NAFTA).

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

Traffic Generating Areas: Economic Activity Center

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

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

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

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

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

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

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

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

USCG: United States Coast Guard

USCS: United States Customs Service (Departamento de Aduanas)

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

UTEP: University of Texas at El Paso

VS: Veterinary Service (Servicio Veterinario)

WIM: Weight in Motion

WSA: Wilbur Smith Associates

APPENDIX B:
DATA BASE

Variable	Type	Length (bytes)	Format	Label
AAXLE	Num	2		TOLL*FOR*ADDTIONAL*AXLES(AUTOS
ADTFRI	Num	8		FRIDAY*ADT
ADTMON	Num	8		MONDAY*ADT
ADTSAT	Num	8		SATURDAY*ADT
ADTSUN	Num	8		SUNDAY*ADT
ADTTHR	Num	8		THURSDAY*ADT
ADTTUE	Num	8		TUESDAY*ADT
ADTWED	Num	8		WEDNESDAY*ADT
AGR	Num	4		AGRICULTURE*&LIVESTOCK
ALIGR	Num	2		APPROACH*ROADWAY*ALIGNMENT*RATING
APPR	Num			
APPR	Num	2		APPROACHES*RATING
APT1	Num	8		AUTOS+1-AX*TRAILER(1XT)
APT2	Num	8		AUTOS+1-AX*TRAILER(2XT)
AREA	Char	4		TYPE OF*AREA
AREAM	Num	8		MUNICIPALITY*AREA(SQRTKM
AREAMEX	Char	1	$AREA.	TYPE OF*AREA(MEXICO
AREAT	Char	5	$AREA.	AREA*TYPE
AREAUS	Char	1	$AREA.	TYPE OF*AREA(US
AUTO	Num	2		TOLL*FOR*AUTOS
AUTO	Num	6		NUMBER OF*AUTOS
AUTOREG	Num	6		NUMBER*OF REGISTERED*AUTOS
AUTOCC	Num	5		VEHICLE*OCCUPANCY
AUTOEM	Num	8		AUTOS&EMPTY PICKUPS
AUTOPICK	Num	5		#OF*AUTOS&*PICKUPS
B	Char	8		BRIDGE
BICY	Num	8		BICYCLES
BIKE	Num	4		NUMBER OF*MOTORBIKES
BIKEMTR	Num	3		#OF*BIKES AND *MOTORCYCLES
BRIDREM	Num	3		YR-BRIDGE*REMOD
BT2AX	Num	2		TOLL FOR BUS/TRUCKS-2AXLES
BT3AX	Num	2		TOLL FOR BUS/T-3AXLES
BUS	Num	4		NUMBER OF*BUSES
CHECKP	Char	20		CHECKPOINT
CHR	Num	2		CHANNEL*RATING
CMEXPRI	Num	2	COMINSP.	COMM-MEX*PRIMARY BOOTHS
COM	Num	4		COMMERCE
COMB	Num	4		COMBINATION

COMM	Num	5		VEHICLES ON*COMMERCIAL BRIDGE
CON	Num	4		CONSTRUCTION
COND	Char	10	$COND.	ROAD*CONDITION
COUNTY	Char	11		BORDER*COUNTIES
CPI	Num	3		CONSUMER*PRICE*INDEX*AVG82/84
CTYBUS	Num	2		CITYBUS
CUSPRI	Num	2	COMINSP.	COMM-US*PRIMARYBOOTHS
DATE	Num	8	DATE7.	
DATE	Num	8	DATE7.	HIGH*HOUR*DATE
DATE	Num	8	MONYY5.	
DATE	Num	8	YYQ4.	DATE*INFORMATION*COMPILED
DECKR	Num	2		DECK*RATING
DELAY	Char	4	$DELAY.	DELAY*CAUSE
DEST	Char	20		DESTINATION
DGR	Num	2		DECK*GEOMETRY*RATING
DISRLF	Num	2		DISASTER*RELIEF
DISTANCE	Num	8		ELAPSED*DISTANCE
DMAT	Char	30		DECK*MATERIAL
E2A	Num	8		EMPTY *2AXLE
E3A	Num	8		EMPTY *3XLE
E4A	Num	8		EMPTY *4AXLE
E5A	Num	8		EMPTY *5XLE
EIGHTAXL	Num	8		TRUCKS/8AXLES-LOADED
ELTIME	Num	8	TIME5.	ELAPSED*TIME
EM	Num	4		NUMBER OF*PEOPLE*EMPLOYED
EMCARTS	Num	3		EMPTY CARTS
EMPA	Num	8		EMPTY *AUTO*PICKS
EXUSEC	Num	2	INSPL.	MAX BOOTHS*SEC-US
EXUSPRI	Num	2	INSPL.	MAX BOOTHS*PRIMARY-US
FE	Num	5		FORMAL*ENTRIES
FIN	Num	4		FINANCIAL*SERVICES
FIVEAX	Num	4		FIVE*AXLES
FIVEAXE	Num	8		TRUCKS/5AXLES-EMPTY
FIVEAXL	Num	8		TRUCKS/5AXLES-LOADED
FMTR	Num	4		FARM*TRUCK
FMTRL	Num	3		FARM*TRAILER
FMTRLTRC	Num	2		FARM_TRAILER*TRACTOR
FOURAX	Num	4		FOUR*AXLES
FOURAXE	Num	8		TRUCKS/4AXLES-EMPTY
FOURAXL	Num	8		TRUCKS/4AXLES-LOADED
FQ1	Num	8		REPORTED*FREQUENCY

FQ2	Char	4	$FQ.	FREQUENCY*UNIT
FREE	Num	8		FREE*PASSES
FROM	Char	20		STARTING*POINT
FROMST	Char	10		STATEOF*STARTING*POINT
FROMTO	Char	4	$FROMTO.	GOINGTO*COMING FROM*(PURPOSE)
FRTR	Num	2		FERTILIZER*TRUCK
FRTVEH	Num	5		FREIGHT VEHICLES
FYEAR	Num	3		FISCAL*YEAR
GOV	Num	4		GOVERNMENT*&DEFENSE
GR	Char	1	$B01N.	APPROACH*GUARDRAIL*RATING
GREND	Char	1	$B01N.	APPROACH*GUARDRAIL*TRANSITION*RATING
GRTR	Char	1	$B01N.	APPROACH*GUARDRAIL*ENDSRATING
HIHOUR	Num	2		ORDINAL*HIGH*HOUR
HIVOL	Num	4		HIGH*HOUR*VOLUME
HTRAIL	Num	3		#OFHOUSE*TRAILERS
HVFRI	Num	8		FRIDAY*HOURLY*VOLUMES
HVMON	Num	8		MONDAY*HOURLY*VOLUMES
HVSAT	Num	8		SATURDAY*HOURLY*VOLUMES
HVSUN	Num	8		SUNDAY*HOURLY*VOLUMES
HVTHR	Num	8		THURSDAY*HOURLY*VOLUMES
HVTUE	Num	8		TUESDAY*HOURLY*VOLUMES
HVWED	Num	8		WEDNESDAY*HOURLY*VOLUMES
HWY	Char	20		HIGHWAY
IBWC	Num	3		IBWC*CODES
IE	Num	6		INFORMAL*ENTRIES
ILLUR	Char	1	$SIGN.	ILLUMINATION*RATING
L2AX	Num	8		LOADED *2AXLE
L3AX	Num	8		LOADED *3AXLE
L4AX	Num	8		LOADED *4AXLE
L5AX	Num	8		LOADED *5AXLE
L6AX	Num	8		LOADED *6AXLE
LANES	Num	2		NUMBER OF*LANES
LANET	Char	5	$LANET.	DIVIDED*OR UNDIVIDED
LANEW	Num	2		LANE*WIDTH*(DM)
LAP	Num	8		LOADED *AUTOPICKUPS
LOAD	Num	2		SAFE*LOAD*CAPACITY
LOCARTS	Num	3		COUNTFOR*LOADED CARTS
LOCATION	Char	20		
LWID	Num	2		LANE WIDTH
MACH	Num	3		MACHINERY

MAN	Num	4		MANUFACTURING
MCONC	Char	1	$MCONC.	UNDER*CONCESSION*IN MEX?
MENUDO	Num	2		NUMBER*OFDOCKS*MEXIMPORT*LOT
MENV	Char	8	$ENV.	ENVIRONMENTAL*ANALYSIS*STATUS-MEX
MEX	Num	8		
MEXAG	Char	30		MEXICAN*AGENCY
MEXCITY	Char	15		
MEXDES	Num	33	DES.	.
MEXF	Num	2		FUNDS*COMMITTED*BYMEX*INMILL$
MEXFACL	Char	45		MEXICAN LOCAL*FACILITY
MEXFACM	Char	20		MEXICAN*MAIN*FACILITY
MEXINT	Char	1	$MEXOFAP.	INTER*SECRETARIAT*AGREEMENT*STATUS
MEXLEN	Num	2		MEX-SIDE*BRLEN
MEXN1	Char	30		MEXICAN*NAME-1
MEXN2	Char	30		MEXICAN*NAME-II
MEXOFAP	Char	1	$MEXOFAP.	OFFICIAL*APPLICATION*IN MEXICO
MEXPRI	Num	2		MEX PRIMARY*INSP BOOTHS
MEXREM	Num	2		YR-REM*MEX INSPFAC
MEXSEC	Num	2		MEXSEC*INSP BOOTHS
MEXST	Char	4		MEXICAN*STATE
MIN	Num	4		MINING
MISC	Num	8		MISC+TD+7AX*OR MORE
MODE	Char	4	$MODE.	TYPES OF*TRAFFIC
MON	Char	3		
MONTH	Char	3		
MOTO	Num	8		MOTORCYCLES
MSITE	Char	1	$SITE.	MEX FINAL*BRIDGE*LOCATION
MSIXAX	Num	4		MORE THAN*SIXAXLES
MSOURCE	Num	2	SOURCE.	SOURCE*OFMEX*FUNDS
MTR	Num	8		MOTORCYCLES
MTRBUS	Num	2		MOTORBUS
MTRMO	Num	4		MOTORCYCLES*MOPEDS
MUNI	Char	9	$TESTFM.	MUNICIPALITY
NB	Num	2		NOLANES*NORTHBOUND
NLANES	Num	2		NUMBER*OFLANES
NONCOMM	Num	5		VEHICLES*NON-COMMERCIAL*BRIDGE
NS	Num	4		UNSPECIFIED*JOBS

ODREAD	Num	8		ODOMETER*READING
OPEN	Num	2		YEAR*OPENED*OR PROPOSED
OPR	Char	4		MAXLOAD*ON THE*BRIDGE
ORDINAL	Num	8		
ORI	Char	20		ORIGIN
OTHER	Num	3		#OF*BUSES AND* OTHER*VEHICLES
OTHER	Num	5		OTHER*ENTRIES
OUTR	Num	3		NUMBER*OF RETAIL*OUTLETS
OUTT	Num	3		NUMBEROF*SALES*OUTLETS
P70	Num	4		POPULATION*IN 1970
P80	Num	4		POPULATION*IN 1980
P90	Num	4		POPULATION*IN 1990
PA	Num	8		#AXLES(TRUCKS)*ORPASS(CARS)
PASS	Num	5		#OF*PASSENGERS
PAVED	Num	5		TOTAL*LENGTHOF*PAVED*HIGHWAY(KM)
PDIST	Num	8		PERCENT*DIRECTIONAL*DISTRIBUTION
PED	Num	8		PEDESTRIANS
PEDLN	Num	2		PEDESTRIAN*LANES
PEDS	Num	6		NUMBER OF*PEDESTRIANS
PEDST	Num	8		TOLL FOR*PEDESTRIANS
PER	Num	4		PERSONAL*SERVICES&*MAINTENANCE
PET	Num	4		PETROLEUM
PLATE	Char	4		LICENSE*PLATE
PORT	Char	10		PORT OF*ENTRY
POST	Char	4	$POST.	POSTED*FORLOAD
PPLATE	Num	2		PERMIT*PLATE
PRO	Num	4		PROFESSIONAL*&TECHNICAL*SERVICES
PRVBUS	Num	2		PRIVATE*BUS
PTAXRET	Num	3		PERCENT*TAXABLE*RETAIL*SALES
PTAXTOT	Num	3		PERCENT*TAXABLE*TOTAL*SALES
PURP	Char	2	$PURP	TRIP*PURPOSE
RAIL	Char	1		RAILINGS*RATING
RAILL	Num	5		TOTAL*RAILROAD*LENGTH(KM)
RDTRC	Num	2		ROAD*TRACTOR
RECVEH	Char	6		RECREATIONVEHICLES
REG	Num	3		REGULAR*CARGO*CARRIER
RES	Num	4		RESTAURANT&*HOTELSERVICES
RETS92	Num	4		RETAIL*SALESIN*100092-DOLLARS
SB	Num	2		NOLANES*SOUHTBOUND

SER	Num	2		
SEVENAXE	Num	8		TRUCKS/7AXLES-EMPTY
SEVENAXL	Num	8		TRUCKS/7AXLES-LOADED
SHW	Num	2		SHOULDER*WIDTH*(DM)
SIGNR	Char	1	$SIGN.	SIGNS*RATING
SIXAX	Num	4		SIX*AXLES
SIXAXE	Num	8		TRUCKS/6AXLES-EMPTY
SIXAXL	Num	8		TRUCKS/6AXLES-LOADED
SL	Num	2		SPEED*LIMIT
SOC	Num	4		SOCIAL*SERVICES
SOLCOSRV	Num	2		SOIL*CONSERVATION
SPEC	Num	2		SPECIALIZED*CARGO*CARRIERS
STATE	Char	8		
STATION	Char	4		STATION*CODE
STSURF	Num	5		TOTAL*LENGTH*STAB*SURFACE*HIGHWAY(KM)
SUBR	Num	2		SUBSTRUCTURE*RATING
SUPR	Num	2		SUPERSTRUCTURE*RATING
SWID	Num	8		SHOULDER*WIDTH(DM)
T2	Num	8		
T3	Num	8		
T4	Num	8		
T4AX	Num	2		TOLL FOR*TRUCKS-4AXLES
T5	Num	8		
T5AX	Num	2		TOLL FOR*TRUCKS-5AXLES
T6	Num	8		
T6AX	Num	8		TOLL FOR*TRUCKS-6AXLES
T7	Num	8		
TADDAX	Num	2		TOLL FOR*TRUCKS>6AX-ADDAXLE
TD	Char	1	$TD.	TRAFFIC*DIRECTION
TF	Char	1	$TF.	TYPE OF*FACILITY
THREEAX	Num	4		THREE*AXLES
THREEAXE	Num	8		TRUCKS/3AXLES-EMPTY
THREEAXL	Num	8		TRUCKS/3AXLES-LOADED
TIME	Num	8		MILITARY*TIME
TKNTRL	Num	4		TOKEN*TRAILER
TO	Char	20		ENDING*POINT
TOLLN	Char	1	$TOLL.	TOLL*NORTHBOUND

TOLLNB	Num	2		MEXSIDE*TOLLBOOTHS
TOLLS	Char	1	$TOLL.	TOLL*SOUTHBOUND
TOLLSB	Num	2		US-SIDE*TOLLBOOTHS
TOST	Char	10		STATEOF*ENDING*POINT
TOTAL	Num	8		TOTAL*VEHICLES
TOTAL1	Num	8		TOTAL OF*AUTOBUS*TRUCK&BIKE
TOTLEN	Num	2		SUM OF USLEN*MEXLEN
TOTM	Num	6		TOTAL*MERCH AND ISE*RELEASE
TOTS92	Num	4		TOTAL*SALES*IN1000*92DOLLARS
TRA	Num	4		TRANSPORTATION*&COMMUNICATION
TRAILERS	Num	3		#OF*TRAILERS
TRF	Char	8	$TEST3FM.	ORIGIN*FORTHE*TRUCK
TRIP	Num	8		
TRT	Char	8	$TEST3FM.	DESTINATION*FORTHE*TRUCK
TRUCK	Num	4		NUMBER OF*TRUCKS
TRUCKR	Num	6		NUMBER*OF REGISTERED*TRUCKS
TRVLTRL	Num	4		TRAVEL*TRAILERS
TVEH	Num	6		TOTALNO*OFVEHICLES
TWOAX	Num	4		TWO*AXLES
TWOAXE	Num	8		TRUCKS/2AXLES-EMPTY
TWOAXL	Num	8		TRUCKS/2AXLES-LOADED
TWOSIXAX	Num	4		#OF*2-6AXLED*VEHICLES
TYPEYR	Char	1	$TYPEYR.	CALENDER OR FISCAL YEAR
UNE	Num	3		NUMBER OF*PEOPLE*UNEMPLOYED
UNPAVED	Num	5		TOTAL*LENGTHOF*UNPAVED*HIGHWAY(KM)
US	Num	8		
USAG	Char	50		US*AGENCY
USCITY	Char	20		
USDES	Num	2	DES.	USBRIDGE*DESIGN*STATUS
USDOWI	Num	2		DOCK WIDTH*US IMPORT LOT
USEC	Num	2		US SEC*INSP BOOTHS
USENV	Char	8	$ENV.	ENVIRONMENTAL*ANALYSIS*STATUS-US
USF	Num	8		FUNDS*COMMITTED*BYUS*INMILL$
USFACL	Char	45		USLOCAL*FACILITY
USFACM	Char	25		USMAIN*FACILITY
USISIZE	Num	8		SITE*SIZE(ACRES)
USITE	Char	1	$SITE.	USFINAL*BRIDGE*LOCATION
USLEN	Num	3		US-SIDE*BRLEN
USN1	Char	35		USNAME-I

USN2	Char	30		USNAME-II
USNUBU	Num	2		NUMBER*OFBUILDINGS*USSIDE
USNUDO	Num	2		NUMBER*OFDOCKS*USIMPORTLOT
USOURCE	Num	2	SOURCE.	SOURCE*OFUS*FUNDS
USP	Num	2	USPP.	STATUS*OFUS*PRESIDENTIAL*PERM IT
USPRI	Num	2		USPRIMARY*INSPBOOTHS
USREM	Num	3		YR-REM*USINSPFAC
VEH	Char	1	$TEST2FM.	MODE
WAT	Num	4		WATER&*ELECTRICITY
WIDTH	Num	3		CURBTO*CURBLENGTH
WWAR	Num	2		WATER*ADEQUACY*RATING
YEAR	Num	2		
YRINSP	Num	3		YEAR OF*INSPECTION