

2002 Laredo and Webb County Texas - Travel Surveys



Executive Summary

June 2005

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Acknowledgments

This report provides a summary of the travel surveys conducted in Laredo and Webb County, Texas in 2003. Details of these surveys are provided in the following separate technical reports.

Laredo Urban Transportation Study Travel Time and Delay Survey Technical Summary, authored by Stephen P. Farnsworth and David F. Pearson, Ph.D., P.E., Texas Transportation Institute, May 2003

Laredo External Survey Technical Summary, authored by David F. Pearson, Ph.D., P.E., Texas Transportation Institute, June 2003

2002 Laredo/Webb County Household Travel Survey Technical Summary, authored by David F. Pearson, Ph.D., P.E., Texas Transportation Institute, December 2003

2003 Laredo Commercial Vehicle Survey Technical Summary, authored by Stephen P. Farnsworth and Haobo Ren, Texas Transportation Institute, August 2004

2003 Laredo/Webb County Work Place Travel Survey Technical Summary, authored by David F. Pearson, Ph.D., P.E., Texas Transportation Institute, August 2004

The factual contents of this report were taken primarily from the above technical summary reports and the contributions of the authors of these reports are acknowledged. Other factual sources are referenced in the report. The author is responsible for the findings and conclusions.

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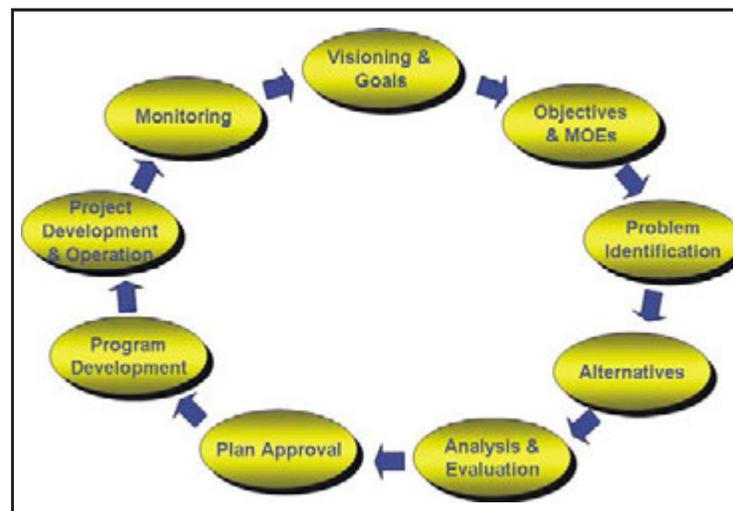
INTRODUCTION

The metropolitan transportation planning process is based on the Federal-Aid Highway Acts of 1962 and 1973. These acts established the cooperative, continuing, and comprehensive (3C) transportation planning process and created the metropolitan planning organization (MPO) to assist in carrying out the process. Subsequent Federal acts strengthened the transportation planning process and the role of the MPO. Figure 1 shows the key elements of the metropolitan transportation planning process.

Where do travel surveys fit in this process? The analysis and evaluation step can and does take many forms. One form used by most MPOs is the travel demand model. The travel demand model is used to evaluate how proposed alternative transportation systems, the forecast transportation capacity, and the forecast demand for transportation — the movement of people and goods — will perform. This analysis is used to support the development of the long-range transportation plan and short-range transportation improvement program and its adoption by the MPOs policy board. These plans are approved at a minimum of once every five years for metropolitan areas that are in attainment of National Ambient Air Quality Standards (NAAQS) and once every three years for metropolitan areas that are not in attainment of the NAAQS.

Travel surveys are required to support travel demand model estimation, calibration, and validation for the model's base year. For Laredo the travel model base year is 2003, the year the travel surveys were performed. After the travel demand model is validated it is used as an evaluation tool to determine how well or how poorly the proposed urban transportation system will perform in the future given the land use forecast of where people will live and work. Travel surveys are the essential first

Key Elements of the Planning Process



step for travel model estimation, calibration, and validation. The Texas Department of Transportation (TxDOT) has supported, and continues to support, the timely conduct of urban travel surveys that are essential for the development of travel demand models to support the metropolitan transportation planning process.

THE CITY OF LAREDO AND WEBB COUNTY

In this section, selected demographic and transportation statistics are detailed to provide a frame of reference for Webb County and the City of Laredo as compared to the state of Texas. The report does not provide any forecasts for these statistics. However, it is clear, that given the dynamic growth experienced by the region during the past decade and the

Figure 1

Source: National Highway Institute Course No. 152069, Metropolitan Transportation Planning.

expectation that this growth will continue for the foreseeable future, it will be a considerable challenge to provide the additional transportation facilities that will be needed to accommodate growth and maintain the excellent level of personal mobility that residents currently enjoy.

Excellent transportation planning and analysis tools will be needed to help meet this challenge. The travel surveys, summarized in this report, provide the necessary data to develop such tools.

DEMOGRAPHIC STATISTICS

Table 1 shows that Webb County is and has been growing at a rate one and a half times faster than the growth rate for all of Texas and this trend is forecast to continue.

Table 1

Source: U.S. Census Bureau

Webb County and Texas Population, Annual Growth Rate: 1960 - 2003

	Webb County	Annual Growth Rate	Texas	Annual Growth Rate
1960	64,791	-	9,579,677	-
1970	72,859	1.14	11,196,730	1.57
1980	99,258	3.14	14,229,191	2.43
1990	133,239	2.99	16,986,510	1.79
2000	193,117	3.78	20,851,820	2.07
2003	213,615	3.41	22,118,509	1.99

Table 2

Source: Texas Transportation Institute, 2004 Urban Mobility Report available at <http://tti.tamu.edu>.

City of Laredo Mobility Data: 1982 - 2002

Year	Population (1,000)	Daily Vehicle Miles of Travel (1,000)	Daily Vehicle Miles of Travel per Person	Peak Travelers (1,000)	Annual Delay per Peak Traveler (person hours)
1982	95	900	9.5	39	2
1983	95	950	10	40	2
1984	95	1,000	10.5	40	2
1985	100	1,050	10.5	43	2
1985	105	1,120	10.7	45	2
1987	110	1,260	11.5	48	2
1988	120	1,315	11	52	2
1989	120	1,370	11.4	53	2
1990	120	1,480	12.3	53	2
1991	125	1,570	12.6	56	3
1992	125	1,650	13.2	57	2
1993	130	1,720	13.2	60	3
1994	140	1,800	12.9	66	3
1995	145	1,850	12.8	69	4
1996	150	1,920	12.8	73	5
1997	165	2,185	13.2	81	6
1998	175	2,450	14	88	7
1999	180	2,600	14.4	91	7
2000	185	2,650	14.3	95	6
2001	190	2,730	14.4	99	8
2002	190	2,760	14.5	101	7

TRANSPORTATION STATISTICS

Travel in Laredo, as measured by vehicle miles per person, increased by over 50 percent from 1982 to 2002 (Table 2). The amount of travel is increasing faster than the amount of capacity (lane-miles) being added to the roadway system, and, as a result, delay to travelers is increasing. Compared to the average delay for small urban areas (urban areas with less than 500,000 persons), the delay per traveler in the City of Laredo is about half, 7 hours per year compared to 12 hours per year (Figure 2).

Persons commuting to work in the City of Laredo use carpools and public transportation more than the average commuter in Texas, and their mean travel times are almost five minutes less (Table 3). Part of the reason for this is a higher percentage of households in the City of Laredo with no vehicle available compared to Texas households as a whole (Figure 3).

Growth in Average Annual Hours of Delay per Peak Traveler

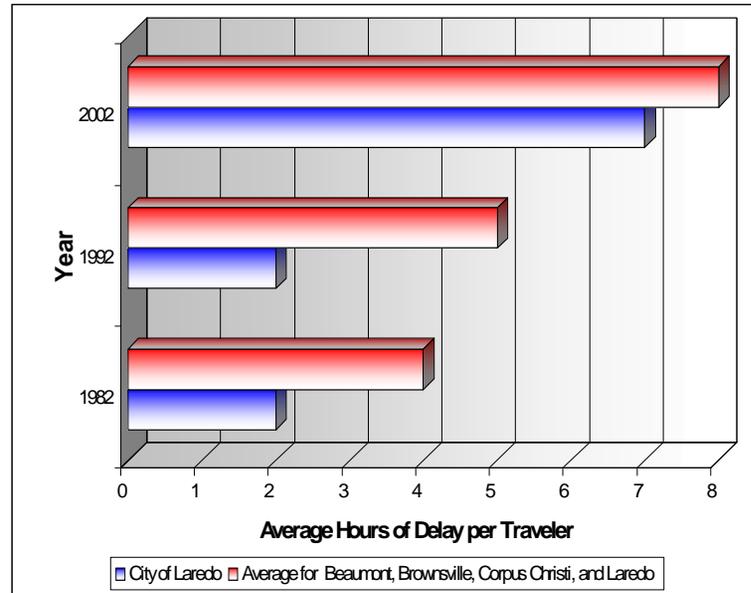


Figure 2

Source: Texas Transportation Institute, 2004 Urban Mobility Report, available at <http://tti.tamu.edu>

City of Laredo Commuting to Work in 2000 (Percent)

Commute Mode							
	Drive Alone	Carpool	Public Transportation	Walk	Other	Work at Home	Mean Travel Time (minutes)
City of Laredo	72.0	18.8	2.5	2.0	1.7	2.9	20.8
State of Texas	77.7	14.5	1.9	1.9	1.3	2.8	25.4

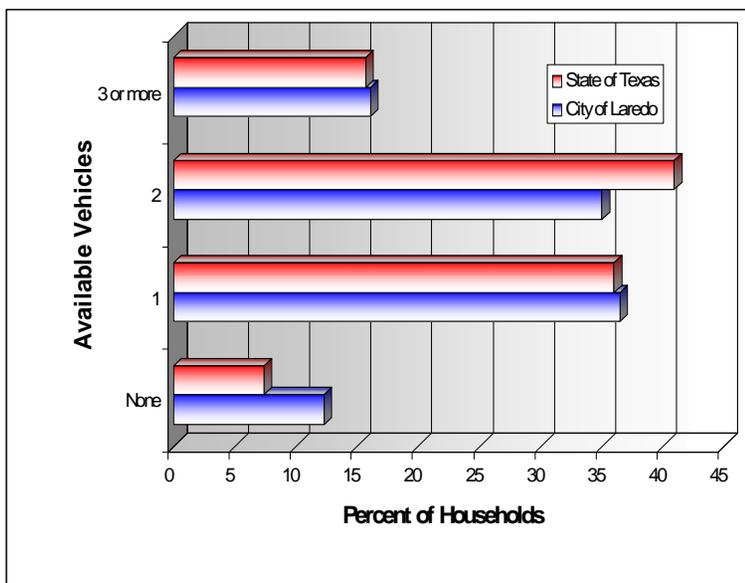
Table 3

Source: U.S. Census Bureau

Figure 3

Source: U.S. Census Bureau

Vehicles Available - City of Laredo and Texas



Not only is the population of Webb County increasing at an above average rate, the amount of daily travel is increasing at an even more rapid rate as seen by the increase in daily vehicle miles per person (Table 4). This demand on the transportation system is expected to increase at a faster rate than the growth rate of the population.

The information provided in the tables and figures above demonstrates the importance of long-range transportation planning for Webb County and the City of Laredo. To facilitate this planning, TxDOT and the Laredo MPO in 2002 and 2003 conducted a comprehensive survey of transportation demand in Webb County and the City of Laredo. This report provides a summary of these surveys.

Table 4

* Estimated from partial data
Source: U.S. Census Bureau and Texas Department of Transportation

Webb County and Texas Vehicle Registrations and Daily VMT

Year	Webb County					Texas	
	Population	Total Vehicle Registrations	Vehicle Ownership per Person	Daily Vehicle Miles of Travel	Daily Vehicle Miles of Travel per Person	Vehicle Ownership per Person	Daily Vehicle Miles of Travel per Person
1960	64,791	19,635	0.30	448,932*	6.9	0.51	5.7
1970	72,859	37,707	0.52	749,076*	10.3	0.68	16.6
1980	99,258	NA	NA	1,367,003	13.8	0.85	21.9
1990	133,239	NA	NA	2,001,850	15.0	0.85	26.2
2000	193,117	97,541	0.51	3,385,482	17.5	0.85	28.1

Webb County Highway Map and MPO Area

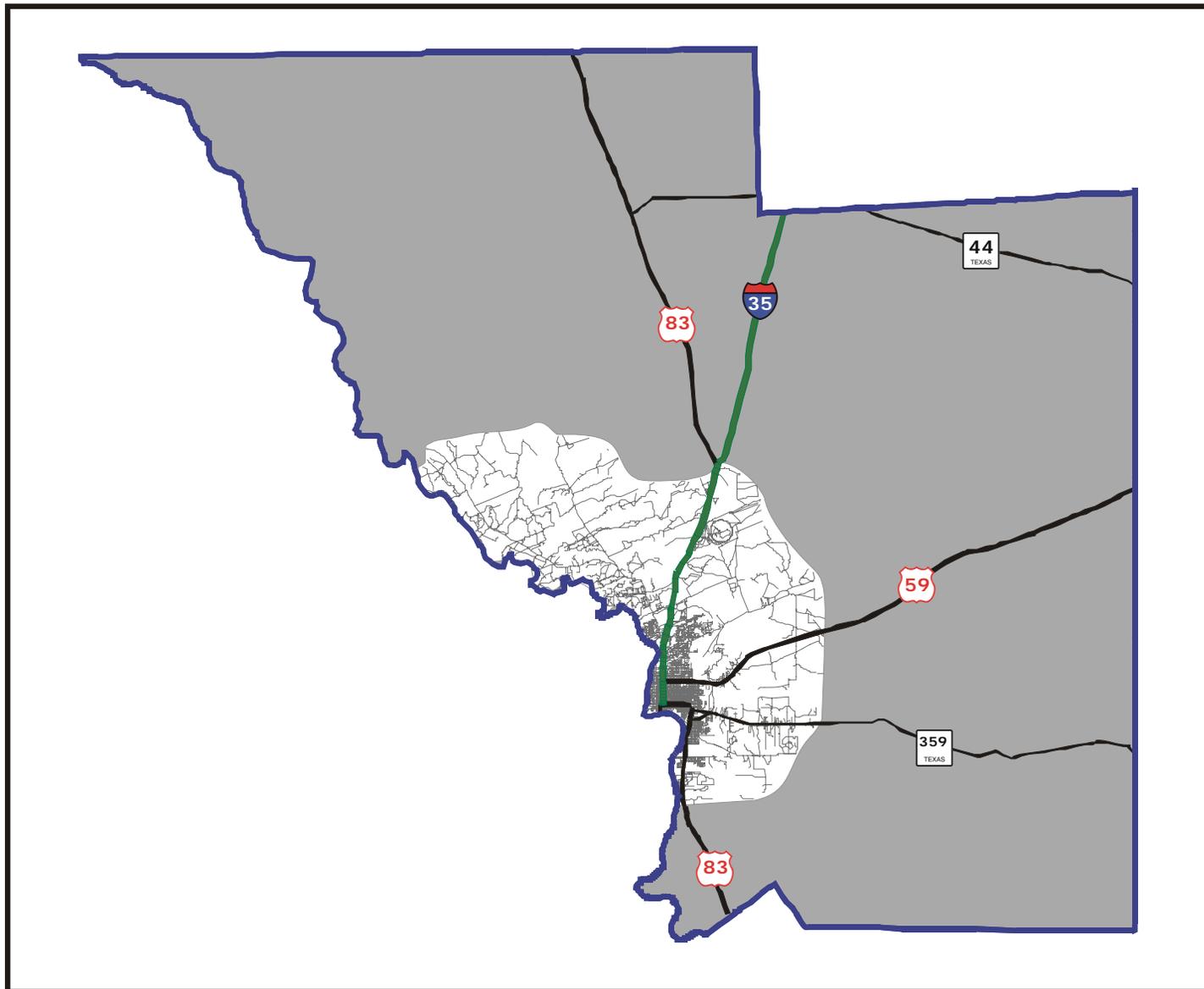


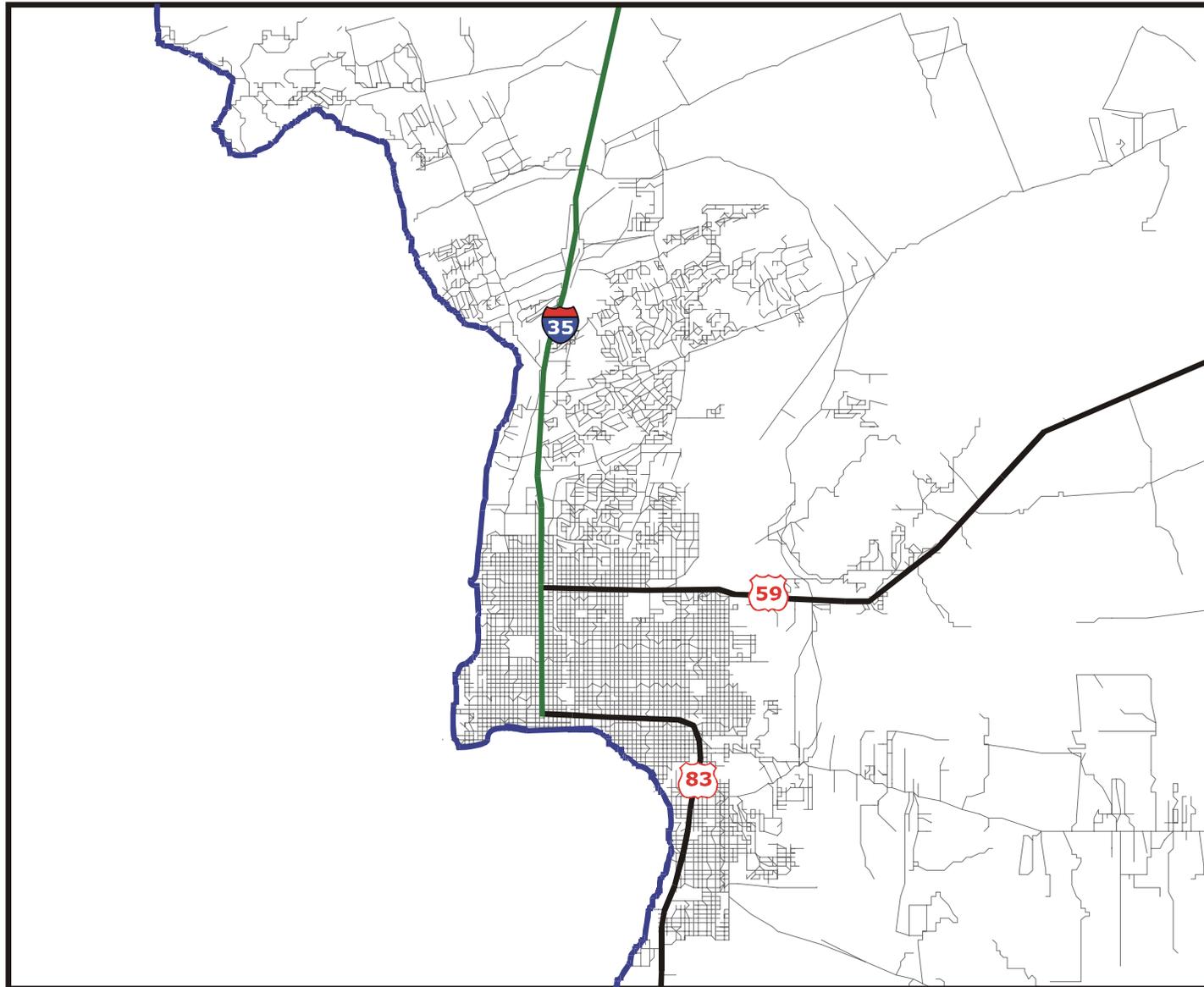
Figure 4

Source: TTI Graphic

Figure 5

Source: TTI Graphic

City of Laredo Highway and Street Map



TRAVEL WITHIN THE REGION

To estimate future travel, trips are divided between trips made within the study area (internal trips), trips made into or out of the study area (external-local trips), and trip made through the study area (external-through trips). This section will discuss internal trips.

HOUSEHOLD SURVEY

The primary purpose of the household survey is to understand the trip making patterns of households as a function of the household characteristics such as family size, number of workers, household income, and vehicle availability and the trip purpose. This data is used in the trip generation step of the travel demand model to estimate household trip production rates by trip purpose. A second product of the household survey is the average trip length and the length frequency distribution for each trip purpose. This data is used in the trip distribution step of the travel demand model to estimate the attraction of each trip produced.

HOUSEHOLD CHARACTERISTICS

Households were selected at random throughout Laredo and Webb County, and those that agreed to participate were asked to record on a diary the travel made by each person over the age of five years during a 24-hour period. For each trip, participants were asked to record the time, place the trip began and ended, mode of travel, number of passengers, purpose of the trip, and other descriptive information. In addition to the trip diary, households were asked to provide information on household charac-

teristics that closely correlated with the household trip making such as the number and age of persons in the household, number of household members employed, household income, and the number of vehicles available to the household. The household survey consisted of 1,838 usable surveys.

The household characteristics of household size and household income are used for estimating and forecasting travel demand. The joint distribution of these two household characteristics was used to expand the household survey data (Figures 6, 7, and Table 5). In general, as household size increases, daily household travel increases and as household income increases, daily household travel increases. By controlling for these two

Webb County 2002 Distribution of Households by Household Size

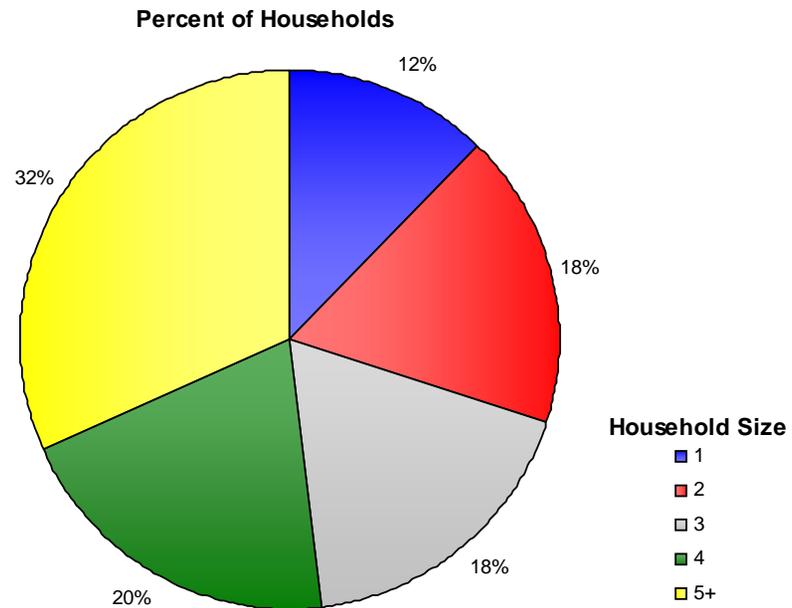


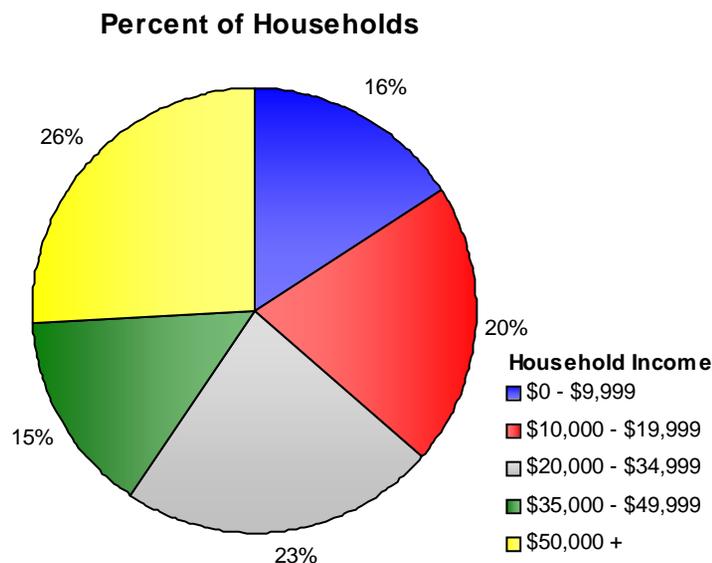
Figure 6

Source: U.S. Census Bureau and TTI analysis

Figure 7

Source: U.S. Census Bureau and TTI analysis

Webb County 2002 Distribution of Households by Household Income



household characteristics, future travel can be estimated with greater accuracy.

In addition to household size and income, the household survey asked several other questions that provide interesting perspectives about the characteristics of Laredo households. Some of these household characteristics may be used in the future to improve the forecasting ability of the travel demand model.

Vehicles Available

In general, as the number of vehicles available to the household increases, daily household travel increases. This household characteristic also impacts estimating and forecasting the demand for public transportation. Figure 8 shows the distribution of households by the number of vehicles available to the household. The sample distribution shows a decline in the number of households with no vehicles available compared to 2000 Census (Figure 4 in the previous section).

Number of Persons Employed

In general, as the number of persons employed in the household increases, daily household travel increases. Employment can also be used to characterize the household life cycle. Figure 9 shows the distribution of households by number of persons employed.

Table 5

Source: U.S. Census Bureau and TTI analysis

Webb County Joint Distribution of Households by Size and Income

Laredo 2002 Distribution of Households by Vehicles Available

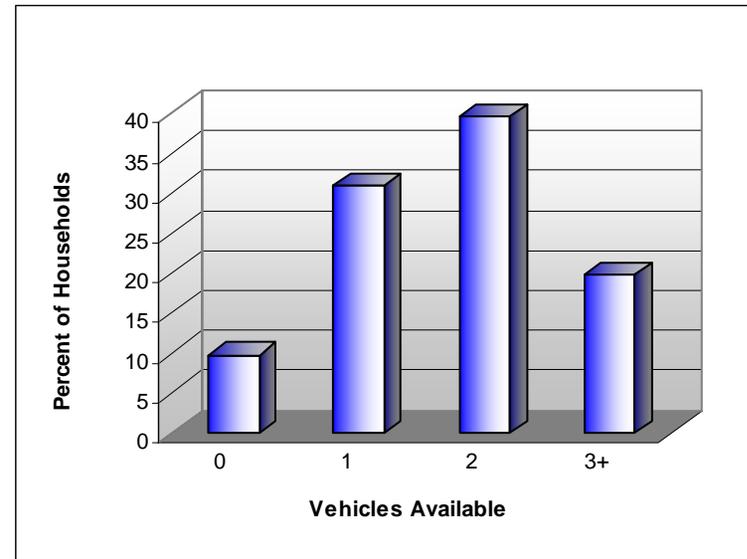


Figure 8

Source: Laredo Travel Survey

Distribution of Persons by Age Cohort

The impact of the age of household members on daily household travel is more complex than the other household characteristics shown and is not usually used directly in travel demand forecasting. Age can be used to characterize household life cycle. Figure 10 shows the distribution of persons by age cohort.

Laredo Distribution of Households by Number of Persons Employed

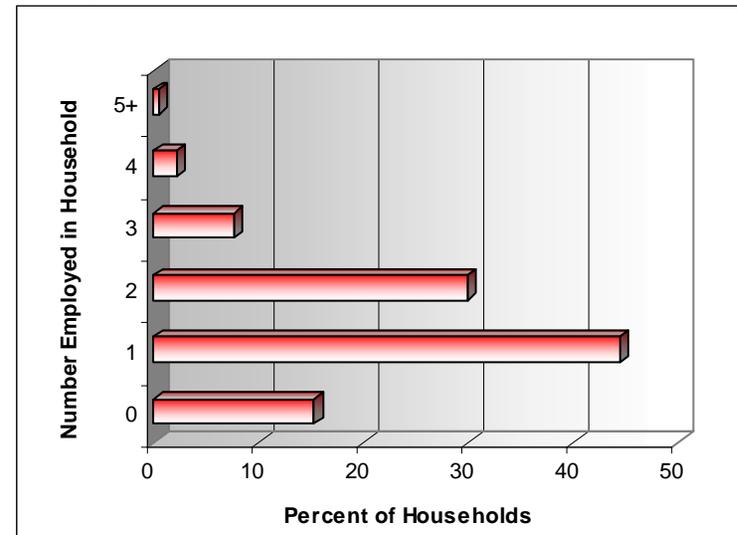


Figure 9

Source: Laredo Travel Survey

Figure 10

Source: Laredo Travel Survey

Laredo Distribution of Households by Age Cohort

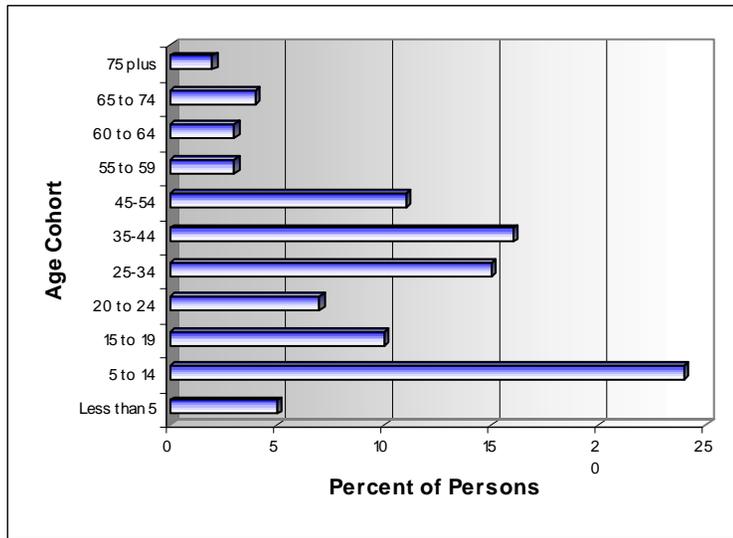
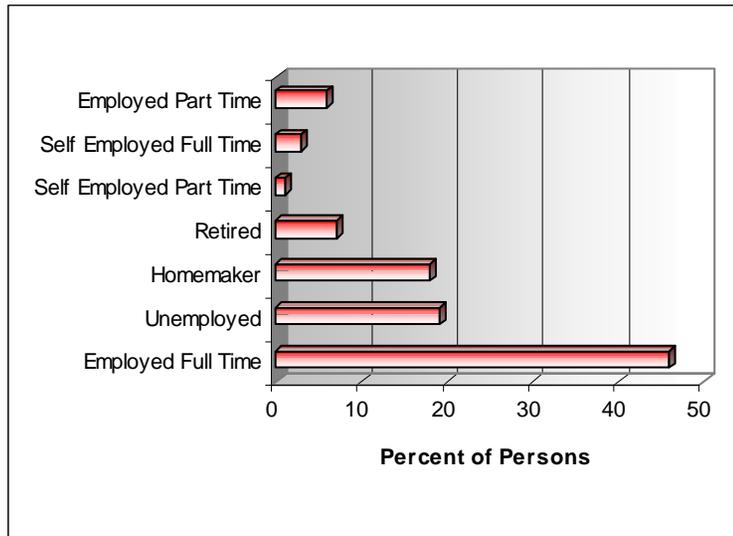


Figure 11

Source: Laredo Travel Survey

Laredo Distribution of Persons by Employment



Distribution of Persons by Employment

Employment status is used to characterize household life cycle (Figure 11). The 19 percent unemployed appears unusually high but the definition used is not the usual definition of employment as the definition includes students and disabled persons (see Figure 12).

Distribution of Unemployed Persons by Status

Unemployment estimates are not used in travel demand forecasting. However, unemployment status does help explain the reasons for unemployment and the probability that persons will move from an unemployed status to an employed status, thereby increasing the demand for travel. Figure 12 shows the distribution of unemployed persons by status.

A household life cycle variable is used in some travel demand models. Life cycle can be defined in different ways. One way is to define life cycle is by a combination of the ages of the head of household and the ages of the children in the household, if any. As an example, the travel demand model for the City of Detroit divided households into five categories as a function of the age of the head of the household and whether the household had children of preschool age, children of school age, or no children. Life cycle recognizes that a young couple of working age with no children will have different daily trip making characteristics than will a retired couple with no children at home. Life cycle can be an excellent household characteristic to help forecast future travel demand. The data to characterize households by life cycle is available from the household survey and is available for future enhancements to the travel demand model.

Distribution of Employed Persons by Type of Work Place

The household characteristics described above are used to help estimate the demand (trip productions) for travel. Work place characteristics are used to help estimate where people are attracted (trip attractions). In the travel demand model, the type of employment is summarized into the three employment types — basic, retail, and service. Each of these employment types has a different attracting power or attraction rates. The type of work place for employed persons from the household survey was initially summarized by the types of work places shown in Figure 14 and then summarized into the basic, retail, and service work place types shown in Figure 15.

HOUSEHOLD TRAVEL CHARACTERISTICS

The primary purpose of the household survey is to understand the trip making characteristics of households as a function of the household characteristics such as family size, number of workers, household income, vehicle availability, and the trip purpose. Trip purposes are defined as home based work trips (HBW), (one end of the trip at home and one end at work), home based non work trips (HBNW) (one end of the trip at home and one end not at home but not at work), and non home based trips (NHB) (neither end of the trip at home). Trips are divided into these purposes to account for the different trip length characteristics of each purpose. HBW trips have the longest average trip length and HBNW trips have the shortest average trip length. For travel demand model application, the HBNW trip purpose may be further divided among trips to school, trips to shop, etc. The household travel survey accounts for person trips which include walk, bicycle, and vehicle trips, and vehicle driver trips which are trips made by an individual

Laredo Distribution of Unemployed Persons by Status

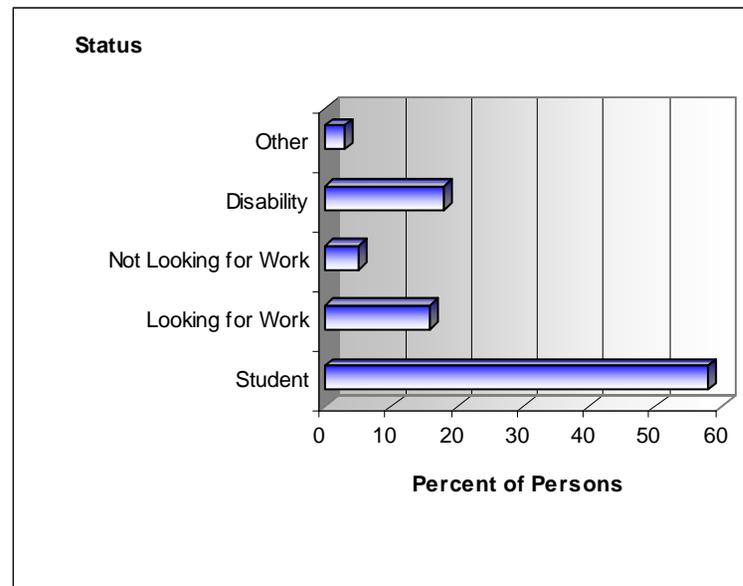


Figure 12

Source: Laredo Travel Survey

Laredo Distribution of Employed Persons by Work Place

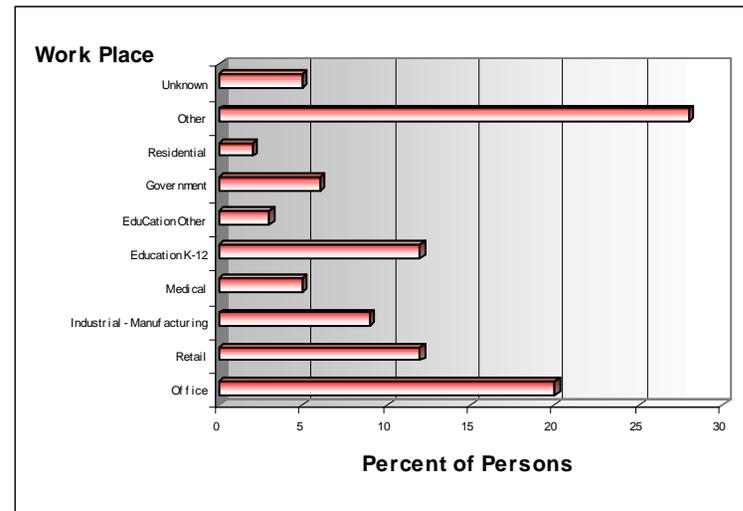


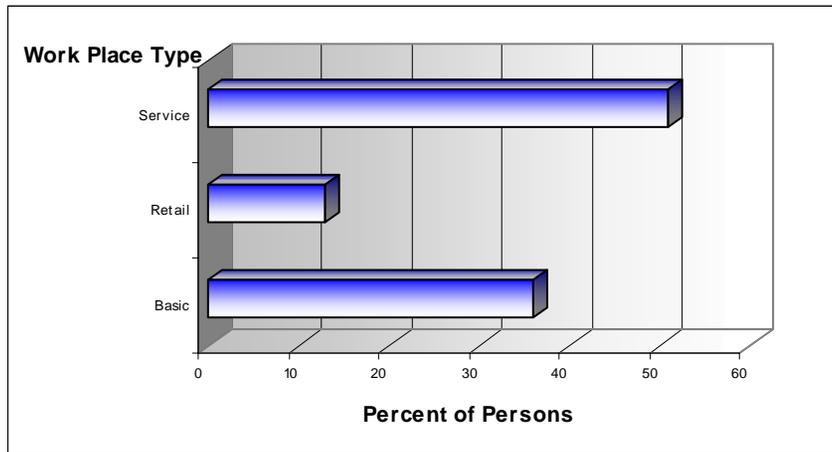
Figure 13

Source: Laredo Travel Survey

Figure 14

Source: Laredo
Travel Survey

Laredo Distribution of Employed Persons by Work Place Type



driving a vehicle. The figures in this section show trips by trip purpose and by person or vehicle driver trips.

Trip Productions

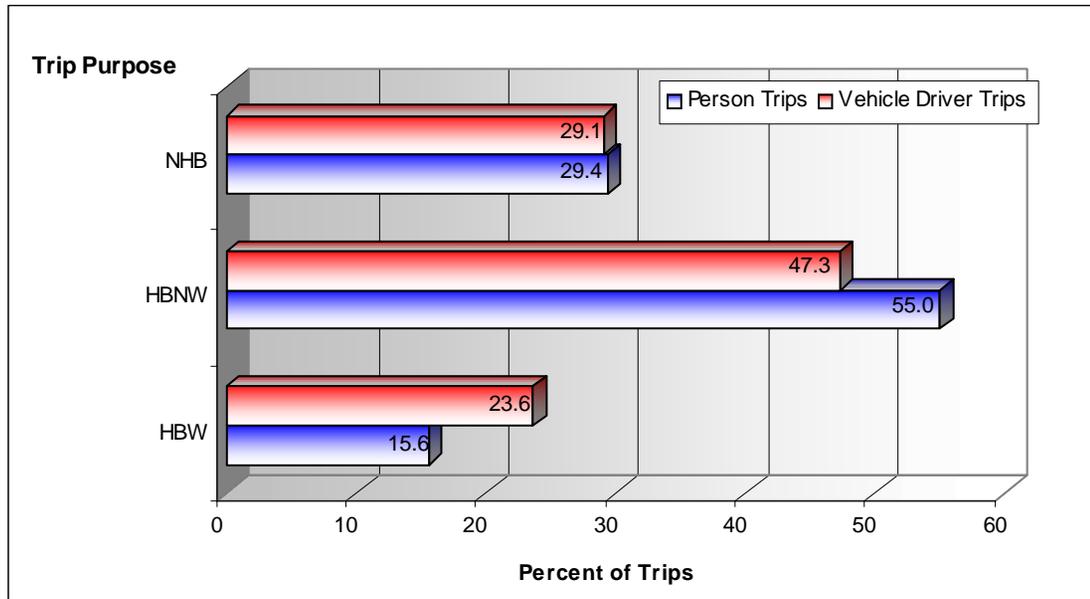
Trip ends are divided between productions, the home end of the trip, and trip attractions, the non-home end of the trip. If neither end of the trip is at home (NHB), the production end of the trip is defined as the origin end of the trip. These distinctions are important as the number of trip productions is a function of the number of households and the household characteristics and the trip attractions are a function of the number of work places, the number of employees, and the type of employment. Figure 15 shows the distribution of trip productions by trip purpose from the expanded house-

hold travel survey.

Trip Attraction Rates

Figures 16 through 23 show the distributions of trip attractions by trip purpose for person trips and vehicle driver trips by activity type. The activity type definitions are similar to the type of work place definitions shown in Figure 14 for the distribution of employed persons. Particularly interesting is the percentage of school trips for HBNW trip purpose.

Distribution of Trip Productions by Trip Purpose



Trip Production Rates

Figure 15

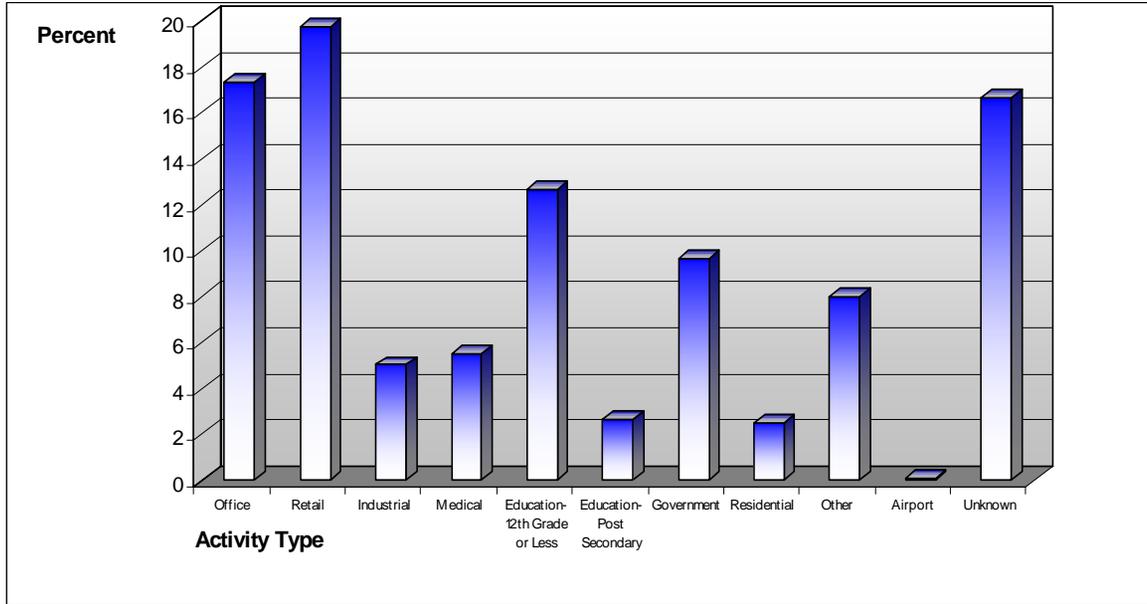
Source: Laredo Travel Survey

Among the important products of the household survey are the trip production rates for use in the trip generation step of the travel demand model. Table 6 shows the person trip production rates for all trip purposes. For the application of the travel demand model, trip production rates are applied separately for each of the internal trip purposes. Table 7 shows the person trip production rates for all trip purposes for small Texas urban areas. From these two tables it clear that household trip rates in Laredo are less than in other small urban areas. The reasons for this are

probably the lower vehicle availability of households in Laredo compared with other small Texas urban areas.

Figure 16

Source: Laredo Travel Survey and TTI analysis

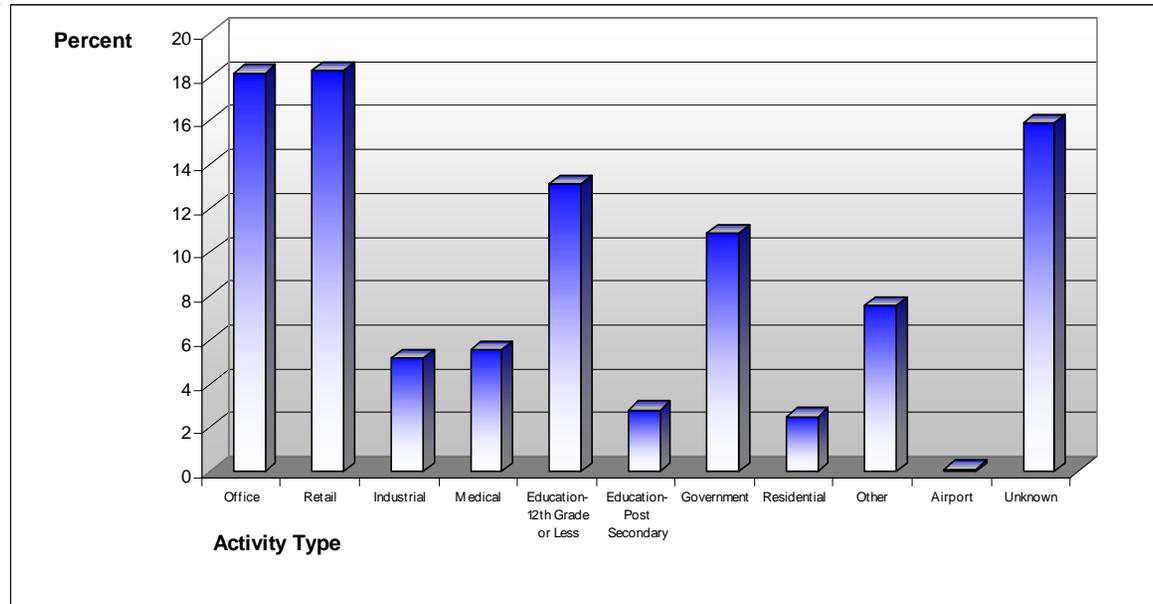


Distribution of HBW Person Attractions by Activity Type

Figure 17

Source: Laredo Travel Survey and TTI analysis

Distribution of HBW Auto Driver Attractions by Activity Type



Distribution of HBNW Person Attractions by Activity Type

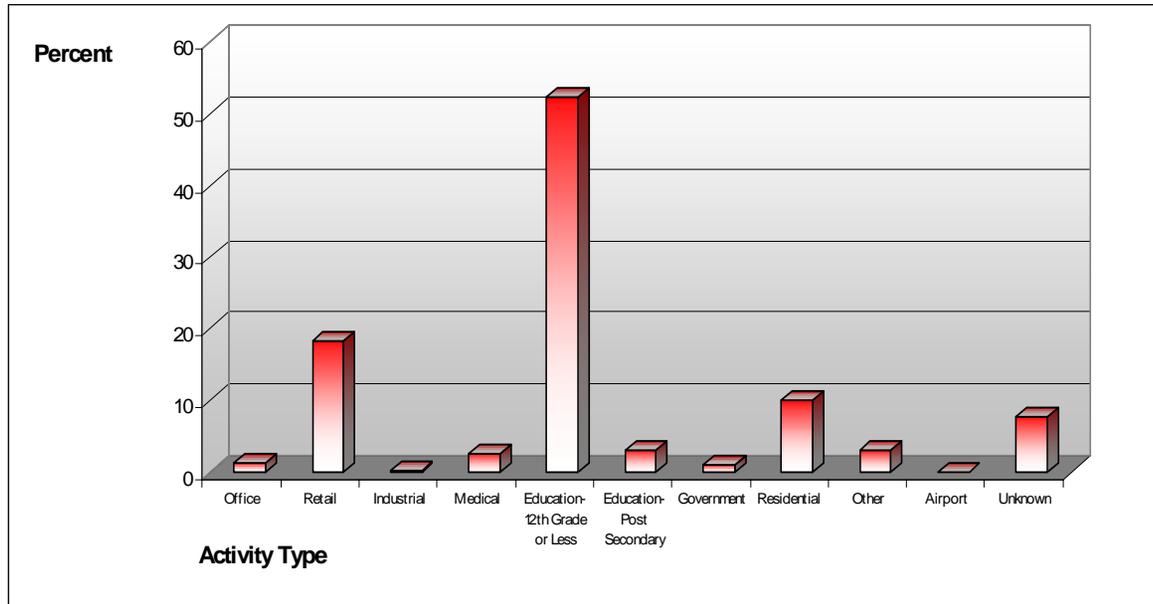
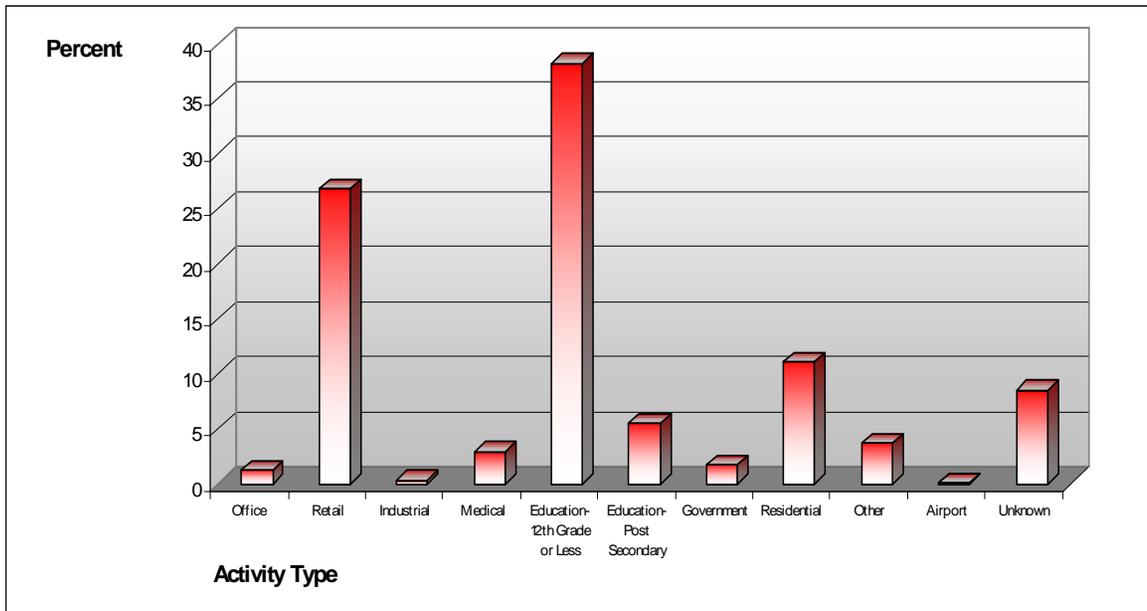


Figure 18

Source: Laredo Travel Survey and TTI analysis



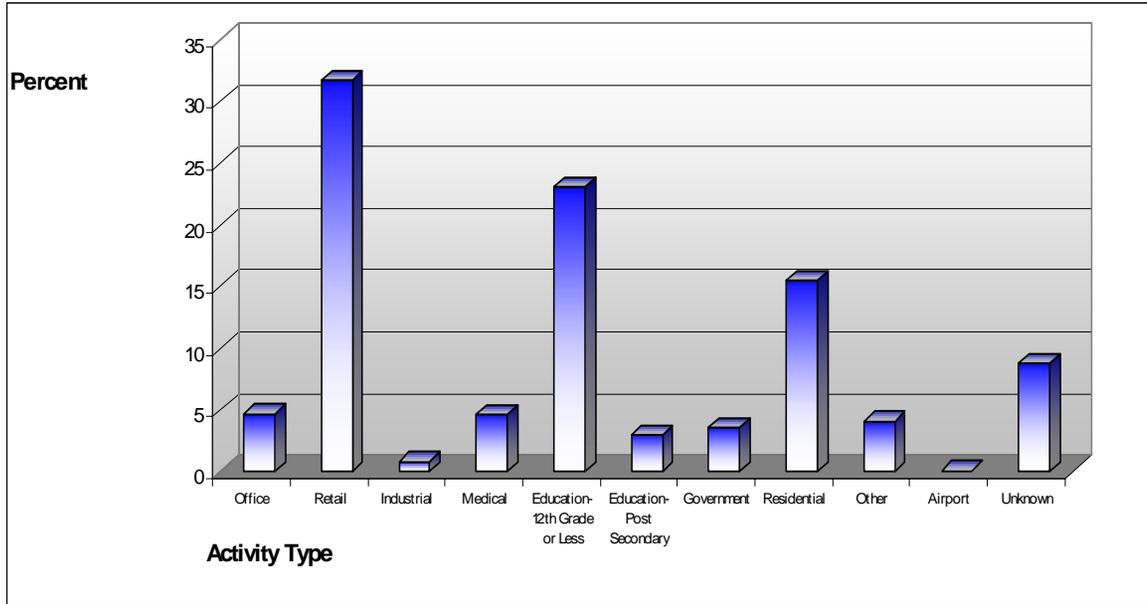
Distribution of HBNW Auto Driver Attractions by Activity Type

Figure 19

Source: Laredo Travel Survey and TTI analysis

Figure 20

Source: Laredo Travel Survey and TTI analysis

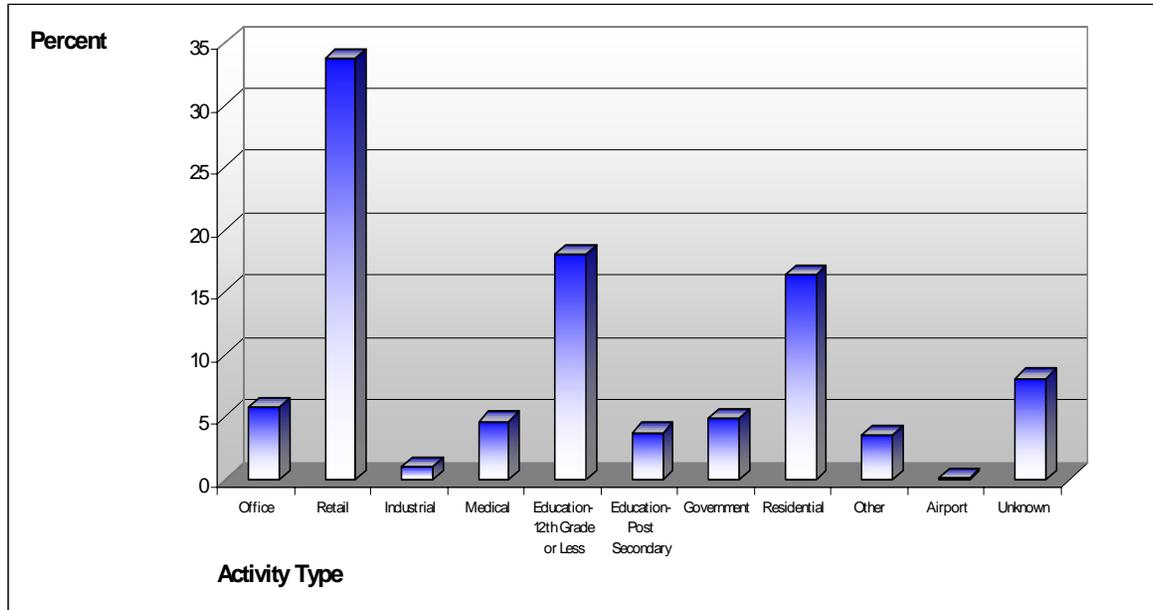


Distribution of NHB Person Attractions by Activity Type

Figure 21

Source: Laredo Travel Survey and TTI analysis

Distribution of NHB Auto Driver Attractions by Activity Type



Distribution of All Person Attractions by Activity Type

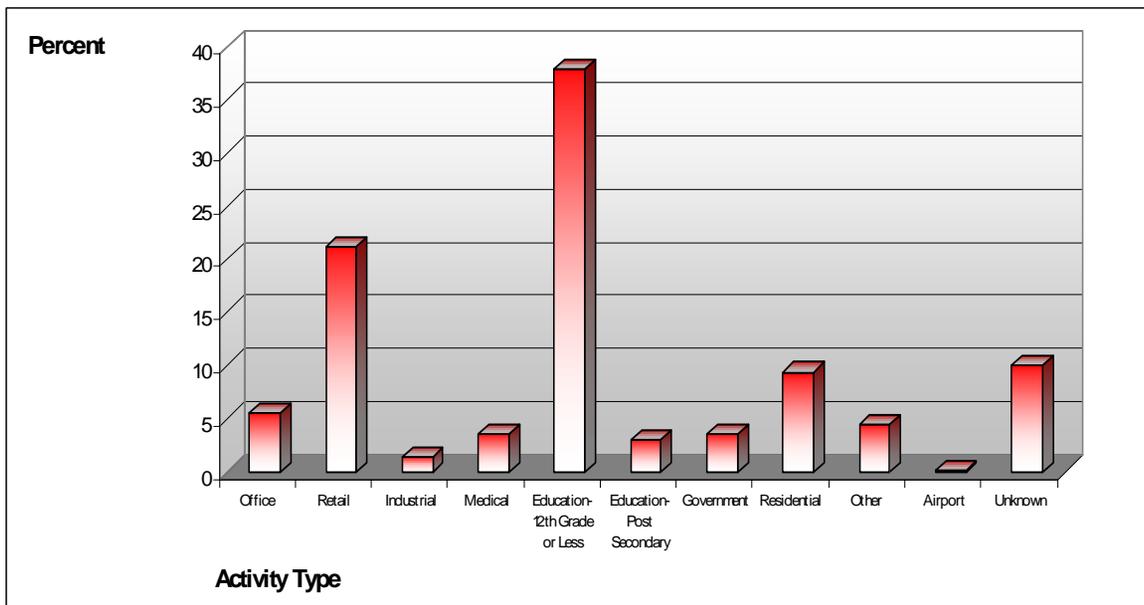
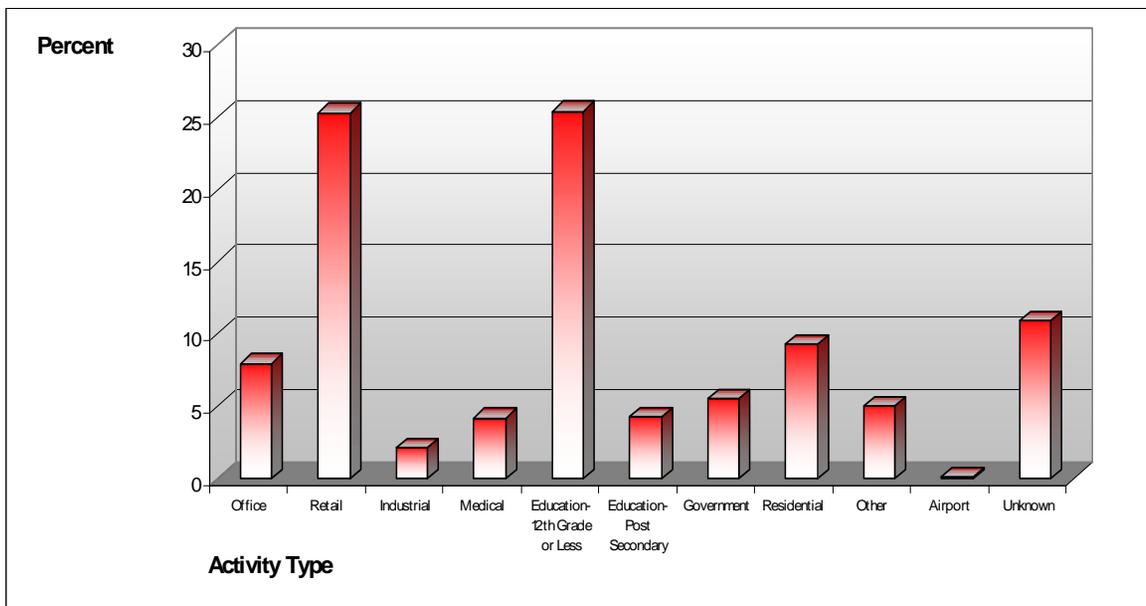


Figure 22

Source: Laredo Travel Survey and TTI analysis



Distribution of All Auto Driver Attractions by Activity Type

Figure 23

Source: Laredo Travel Survey and TTI analysis

The following example illustrates how these rates are used to forecast travel demand. The travel demand model assumes that trip production rates do not change over time. Therefore, trip production rates obtained from the 2002 household survey are the trip production rates used to forecast travel for 2025. However, the number of households and the characteristics of these households with respect to household size and household income do change over time. The number of households and their characteristics are forecast for 2025 for the entire study area and for small geographic divisions of the study area. Each small geographic area is called a traffic analysis zone (TAZ). For each TAZ, the number of households in a household size by income range cell is multiplied by the trip production rate for that cell to estimate the number of daily

Table 6

Source: Laredo Travel Survey and TTI analysis

Laredo Trip Production Rates for All Trip Purposes

Household Income Range (In 2002 \$)	Person Trips Per Household				
	Household Size				
	1	2	3	4	5 +
\$0,000 – \$9,999	1.86	5.51	8.59	11.34	13.60
\$10,000 – \$19,999	2.95	6.99	10.38	13.80	15.88
\$20,000 – \$34,999	3.63	8.02	11.99	15.55	17.78
\$35,000 – \$49,999	4.01	8.94	13.30	16.96	19.68
\$50,000 - Plus	4.28	9.93	14.64	18.31	20.98

person trips made by the households in the zone. Table 6 and Table 7 show the person trip rates for all trip purposes. Table 8 shows an example calculation for households with four persons and a household income range of \$20,000 - \$34,999 per year.

Table 7

Source: Laredo Travel Survey, TTI analysis, and TTI Research Report, 1099-3F, January 1996

Small Texas Urban Area Trip Production Rates for All Trip Purposes

Household Income Range (In 2002 \$)	Person Trips Per Household				
	Household Size				
	1	2	3	4	5 +
\$0,000 – \$9,999	2.49	5.02	7.14	10.36	14.03
\$10,000 – \$19,999	3.21	6.28	8.67	12.43	16.37
\$20,000 – \$34,999	4.19	7.35	10.07	14.3	18.43
\$35,000 – \$49,999	5.02	8.54	11.54	16.18	20.86
\$50,000 - Plus	6.25	9.98	13.33	18.53	23.80

Example Estimation of Trip Productions

Year	Trip Rate (Trips per Household)	Number of Households	Trip Productions
2002	15.55	39	606
2025	15.55	122	1,897

Table 8

Trip rate and number of households for Household Size 4, Household Income Range \$20,000 - to-\$34,999 per year for TAZ 179 Source: TTI analysis

WORK PLACE AND SPECIAL GENERATOR SURVEYS

The primary purpose of the work place and special generator surveys is to understand the trip attraction characteristics of basic, retail, and service work places and the trip attraction characteristics of two special generators, the Laredo International Airport and the Greyhound Bus Terminal. This data is used in the trip generation step of the travel demand model to estimate work place trip attraction rates by trip purpose. The Laredo International Airport and the Greyhound Bus Terminal were surveyed separately as these work places were expected to attract a significantly higher number of trips per basic employee than for typical basic employment work place establishments. A second product of the work place survey is an average trip length and trip length frequency distribution for each trip purpose. This data is used in the trip distribution step of the travel model to estimate to which attraction zone each trip produced will be attracted.

The work place survey consisted of two parts. The first part was to collect information on a sample of work place establishments by employment type (basic, retail, service) that were free and non-free standing and by the area type (central business district, central business district fringe, suburban, industrial, rural), where the work place was located, and the number of employees at the work place. For the travel demand model, Laredo/ Webb County was divided into small geographic areas called

Example of Non-Free Standing Business Establishments



Figure 24

Source: TTI Photo

zones and each zone was classified by area type. Work place attraction rates were estimated for each cross classification of employment and area type. Work place locations (employment types) were classified as: basic (mining, construction, manufacturing); and retail and service (finance, insurance, real estate, education, government) as the trip attraction characteristics (attraction rates) by employment type are similar for work places with the same employment type. Attraction rates for work places within the same area type are more similar than for work places in different area types.

The second part of the work place survey was to select a random sample of work places and collect detailed data for each work place in the sample. Five separate surveys were performed for each work place selected. The first survey was a general survey of the establishment to determine if it was free or non-free standing, the number of employees, amount of parking, number of daily deliveries, hours of operation, etc. For the second survey, employees of the establishment were asked to keep a diary of all their trips for a 24-hour period. For the third survey, some of the visitors to the establishment were interviewed to determine their trip making activity. For the fourth survey a sample of drivers of commercial vehicles making deliveries or picking up goods from the establishment were interviewed to determine their trip making activity. And, for the fifth survey, a count was made of all persons and private vehicles, all commercial vehicles, and all pedestrians visiting the establishment. This last survey was used to establish expansion factors for the third and fourth surveys.

WORK PLACE TRAVEL CHARACTERISTICS

One purpose of the work place survey is to understand the trip attracting characteristics of work places as a function of the work place employment type, the area type, and the trip pur-

pose. On average, retail work place types attract more trips per employee than do service work place types and service work place types attract more trips per employee than do basic work place types. The area type is a measure of urban density and the attracting power per employee of a particular work place type varies with the urban density. The work place travel survey accounts for all persons attracted to a work place regardless of mode of travel.

Figure 25 shows the location of the work places surveyed and the area type geographic boundaries. Trip attraction rates were estimated for each combination of trip purpose, employment type, and area type.

Work Place Survey Locations and Area Type Boundaries

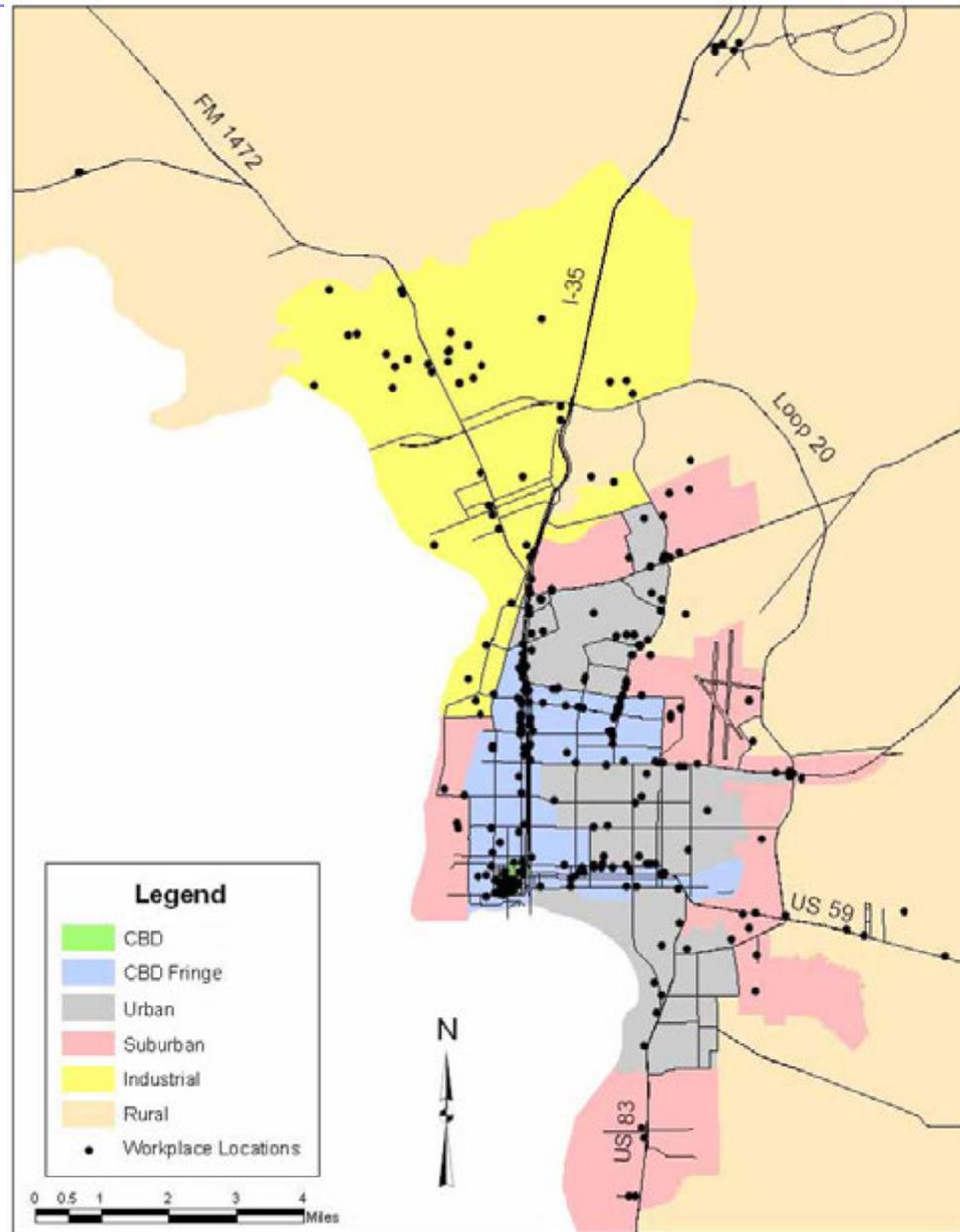


Figure 25

Source: TTI
Graphic

Table 10

Source: Laredo Travel Survey and TTI analysis

HBW Person Trip Attractions per Employee

Area Type	Employment Type		
	Basic	Retail	Service
CBD	1.28	1.80	1.40
Urban	1.79	1.93	1.56
Suburban	1.23	3.67	1.55
Rural	1.88	1.98	1.08
Average	1.65	2.20	1.53

Table 11

Source: Laredo Travel Survey and TTI analysis

HBNW Person Trip Attractions per Employee

Area Type	Employment Type		
	Basic	Retail	Service
CBD	0.86	3.93	2.75
Urban	0.36	9.48	5.34
Suburban	0.49	13.42	8.67
Rural	0.51	6.05	6.24
Average	0.43	9.11	6.14

Trip Attractions

From the work place survey, the number of trips attracted by trip purpose is divided by the number of employees at the work places within a given area type to estimate the trip attraction rate per employee. Tables 10 through 12 show person trip attraction rates per employee by trip purpose, by employment type, and by area type.

The following example illustrates how these attraction rates are used to forecast future travel demand. First, it is assumed that trips attraction rates do not change over time. Therefore, the trip attraction rates estimated from the 2002 work place survey are the trip attraction rates used to forecast travel for 2025. Second, the number of employees by employment type and area type are forecast for 2025 for each TAZ in the study area. Third, the number of forecast employees for an employment type and area type cell is multiplied by the attraction trip rate for that cell to estimate the number of trips attracted to work places in the TAZ for 2025. Table 13 shows an example of these calculations for one TAZ for one trip purpose.

NHB Person Trip Attractions per Employee

Area Type	Employment Type		
	Basic	Retail	Service
CBD	5.52	3.55	1.27
Urban	1.08	4.61	2.72
Suburban	0.91	4.46	1.93
Rural	0.99	7.47	3.08
Average	1.45	4.46	2.37

Table 12

Source: Laredo Travel Survey and TTI analysis

	2002	2025
Trips per Basic Employee	0.36	0.36
Number of Basic Employees	25	40
Basic Trip Attractions	9	14
Trips per Retail Employee	9.48	9.48
Number of Retail Employees	147	301
Retail Trip Attractions	1,393	2,853
Trips per Service Employee	5.34	5.34
Number of Service Employees	79	90
Service Trip Attractions	422	481
Total Trip Attractions	1,824	3,348

Example Estimation of HBNW Person Trip Attractions

Table 13

(Area Type Urban, Zone 135)
Source: TTI analysis

Trip Lengths

Trip lengths vary by trip purpose with the home-to-work trip purpose having the longest average trip length. The average trip lengths and the trip length frequency distributions by trip purpose are estimated from both the household survey and the work place survey. The surveyed average trip lengths and the trip length frequency distributions are used to calibrate the trip distribution step of the travel demand model. The trip distribution model is calibrated so that the modeled average trip length and trip length frequency distributions agree with the average

trip length and trip length frequency distributions estimated from the travel surveys. Over time, as an urban area grows larger in area, the average trip length for the HBW trip purpose tends to increase and average trip length for HBNW trip purpose tends to remain stable. For the HBNW trip purposes, which are largely shopping and school trips, the marketplace will provide new destination opportunities, new retail, and new schools as the urban area grows. Table 14 shows the average trip length by trip purpose and Figure 26 shows the person trip, trip length frequency distribution estimated from the survey.

Table 14

Source: TTI analysis

Average Trip Length by Trip Purpose

Trip Purpose/ Type	Person Trips		Vehicle Trips	
	Average Trip Length		Average Trip Length	
	Minutes	Miles	Minutes	Miles
HBW	8.2	4.5	8.2	4.6
HBNW	6.3	3.4	6.4	3.4
NHB Attractions	6.1	3.4	6.3	3.4
Non-Resident	5.6	3.5	6	3.8

Person Trip Length Frequency Distribution

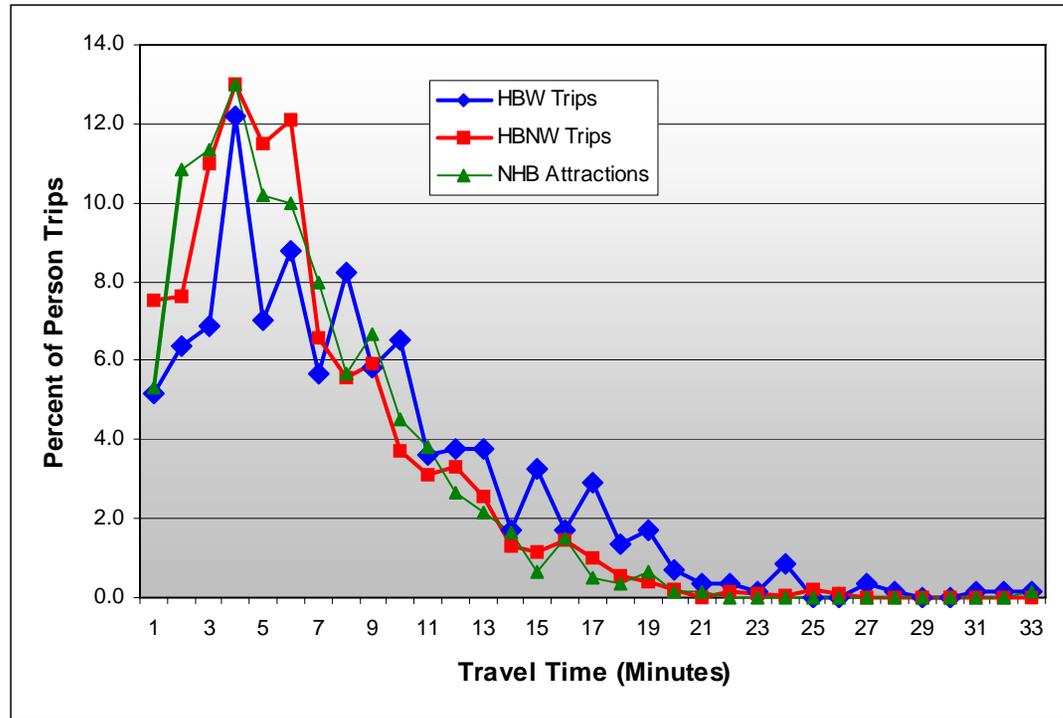


Figure 26

Source: TTI analysis

Special Generators

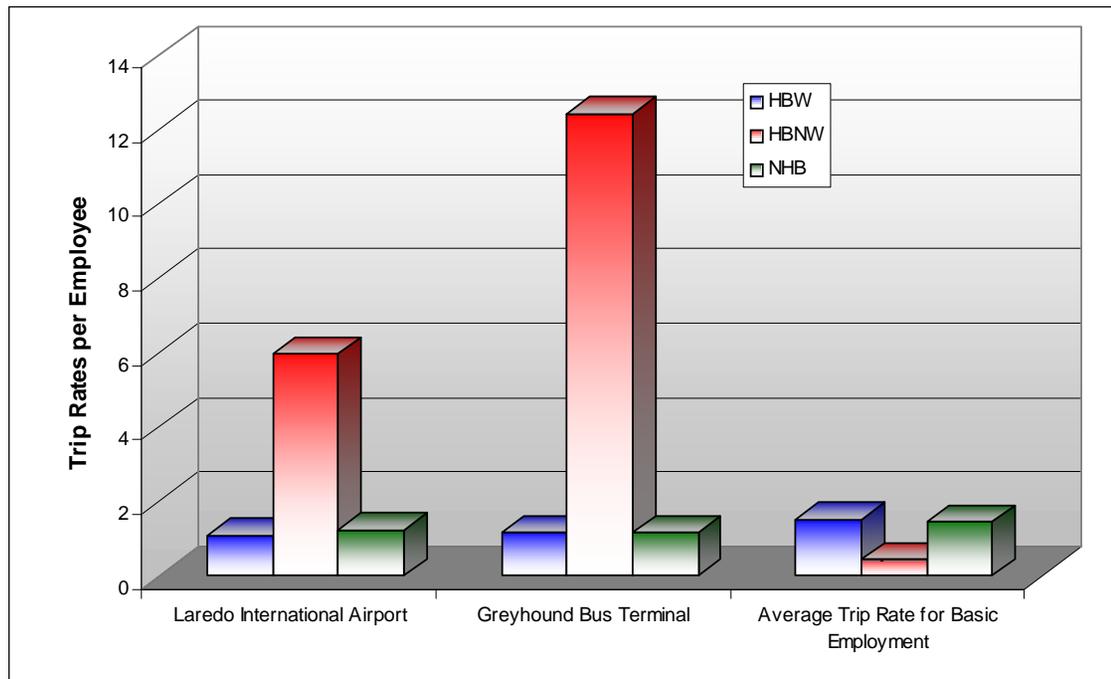
The Laredo International Airport and the Greyhound Bus Terminal were treated as special generators rather than being included among other work places in the basic employment type. It was thought that the number of trips attracted per employee would be considerably greater than for these two work places than for other basic work places. Transportation is classified as basic employment. As Figure 26 shows, this was the case for the HBNW trip purpose. Trips rates per employee

by trip purpose were estimated from the survey data. Figure 27 shows the HBNW trip rate per employee for the airport and the bus terminal and the average trip rate for the basic employment type. Several techniques may be used for forecasting future trips for special generators. For airports, typically the airport's enplanements are related to the number of airport employees which is then related to the number of trips attracted per airport employee for each trip purpose. Forecast airport trip attractions, therefore, are based on the airport's forecast enplanements.

Figure 27

Source: Laredo
Travel Survey

Trip Rates per Employee for the Laredo International Airport, the Greyhound Bus Station, and the Average Trip Rate for Basic Employment



TRAVEL INTO, OUT OF, AND THROUGH THE REGION

The primary purpose of the external station survey is to understand the trip making characteristics of trips entering or leaving the study area. These trips are subsequently divided between trips passing through the study area (external-through trips) and trips by persons coming into the study area to conduct activities within the study area (external-local trips).

External stations are locations where trips enter and leave the study area. Therefore external stations are locations where a transportation facility crosses the study area boundary. For the external station survey locations, Webb County was used for the study area boundary. There were 14 external station locations including four international bridges. Twelve of the 14 external locations were surveyed. At most of the external station locations, vehicles headed in the outbound direction were randomly selected and the drivers interviewed to determine the time, the number of persons in the vehicle, the location of the last place they got into their vehicle, the purpose of the activity, and the time of the activity at that location. Drivers also were asked the purpose of the trip and the next destination, whether the driver lived in Laredo/Webb County, and, if visiting, the number of nights the driver stayed in Laredo/Webb County. Finally, the driver was asked to provide a list of locations visited in Laredo/Webb County before departing the study area. The four international bridges were surveyed in the inbound direction. Separate survey instruments were used for private and commercial vehicles interviewed at external stations.

On a typical weekday, a large number of vehicles travel into and out of Laredo/Webb County. Most of this travel is external-local travel, that is, vehicles coming into the county or leaving

Daily Two-Way External-Local Trips

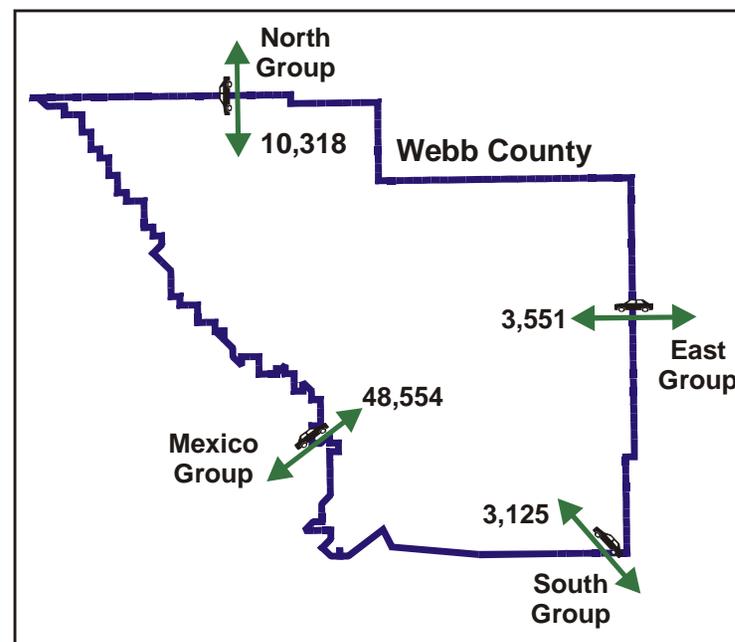


Figure 28

Source: TTI
Graphic

the county on a daily basis.

Figure 28 shows the daily external-local trip volumes. The trip volumes shown in Figure 28 are the two-way, 24-hour vehicle trips between Laredo/Webb County and Mexico (74 percent of the trips) and between Laredo/Webb County and San Antonio or Eagle Pass (16 percent of the trips). The figure additionally shows the two-way, 24-hour vehicle trips between Laredo/Webb County and Freer or Corpus Christi (5 percent of the trips), and trips between Laredo/Webb County and the Lower Valley (5 percent of the trips).

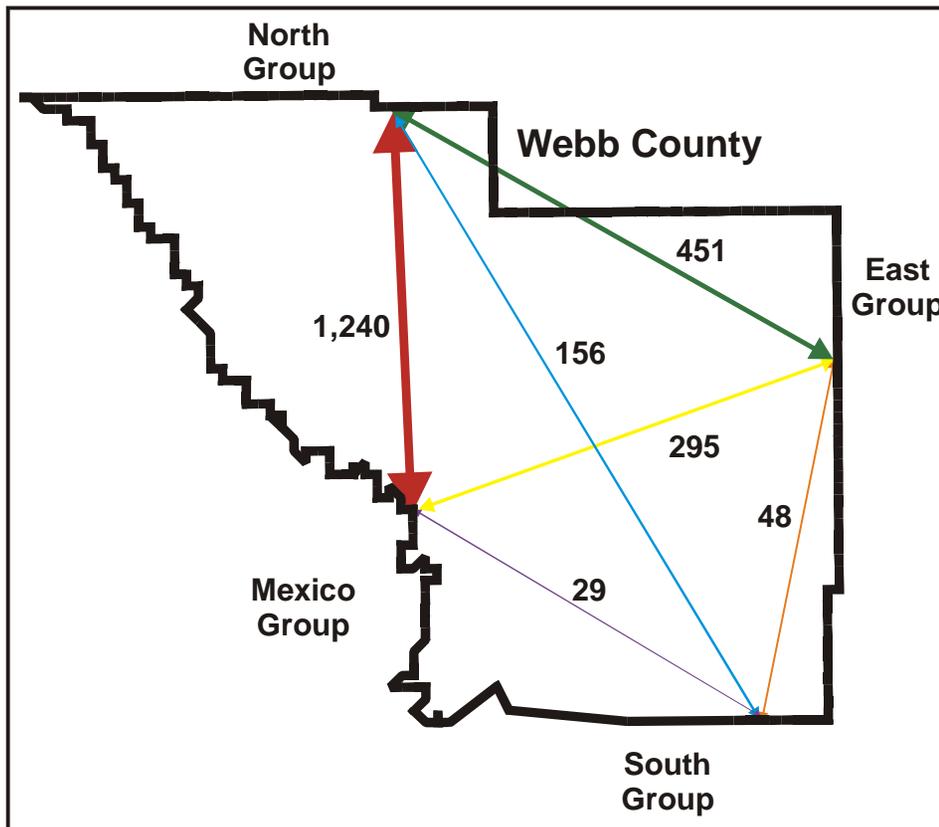
Figure 29 shows the external through trips. The volumes shown

in Figure 29 are the two-way trip volumes between Laredo/ Webb County and San Antonio or Eagle Pass (56 percent of the trips), and between Webb County and the adjacent counties. Only one percent of the trips interchange between the International border and the Lower Valley.

Figure 29

Source: TTI
Graphic

Daily Two-Way External-Through Trips



TRAVEL BY COMMERCIAL VEHICLES

The primary purpose of the commercial vehicle survey is to understand the trip making characteristics of commercial vehicles operating in Laredo/Webb County. In the travel demand model, trips made by commercial vehicles are modeled separately from trips made by privately owned vehicles. The commercial vehicle survey is concerned with internal commercial vehicle trips, trips made within the study area boundary. Commercial vehicle trips that are coming into or departing the study area boundary are surveyed as a part of the external station survey. The data are used in the trip generation step of the travel demand model to estimate trip rates for commercial vehicle trips.

A sample of vehicles was randomly selected from motor carrier and vehicle registration databases. A commercial vehicle was defined as any vehicle having six or more tires, a gross vehicle weight of over 8,500 pounds, and used for commercial purposes. The firms operating the selected vehicles were contacted and asked to participate in the survey. The drivers of the vehicle were asked to keep a 24-hour diary of the locations of all trips made by the vehicle. A variety of questions were asked about the vehicle, the cargo, the trip purpose, etc. The questions of primary concern for estimating commercial vehicle trip rates were the location and time of each stop from when the driver of the vehicle started his or her daily activities until the driver of the vehicle completed his or her daily activities. A total of 524 vehicle diaries were obtained from 196 participating firms.

In addition to the commercial vehicle diary surveys, 99 vehicle classification counts were performed at randomly selected locations that included freeways, arterial streets, collector streets, and local streets. The application for this classification data is explained in the next paragraph.

The number of commercial vehicles in Webb County cannot be determined reliably from vehicle registration data due to the presence of commercial vehicles registered in Mexico, vehicles registered in other Texas counties, and vehicles registered in other states. To calculate an expansion factor for the commercial vehicle survey, the following procedure was used. The

Typical Commercial Vehicle Survey Traffic Control Plan



Figure 30

Source: TTI Photo

annual average daily traffic by roadway functional classification for Webb County was obtained from TxDOT's Highway Performance Monitoring System data. The annual average daily traffic data was used with vehicle classification count data to estimate the daily number of vehicle miles of travel (VMT) for commercial vehicles by roadway functional classification. This estimate was used to expand the daily VMT for the commercial vehicles in the survey.

The commercial vehicle trip purpose in the travel demand model is for commercial vehicles making internal study area trips. External through and external local commercial vehicle trips are modeled as a part of those trip purposes. Therefore, the daily VMT for commercial vehicles making external through and external local trips (436,209 miles) estimated from the external station survey were subtracted from the total commercial VMT to estimate the commercial VMT for internal trips (297,692 VMT).

Table 15 shows the total commercial VMT and the total vehicles miles of travel by roadway functional classification

estimated for Webb County. The proportion of commercial vehicles on the freeway and arterial street systems is unusually high. This observation will be of no surprise to those who regularly drive on the streets of Laredo.

The survey demonstrated that on a typical weekday, an estimated 10,324 commercial vehicles, trucks with a gross vehicle weight of greater than 8,500 pounds, operate on Webb County roadways. This compares with 1,499 trucks with a gross vehicle weight greater than 8,500 pounds registered in Webb County.

TRAVEL TIME AND DELAY

The primary purpose of the travel time and delay survey was to collect travel time data to estimate average speeds during peak and off-peak periods for roadways in Laredo/Webb County. The data were collected by the roadway functional classification (freeway, arterial, collector, local, and frontage) and by the area type (central business district, central business district fringe, suburban, industrial, and rural) where the roadway is located.

Table 15

Webb County VMT and Commercial VMT

Functional Classification	Total VMT	Percent Commercial VMT	Commercial VMT*
Freeway	731,235	51.12	373,807
Arterial	1,819,465	15.29	278,196
Collector	448,046	9.29	41,623
Local	547,963	7.35	40,275
Total	3,546,708	20.6	733,901

* Commercial vehicle VMT for internal trips.
Sources: Webb County HPMS data for 2002; Laredo Travel Survey Classification Count data for 2002; Laredo External Station Survey

In the travel demand model, the minimum travel time path and the freeflow travel time between any two TAZs is a function of the functional classifications, the number of lanes, the area types, and the freeflow speeds of the roadway links that comprise the minimum travel time path. The travel time and delay survey is used to establish within the travel demand model the freeflow speed and capacity for each roadway link in the study area as a function of the roadway's functional classification, number of lanes, and area type for the peak and off-peak time periods.

The zone-to-zone travel times are used in the trip distribution step of the travel demand model, together with the number of trips produced and attracted by each zone from the trip generation step, to estimate all the trip interchanges for the study area. The zone-to-zone travel times are also used in the trip assignment step of the travel demand model to assign trips to each roadway link in the study area. Consequently, the travel time and delay surveys are critical for the calibration and validation of the trip distribution and trip assignment steps in the travel demand model.

For the travel time and delay survey a vehicle equipped with a Global Positioning Satellite (GPS) receiver and a laptop computer was driven both directions on five different routes during peak and off-peak periods. The routes were designed so that all roadway functional classifications and all roadway area types were sampled in both the peak and off-peak periods. The routes were subdivided into segments with the functional classification and the area type defined for each segment. Travel times, distance, and average speeds were calculated for each segment. For each of the five routes, three runs were made in each direction during the peak and off-peak periods, that is, there were three replicates for each route and time period combination. Average speeds were calculated for each functional class

and area type cross classification for peak and off-peak periods for each route, for all routes combined, and for all routes and time periods combined.

Speeds are cross classified by the area type where the roadway link is located and the roadway link functional classification. The area type reflects the density of the land use adjacent to the roadway link. In general, as the density of the land use adjacent to a roadway increases, the speed and capacity of the roadway is reduced due to the increased number of traffic control devices, intersections, curb cuts, and turning movements. Tables 16 and 17 summarize the results of the time and delay survey. The peak periods were defined as 7-9 a.m. and 4-6 p.m. and the off-peak periods were defined as 9 a.m. to 12 noon and 1-4 p.m. All data was collected between 7 a.m. and 6 p.m. Table 18 shows the range of speeds limits for each functional class and area type cross classification.

The average peak and off-peak speeds in Tables 16 and 17 are similar. This indicates that in 2002, traffic congestion was not appreciably different between the peak and off peak hours and, therefore, there is not a need to develop a time-of-day travel demand model for Laredo. A comparison of Tables 16 and 17 with Table 16 shows that peak and off peak traffic is moving at speeds less than the posted speed limit for most area type/functional class cross classifications. Laredo experiences congestion on all roadways with the possible exception of rural roadways and the congestion is most severe for the arterial, and collector functional classifications. The lower speed on local roadways is due to the traffic calming devices in residential neighborhoods. These findings will be of no surprise to those motorists who frequently drive in Laredo.

Table 16

Source: Laredo Travel Time and Delay Survey

Peak Period Average Speeds

	Frontage	Freeway	Arterial	Collector	Local
CBD	N/A	N/A	16.6	17.1	8.4
CBD Fringe	36.2	60.1	20.5	19.1	24.9
Urban	N/A	61.1	29.5	22.7	18.6
Suburban	54.8	57.4	41.3	19.1	17.7
Industrial	39.3	55.1	30.3	29.7	26.1
Rural	N/A	N/A	40.2	N/A	N/A

Table 17

Source: Laredo Travel Time and Delay Survey

Off-Peak Period Average Speeds

	Frontage	Freeway	Arterial	Collector	Local
CBD	N/A	N/A	14.8	13.3	8.9
CBD Fringe	39.0	60.6	19.2	21.1	27.1
Urban	N/A	61.7	32.6	23.6	18.8
Suburban	53.4	58.0	42.7	21.1	19.2
Industrial	43.7	54.1	36.5	31.2	25.3
Rural	N/A	N/A	N/A	N/A	N/A

Laredo Posted Speed Limits

	Frontage	Freeway	Arterial	Collector	Local
CBD	N/A	N/A	30	30	30
CBD Fringe	30	65	30-35	30	30
Urban	N/A	65	30-45	30	30
Suburban	45	65	35-50	30	30
Industrial	45	65	30-45	35	30
Rural	N/A	N/A	30-45	N/A	N/A

Table 18

Source: Laredo Travel Time and Delay Survey

FINDINGS AND CONCLUSIONS

AN EVALUATION AND ANALYSIS TOOL

The five travel surveys conducted in 2002 and 2003 provide the household, work place, and commercial vehicle travel behavior information needed to estimate, calibrate, and validate a travel demand model that can be used as a transportation analysis tool for planning improvements to the City of Laredo and Webb County transportation systems for the next 20 years. The travel demand model is the preferred tool for supporting analysis and evaluation of proposed transportation alternatives within the transportation planning process. Given the population growth rate, nearly twice the state of Texas growth rate, and the travel growth rate, which is even higher than the population growth rate, TxDOT, the City of Laredo, and Webb County will need to plan, design, construct, and operate a significant amount of additional transportation capacity during the next 20 years. This

is needed to maintain a desired level of mobility within the city and the county. The travel surveys are one of several components needed for an effective transportation planning process.

GROWTH IN TRAVEL

Daily VMT per person increased from 9.5 in 1982 to 14.5 in 2002, an increase of 53 percent. The population of the City of Laredo increased from 95,000 in 1982 to 190,000 in 2002, an increase of 100 percent. The daily VMT in 2002 was 2,760,000. The forecast 2025 population for the City of Laredo is 386,000 (projection scenario 0.5). This implies a daily VMT in 2025 of 5,600,000 with no increase in the VMT per person. Assuming an increase in VMT per person of one-half the rate of increase from 1982 to 2002 to 18.3 by 2025, a reasonable but conservation assumption, the daily VMT in 2025 will be about

7,100,000. This is almost a three-fold increase in VMT during the next 20 years. By 2025 the City of Laredo will be approaching the daily traffic volume of Corpus Christi in 2002.

HOUSEHOLD CHARACTERISTICS AND TRAVEL BEHAVIOR

Persons commuting to work in the City of Laredo use carpools and public transportation more than the average commuter in Texas. In the City of Laredo, 12 percent of the households do not have a vehicle available compared to 7 percent of the households in Texas. As household income increases, the percentage of zero-vehicle households will decrease and travel per household will increase. The average household size in the City of Laredo is 3.75 compared to 2.74 for Texas. Urban travel is more closely correlated with household size than to population. If the average household size in the City of Laredo decreases, travel rates per household will increase.

HOUSEHOLD TRIP PRODUCTIONS

The trip rates in the City of Laredo are, for any combination of household size and household income group, different than the trip rates for other small Texas urban areas. Trips per household are a product of the trip rate, for a given household size and income group, and the number of households in that household size and income group. The average household size in Laredo is higher than for other small Texas urban areas and the median household income is less. The household size effect is greater than the income effect with the result that average trips per household are higher in the City of Laredo than for other small urban areas. In time, if Laredo follows the pattern of other urban areas, as household income increases, average household size will decrease, and the trip rates for a given household size and income group will increase modestly.

EXTERNAL-LOCAL AND EXTERNAL-THROUGH TRAVEL

External-local travel to and from Webb County and the City of Laredo is dominated by traffic coming from and to Mexico. This traffic accounts for 74 percent of the external-local travel followed by traffic coming from the direction of or going to the direction of San Antonio, with 16 percent of the travel. Travel coming from or going to the Lower Texas Valley is less than 5 percent of the external-local travel. Similarly, external-through travel is dominated by travel coming from or going to Mexico from the direction of San Antonio, with 56 percent of the external-through travel.

COMMERCIAL VEHICLE TRAVEL

Traffic in the City of Laredo and Webb County is dominated by commercial vehicles. Commercial vehicles account for 19 percent of the daily vehicle miles of travel in Laredo and Webb County. Over 52 percent of this traffic is on the freeway system. This is the highest 24-hour truck percentage observed for any Texas county. The 15 percent arterial roadway truck percentage is 50 percent higher than the typical arterial truck percentage of 10 percent. This finding is no surprise to anyone who drives the streets of Laredo.

TRAVEL SPEED AND DELAY

The travel time and speed survey found very little difference between the average peak and off-peak speeds within the City of Laredo. This finding does not mean there is little if any congestion. Rather, it means there is congestion and the congestion is relatively uniform throughout the workday. Average speeds were less than the posted speed limits regardless of the area type. Area type is a measure of the urban density.

GLOSSARY AND TERMINOLOGY

Within the context of travel surveys, there are a number of terms used that may cause confusion. These terms are defined as follows.

Person Trip: A person trip is the movement of an individual from one location to another location. In the 2002 Laredo Household Survey, these trips were recorded for persons five years of age or older in a surveyed household.

Auto Driver Trip: An auto driver trip is the movement of a vehicle from one location to another location. These trips are recorded for the person driving the vehicle. These may also be referred to as “vehicle” trips.

Trip Purpose: This is the purpose of the trip being made by an individual. It is stated in terms of the purpose at the location the trip began and the purpose at the location the trip ended. For example, a trip that began at home and ended at work would be referred to as a home-based work (HBW) trip. There were 11 purposes identified and used in the Laredo Household Survey.

Trip Activity: This is the activity the individual did at the location the trip began and/or the location the trip ended. There were 20 activities used in the Laredo Household Survey. These activities were recorded in the survey and post processed to identify the purpose associated with the activity.

Vehicle Availability: This term refers to the vehicles available to members of a household for travel.

Vehicle Occupancy: The number of occupants in a vehicle during a vehicle trip. This number includes the driver of the vehicle.

Mode of Travel: This is the physical means used to make a trip. The modes recorded in the Laredo Household Survey included walk, vehicle driver, vehicle passenger, carpool driver, carpool passenger, vanpool driver, vanpool passenger, commercial vehicle driver, commercial vehicle passenger, public transportation, school bus, taxi/paid limo, bicycle, motorcycle/moped, and other.

Home-Based Work (HBW) Trip: A trip which has one end at home and the other at work. It is non-directional in terms of the activity/purpose, i.e., a trip from home to work or from work to home is still defined as a HBW trip.

Home Based Non Work (HBNW) Trip: A trip which has one end at home and the other at a location other than the work location. It is non-directional in terms of the activity/purpose.

Non Home Based (NHB) Trip: A trip which has neither end at home.

Productions: The number of trips that are produced by members of a household. These are computed by purpose and mode of travel. Production rates refer to the number of trip productions divided by the number of households.

Attractions: The number of trips that are attracted to a location. These are computed by purpose and mode of travel for different land use categories.

Linked Trips: Trips are linked (i.e., combined) into a single trip that reflects what is perceived to be the true purpose of the trip. Only trips that involve a serve passenger or change mode of travel between home and work (or vice-versa) are considered for linking. For example, a person driving a child to a day care center (or school) and then proceeding on to work would have made two unlinked trips, a HBNW trip and a NHB trip. These two trips would be “linked” to create one trip, a HBW trip.

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