

TEXAS DEPARTMENT OF TRANSPORTATION

EXECUTIVE SUMMARY



2005 • 2006 • 2007 • 2008 • 2009 • 2010

Lubbock Travel Surveys

Lubbock County

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ACKNOWLEDGEMENTS

This report provides a summary of the travel surveys conducted during the period between 2005 and 2010 in the Lubbock Metropolitan Planning Organization (MPO) study area. Details of these surveys are provided in the following separate technical reports which are available for viewing through the Lubbock MPO and the TxDOT Transportation Planning and Programming Division.

- 2005 Lubbock Commercial Vehicle Survey Technical Summary, authored by Stella Amor Nepal, Stephen P. Farnsworth, and David Pearson, Texas Transportation Institute, October 2007.
- 2005 Lubbock External Survey Technical Summary, authored by Stephen P. Farnsworth, Texas Transportation Institute, April 2006.
- 2006-2007 Lubbock MPO Household Travel Survey Technical Summary, authored by Debbie Spillane and David F. Pearson, Texas Transportation Institute, April 2012.
- 2010 Lubbock Work Place Travel Survey Technical Summary, authored by Stella Amor F. Nepal and David F. Pearson, March 2012.
- Memo-Lubbock Work Place 2010 Travel Survey Data, authored by Stella Nepal and David F. Pearson, Texas Transportation Institute, January 2012.
- Amarillo Lubbock Workplace Survey Final Report (draft), authored by Alliance Transportation Group, Inc., January 2011.

The factual contents of this report were taken from the above summary reports and the contributions of the authors of these reports are acknowledged. Other factual sources are referenced in the report. The authors are responsible for the opinions, findings, and conclusions. There were a number of individuals who extended technical support and assistance during the preparation of this report. Special thanks are due to Gary Lobaugh, Patti Ellis, and Dennis Perkinson of the Texas A&M Transportation Institute. The authors would also like to thank Charlie Hall, TxDOT Travel Survey Program Manager, and the Department for its continuing program to collect and analyze urban travel data to support travel demand modeling.

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Sponsored by the Lubbock Metropolitan Planning Organization (MPO) in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA)

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View of downtown Lubbock, Texas

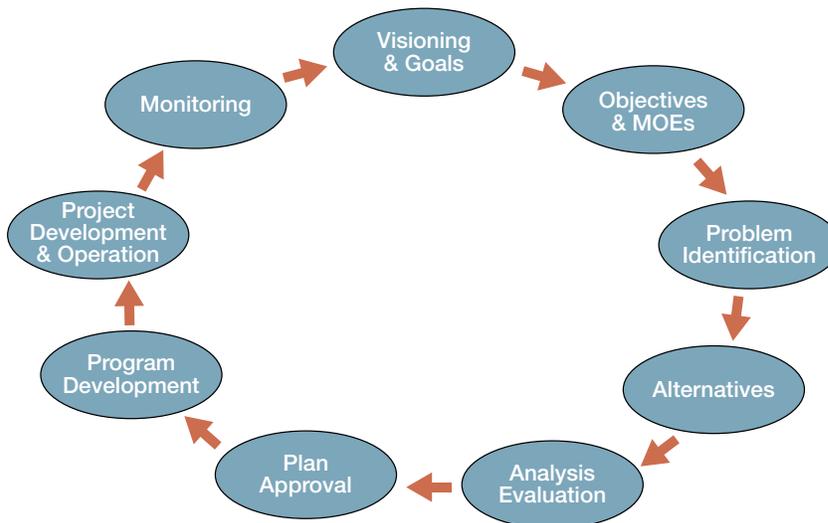
INTRODUCTION

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 conducting the process. Subsequent federal acts strengthened the transportation planning process and the role of the MPO. The key elements of the metropolitan transportation planning process are shown in Figure 1.

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The metropolitan transportation planning process is based on the Federal-Aid Highway Acts of 1962 and 1973.

Figure 1. Key Elements of the Planning Process.



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



Travel surveys are required to support travel demand model estimation, calibration, and validation for the model's base year.

Where do travel surveys fit into this process? Data collected from travel surveys serve as vital input to travel demand models. Most MPOs use a travel demand model to forecast the demand for transportation and capacity needs and to evaluate how proposed alternative transportation systems will perform. This analysis is used to support the development of a long-range transportation plan and short-range transportation improvement program that are adopted by an MPO's 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 four 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. 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 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.

During the period between 2005 and 2010, the Transportation Planning and Programming Division (TPP) of TxDOT funded a comprehensive set of travel surveys in the Lubbock MPO study area. Four types of travel surveys were conducted to collect information on different aspects of travel and trip-making in the Lubbock MPO study area. These included the following:

- A household travel survey to collect information on amounts, origins, and destinations of resident travel within the area.
- A work place survey (including special generators) to collect information on the number and types of trips attracted to basic, retail, service, and education establishments.
- An external survey to collect information on travel coming into, going out of, or passing through the study area.
- A commercial vehicle survey to collect information on travel made by commercial vehicles operating within the study area.

Transportation Statistics

Persons commuting to work in the Lubbock MPO study area primarily drive alone or use carpools (Table 2). In Lubbock County, there is limited use of public transportation (even lower than the average for the state of Texas). Part of the reason for this modest use of public transportation is that the percentage of households with a vehicle available in the Lubbock MPO study area is over 96 percent.

Table 2. Mode of Commuting to Work, 2007.

Mode of Commuting to Work	Lubbock County	Texas
Drive Alone	81.16	78.88
Carpool	11.66	12.19
Public Transportation	0.70	1.69
Walk	2.64	1.76
Work at Home	2.78	3.61
Other	1.06	1.87
Total	100.00	100.00

Source: U.S. Census Bureau, 2007 American Community Survey (ACS).

The population and daily vehicle miles of travel (VMT) estimates and projection for the Lubbock MPO study area are shown in Table 3. The daily VMT is projected to increase by around 29.1 percent, but the daily VMT per person is estimated to remain fairly constant being 2.06 vehicle miles per person in 2035. This relatively low rate may partially be a reflection of the fact that Texas Tech is located in Lubbock and many students may walk rather than travel by vehicle.

Table 3. Population and Vehicle Miles Traveled Data.

Year	Population of Lubbock County	Daily Vehicle Miles of Travel (1,000)	Daily Vehicle Miles of Travel per Person
2007	269,032	571.1	2.12
2030	337,364	701.0	2.08
2035	351,864	737.5	2.06

Source of 2007 Daily Vehicle Miles of Travel: Appendix E. of *Development of Regional On-Road Mobile Source, 1999 through 2030 Emissions Trends-Executive Summary*, Texas Transportation Institute, July 2011.

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 trips made through the study area (external-through trips). The household survey collected information and data on internal trips.



Persons commuting to work in the Lubbock MPO study area primarily drive alone or use carpools.

HOUSEHOLD SURVEY

The primary purpose of the household survey is to understand the travel patterns of households as a function of their characteristics such as household size, number of persons employed, income, vehicles available, and trip purpose. The data obtained from the survey are used in the trip generation step of the travel demand model to estimate trip production rates by trip purpose. The average travel distances and trip length frequency distributions for each trip purpose are then estimated, and along with the number of productions and attractions are used in the trip distribution step of the travel demand model to estimate the attraction end for each trip produced (see the Glossary and Terminology section of this report for an explanation of terms).

Household Characteristics

Households that participated in the survey were randomly selected and were asked to record in a diary the trips made by each person in the household 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 characteristics that are closely correlated with household travel such as the number and age of persons in the household, number of members employed, income, and the number of vehicles available to the household.

The Lubbock MPO study area household survey included 1,506 randomly-selected households from within the study area. The joint distribution of household size and income characteristics from the 2000 U.S. Census and the Texas State Data Center (TSDC) population projections for the study area were used to expand the household survey data. The results presented in this section are based on expanded survey data.

Household Size and Income

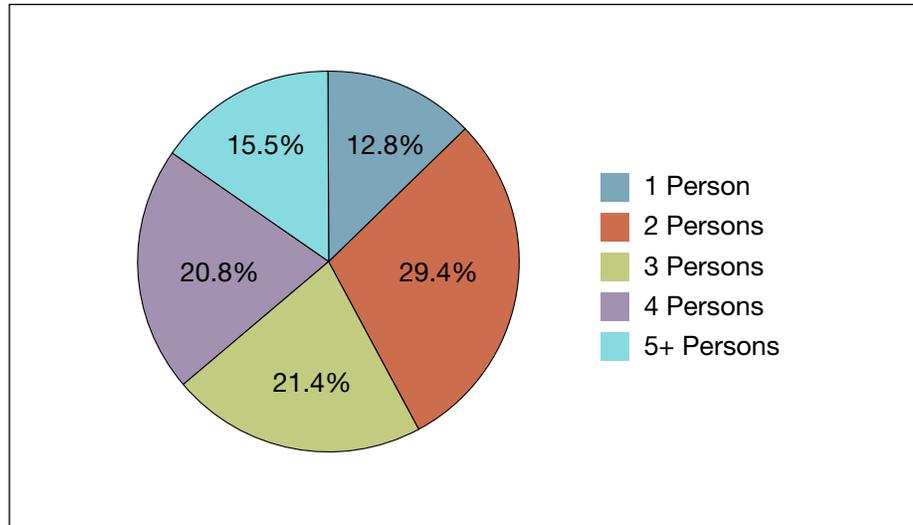
Household size and income are used in the travel demand model for estimating and forecasting travel. In general, as household size increases, daily household travel increases. Similarly, when household income increases, daily household travel increases. By controlling for these two household characteristics, future travel demand can be estimated with greater accuracy. The average household size in the Lubbock MPO study area in 2006-2007 was 2.76. This value is essentially identical to the average of 2.8 persons per household for the state of Texas that is listed as the 2007 ACS estimate. The distributions of households by household size and household income in the study area from 2006-2007 are shown in Figures 3 and 4. Nearly 13 percent of the households have a household size of one, and about 29 percent have a household size of two. Fewer than 38 percent of households have an annual household income greater than \$50,000.



The Lubbock MPO study area household survey included 1,506 randomly-selected households from within the study area.

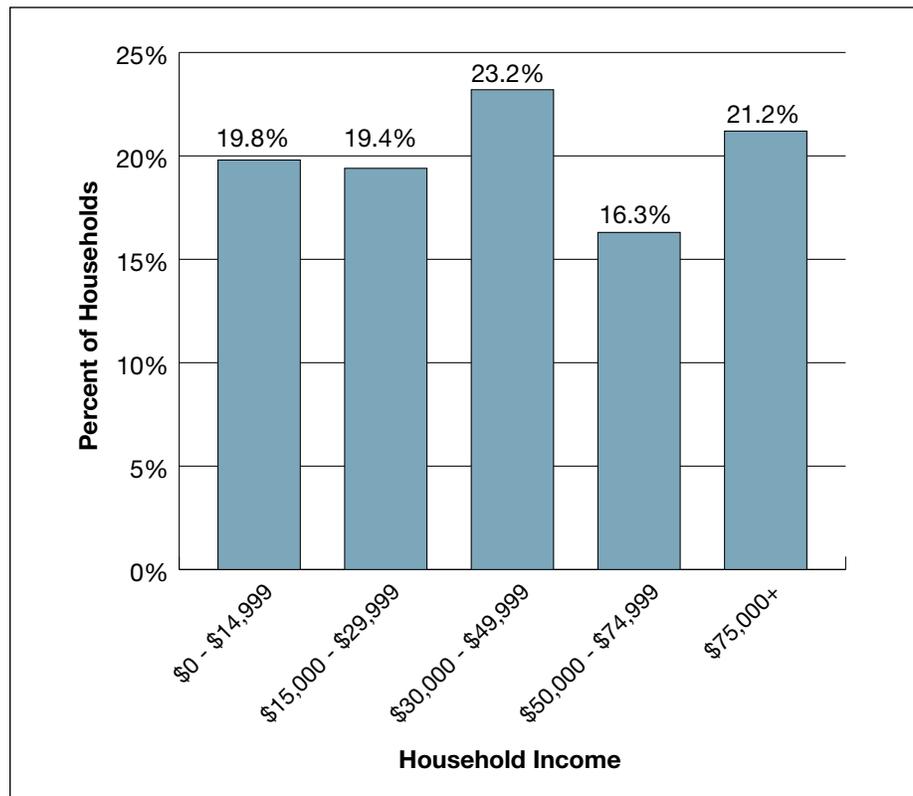


Figure 3. Distribution of Households by Household Size.



Household demand for public transportation tends to decrease as vehicle availability to the household increases.

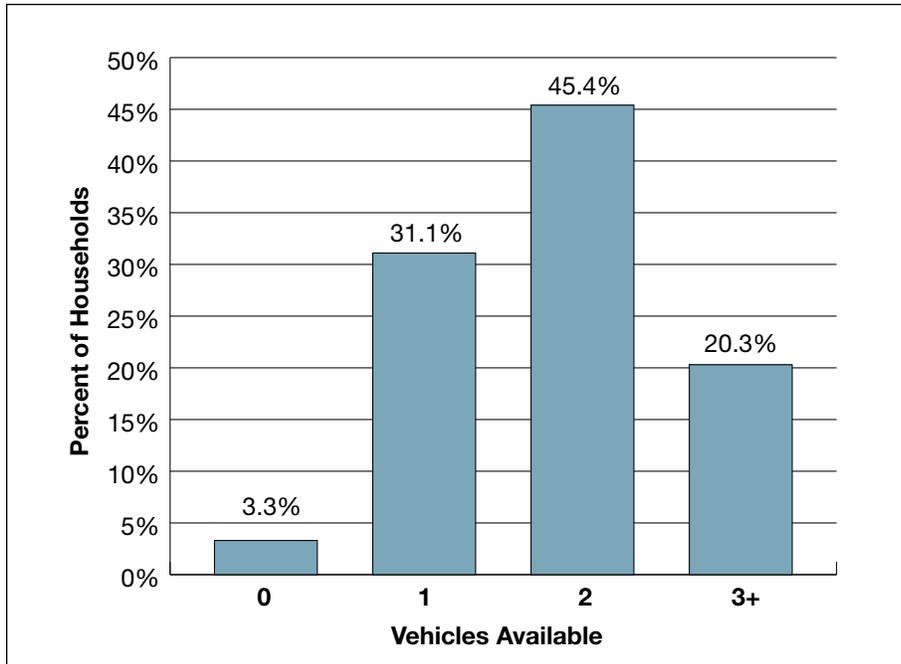
Figure 4. Distribution of Households by Household Income.



Vehicles Available

Generally, daily household travel also increases as the number of vehicles available to the household increases. Household demand for public transportation tends to decrease as vehicle availability to the household increases. The distribution of households by number of vehicles available is shown in Figure 5. Just over three percent of households in the study area do not have a vehicle available, and slightly more than 31 percent of the households have only one vehicle available. Over 20 percent of households have three or more vehicles available to them.

Figure 5. Distribution of Households by Vehicles Available.

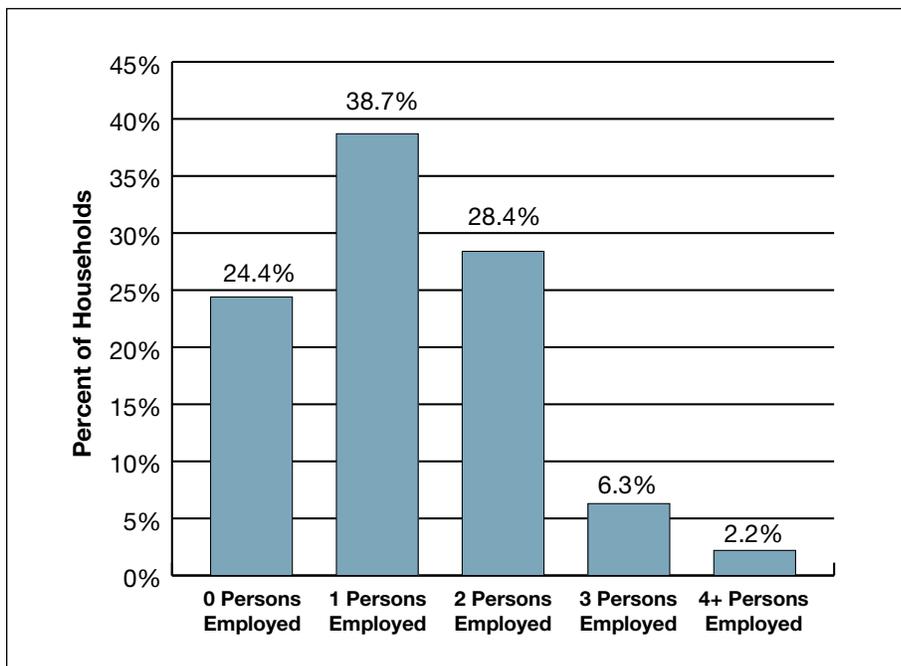


Daily household travel also increases as the number of persons employed in the household increases. The distribution of households by number of persons employed in the study area is shown in Figure 6. Interestingly, 24.4 percent of the households do not have an employed household member. This may stem partially from unemployment and partially from households with retired household members.

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Daily household travel also increases as the number of persons employed in the household increases.

Figure 6. Distribution of Employed Household Members



Age Cohort

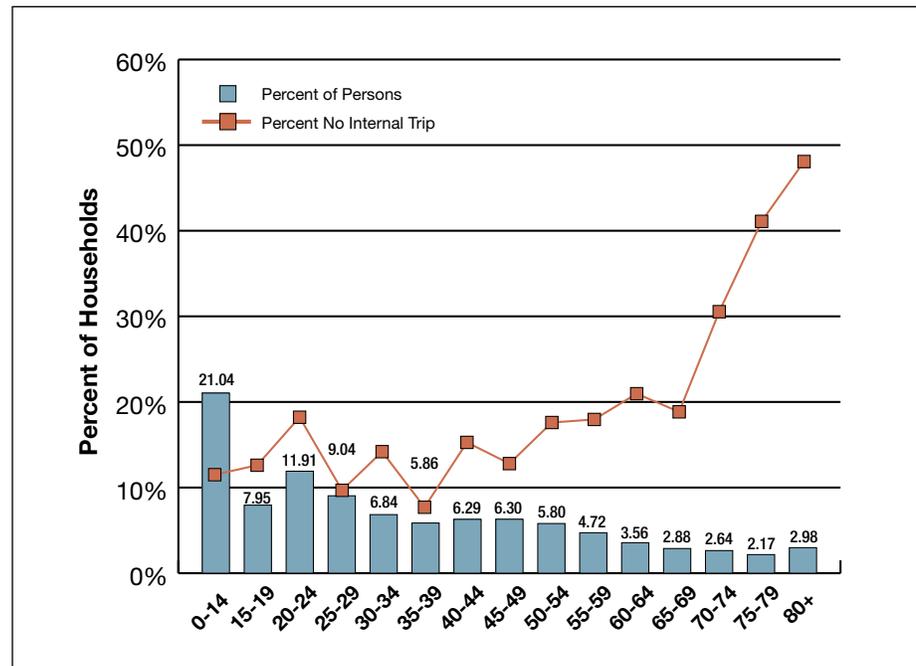
The impact of age on daily travel of household members is more complex than the other household characteristics shown and is not being used directly in the travel demand model. However, age cohort can be used to characterize household life cycle. The distribution of persons by age cohort and the percentage of persons not making any internal trips on their survey day are shown in Figure 7. As expected, older persons are less likely to travel than younger persons, but the older population is mobile and contributes significantly to the amount of household travel. The percentage of people not making internal trips ranged from 18.9 percent to 48.2 percent for those 65+ age cohorts.



Employment status is used to characterize household life cycle.



Figure 7. Distribution of Persons by Age Cohort and People Not Making Trips.

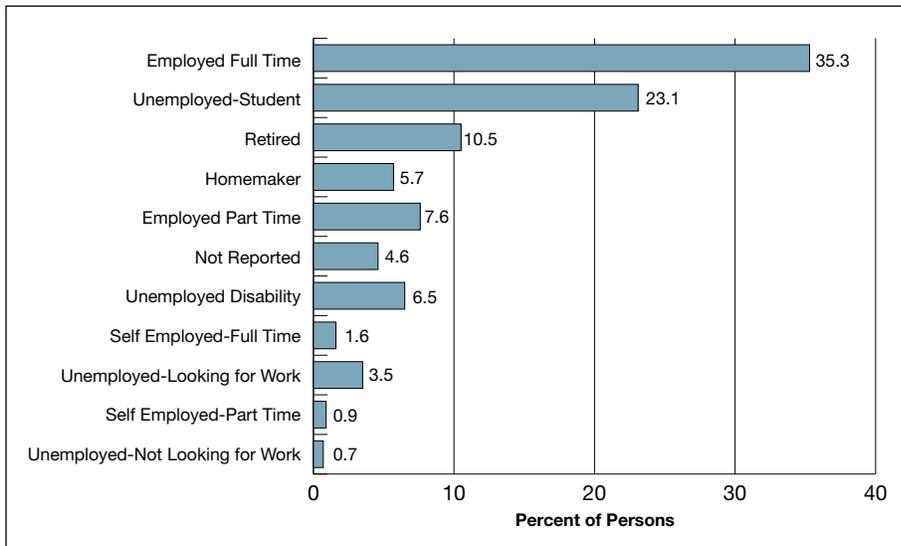


Employment Status

Employment status is used to characterize household life cycle. Life cycle can be an excellent household characteristic to help forecast future travel demand. It can be defined by a combination of the ages of the head of household and the ages of the children in the household, if any. 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.

The distribution of all persons, regardless of age, by employment status in the study area is provided in Figure 8. Over a third of the population is employed full time (35.3 percent) and over 23 percent of the population is unemployed students.

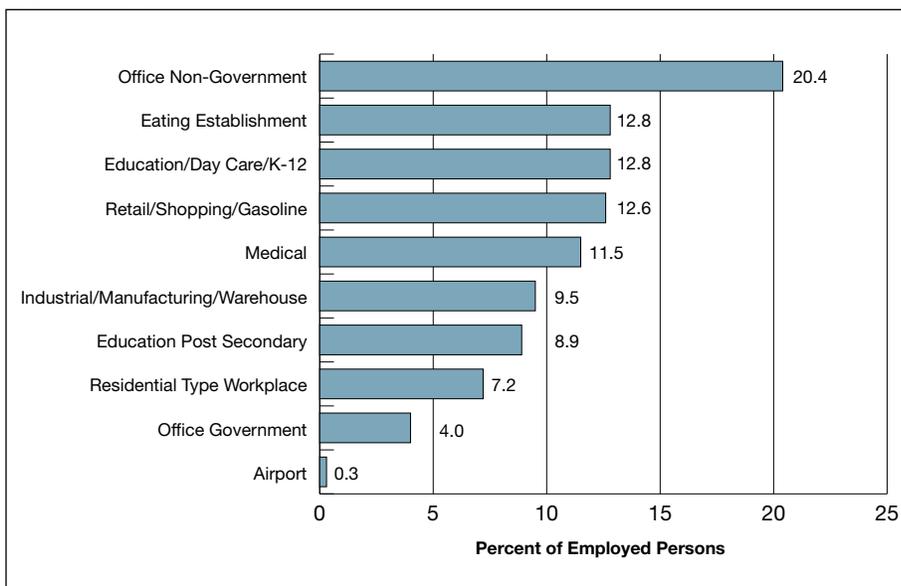
Figure 8. Distribution of Persons by Employment Status.



Employment Type

The household characteristics described previously 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 four employment types—basic, retail, service, and education. Each of these employment types has a different attracting power or attraction rate. The data on the type of work place for employed persons from the household survey are shown in Figure 9. Over 20 percent of employed persons work at non-government offices, and there is a nearly even split among eating establishments (12.8 percent), day care and K-12 educational establishments (12.8 percent), and retail locations (12.6 percent). Additional employment types reported include medical, industrial, post secondary education, residential, government office, and airport work place types used in travel demand modeling (see Figure 9).

Figure 9. Type of Work Place.



In the travel demand model, the type of employment is summarized into four employment types—basic, retail, service, and education.





Person trips include walk, bicycle, and vehicle trips, while vehicle driver trips are those trips made by an individual driving a vehicle.



Household Travel Characteristics

The travel characteristics of households are determined by the purpose for each trip being made at certain locations. In travel demand modeling, trip purposes are defined as home-based work trips (HBW), home-based non-work trips (HBNW), and non home-based trips (NHB). HBW trips are those trips with one end at home and the other at work. HBNW trips are those trips with one end at home and the other not at work. NHB trips are those trips with neither end at the home. Trips are divided into these purposes to account for the different trip length characteristics of each purpose. HBW trips generally have the longest average trip length, while HBNW trips and NHB trips tend to have shorter average trip lengths.

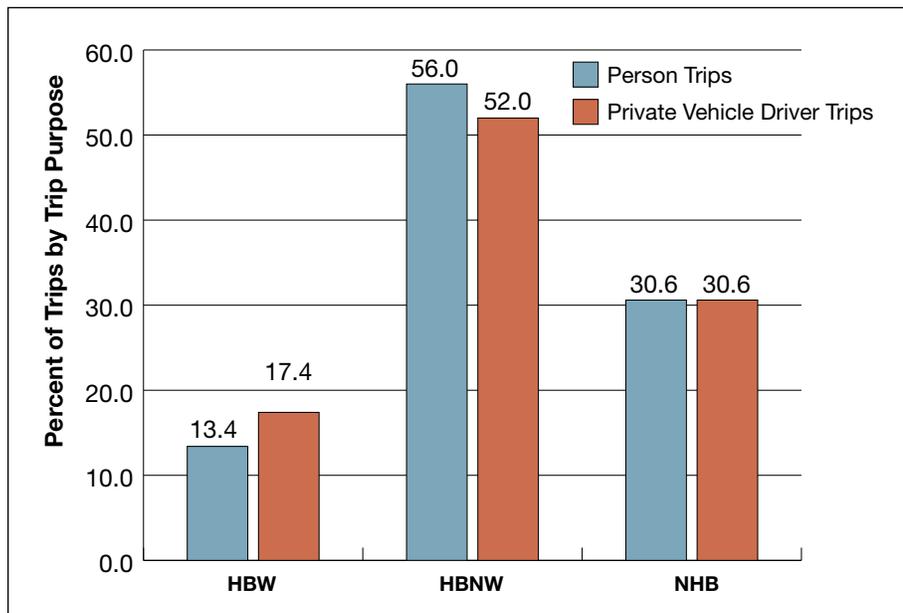
For travel demand model application, the HBNW trip purpose may be further divided among trips to school, trips to shop, and trips to other locations. The trip purposes are also classified in terms of person trips or vehicle driver trips, depending on the mode of travel used. Person trips include walk, bicycle, and vehicle trips, while vehicle driver trips are those trips made by an individual driving a vehicle.

Trip Productions

Trip ends are divided between trip 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 number of trip attractions is a function of the number of work places, the number of employees, and the types of employment

The distribution of trip productions by trip purpose in the study area is shown in Figure 10. HBNW trips account for more than half of person trips (56.0 percent), as well as over half of household vehicle trips (52.0 percent).

Figure 10. Distribution of Trip Productions by Trip Purpose.



Trip Production Rates

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. The person trip rates (trips per household) cross-classified by household size and household income for all internal trip purposes combined, that is, trips that begin and end inside the Lubbock MPO study area is shown in Table 4. These trip rates are for all trips by all modes including transit, bicycle, and walk trips. For travel forecasting applications, the cross-classified trip rates are disaggregated by trip purpose into HBW trips, HBNW trips, and NHB trips. As part of the travel forecasting process, the person trips are divided among the modes during the mode split step. The average daily person trip rate for all households, internal to the study area, is around 9.7 trips per household.

Table 4. Person Trips per Household Cross-Classified by Household Size and Household Income.

Household Income Range	Household Size				
	1	2	3	4	5+
\$0-\$17,499	2.93	5.64	7.29	13.30	14.69
\$17,500-\$32,499	4.44	7.58	9.99	11.97	23.82
\$32,500-\$49,999	4.66	7.42	10.06	17.75	19.34
\$50,000-\$74,999	4.31	6.98	10.57	15.09	31.23
\$75,000+	3.61	8.63	12.30	18.80	23.15

Trip Length

Travel distances vary by trip purpose with the home-to-work trip purpose having the longest average trip length. The average travel distance and trip length frequency distribution by trip purpose are estimated from the household survey. These measures are used to calibrate the trip distribution step of the travel demand model. The trip distribution model is calibrated so that the modeled average travel distance and trip length frequency distribution by trip purpose agree with the values estimated from the travel surveys.

Over time, the average trip length for HBW trip purposes tends to increase along with urban growth, and the average trip length for HBNW trip purposes tends to remain stable. For HBNW trip purposes, which are largely shopping and school trips, the marketplace provides attraction opportunities such as new retail stores and new schools, as the urban area grows.



Travel distances vary by trip purpose with the home-to-work trip purpose having the longest average trip length.

The distribution of person trips by the length of the trip in miles by trip purpose is shown in Figure 11, while the distribution of person trips by trip duration in minutes by trip purpose is provided in Figure 12. The distribution is for internal person trips, those trips beginning and ending within the Lubbock MPO study area. The average person trip length for HBW trips is 4.82 miles, 4.06 miles for HBNW trips and 3.71 miles for NHB trips. The average person trip duration for HBW trips is 7.88 minutes, 6.70 minutes for HBNW trips and 6.26 minutes for NHB trips.

Figure 11. Distribution of Person Trips by Trip Duration in Miles by Trip Purpose.

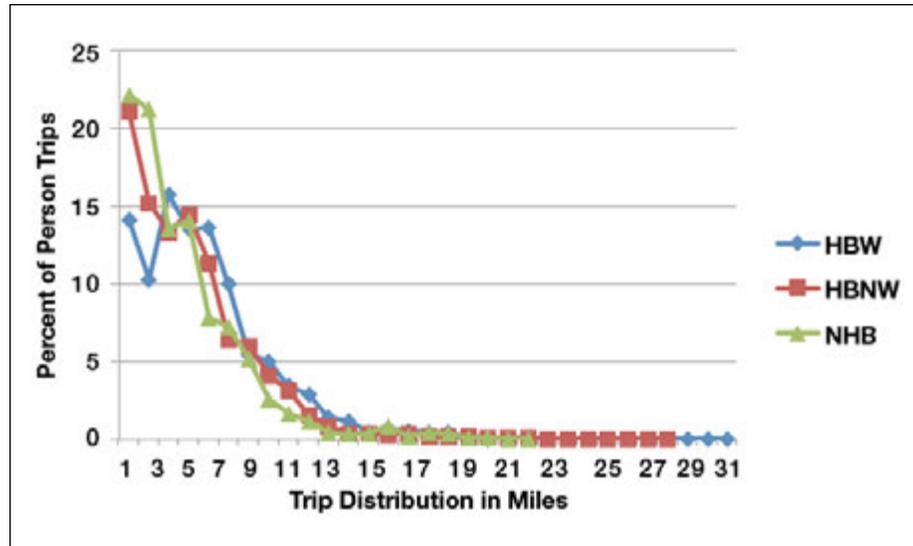
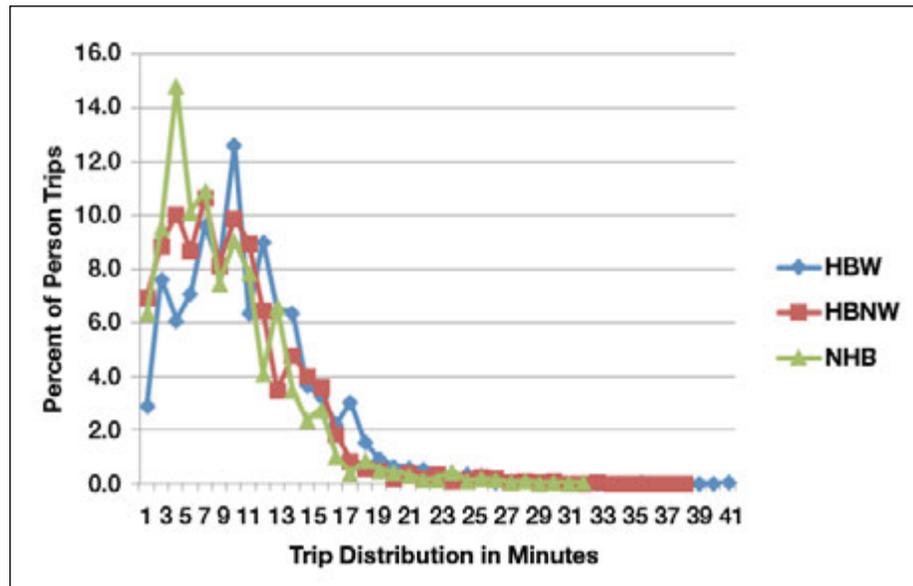


Figure 12. Distribution of Person Trips by Trip Duration in Minutes by Trip Purpose.



Overall, the average person trip length is 4.10 miles and the average person trip duration is 6.78 minutes.



The time-of-day that people travel is generally dictated by the scheduled start times of their activities.

Time-of-Day Travel

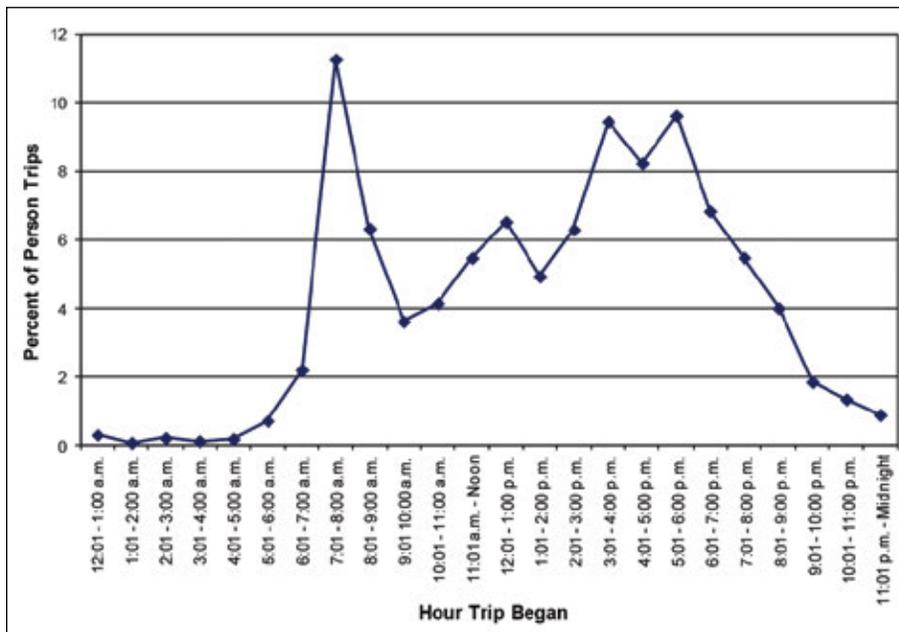
The time-of-day that people travel is generally dictated by the scheduled start times of their activities (i.e., home to work/home to school). For other trips, the start times are flexible and the decision as to when to make these trips may partially depend on the amount of traffic congestion that the trip-maker expects to experience. As the amount of peak period traffic increases, the trip-maker may choose to make discretionary trips during a less congested time-of-day.

The distribution of daily person trips by time-of-day is shown in Figure 13. The highest percentage of daily person trips occur during the morning peak, as both home to work and home to school trips are occurring during this time period. The modest noon peak, the school to home peak, and the work to home peak are all evident. As the amount of travel in an urban area increases, the duration of the morning and afternoon peak periods increases in time as people choose to travel just prior or just after the morning and afternoon peaks. This phenomenon is referred to as peak spreading. Time-of-day travel information may also be used to estimate air quality emissions inventories that are used for air quality photochemical analysis models.

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The modest noon peak, the school to home peak, and the work to home peak are all evident.

Figure 13. Distribution of Person Trips by Time-of-Day.

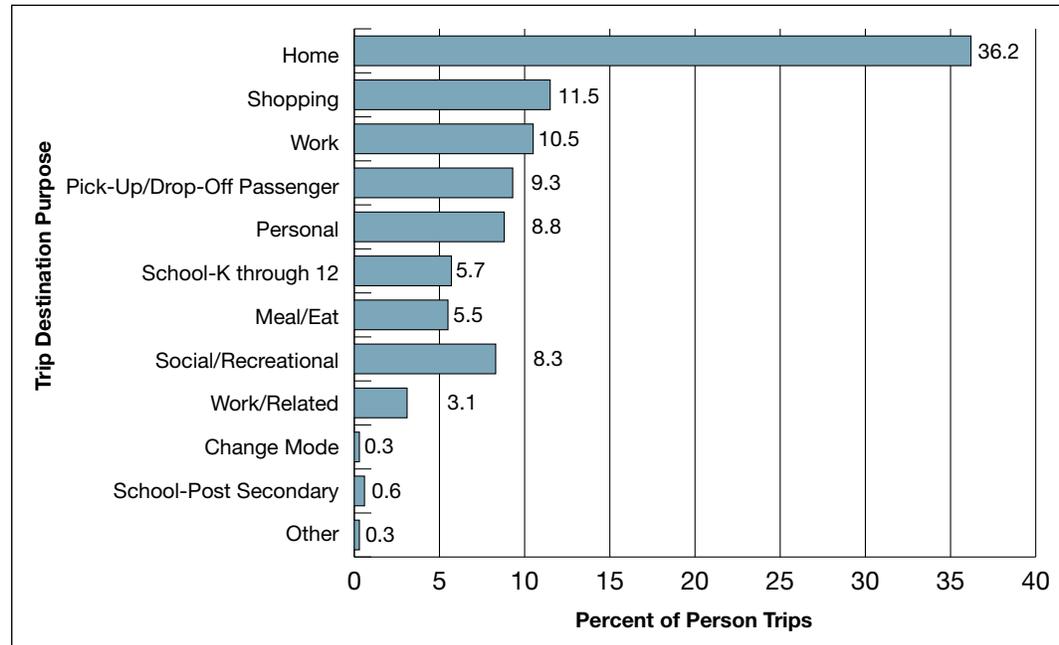


Trip Purpose

As a part of their travel diary, each household member in the Lubbock household survey was asked to identify from a list of choices what they did at each trip destination. The information about the trip destination was used to categorize the trip by trip purpose. In travel demand modeling, typically there are three internal trip purposes—HBW, HBNW, and NHB trips, that are used for forecasting future travel. For each of these trip purposes, trip rates and trip length frequency distributions are estimated from the household survey.

The distribution of person trips by the trip destination purposes used in the survey is shown in Figure 14. As would be expected, the most frequent trip destination is the return to home trip which accounts for 36.2 percent of the total person trips.

Figure 14. Distribution of Person Trips by Trip Destination Purpose.



The primary purpose of a work place survey is to understand the trip attraction characteristics of basic, retail, service, and education establishments.

The household survey provides a representative sampling of trip origins and destinations within the study area. This information is then used in a gravity model formula to estimate trip volumes between distinct geographical areas used in modeling, termed traffic analysis zones (TAZs). Using the results from the household survey, the relative amounts of travel between subregions in the Lubbock area are shown in the Lubbock Household Survey Technical Summary.

WORK PLACE SURVEY

The primary purpose of a work place survey is to understand the trip attraction characteristics of basic, retail, service, and education establishments. While the household survey collects information on the travel characteristics of persons living in the study area at the household level, the work place survey collects similar information at the destination end of travel. The Lubbock Work Place Survey, like other work place surveys across the U.S., consisted of a combination of survey instruments and data collection efforts, which included

- a general survey of the work place
- a travel survey of employees and visitors at the work place; and,
- counts of either persons or vehicles traveling to and from the work place.

Data collected from these efforts were used to develop trip attraction rates by purpose, stratified by area type and employment type.

For analysis purposes, TAZs in the work place survey are grouped according to the level of activity within the zone as measured by the density of population and employment within the zone. There were four area types identified in the Lubbock MPO study area— Central Business District (CBD) , Urban, Suburban, and Rural.

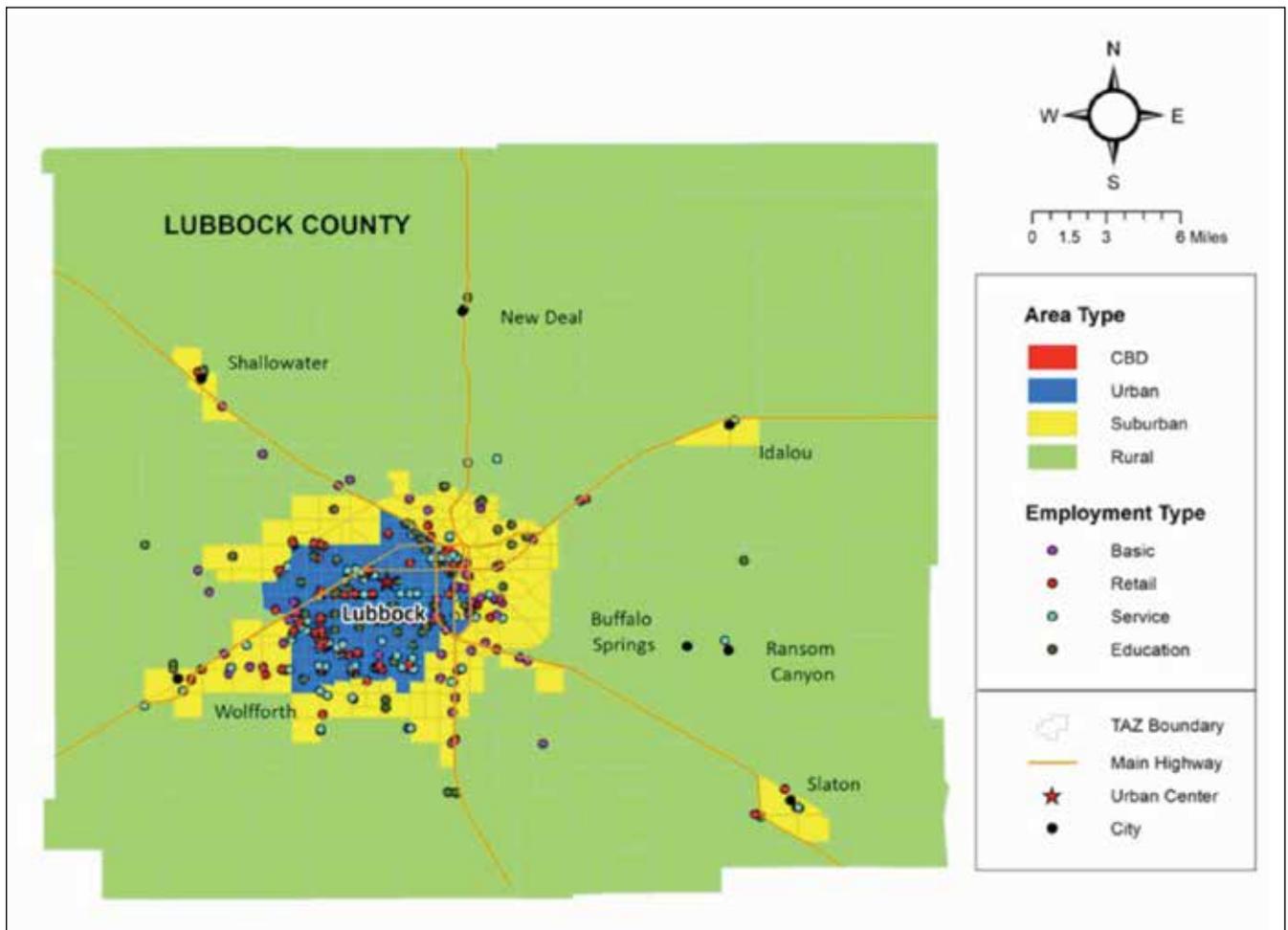
The 2010 Lubbock Work Place Survey included 309 randomly selected business establishments, of which 112 had complete full surveys and 197 had partial surveys. The full surveys consisted of surveys of 1,374 employees and 2,038 visitors or non-employees. The full surveys also included surveys of vehicles owned and leased by the establishments and used for business purposes, and counts of persons or vehicles arriving and departing the establishments. The partial survey mainly included a general survey of the establishment, such as the type, location, total employment, and number of employees at work on the day of the survey.

The locations of the establishments that participated in the work place survey are shown in Figure 15. The data presented in this section are based on survey data and are not expanded.

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The full surveys consisted of surveys of 1,374 employees and 2,038 visitors or non-employees.

Figure 15. Lubbock Work Place Survey Locations.



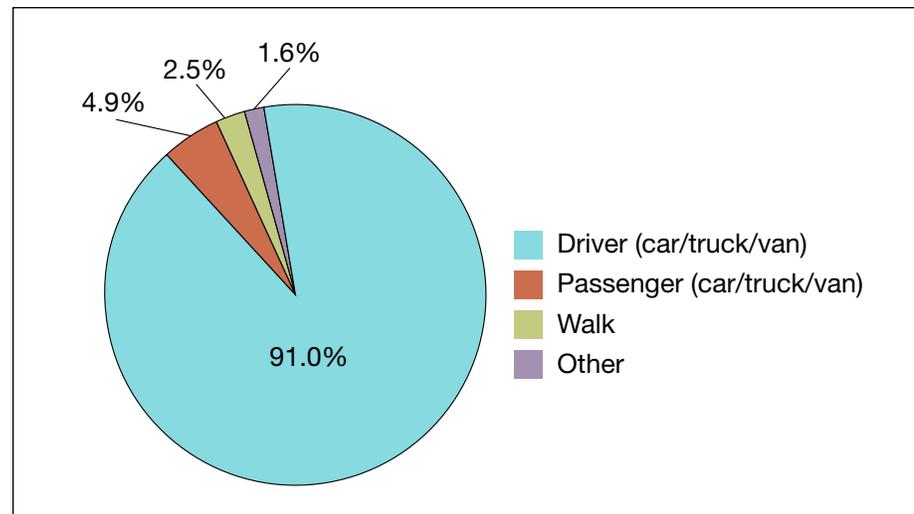


Less than three percent of the trips were made by walking, with relatively few trips made by other modes.

Trip purposes to the workplace are categorized to include not only internal home-based (HBW and HBNW) trips and non-home based (NHB-O and NHB-D) trips at origin and destination locations, but also external trips from and to the study area. The external trips include external origin trips (EXT-O), trips whose destinations are outside the study area when leaving the establishment, and non-resident trips (NON-RES), those internal trips to the establishment made by persons who live outside the study area. Attraction rates are then developed for each trip purpose, area type, and employment type for use in travel demand models.

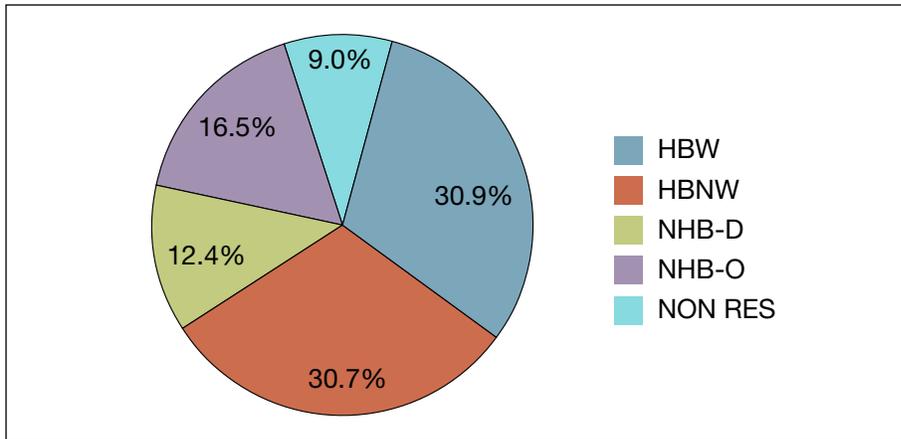
The distribution of reported trips to the workplace by mode of travel is provided in Figure 16. The majority of trips are by drivers. A total of 91 percent of the work place trips were made by drivers of a vehicle, with less than five percent of the trips made as a passenger of a vehicle. Less than three percent of the trips were made by walking, with relatively few trips made by other modes.

Figure 16. Distribution of Reported Trips to the Workplace by Mode of Travel.



The distribution of reported trips by trip purpose is shown in Figure 17. Approximately 90.6 percent of the trips are internal trips, with 30.7 percent being HBNW trips, 30.9 percent as HBW trips, and 28.9 percent as NHB trips. The remaining 9.4 percent are external trips, with 0.1 percent being EXT-O trips, another 0.3 percent as EXT-D trips, and 9.0 percent as NON-RES trips.

Figure 17. Distribution of Reported Trips by Trip Purpose.



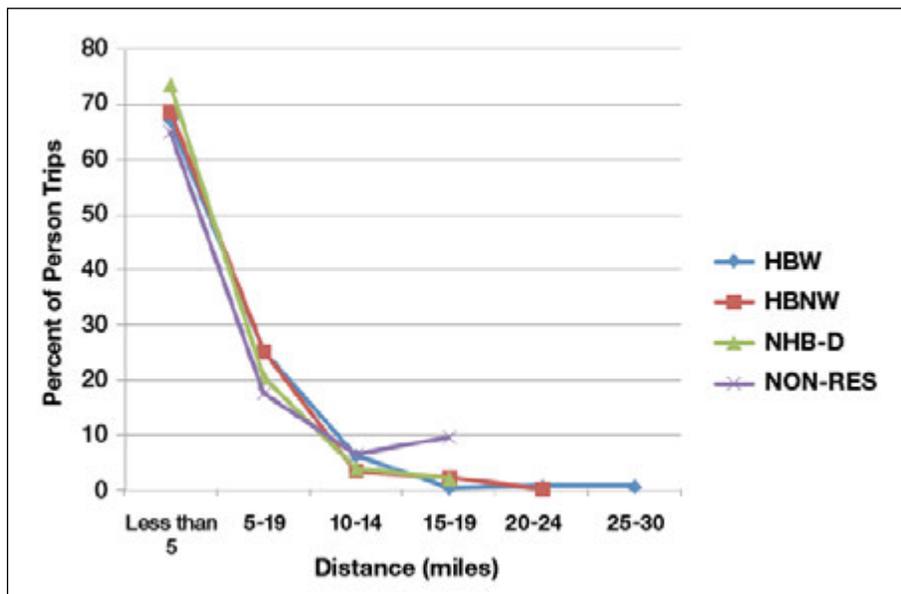
The reported trips for both employees and visitors were geocoded to the study area’s TAZs to compute the travel distance by trip purpose. The average trip length by trip purpose for person trips and vehicle trips is shown in Table 5. The trip length frequency distributions for person trips by travel distance are provided in Figure 18. The average trip lengths and trip length frequency distributions are only for HBW, HBNW, NHB-D, and NON-RES travel.

Table 5. Average Trip Lengths by Trip Purpose for Person Trips and Vehicle Trips to the Workplace (does not reflect intra-zonal trips).

Trip Purpose/Type	Person Trips (Miles)	Vehicle Trips (Miles)
HBW	5.23	5.23
HBNW	5.26	5.23
NHB-D	4.84	4.83
NON-RES	6.56	6.69

Source: 2010 Lubbock Work Place Travel Survey and TTI Analysis.

Figure 18. Frequency Distribution of Person Trips by Travel Distance at Surveyed Workplace Establishments.



Attraction rates are then developed for each trip purpose, area type, and employment type for use in travel demand models.

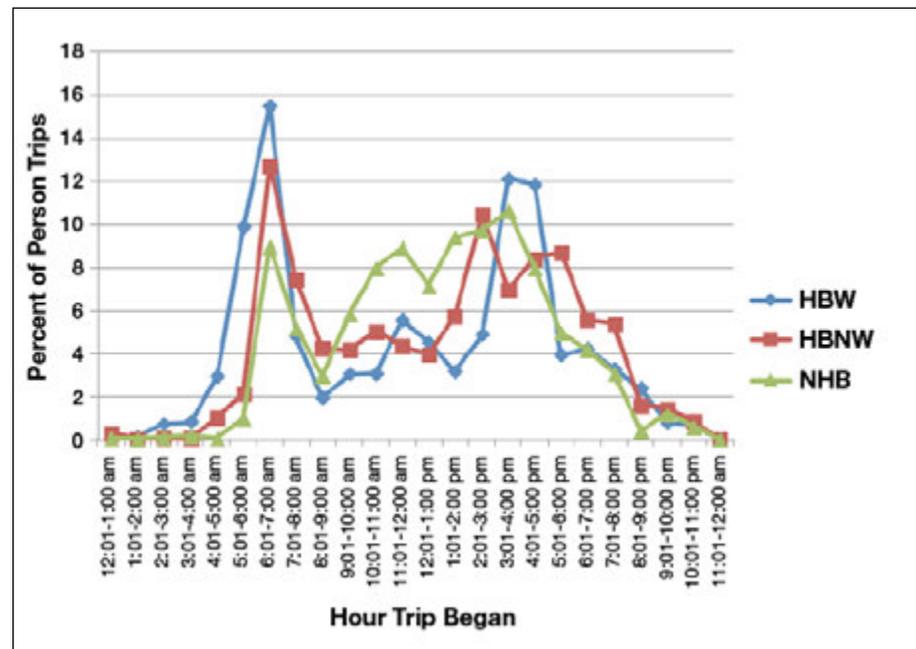
As shown in Table 5, the surveyed NON-RES person trips have the highest average length when compared against the average person trip length of HBW, HBNW, and NHB-D. This result is not surprising, as non-residents, by definition, do not live within the study area. This opens up the possibility for longer trips by non-residents because there is no limit on the distance from the origin of their trip to the Lubbock MPO study area border. Although normally HBW trip length averages would be anticipated to have a higher average trip length than HBNW trips, note that the average trip lengths shown in Table 5 only include inter-zonal trips, not intra-zonal trips. Thus, short HBNW trips that are intra-zonal trips would normally be considered in calculating the HBNW average trip length, but are not included in this analysis. The surveyed average trip lengths and the trip length frequency distribution 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 closely match the average trip length and trip length frequency distributions estimated from the travel surveys.



Trips by purpose typically have distinct characteristics by time-of-day that are consistent for nearly all urban areas.

Trips by purpose typically have distinct characteristics by time-of-day that are consistent for nearly all urban areas. The distribution of trips by purpose by their time of arrival at the establishments surveyed is shown in Figure 19. The results indicate that the characteristics for travel in the Lubbock MPO study area are similar to those for other urban areas. HBW trips exhibit two time periods when those types of trips are most likely to occur, in the morning and afternoon. The morning peak is between 6:01 a.m. and 7:00 a.m., and the afternoon peak is highest between 3:01 p.m. and 4:00 p.m. Typically, HBNW and NHB trips peak during the middle of the day and are spread throughout the day. The distribution of NON-RES trips by their time of arrival shows a pattern similar to that of HBNW and NHB trip.

Figure 19. Distribution of Person Trips by Time-of-Day.





Lubbock International Airport

SPECIAL GENERATORS

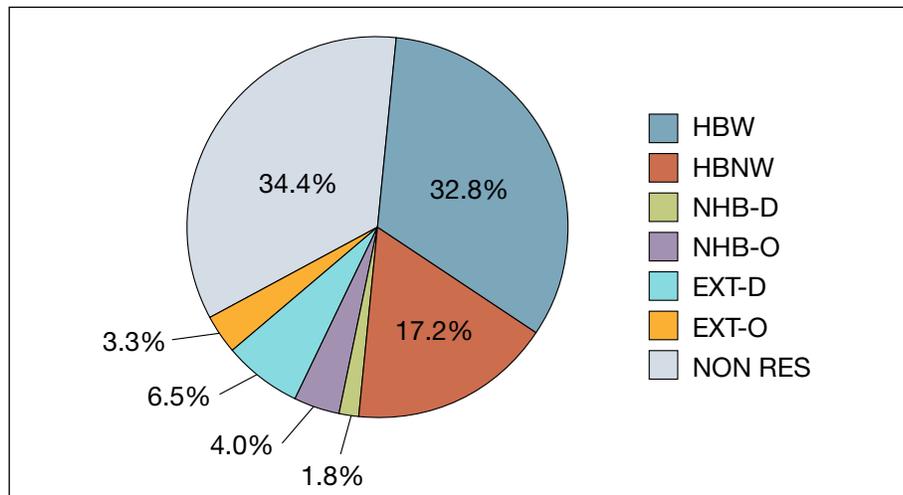
Two important work places surveyed, the Lubbock International Airport and Texas Tech University, were treated as special generators. Special generators are those types of employment locations that are considered unique and subject to modeling outside the typical modeling framework. The methodology used to survey special generators is the same as that used for a full work place survey, except to a much larger scale.

Lubbock International Airport

Vehicle counts for the Lubbock International Airport, performed for a 12-hour period from 7:00 a.m. to 7:00 p.m., totaled 4,378 non-commercial vehicles, and 29 commercial vehicles. A total of 56 employees and 168 non-employees participated in the survey. It was estimated that 250 of the 700 employees were at work on the travel survey day.

The surveyed trips by trip purpose at the Lubbock International Airport are shown in Figure 20. Approximately one-third of the surveyed trips were NON-RES (34.4 percent), about one-third of the surveyed trips were HBW (32.8 percent), and just over 17 percent were HBNW.

Figure 20. Surveyed Trips by Trip Purpose at Lubbock International Airport.



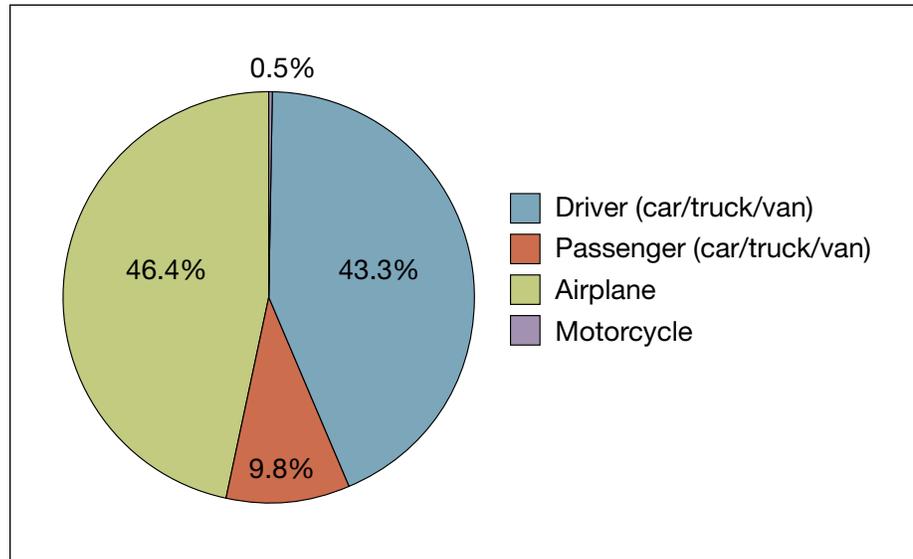
Source: Lubbock Work Place Technical Summary



Two important work places surveyed, the Lubbock International Airport and Texas Tech University, were treated as special generators.

The distribution of mode of travel to the Lubbock International Airport is shown in Figure 21. Over 46 percent of trips were made by airplane, which is not surprising considering the location is an airport. Another 43.3 percent of travelers were vehicle drivers, with the remaining mode distribution consisting of vehicle passengers (9.8 percent) and a few motorcyclists (0.5 percent).

Figure 21. Distribution of Mode of Travel to Lubbock International Airport



The internal survey trips were geocoded for both employees and visitors to the TAZs in the Lubbock MPO study area.

The internal survey trips were geocoded for both employees and visitors to the TAZs in the Lubbock MPO study area. The data were processed and average trip length computed for travel distance by trip purpose. It is recognized that these data are based on a small number of observations but they do provide a reference of comparison with the average trip lengths found for the full work place survey. The average trip lengths to the Lubbock International Airport by trip purpose are shown in Table 6.

Table 6. Average Surveyed Inter-Zonal Trip Lengths to the Lubbock International Airport by Trip Purpose.

Trip Purpose	Average Person Miles	Average Vehicle Miles
HBW	4.07	4.13
HBNW	6.87	7.29
NHB-D	5.19	4.50
NON-RES	6.06	7.52
ALL	5.70	5.60



Silent Wings Museum

The expanded survey results for the Lubbock International Airport are shown in Table 7. The total trips and trip rates were estimated by multiplying the non-commercial vehicle counts with the average employee and visitor auto-driver vehicle occupancy.

Table 7. Lubbock International Airport Person and Auto-Driver Trips and Attraction Rates.

Trip Purpose	Person Trips	Person Trip Rates	Auto-Driver Trips	Auto-Driver Trip Rates
HBW	1,266	1.81	1,031	1.47
HBNW	1,272	1.82	889	1.27
NHB-D	158	0.23	118	0.17
Non-Resident Trips	2,409	3.44	1,735	2.48
Commercial Vehicle Trips	29	0.04	29	0.04
Total	5,134	7.34	3,802	5.43



Over 46 percent of trips were made by airplane, which is not surprising considering the location is an airport.





Texas Tech University Education Building

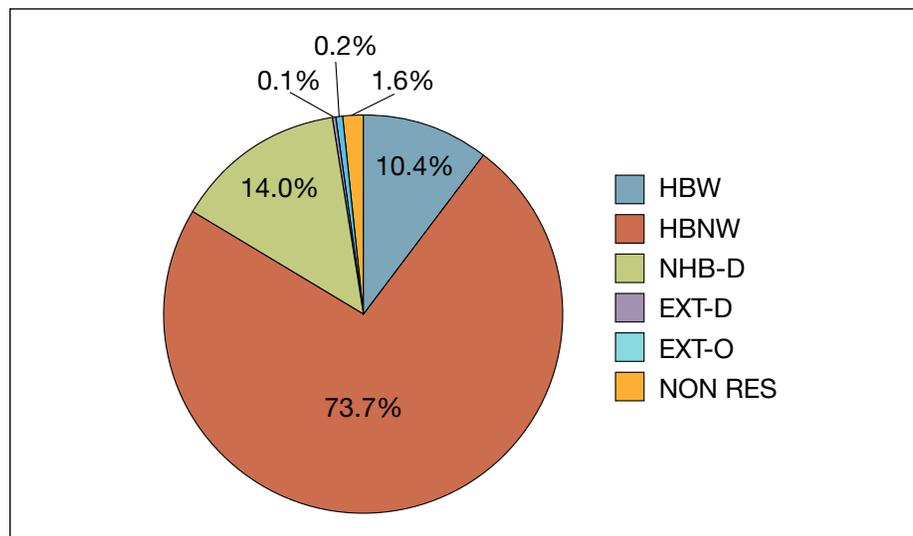


For Texas Tech University, vehicle counts performed for a 12-hour period from 7:00 a.m. to 7:00 p.m. totaled 79,844, of which just over one percent was commercial vehicles.

Texas Tech University

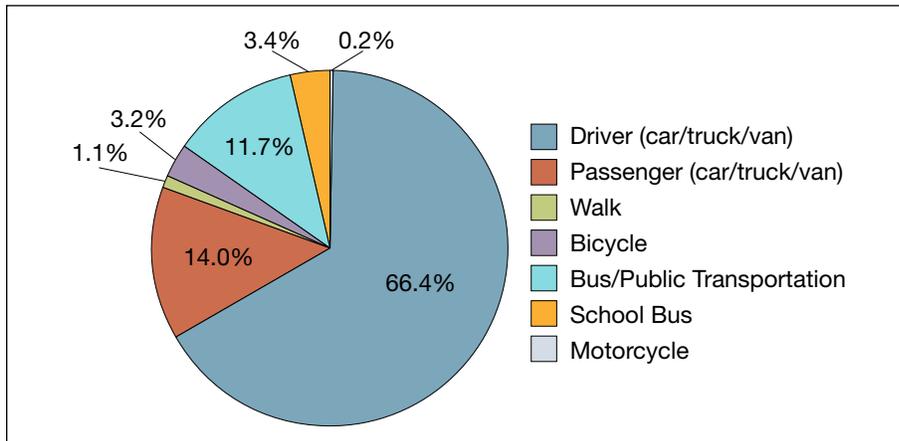
For Texas Tech University, vehicle counts performed for a 12-hour period from 7:00 a.m. to 7:00 p.m. totaled 79,844, of which just over one percent was commercial vehicles. A total of 60 employees and 449 non-employees (403 students and 46 non-employees) participated in the survey. It was estimated that 10,194 of the 12,097 employees were at work during the travel survey day. The surveyed trips by trip purpose at Texas Tech University are shown in Figure 22. Nearly three-fourths of the surveyed trips (73.7 percent) were HBNW, which makes sense given that all of the students traveling from home to school or school to home were in a college setting. Over 10 percent were HBW. This group of trips likely largely stems from professors, staff, and student workers.

Figure 22. Surveyed Trips by Trip Purpose at Texas Tech University.



The distribution of mode of travel to Texas Tech University is shown in Figure 23. Approximately two-thirds of the trips (66.4 percent) were made by vehicle drivers, 14 percent of the trips were made as vehicle passengers, and nearly 12 percent of the trips were made by bus/public transit. The remaining trips consisted of the modes of walk, bicycle, school bus, and motorcycle.

Figure 23. Distribution of Mode of Travel to Texas Tech University.



Similar to those calculated for the Lubbock International Airport previously, the average trip lengths for the surveyed Texas Tech University trips are shown in Table 8.

Table 8. Average Surveyed Inter-Zonal Trip Lengths to Texas Tech University by Trip Purpose.

Trip Purpose	Average Person Miles	Average Vehicle Miles
HBW	7.39	6.00
HBNW	4.74	4.81
NHB-D	3.90	3.65
NON-RES	8.37	8.37
ALL	4.91	4.66

The expanded survey results for Texas Tech are shown in Table 9. Like those from the airport, the total trips and trip rates were estimated by multiplying the non-commercial vehicle counts with the average employee and visitor auto-driver vehicle occupancy.

Table 9. Texas Tech University Person and Auto-Driver Trips and Attraction Rates.

Trip Purpose	Person Trips	Person Trip Rates	Auto-Driver Trips	Auto-Driver Trip Rates
HBW	15,317	1.27	15,257	1.26
HBNW	61,147	5.05	49,895	4.12
NHB-D	6,954	0.57	6,000	0.50
Non-Resident Trips	1,593	0.13	1,444	0.12
Commercial Vehicle Trips	926	0.08	926	0.08
Total	85,937	7.10	73,522	6.08



A total of 60 employees and 449 non-employees (403 students and 46 non-employees) participated in the survey.

★

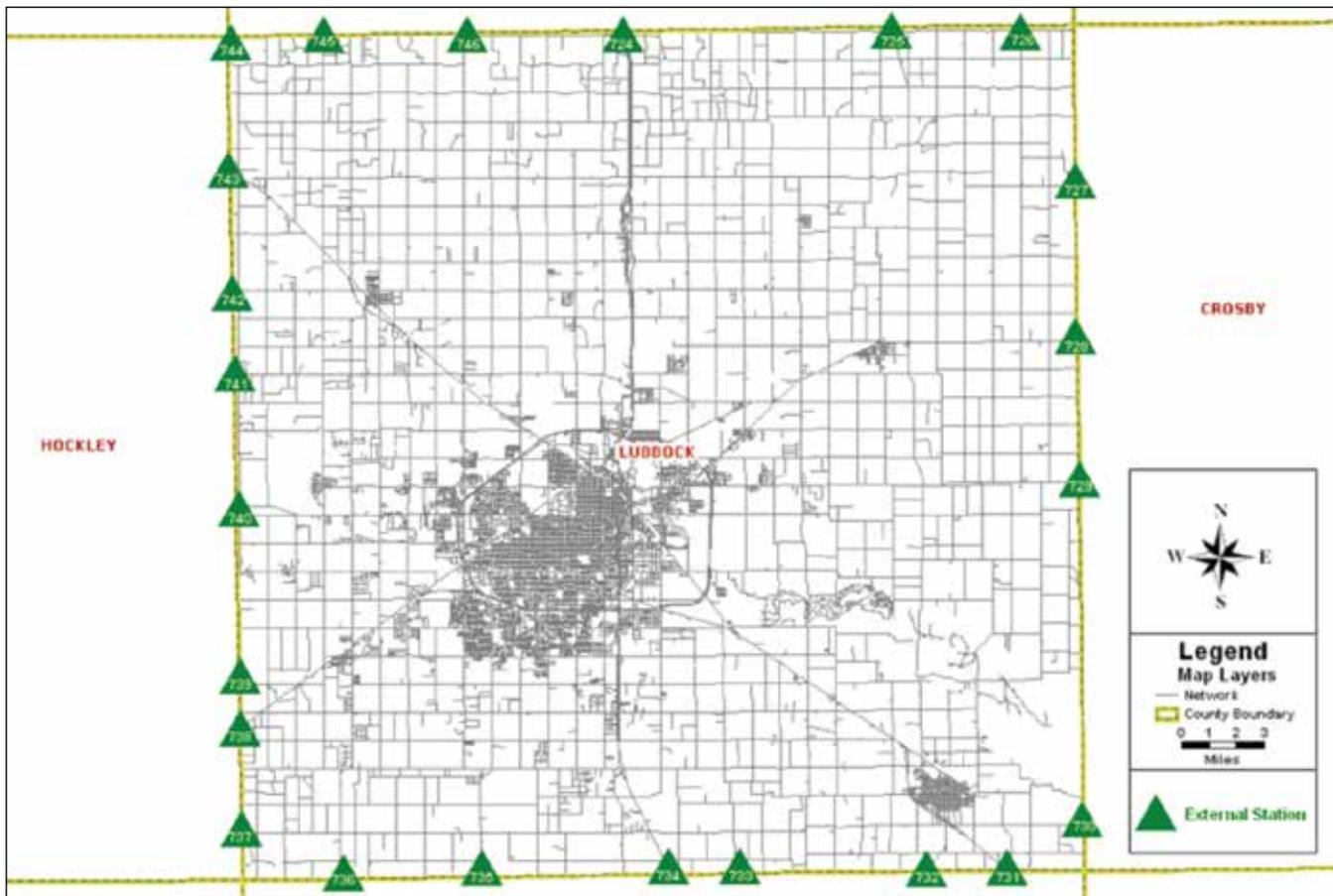
The primary purpose of the external station survey is to understand the travel patterns of people and vehicles entering and exiting the study area.

EXTERNAL SURVEY

The primary purpose of the external station survey is to understand the travel patterns of people and vehicles entering and exiting 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). Surveys are conducted during daylight hours for one day at each designated location. Additionally, 24-hour vehicle classification counts are performed on the same day as the survey at each survey location. These counts provide a basis for expanding the survey data to represent the average weekday movements into and out of the study area. Data are also collected on the movements of the vehicle during the survey day prior to the point at which the vehicle is surveyed. These data provide a basis for estimating the amount of travel occurring within the study area prior to the time of the survey.

There were 23 roadways/highways that crossed the border of the Lubbock MPO study area, and 14 of these locations were selected as sites to conduct external travel surveys. The location of the external station sites is shown in Figure 24.

Figure 24. Lubbock External Station Locations.



These locations are transportation facilities that cross the study area boundary and represent where travelers may enter and exit the study area. The number of surveys collected varied by survey site. The sites were operated during daylight hours. Data were collected for vehicles leaving the study area (outbound) by performing a survey in areas set-up with trained survey personnel. Approximately 17 percent of non-commercial vehicles and 17 percent of commercial vehicles that traveled through the external stations during survey hours were interviewed. The 2005 Lubbock External Station Survey had 3,988 surveyed vehicles. Approximately 85 percent of the surveyed vehicles were non-commercial vehicles and 15 percent were commercial vehicles.

The estimates presented in this section are based on expanded survey data. Based on 24-hour vehicle counts, there were 36,983 inbound vehicles and 35,861 outbound vehicles entering and exiting the Lubbock MPO study area on a daily basis. The estimates of external-local and external-through trip movements of non-commercial and commercial vehicles by direction and location group are shown in Figure 25 and Figure 26, respectively.



FM 400 Lubbock County

Figure 25. External-Local Trip Movements by Location Group.

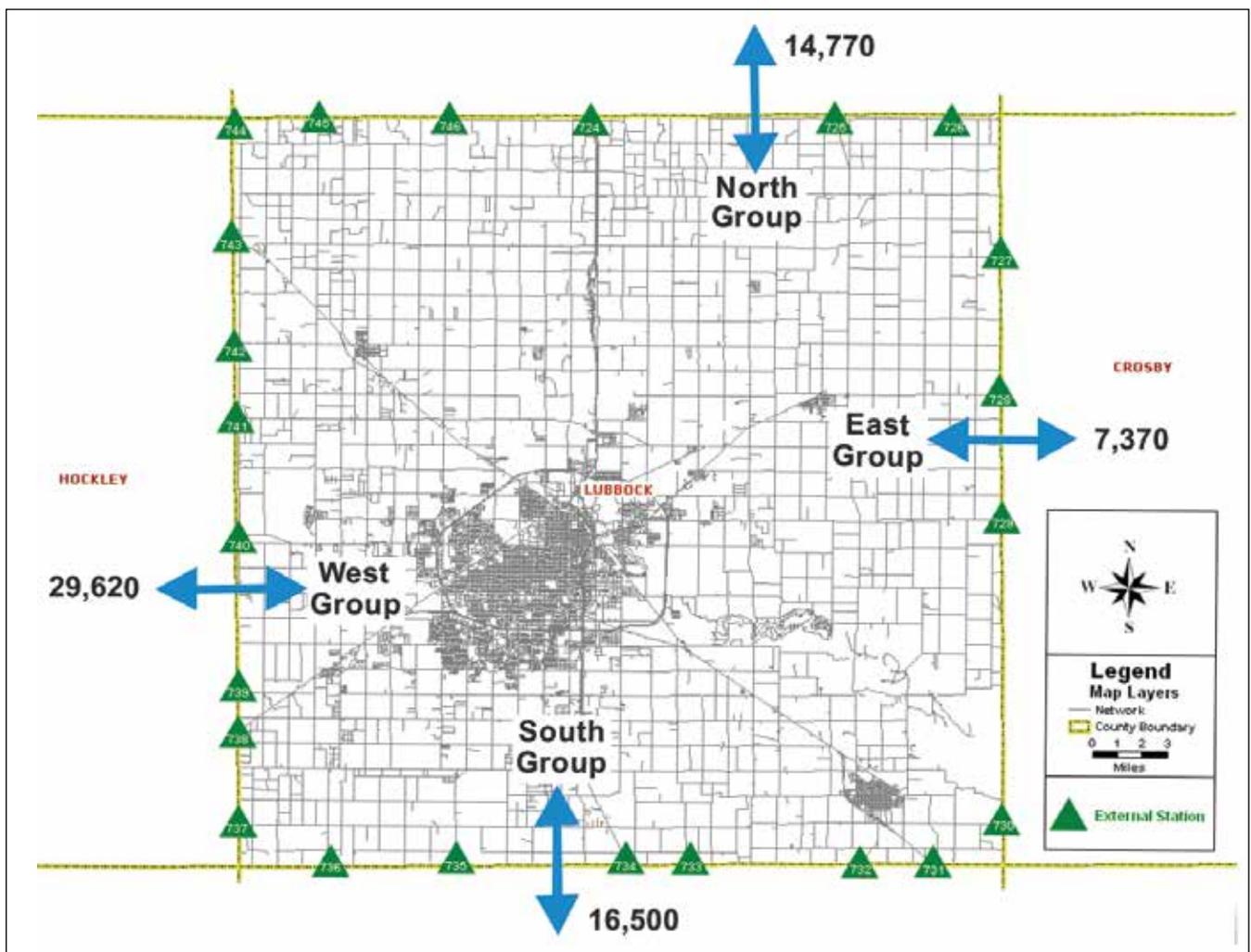
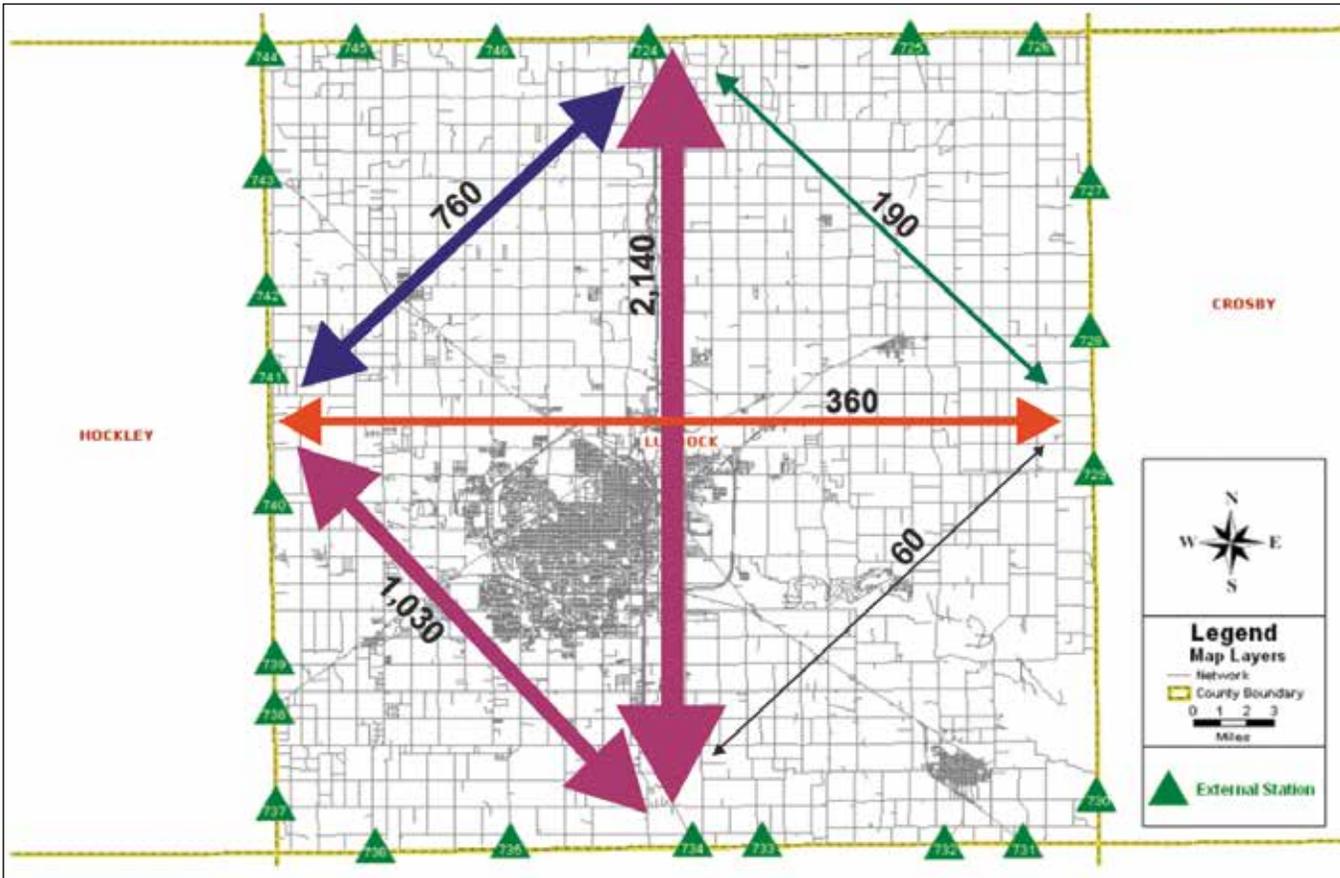


Figure 26. External-Local and External-Through Trip Movements by Location Group.



The external stations were grouped by location and included North, East, South, and West groups. The West group had the largest estimated number of external-local trip movements, with 29,639 total daily trips. The South group had the second largest estimated number of external-local trips with 16,656 total daily trips. While the South group had the largest number of external-through daily trips with 1,459 trips, the North group was not far behind with 1,404 trips.



While the South group had the largest number of external-through daily trips with 1,459 trips, the North group was not far behind with 1,404 trips.

COMMERCIAL VEHICLE SURVEY

The primary purpose of the commercial vehicle survey is to collect data on commercial vehicle trip-making that is needed to estimate total commercial vehicle travel in the Lubbock MPO study area. In the travel demand model, trips made by commercial vehicles are modeled separately from trips made by non-commercial or private passenger vehicles. The commercial vehicle survey is concerned with internal commercial vehicle trips, trips made within the study area. Commercial vehicle trips that are coming into or departing the study area boundary are surveyed as a part of the external station survey. The surveys collect data on commercial cargo/freight vehicles as well as vehicles used for commercial services, such as plumbers, electricians, deliveries, and governmental fleet vehicles. The data are used in the trip generation step of the travel demand model to estimate total trips and travel patterns for commercial vehicle trips.

In the 2005 Lubbock Commercial Vehicle Survey, the sample vehicles were randomly selected from motor carrier and vehicle registration databases. The establishments or agencies operating the selected vehicles were contacted and asked to participate in the survey. A total of 273 commercial vehicles participated in the survey. The drivers of the vehicles 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, such as the type of cargo being transported (if any) and the purpose of the trip. The questions of primary concern for estimating commercial vehicle trip patterns were the location and time of each trip 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.

The number of commercial vehicles in a designated study area cannot be determined reliably from vehicle registration data due to the presence of commercial vehicles registered in other counties, and in other states. The commercial VMT observed from sampled commercial vehicles in the Lubbock area was expanded using VMT estimates from the Highway Performance Monitoring System (HPMS) data, combined with vehicle classification counts for roadways functional classification (freeway, arterial, collector, and local). The estimated VMT for commercial vehicles operating in the Lubbock MPO study area by roadway functional classification is shown in Table 10. The total commercial VMT was 771,260 miles, with external commercial VMT estimated at 204,119 miles and internal commercial VMT estimated at 567,141 miles.

Table 10. Estimated VMT for Commercial Vehicles Operating in the Lubbock MPO Study Area by Roadway Functional Classification.

Functional Classification	Weekday VMT	Percent Commercial Vehicles	Commercial Vehicles Weekday VMT
Freeway	1,181,089	17.8	209,764
Arterial	3,231,733	12.3	398,440
Collector	919,482	14.0	129,152
Local	376,430	9.0	33,904
Total	5,708,734	-	771,260



The primary purpose of the commercial vehicle survey is to collect data on commercial vehicle trip-making that is needed to estimate total commercial vehicle travel in the Lubbock MPO study area.





On a daily basis, approximately 15,715 commercial vehicles were estimated to be operating in the Lubbock study area, with each vehicle averaging 7.07 trips per day.



On a daily basis, approximately 15,715 commercial vehicles were estimated to be operating in the Lubbock study area, with each vehicle averaging 7.07 trips per day. The average distance traveled was 5.6 miles. Approximately 13.6 percent of the surveyed commercial vehicles in the study area in the spring of 2005 were cargo or freight transport, with 86.4 percent being local services transport. Among the surveyed commercial vehicles, the most frequently reported types of cargo included manufactured goods and equipment (22.5 percent of trips); food, health, and beauty products (22.0 percent of trips); and clay/concrete/glass or stone (14.0 percent of trips). Over 20 percent of the surveyed commercial cargo vehicle trips were not carrying any cargo.

SUMMARY OF FINDINGS

The travel surveys conducted in the Lubbock MPO study area during the period between 2005 and 2010 provide the household, work place, external station, and commercial vehicle travel behavior information needed to estimate, calibrate, and validate a travel demand model. This model can be used as a transportation analysis tool for planning improvements to the region's transportation system 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. The population of Lubbock County is forecasted to increase from 269,032 in 2007 to 351,864 by 2035, an increase of about 30.8 percent. The daily VMT is expected to increase by 29.1 percent during this 28-year period, from 571,084 miles in 2007 to 737,479 miles by 2035. With this growth, TxDOT and the Lubbock MPO will need to plan for new and/or improved facilities to provide added transportation capacity during the next 20 years. Such facilities will be needed to maintain the relatively high level of mobility currently enjoyed by travelers in the Lubbock MPO study area.

Household Travel

Persons commuting to work in the Lubbock MPO study area use public transportation less often than the average commuter in Texas. Over 96 percent of the households have at least one vehicle available. The average household size in the study area in 2006-2007 was 2.76 persons, essentially identical to the 2.8 person household size average for the state of Texas that is listed as the 2007 ACS estimate. The average number of person trips per household was around 9.7 trips per day, with each person in the household making between three and four trips per day. The average person trip length was 4.1 miles, and the average duration on the trip was 6.8 minutes.

Trip purposes in the household survey were categorized as internal (HBW, HBNW and NHB) trips. The HBW trips in the Lubbock MPO study area in 2006-2007 had the longest average travel distance of 4.82 miles, and accounted for 13.4 percent of the total household person trips. In terms of trip purpose by destination, the return-to-home trip was the most frequent trip destination, which accounted for 36.2 percent of the total household person trips. HBNW trips accounted for 56.0 percent of the total household person trips, with an average travel distance of 4.06 miles. NHB trips accounted for around 30.6 percent of the total household person trips, with an average travel distance

of 3.71 miles. Trips to work, shopping, pick-up/drop-off and personal business made up over 40 percent of the total person trips by destination purpose.

Work Place Travel

Trip purposes in the work place survey were categorized to include not only internal trips but also external trips (EXT-O, EXT-D and NON-RES) from and to the study area. In terms of trip purposes from and to the work place based on survey trips, external trips (EXT-D, EXT-O, NON RES) accounted for 9.4 percent of the total person trips in the Lubbock MPO study area. The majority of trips (90.6 percent) were internal trips, of which more than two-thirds were home-based trips (33.9 percent HBNW and 34.1 percent HBW), and 31.9 percent were NHB trips. The average person trip length for HBW trips was 5.23 miles, compared to 5.26 miles for HBNW trips, and 4.84 miles for NHB-D trips. The average person trip length for NON-RES trips was 6.56 miles.

External-Local and External-Through Travel

Nearly 73,000 vehicles entered or exited the Lubbock MPO study area on an average weekday basis. Approximately 94.2 percent of the total daily external trip movements were external-local trips, while the remaining 5.8 percent were external-through trips. Of the total external-local trips, 86.5 percent were made by non-commercial vehicles and 13.5 percent were made by commercial vehicles. Approximately 52.8 percent of the total external-through trips were made by non-commercial vehicles and the remaining 47.2 percent were made by commercial vehicles.

Commercial Vehicle Travel

The total commercial VMT for the Lubbock MPO study area in 2005 was estimated at 771,260 miles, of which 204,119 miles were external commercial VMT and 567,141 miles were internal commercial VMT. Approximately 111,129 total internal commercial trips were made in the study area. On an average weekday basis, approximately 15,715 commercial vehicles were found to be operating in the study area (more than four times the 3,575 trucks registered in the study area in 2005), with each surveyed vehicle averaging 7.36 trips per day (7.07 internal trips per day). The average travel time was estimated to be 8.5 minutes per trip, with the average travel speed estimated at 39.5 miles per hour.

Approximately 13.6 percent of the surveyed commercial vehicles were cargo or freight transport, while the remaining 86.4 percent were local services transport. Among the surveyed commercial vehicles, the most frequently reported types of cargo included manufactured goods and equipment (22.5 percent of trips); food, health, and beauty products (22.0 percent of trips); and clay/concrete/glass or stone (14.0 percent of trips). Over 20 percent of the surveyed commercial cargo vehicle trips were not carrying any cargo.



Nearly 73,000 vehicles entered
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COMPARISON TO OTHER AREAS

A comparison of the household survey summary data for the Lubbock MPO study area, to McLennan County, Potter and Randall counties, and Cameron and Hidalgo counties is shown in Table 11.

Table 11. Comparative Household Survey Data for Lubbock Study Area, McLennan County, Potter and Randall Counties, and Cameron and Hidalgo Counties.

Urban Area	Lubbock County	McLennan County	Potter and Randall Counties	Cameron and Hidalgo Counties
Demographics				
Household Population	269,032	228,241	233,533	1,030,139
Licensed Drivers	185,436	151,191	164,001	585,035
Number of Households	97,598	83,995	88,507	294,825
Average Household Size	2.76	2.72	2.64	3.49
Number of Motor Vehicles	186,412	158,805	178,784	555,443
Motor Vehicles per Household	1.91	1.89	2.02	1.88
Number of Daily Trips by Mode				
Total Person Trips	950,628	712,766	830,583	3,583,480
Automobile-Driver Trips	628,352	450,637	523,635	2,023,295
Motor Vehicle Passenger Trips	268,711	223,990	265,544	1,243,681
School Bus Trips	4,957	3,201	7,872	188,781
Walk Trips	14,964	16,627	11,563	93,337
Public Transit Trips	4,957	3,201	7,872	9,889
Bicycle Trips	1,829	4,781	2,002	6,571
Commercial Vehicle Trips	18,051	2,856	9,583	14,250
Other Modes/Taxi	2,907	NA	1,873	3,709
Number of Daily Trips by Destination/Purpose				
Trips to Home	328,343	254,084	300,993	1,322,199
Trips to Work	111,325	80,919	86,938	353,105
Trips Work Related	43,807	21,604	25,302	109,126
Trips to Shop	94,199	74,105	95,421	333,674
Trips to Pick-Up/Drop Off Passenger	82,822	65,744	77,014	410,936
Trips for Personal Business	73,200	59,229	73,011	228,654
Trips for Social/Recreation	82,872	69,543	68,556	276,680
Trips for School K-12	45,823	35,467	46,973	292,203
Trips for School Post Secondary	17,321	5,739	4,897	46,762
Trips for Meal/Eat	57,574	40,757	46,049	171,603
Trips to Change Mode	6,083	4,038	2,836	24,622
Other Trips	7,261	1,537	2,590	3,596
Person Trips per Person	3.53	3.12	3.62	3.48
Person Trips per Household	9.74	8.49	9.38	12.15
Trip Lengths and Durations				
Average Person Trip Length in Miles	4.1	5.8	4.7	6.5
Average Vehicle Trip Length in Miles	NA	6.3	5.0	7.0
Average Person Trip Duration in Minutes	6.8	8.8	5.9	9.2
Average Vehicle Trip Duration in Minutes	NA	9.4	6.1	9.8

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: The movement of an individual from one location to another location. In the 2006-2007 Lubbock Household Survey, these trips were recorded for all persons, regardless of age.

Vehicle Trip: The movement of a vehicle from one location to another location. These trips are recorded for the person driving the vehicle.

Trip Purpose: 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.

Trip Activity: The activity the individual did at the location the trip began and/or the location the trip ended. These activities were recorded in the survey and post-processed to identify the purpose associated with the activity.

Vehicle Availability: 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: The physical means used to make a trip. The modes recorded in the survey include 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 that 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 an HBW trip.

Home-Based Non-Work (HBNW) Trip: A trip that 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 that has neither end at home.

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



A vehicle trip is the movement of a vehicle from one location to another location.





Only trips that involve a serve passenger or change mode of travel between home and work (or vice versa) are considered for linking.



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