2004 San Angelo External Survey Technical Summary

★ **San Angelo**

Texas Department of Transportation

2004 San Angelo External Survey

TECHNICAL SUMMARY

Texas Department of Transportation Travel Survey Program

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Acknowledgements

INTRODUCTION

In 2004 the Transportation Planning and Programming (TPP) Division of the Texas Department of Transportation (TxDOT) funded an external station travel survey in the San Angelo Metropolitan Planning Organization (MPO) study area. This survey measured and identified travel patterns into, within, and out of San Angelo, which is in Tom Green County. This report presents a Technical Summary of the 2004 San Angelo External Station Survey and documents the data collected and the analysis results for the study area.

EXTERNAL STATION SURVEY

An external station survey collects data through personal interviews to measure and identify travel patterns of vehicles and/or pedestrians entering and exiting a particular study area. 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. This data provides a basis for estimating the amount of travel occurring in the study area prior to the time of the survey.

SAN ANGELO STUDY AREA

The study area, as shown in Figure 1, is located in Tom Green County in the western portion of Texas. Tom Green County has a land area of over 1,500 square miles and a population density of 68.2 persons per square mile. The population center of the county is comprised of the city of San Angelo, which according to the 2000 census had a population of approximately 88,000 persons. The boundary established for the San Angelo external survey was determined by the local MPO.
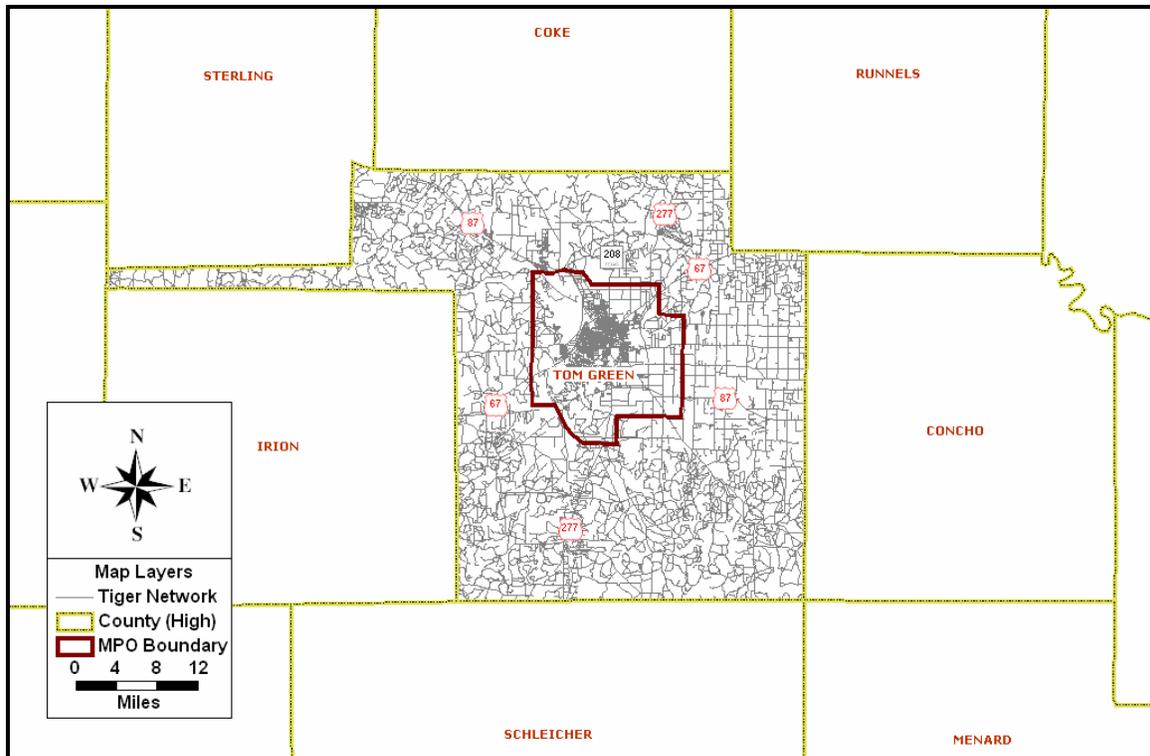
Figure 1. San Angelo Study Area.

EXTERNAL STATIONS

There were 23 locations on the border of San Angelo study area identified as external stations. These locations are transportation facilities that cross the study area boundary and represent where travelers may enter and exit the study area. Of these 23 locations, eleven were selected for travel surveys. Figure 2 shows the location of the external stations in San Angelo and Table 1 identifies the external surveys, their general location, whether or not surveys were conducted, and the 24-hour traffic count at the location. Additionally, Table 1 groups the external station locations by direction. The location group aggregated data will be utilized to present external local and through trip information later in the summary.
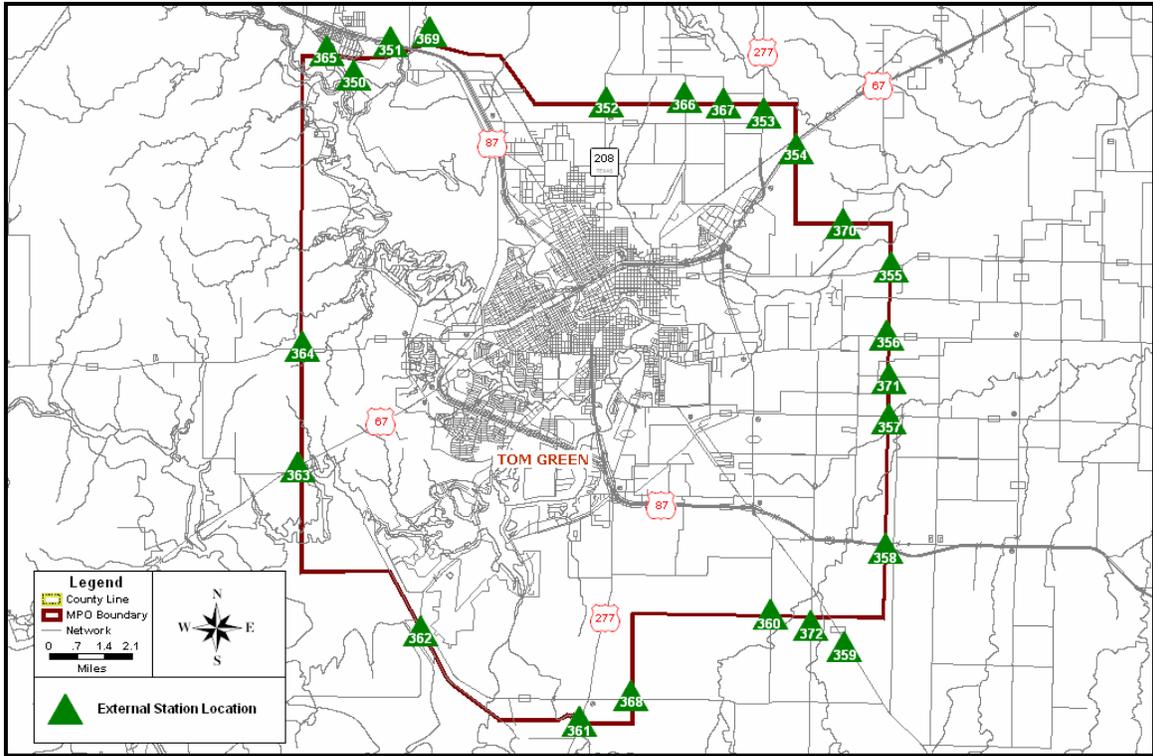
Figure 2. San Angelo External Station Locations.

Table 1. San Angelo External Stations.

Station Number	Facility	Location	Surveyed	24-Hour Vehicle Count		Location Group
				Inbound	Outbound	
365	Old Sterling City Hwy.	Between FM 2288 and US 87	No	1,105	1,162	North
350	FM 2288	Between Old Sterling City Hwy. and US 87	Yes	897	820	
351	US 87 N	Between Grape Creek Rd. and Sunflower Ave.	Yes	6,313	5,863	
369	Grape Creek Rd.	Between US 87 and Wren Rd.	No	535	564	
352	SH 208	Between FM 2105 and E. Red Creek Rd.	Yes	1,425	1,289	
366	Rust Rd.	Between FM 2105 and E. Red Creek Rd.	No	157	183	
367	N. Red Creek Rd	Between FM 2105 and E. Red Creek Rd.	No	46	44	
353	US 277 N	North of FM 2105	Yes	1,237	1,499	
354	US 67 N	Between Old Ballinger and Harriet	Yes	2,977	2,866	
370	City Farm Rd.	Northeast of FM 380	No	98	82	
355	FM 380	East of Ames Rd.	Yes	696	687	East
356	FM 388	Between Olsak Rd. and Hawk Ave.	Yes	256	291	
371	E. Ames Rd.	Between Wilde Rd. and Hawk Ave.	No	47	45	
357	FM 765	Between Wilde Rd. and Hawk Ave.	Yes	580	424	
358	US 87 S	Between Wilde Rd. and Spur 570	Yes	3,344	2,640	
359	FM 1223	Between Robby Jones Rd. and Wood Rd.	No	145	126	South
372	Robby Jones Rd.	South of FM 1223	No	63	67	
360	Mikulik Rd.	South of Schwartz Rd.	No	423	309	
368	Walling Pelican	East of US 277	No	41	40	
361	US 277 S	Between FM 584 and Reece Rd.	Yes	2,368	2,301	
362	Knickerbocker	South of FM 584	No	160	168	
363	US 67 S	Between Chapel Hill Dr. and Jameson Rd.	Yes	2,301	2,283	West
364	FM 853	Between FM 2288 and Pullam Ranch Rd.	No	153	145	
		Total		25,367	23,898	

SURVEY METHODOLOGY

The methodology employed in the survey was personal interview. For each external station surveyed, traffic control plans were set up and vehicles in the outbound direction (i.e. leaving the study area) were directed into an area where trained survey personnel interviewed the drivers. Those declining were allowed to continue on their trip. Drivers of commercial and non-commercial vehicles were interviewed using different survey instruments and those forms are provided in the Appendix. Figure 3 shows a typical survey station at an external station.

For a more detailed discussion and description of the survey methodology, see the report, *San Angelo External Station Travel Survey*, prepared by Gram Traffic Counting, Inc., the vendor selected to conduct the survey.

Figure 3. Typical External Survey Station.

DATA ANALYSIS

Data analysis for non-commercial and commercial vehicles is developed separately and presented in this section. Non-commercial vehicles are typically personal use passenger cars, trucks, vans, and motorcycles. Commercial vehicles are those used for commercial purposes and, in most cases, consist of heavy-duty trucks.

The analysis is based on information obtained from completed interviews of motorists. In San Angelo, the majority of vehicles surveyed were non-commercial. Nearly 90 percent of the surveys (89.33 percent) were for non-commercial vehicles. The number of surveys for commercial and non-commercial vehicles by station is provided in Table 2.

Table 2. Number of Non-Commercial and Commercial Vehicle Surveys.

Station Number	Facility	Location	Number Surveyed	
			Non-Commercial	Commercial
350	FM 2288	Between Old Sterling City Hwy. and US 87	295	23
351	US 87 N	Between Grape Creek Rd. and Sunflower Ave.	438	63
352	SH 208	Between FM 2105 and E. Red Creek Rd.	404	28
353	US 277 N	North of FM 2105	380	54
354	US 67 N	Between Old Ballinger and Harriet	423	57
355	FM 380	East of Ames Rd.	208	15
356	FM 388	Between Olsak Rd. and Hawk Ave.	92	5
357	FM 765	Between Wilde Rd. and Hawk Ave.	167	14
358	US 87 S	Between Wilde Rd. and Spur 570	369	58
361	US 277 S	Between FM 584 and Reece Rd.	404	58
363	US 67 S	Between Chapel Hill Dr. and Jameson Rd.	421	55
Total			3,601	430

During the review of the data, there were a number of vehicles that indicated that the location where they entered the study area was the same location at which they were being surveyed. Since the survey is conducted in the outbound direction, it was assumed that the motorists misinterpreted the definition of a trip, and subsequently did not provide information on where they may have stopped within the study area. A total of twenty-five non commercial and two commercial vehicles were dropped from the analysis due to this occurrence.

Trip Types

There are two types of trips identified as part of an external survey - external-local trips and external-through trips. A local trip is one where either the origin or destination of the trip is in the study area and the other trip end is outside the study area. A through trip is one traveling through the study area without stopping. Table 3 presents the survey data for non-commercial and commercial vehicles in terms of trips identified as local or through movements. Over 90

percent of non-commercial vehicle trips (93.59 percent) and nearly 80 percent of commercial vehicle trips (76.05 percent) were local trips.

Table 3. Survey Results by Trip Type (Commercial and Non-Commercial Vehicles).

Station Number	Facility	Non-Commercial Vehicles			Commercial Vehicles		
		Local	Through	Total	Local	Through	Total
350	FM 2288	284	11	295	20	3	23
351	US 87 N	379	59	438	47	16	63
352	SH 208	386	18	404	22	6	28
353	US 277 N	354	26	380	35	19	54
354	US 67 N	404	19	423	49	8	57
355	FM 380	203	5	208	12	3	15
356	FM 388	89	3	92	5	0	5
357	FM 765	162	5	167	14	0	14
358	US 87 S	316	53	369	40	18	58
361	US 277 S	382	22	404	34	24	58
363	US 67 S	411	10	421	49	6	55
Total		3370	231	3601	327	103	430

The second type of trip identified in the survey is a sub-category of external local trips. These are reported as resident and non-resident trips. A resident is a survey respondent that reported they resided in San Angelo. A non-resident is a respondent that reported they lived outside of San Angelo. Table 4 presents the survey data by residents and non-residents as well as the number of trips made by non-residents within the study area. An important element of the trips reported by non-residents is the number of trips made prior to being surveyed. Based on the information provided in the survey, these trips are evaluated to estimate the number of internal trips, trips where both the origin and destination are within the study area, made by non-residents. By measuring the number of non-residents that travel in and out of San Angelo and the number of internal trips they make, an estimate of the total internal trips within the study area attributable to non-residents can be developed.

The residency questions were only asked of respondents in non-commercial vehicles. Table 4 indicates that individuals who do not live in the study area make a sizeable proportion, 44.85

percent, of the non-commercial travel in and out of San Angelo. The average number of internal trips made by those individuals is 0.31 trips per vehicle.

Table 4. Survey Results by Residency (Non-Commercial Vehicles Only).

Station Number	Facility	Number of Surveys	Residents	Percent	Non-Residents	Percent	Internal Trips (non-residents)
350	FM 2288	295	233	78.98	62	21.02	22
351	US 87 N	438	267	60.96	171	39.04	35
352	SH 208	404	204	50.50	200	49.50	49
353	US 277 N	380	191	50.26	189	49.74	32
354	US 67 N	423	242	57.21	181	42.79	49
355	FM 380	208	139	66.83	69	33.17	27
356	FM 388	92	69	75.00	23	25.00	10
357	FM 765	167	98	58.68	69	41.32	52
358	US 87 S	369	133	36.04	236	63.96	67
361	US 277 S	404	165	40.84	239	59.16	84
363	US 67 S	421	245	58.19	176	41.81	77
Total		3601	1986	55.15	1615	44.85	504

Travel Purpose

To understand the reasons people travel, the survey included questions about the driver's purpose for being at the location where the trip began (i.e., trip origin) and the purpose for traveling to their destination. There were sixteen different purposes included on the survey instrument for non-commercial vehicles and nine purposes on the commercial vehicle survey. Table 5 provides the trip purposes for each survey. For the purpose of presenting survey results, the trip purpose categories are combined into a fewer number to reflect the primary purposes of travel.

Table 5. Trip Purpose Categories.

Code	Non-Commercial Vehicle Trip Purpose	Code	Commercial Vehicle Trip Purpose
1	Home/Return Home	1	Base location/Return to Base location
2	Go/Return to Work	2	Delivery
3	Work Related	3	Pick Up
4	School	4	Maintenance
5	Vacation	5	Driver Needs (lunch, etc)
6	Visit Friends/Family	6	To Home
7	Eat Out	7	Buy Fuel
8	Shop	8	Other (specify)
9	Buy Gas	9	Unknown/Refused
10	Personal Business		
11	Pick Up/Drop Off Passenger		
12	Change Travel Mode		
13	Delivery		
14	Recreation		
15	Refused/Do Not Know		
16	Other		

For non-commercial vehicles, the trip purposes listed in Table 5 were combined into the following six categories:

Category	Trip Purpose Codes (from Table 5)
Home	1
Work	2 and 3
School	4
Personal	5, 6, 10, 11, and 14
Shop	7, 8, and 9
Other	12, 13, 15, and 16

Figure 4 presents the distribution of non-commercial vehicles by reported trip purpose at the origin of the trip and Figure 5 shows the distribution of non-commercial vehicles at the destination of the trip. The distribution for the origin purpose shows that the largest percentage of trips (30 percent) began at home, while 29 percent were at shopping related origins, and 22

percent were work related. A total of 40 percent of the trips destinations were for home, 30 percent were for work, and 25 percent were determined to be personal.
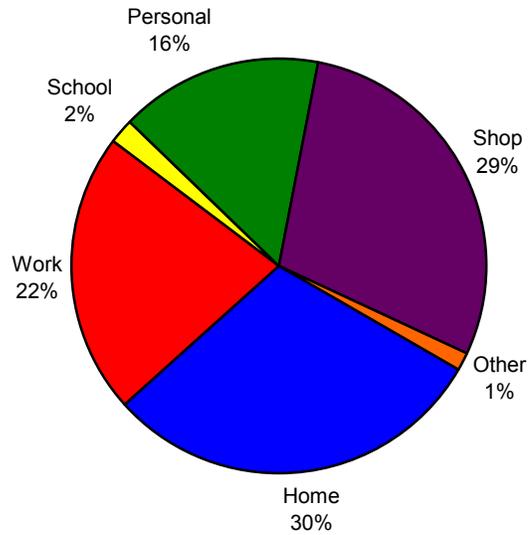
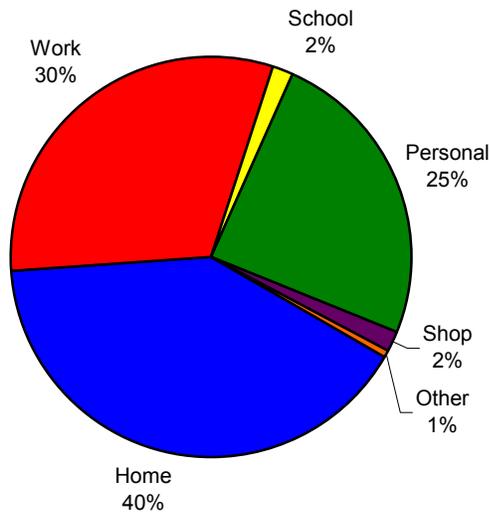**Figure 4. Trip Purpose at Origin for Non-Commercial Vehicles.**

Figure 5. Trip Purpose to Destination for Non-Commercial Vehicles

The trip purposes normally used in travel demand modeling are home-based work (HBW), home-based non-work (HBNW), and non-home based (NHB). HBW trips are those that have one end of the trip at home and the other end of the trip at work. Trips that begin at home and end at work or those that begin at work and end at home are HBW. A HBNW trip is one that one end of the trip is at home and the other trip end is any location other than work. A NHB trip is a trip that does not begin or end at home. A distribution of trips by trip purpose is provided in Figure 6. Over 40 percent of the trips (42.71 percent) were home-based non-work trips. Non-home based trips accounted for 29.96 percent of the trips and home-based work comprised the remaining 27.33 percent of the trips.
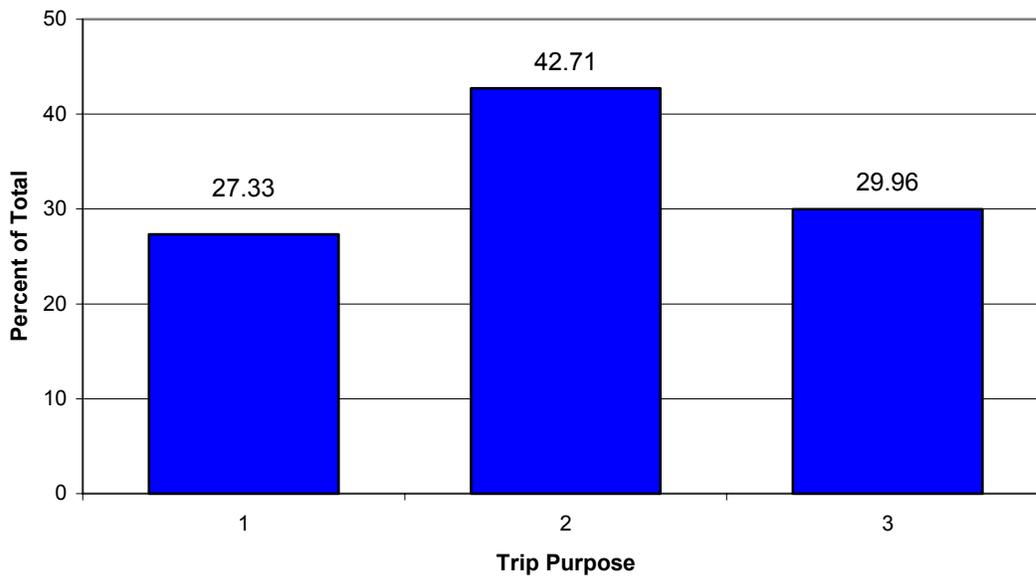
Figure 6. Distribution of Non-Commercial Vehicle Trips by Trip Purpose.

For commercial vehicles, the trip purposes shown in Table 5 were combined into the following five categories:

Category	Trip Purpose Codes
Base Location	1
Delivery	2
Pick Up	3
Support Functions	4, 5, 6, and 7
Other	8 and 9

Figures 7 and 8 present the distribution of commercial vehicle trips by reported trip purpose at the origin and destination of the trip. The distribution of commercial trips by purpose at the trip origin shows a relatively even allocation among pick-up, delivery, base, and support functions. Pick-up is the most common origin trip purpose (32 percent), while support functions (23 percent), base (23 percent), and delivery (21 percent) account for nearly a quarter of the trip purposes each. The distribution for destination trip purpose shows that the majority of the surveyed vehicles, 62 percent, were destined for delivering cargo and another 23 percent were destined for picking up cargo. Only 10 percent of the trip destinations were for support functions and 4 percent of the destinations were for the base category.
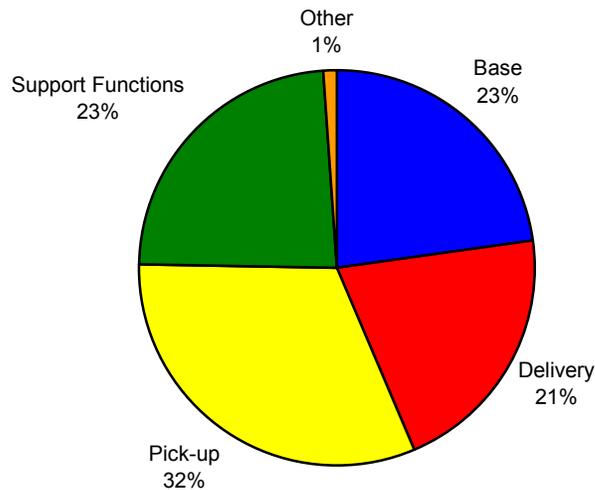

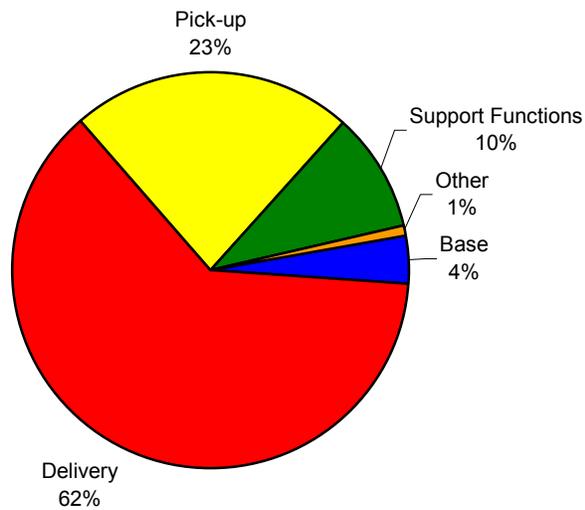**Figure 7. Trip Purpose at Origin for Commercial Vehicles.**

Figure 8. Trip Purpose to Destination for Commercial Vehicles.

In addition to obtaining information on the purpose of travel, questions were asked to identify the type of place associated with the origin of the trip. Table 6 provides the results of the responses provided for both commercial and non-commercial vehicles. For non-commercial vehicles, the largest percentage of respondents listed residential (37.96 percent) as the type of place at the origin. An additional 26.02 percent of the non-commercial vehicles cited retail/shopping/gas as the type of place. For commercial vehicles, the majority of the respondents (61.40 percent) listed industrial/manufacturing as the type of place at the origin. Retail/shopping/gas was the next largest percentage of type of place at the origin for commercial vehicles at 23.26 percent.

Table 6. Type of Place at Trip Origin.

Type of Place	Non-Commercial Vehicles		Commercial Vehicles	
	Number	Percent	Number	Percent
Office Building	341	9.47	3	0.70
Retail/Shopping/Gas	937	26.02	100	23.26
Industrial/Manufacturing	303	8.41	264	61.40
Medical	174	4.83	2	0.47
Educational	124	3.44	2	0.47
Government	51	1.42	0	0.00
Residential	1367	37.96	18	4.19
Airport	8	0.22	0	0.00
Eating Establishment	203	5.64	19	4.42
Hotel/Motel	50	1.39	2	0.47
Other	43	1.19	20	4.65
Total	3601	100.00	430	100.00

Time-of-Day

Vehicle classification counts were conducted at each external survey location on the same day as the survey. These counts were for a 24-hour period and they include data by time-of-day and by direction. This information is primarily used for expansion of the survey data, but is also of interest to examine the distribution of vehicles by time-of-day. Figures 9 and 10 provide the distribution of non-commercial and commercial vehicles by time-of-day for all of the external locations by inbound and outbound direction, respectively.

For inbound vehicles (Figure 9), the morning peak occurs between 7 a.m. and 8 a.m. for non-commercial and commercial vehicles. There is an afternoon peak period for non-commercial vehicles between 5 p.m. and 6 p.m., while commercial vehicles remain fairly constant from the morning peak through 3 p.m. when the amount of commercial vehicles begins to decline.

For outbound traffic (Figure 10), the morning peak period is less pronounced, but it also occurs between 7 a.m. and 8 a.m. Non-commercial vehicles have a significant afternoon peak between 5 p.m. and 6 p.m., while the commercial vehicles remain constant from the morning peak through 5 p.m.
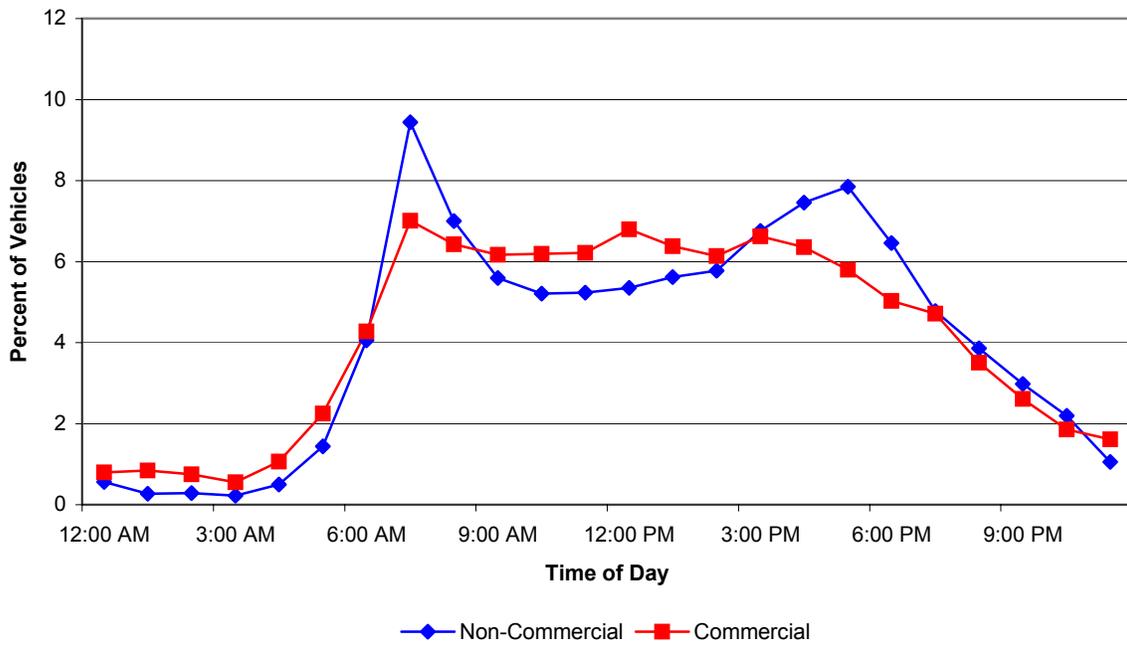
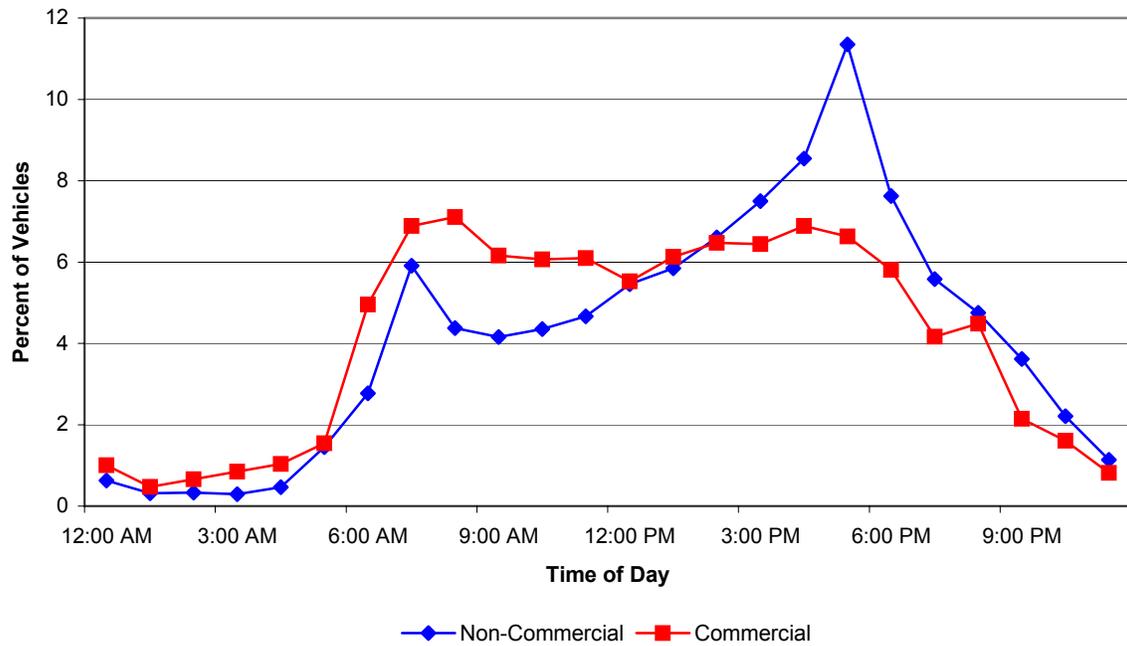**Figure 9. Distribution of Inbound Vehicles by Time-of-Day.**

Figure 10. Distribution of Outbound Vehicles by Time-of-Day.

Vehicle Characteristics

As part of the survey, interviewers collected data on the year, make, odometer readings, and model of each vehicle surveyed. This provides an indication of the distribution of vehicles traveling through the external stations by type, age, and condition (as implied by the number of miles on the vehicle). Figure 11 represents the percent distribution of non-commercial and commercial vehicles by age as reported in the surveys. The average age of non-commercial vehicles was 5.45 years and for commercial vehicles the average age was 6.40 years. The median age was 2000 for non-commercial vehicles and 1999 for commercial vehicles.
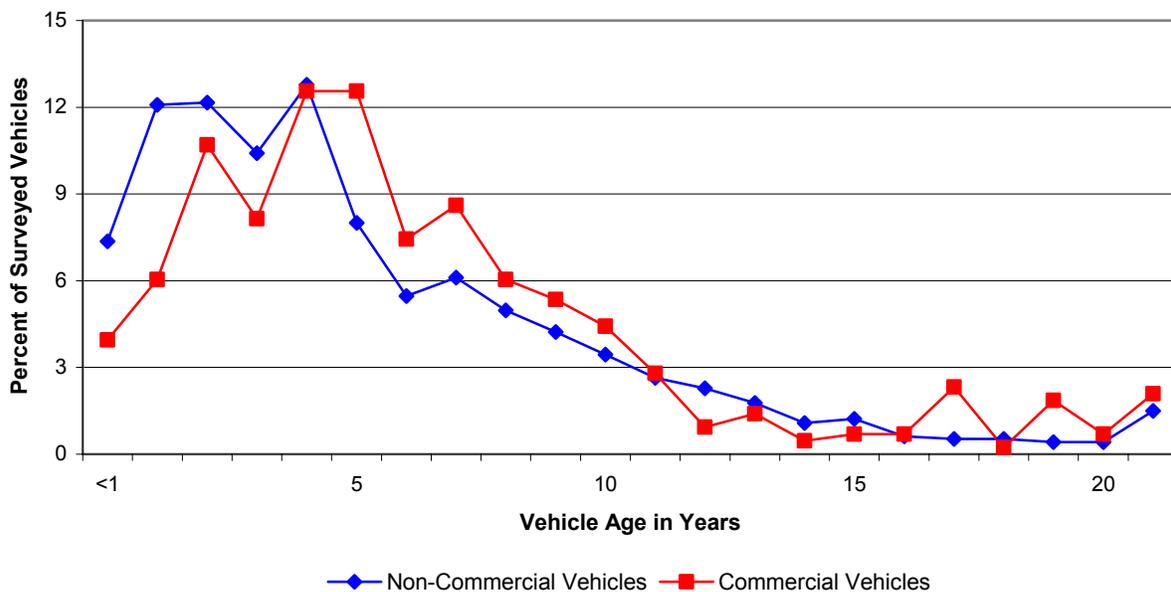
Figure 11. Distribution of Surveyed Vehicles by Age of Vehicle.

Figure 12 presents the average odometer reading for non-commercial and commercial vehicles by age. This data shows the difference in mileage accumulation rates of commercial vehicles as compared to non-commercial vehicles. Unlike non-commercial vehicles, the data for commercial vehicles do not show smooth trends. This is due in part to the number of observations in the non-commercial and commercial surveys (3601 and 430, respectively). For example, for vehicles twenty years old, there were 15 observations for commercial vehicles and only 3 for commercial vehicles. One commercial vehicle surveyed had an odometer reading of over a million miles, and as a result, the average for the group is higher than a trend would indicate.

The average odometer reading for non-commercial vehicles was 87, 692 and the average commercial vehicle odometer reading was 347,465. For more detailed information, Table 7 presents the numerical values for the non-commercial data plotted in Figures 11 and 12. Table 8 provides similar information for commercial vehicles.
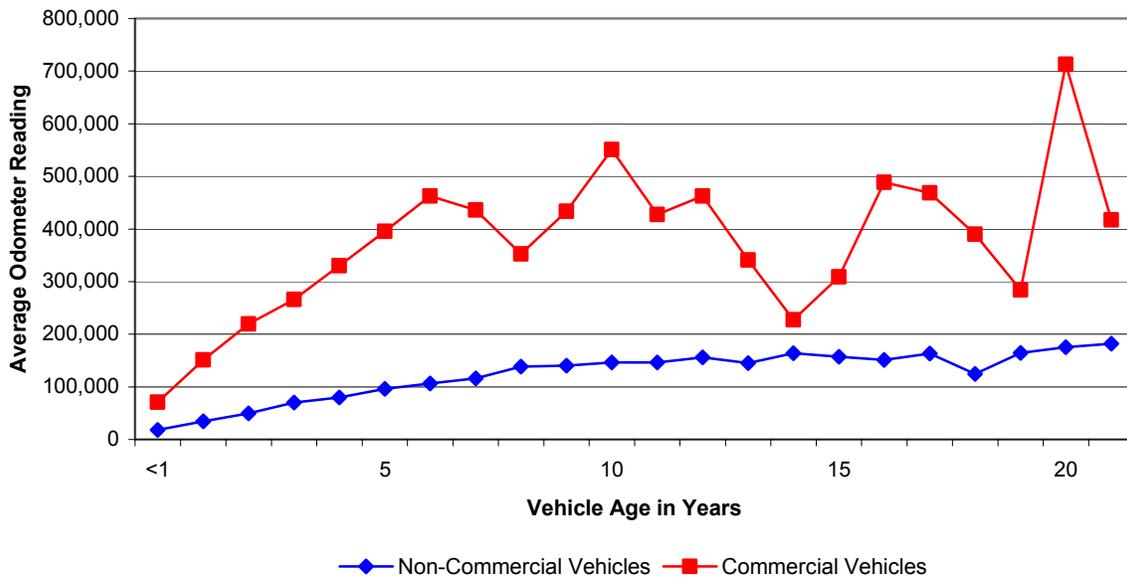

Figure 12. Average Odometer Readings for Vehicles by Age of Vehicle.

Table 7. Distribution of Non-Commercial Vehicles by Age and Average Odometer Readings.

Age	Number of Vehicles	Percent of Total	Cumulative Percent of Total	Average Reported Odometer Value
<1	265	7.36	7.36	18,135
1	435	12.08	19.44	34,428
2	438	12.16	31.60	49,332
3	375	10.41	42.02	70,110
4	460	12.77	54.79	79,834
5	288	8.00	62.79	95,847
6	197	5.47	68.26	106,441
7	220	6.11	74.37	115,909
8	179	4.97	79.34	138,317
9	152	4.22	83.56	140,316
10	124	3.44	87.00	146,291
11	95	2.64	89.64	146,584
12	82	2.28	91.92	156,301
13	64	1.78	93.70	145,391
14	39	1.08	94.78	164,138
15	44	1.22	96.00	157,163
16	22	0.61	96.61	151,095
17	19	0.53	97.14	163,491
18	19	0.53	97.67	124,367
19	15	0.42	98.08	164,334
20	15	0.42	98.50	175,635
>20	54	1.50	100.00	181,838
Total	3601	100.00		

Table 8. Distribution of Commercial Vehicles by Age and Average Odometer Readings.

Age	Number of Vehicles	Percent of Total	Cumulative Percent of Total	Average Reported Odometer Value
<1	17	3.95	3.95	70,850
1	26	6.05	10.00	151,305
2	46	10.70	20.70	219,594
3	35	8.14	28.84	266,345
4	54	12.56	41.40	330,172
5	54	12.56	53.95	395,584
6	32	7.44	61.40	462,400
7	37	8.60	70.00	436,191
8	26	6.05	76.05	352,692
9	23	5.35	81.40	433,358
10	19	4.42	85.81	551,064
11	12	2.79	88.60	427,542
12	4	0.93	89.53	462,319
13	6	1.40	90.93	340,762
14	2	0.47	91.40	227,388
15	3	0.70	92.09	309,053
16	3	0.70	92.79	488,791
17	10	2.33	95.12	468,404
18	1	0.23	95.35	389,900
19	8	1.86	97.21	283,902
20	3	0.70	97.91	713,073
>20	9	2.09	100.00	417,466
Total	430	100.00		

Vehicle Occupancy

As vehicles were surveyed, one of the data items recorded was the class or type of vehicle and the number of persons in the vehicle. This information provides a means for estimating the number of persons traveling in and out of the San Angelo study area. Table 9 presents the number of observed non-commercial and commercial vehicles by class and the average occupancy of each. Nearly all of the non-commercial vehicles (99.31 percent) were classified as passenger vehicles. The majority of commercial vehicles (70.47 percent) were semi/tractor-trailer combinations. The overall average occupancy for non-commercial vehicles was 1.32 and 1.06 for commercial vehicles.

Table 9. Distribution of Vehicles by Class and Average Occupancy.

Non-Commercial Vehicles	Observed Vehicles	Average Occupancy	Commercial Vehicles	Observed Vehicles	Average Occupancy
Passenger Vehicle	3576	1.32	Single Unit 2-axle (6 wheels)	63	1.11
Bus	0	—	Single Unit 3-axle (10 wheels)	53	1.11
Taxi/Paid Limo	0	—	Single Unit 4-axle (14 wheels)	11	1.00
School Bus	0	—	Semi (tractor-trailer)	303	1.04
Motorcycle	17	1.24	Other	0	—
Recreational Vehicle	8	1.63			
Other	0	—			
Total	3601	1.32	Total	430	1.06

COMMERCIAL VEHICLE CARGO CHARACTERISTICS

Commercial vehicles represent a major component of travel into, out of, and through most study areas. Specific questions were included in the commercial vehicle survey to obtain information on the cargo being transported, the type of facility where it was picked up and dropped off, and how the cargo was transported to the vehicle. Table 10 presents data on the number of commercial vehicles surveyed by external station, the number and percent of vehicles not transporting any cargo, and whether or not their cargo was from Mexico.

Over thirty percent of the vehicles (31.16 percent) reported not carrying any cargo. Of those vehicles transporting cargo, 98.31 percent of those cargos were not from or headed to Mexico. Only five vehicles indicated that their cargo was from or destined to Mexico. For those vehicles carrying a cargo, only 3.72 percent reported picking their cargo up at an intermodal facility and 2.36 percent indicated that they would be dropping their cargo off at an intermodal facility. An intermodal facility is a site where cargo may be transferred between several different modes (e.g. rail to truck, ship to truck, etc.).

Table 10. Commercial Vehicles With Cargo from Mexico.

Station Number	Facility	Surveyed Vehicles	Empty Vehicles	Percent Empty	Vehicles with Mexico Cargo	Vehicles without Mexico Cargo
350	FM 2288	23	9	39.13	2	12
351	US 87 N	63	17	26.98	0	46
352	SH 208	28	11	39.29	1	16
353	US 277 N	54	12	22.22	0	42
354	US 67 N	57	15	26.32	1	41
355	FM 380	15	5	33.33	0	10
356	FM 388	5	0	0.00	0	5
357	FM 765	14	7	50.00	0	7
358	US 87 S	58	23	39.66	1	34
361	US 277 S	58	20	34.48	0	38
363	US 67 S	55	15	27.27	0	40
Total		430	134	31.16	5	291

A detailed summary of cargo types reported for commercial vehicles is provided in Table 11. Empty vehicles comprised 31.16 percent of those surveyed. For vehicles with identified cargo types, 15.35 percent reported that their cargo was food, health, and beauty products, 10.23 percent reported a cargo of clay, concrete, glass, or stone, and an additional 10.23 percent cited farm products as the cargo.

Table 11. Distribution of Commercial Vehicles by Type of Cargo.

		Cargo Description	Number of Vehicles	Percent of Vehicles
1	—	Farm Products	44	10.23
2	—	Forest Products	0	0.00
3	—	Marine Products	1	0.23
4	—	Metals and Minerals	24	5.58
5	—	Food, Health, and Beauty Products	66	15.35
6	—	Tobacco Products	0	0.00
7	—	Textiles	1	0.23
8	—	Wood Products	21	4.88
9	—	Printer Matter	1	0.23
10	—	Chemical Products	1	0.23
11	—	Refined Petroleum or Coal Products	10	2.33
12	—	Rubber, Plastic, and Styrofoam Products	7	1.63
13	—	Clay, Concrete, Glass, or Stone	44	10.23
14	—	Manufactured Goods/Equipment	26	6.05
15	—	Wastes	1	0.23
16	—	Miscellaneous Shipments	21	4.88
17	—	Hazardous Materials	4	0.93
18	—	Transportation	23	5.35
19	—	Unclassified Cargo	0	0.00
20	—	Driver Refused to Answer	1	0.23
21	—	Unknown to Driver	0	0.00
22	—	Empty	134	31.16
		Total	430	100.00

Figures 13 and 14 present the distribution of surveyed commercial vehicles by the type of transfer for their cargo at the origin (point of pick up) and at their destination (point of delivery). The majority of cargo transfers at both the origin and destination were reported as warehouse (62 percent and 63 percent, respectively). The second most reported transfer (25 percent for both the origin and destination) was for truck to truck. Pipeline to truck accounted for approximately ten percent of transfers at both the origin and destination. There were no vehicles that reported transferring their cargo from a ship or plane.
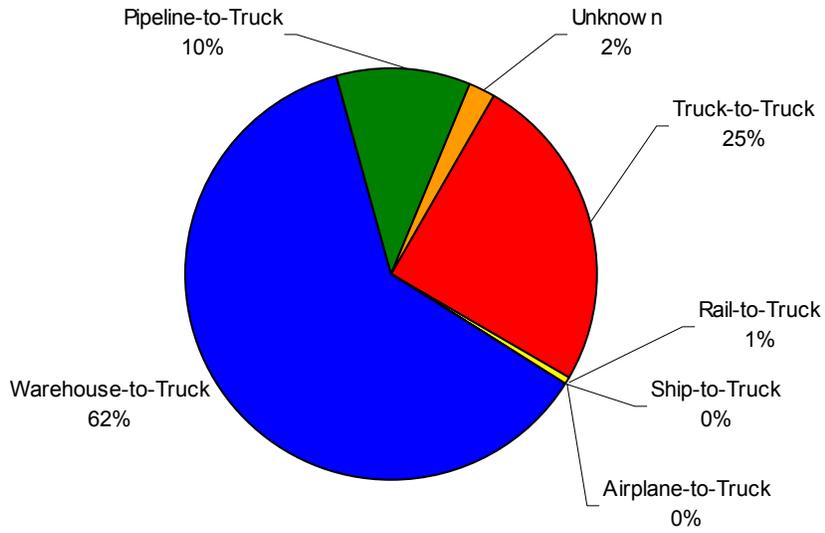
Figure 13. Cargo Transfer at Point of Pick-Up.
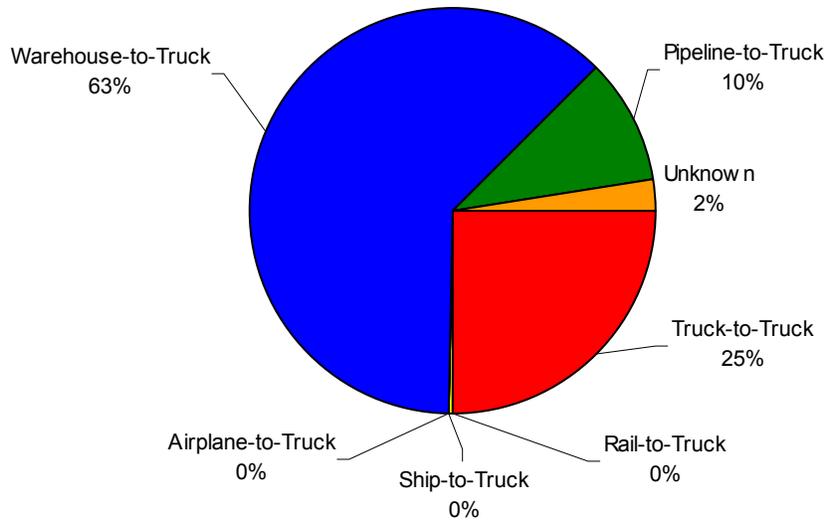
Figure 14. Cargo Transfer at Point of Drop-Off.

SURVEY DATA EXPANSION

The vehicle survey data were expanded based on the 24-hour directional vehicle classification counts conducted at each survey site on the day the site was surveyed. The assumption is made that the traffic in the non-surveyed direction is a mirror image of the traffic in the surveyed direction. For example, if 10 percent of the surveyed outbound traffic was through trips, it is assumed that 10 percent of the inbound traffic will be through trips. It is also assumed that the surveyed vehicles are a representative sample of the vehicles at each site for a 24-hour period. Table 12 presents the expanded estimates of external-local and external-through trips for non-commercial and commercial vehicles by site as well as the estimates of trips by residents and visitors (non-residents). It should be noted that estimates are included in Table 12 for the non-surveyed sites. For non-surveyed sites, it was assumed that all trips made were local trips. Additionally, the number of residents and visitors for the non-surveyed sites was determined using the percentage of residents and visitors from a proximal surveyed site. For example, the percentage of residents as determined from the survey for FM 2288 (station number 350) were applied to the total number of trips for Old Sterling City Highway (station number 365) which was a non-surveyed location.

The expanded survey data were used to develop zone-to-zone estimates of non-commercial and commercial vehicle trips based on the geocoded origins and destinations for the surveyed trips. Trips for the non-surveyed sites were distributed to the destination zones observed from the surveyed sites on a proportional basis. It is assumed that the surveyed sites are representative of the most likely destination zones for the non-surveyed sites. Since the volume of vehicle trips at the non-surveyed sites is typically low, the amount of error that may be generated by that assumption is believed to be small.

Table 12. Expanded Survey Results by Station.

Station Number	Facility	Non-Commercial Vehicles			Commercial Vehicles			Residents	Visitors
		Local	Through	Total	Local	Through	Total		
350	FM 2288	1,489	25	1,514	184	19	203	1,176	313
351	US 87 N	9,132	1,044	10,176	1,597	403	2,000	5,567	3,565
352	SH 208	2,211	77	2,288	384	42	426	1,117	1,094
353	US 277 N	2,106	130	2,236	361	139	500	1,059	1,047
354	US 67 N	4,939	315	5,254	467	122	589	2,826	2,113
355	FM 380	1,135	39	1,174	161	48	209	759	376
356	FM 388	472	9	481	66	0	66	354	118
357	FM 765	864	16	880	124	0	124	507	357
358	US 87 S	4,085	822	4,907	731	346	1,077	1,472	2,613
359	FM 1223	206	0	206	65	0	65	84	122
360	Mikulik Rd.	705	0	705	27	0	27	288	417
361	US 277 S	3,527	257	3,784	603	282	885	1,441	2,086
362	Knickerbocker	301	0	301	27	0	27	123	178
363	US 67 S	3,772	109	3,881	619	84	703	2,195	1,577
364	FM 853	161	13	174	124	0	124	94	67
365	Old Sterling City Hwy.	2,234	0	2,234	33	0	33	1,764	470
366	Rust Rd.	293	0	293	47	0	47	148	145
367	N. Red Creek Rd	69	0	69	21	0	21	35	34
368	Walling Pelican	57	0	57	24	0	24	23	34
369	Grape Creek Rd.	986	49	1,035	57	7	64	779	207
370	City Farm Rd.	153	3	156	19	5	24	77	76
371	E. Ames Rd.	69	0	69	23	0	23	52	17
372	Robby Jones Rd.	89	0	89	41	0	41	36	53
	Total	39,055	2,908	41,963	5,805	1,497	7,302	21,976	17,079

Figure 15 shows the estimates of external-local trip movements by direction and location group. The North group had the largest estimated number of trip movements, with nearly 27,000 total daily trips. This group had nearly 50 percent more trips than the other three direction groups combined.
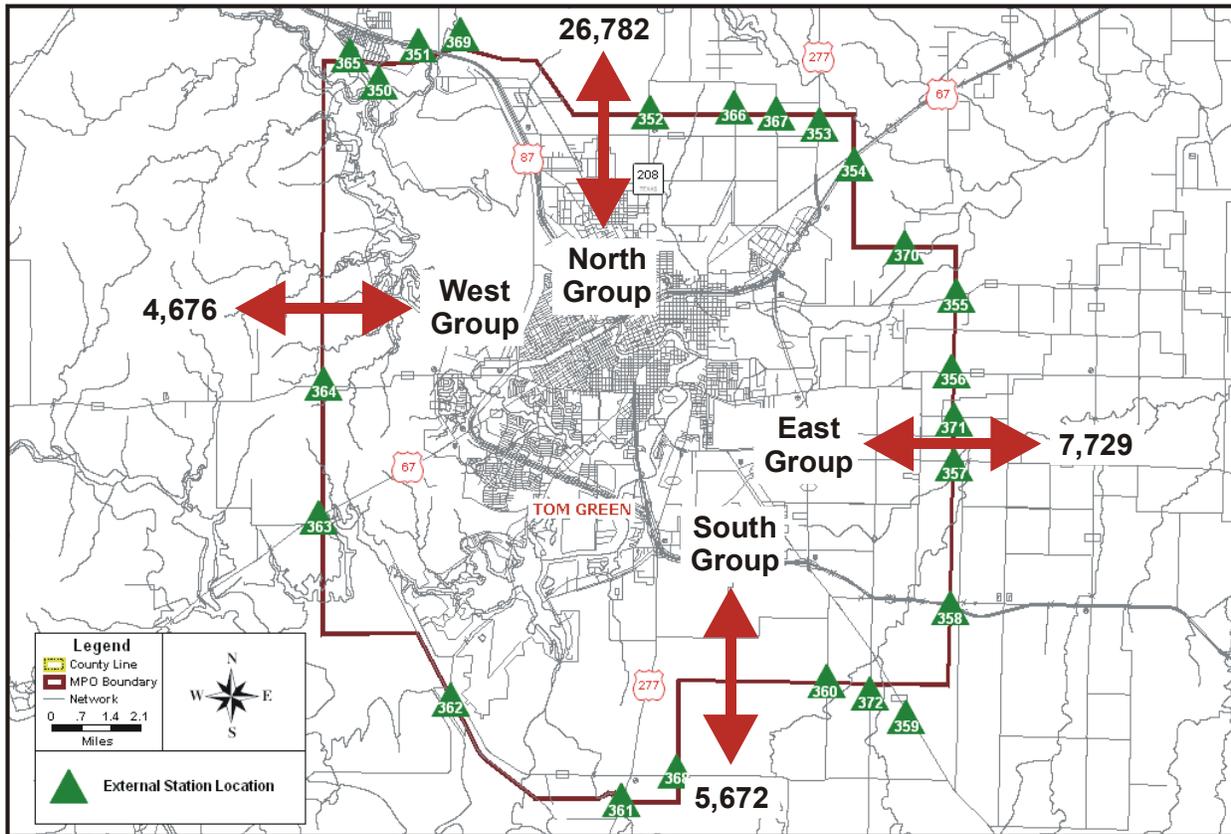
Figure 15. Estimates of External-Local Trip Movements by Location Group.

Figure 16 shows the estimates of external-through trip movements by direction and location group. The most common external-through movements were between the North and East groups. North-South external-through trips were the second most common movement.
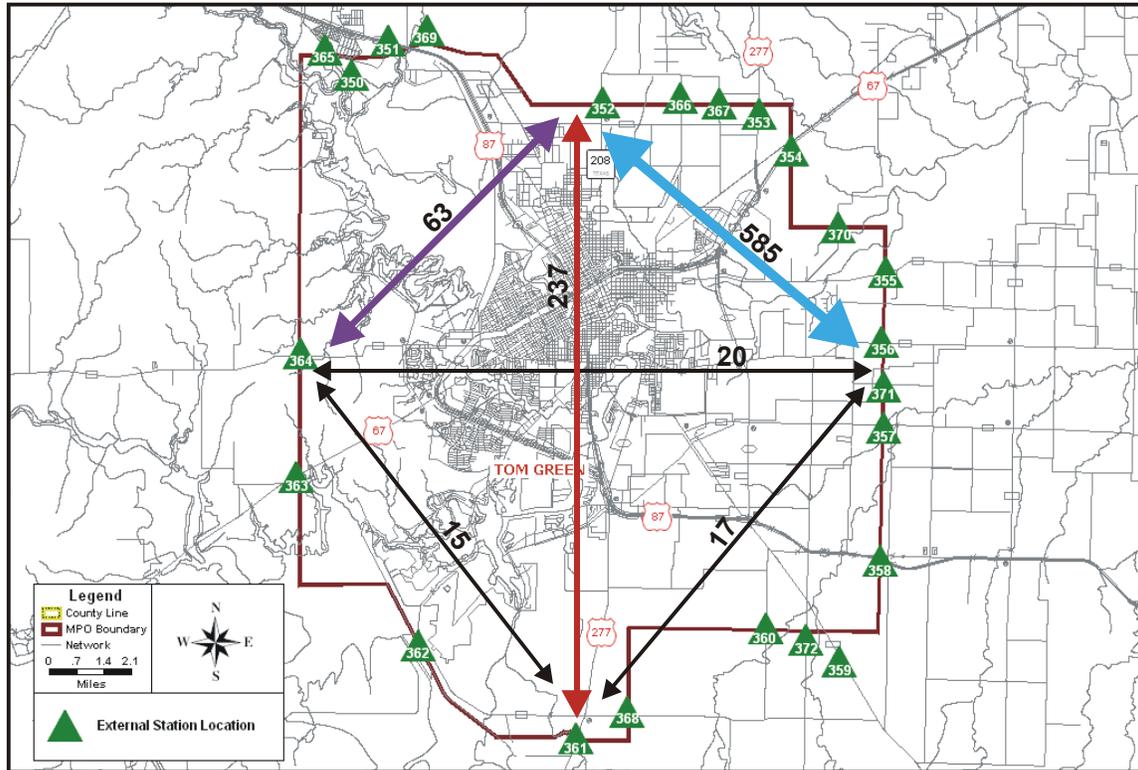
Figure 16. Estimates of External-Through Trip Movements by Location Group.

SURVEY SUMMARY

More than 49,000 vehicles enter and leave the San Angelo area daily. Nearly 15 percent are commercial vehicles. Only 8.94 percent of the approximate 49,000 vehicles make through trips. Over 18,000 vehicles, nearly one third of the non-commercial and commercial vehicles, enter or leave San Angelo via US 87. Based on the average vehicle occupancy observed in the survey, an estimated 55,400 persons are entering and leaving San Angelo daily by non-commercial vehicle and nearly 7,800 persons are entering and leaving by commercial vehicle. The estimated number of non-residents (persons that do not live in San Angelo) that enter the study area daily is just over 22,500. Of these 22,500 persons, approximately 19,200 are making local trips within the study area.

Approximately 30 percent of non-commercial trip origins were leaving home and over 40 percent of non-commercial trip destinations were returning to home. HBNW trips accounted for

more than 40 percent of the non-commercial trips. The percentage of trips that were HBW and NHB were nearly equal (27 percent and 30 percent, respectively).

Commercial vehicle drivers reported varied trip purposes at the origin and destination ends of their trip. Approximately 32 percent of the trip origin purposes were reported to be for picking up. Delivery of cargo accounted for an additional 21 percent of trip origins. Delivering cargo was the stated purpose for 62 percent of the destination trips, while picking up cargo accounted for 23 percent of the destinations. Leaving base operations accounted for 23 percent of the commercial vehicle trip origins and only 4 percent of the destination trips.

The percent distribution of non-commercial and commercial vehicles by time-of-day was similar between inbound and outbound directions for all the sites combined. The outbound volumes "mirrored" the inbound volumes, which is the expected result. The largest "spike" in the inbound direction occurred during the morning peak period (as people entered the study area to work, shop, etc.), and the spike for the outbound direction was in the afternoon peak period.

The median vehicle year for non-commercial vehicles was 2000 and for commercial vehicles it was 1999. The difference between the average vehicle age of commercial and non-commercial vehicles was similar with commercial vehicles averaging 6.4 years and non-commercial vehicles averaging 5.5 years. The average odometer reading for commercial vehicles was approximately four times higher than that for non-commercial vehicles. Average vehicle occupancy for non-commercial vehicles was 1.32, or nearly 25 percent greater than the 1.06 reported for commercial vehicles.

Commercial vehicles represent 15 percent of the vehicles traveling into and out of the San Angelo area daily. Nearly a third of the commercial vehicles (31 percent) are carrying no cargo. Of those carrying cargo, more than 98 percent are carrying cargo not of Mexico origin/destination.

APPENDIX

Station # _____   Survey Date _____

Station Name/Location _____   Interviewer _____

For each vehicle you collect	Vehicle 1	Vehicle 2	Vehicle 3
Time	_____a.m. _____p.m.	_____ a.m. _____p.m.	_____a.m. _____p.m.
Number of people in vehicle			
Vehicle Type			

Vehicle Type options: 1) Passenger (car/truck/van)   **2)**Bus   **3)**Taxi/Paid Limo   **4)**School Bus
5)Commercial Vehicle (over 1 ton)   **6)**Motorcycle   **7)**Recreational Vehicle   **8)**Other (specify in block)   99) Refused/Unknown

QUESTIONS:	Vehicle 1	Vehicle 2	Vehicle 3
1. What year, make, and model is this vehicle? Gas (leaded, unleaded), diesel, propane or other fuel?	_____ Year _____ Make _____ Model Leaded ☐ Unleaded ☐ Diesel ☐ Propane ☐ Other ☐ _____	_____ Year _____ Make _____ Model Leaded ☐ Unleaded ☐ Diesel ☐ Propane ☐ Other ☐ _____	_____ Year _____ Make _____ Model Leaded ☐ Unleaded ☐ Diesel ☐ Propane ☐ Other ☐ _____
2. What is the mileage on your odometer?			
3. Do you live in Texas?	☐ Yes ☐ No (go to 4) ☐ Refused (go to 4)	☐ Yes ☐ No (go to 4) ☐ Refused (go to 4)	☐ Yes ☐ No (go to 4) ☐ Refused (go to 4)
3a. Did you travel from home today?	☐ Yes ☐ No ☐ Refused	☐ Yes ☐ No ☐ Refused	☐ Yes ☐ No ☐ Refused
3b. What city/county is your home located in? *If Not a resident of San Angelo ask:*			
3c. Did you stay in San Angelo overnight?	☐ Yes ☐ No ☐ Refused (if no, go to 5)	☐ Yes ☐ No ☐ Refused (if no, go to 5)	☐ Yes ☐ No ☐ Refused (if no, go to 5)
3d. How many nights have you stayed in San Angelo? **(after 3d, go to 5)**			
4. What city and state do you live in? (also write in city / state info for Mexico)	_____ _____ (city / state in US or Mexico) ☐ Refused	_____ _____ (city / state in US or Mexico) ☐ Refused	_____ _____ (city / state in US or Mexico) ☐ Refused
4a. Did you enter Texas today? *If No*, what date did you enter Texas?	☐ Yes (if yes, go to 4b) ☐ No _____(date) ☐ Refused	☐ Yes (if yes, go to 4b) ☐ No _____(date) ☐ Refused	☐ Yes (if yes, go to 4b) ☐ No _____(date) ☐ Refused
4b. Where outside of Texas did you travel from? (city, county, state)			
4c. What road / bridge did you use to enter Texas?			
4d. Did you stay in San Angelo overnight? 4e. How many nights have you stayed in San Angelo?	☐ Yes ☐ No ☐ Refused (if no, go to 5)	☐ Yes ☐ No ☐ Refused (if no, go to 5)	☐ Yes ☐ No ☐ Refused (if no, go to 5)

5. Where was the *last* place you got into your vehicle(place/address or nearest intersection/city)			
5a. What time did you leave that place?	_____a.m. _____p.m.	_____a.m. _____p.m.	_____a.m. _____p.m.
5b. What type of place was that? (choose from type of place options)			
5c. What was your purpose for being at your last location? (Choose from trip purpose options)			
5d. Was that location in San Angelo?	☐ Yes ☐ No ☐ Refused (Yes go to 6)	☐ Yes ☐ No ☐ Refused (Yes go to 6)	☐ Yes ☐ No ☐ Refused (Yes go to 6)
5e *If not in San Angelo*, what road/bridge did you use to enter San Angelo?			

Type of Place Options: 1) Office building 2)Retail Shopping/Gas 3) Industrial/Manufacturing/Warehouse
4) Medical 5) Educational (12th grade or lower) 6) Educational (college, trade, etc.)
7) Government 8) Residential 9) Airport 10) Eating Establishment
11) Hotel/Motel 12) Other (specify) 99) Refused/Unknown

Trip Purpose Options: 1) Home/Return Home 2) Go/Return to work 3) Work-related 4) School
5) Vacation 6) Visit Family/Friends 7) Eat out 8) Shop
9) Buy gas 10) Personal business 11) Pick-up/Drop off Passenger
12) Change Travel Mode 13) Delivery 14) Recreation 15) Unknown/Refused
16) Other (specify) 99) Unknown/Refused

6. Where is your next destination? (place/address or nearest intersection/city)			
6a. What is your purpose for traveling to this destination? (Choose from trip purpose options)			
7. Are you going to a location out of Texas?	☐ Yes ☐ No ☐ Refused (if no, go to 7d)	☐ Yes ☐ No ☐ Refused (if no, go to 7d)	☐ Yes ☐ No ☐ Refused (if no, go to 7d)
If Yes: 7a. What city and state are you going to?			
7b. What road / bridge will you use to leave Texas?			
7c. How many more days will you be in Texas?			
If No 7d. What city / county in Texas are you going To?			

To measure the amount of travel you made today, we need to know the number of places you have gone today. Would you please tell us:

8. Where did your first trip today begin? (city/county/landmark))			
9. Where did you go from there? (city/county/landmark)			
10. Where did you go next? (city/county/landmark)			
11. Where did you go next? (city/county/landmark)			
12. How many more places did you stop today?			

NOTE: Address, cross-street, and/or landmark information should be obtained for questions 8 through 11.

Station # _____   Survey Date _____

Station Name/Location _____   Interviewer _____

For each vehicle you collect:	Vehicle 1	Vehicle 2	Vehicle 3
1. Time	____a.m. ____p.m.	____a.m. ____p.m.	____a.m. ____p.m.
2. Number of people in vehicle			
3. Vehicle Classification			
4. What is the cargo ? (choose from vehicle cargo codes)	_____ ☐ Empty (no cargo)	_____ ☐ Empty (no cargo)	_____ ☐ Empty (no cargo)
4a. If empty, what was the last cargo you delivered?	(go to 12)	(go to 12)	(go to 12)
4b. Is your load full or partial? *determine 4a and 4b by observation*	☐ Full ☐ Partial	☐ Full ☐ Partial	☐ Full ☐ Partial
4c. Is cargo being hauled using an multi-modal container/trailer or TEU? **If Yes**	☐ Yes ☐ No (go to 5)	☐ Yes ☐ No (go to 5)	☐ Yes ☐ No (go to 5)
4d Is the container a Reefer or Dry Box?	☐ Reefer ☐ Dry Box	☐ Reefer ☐ Dry Box	☐ Reefer ☐ Dry Box
5. Did your cargo come from or is it going to Mexico?	☐ Yes ☐ No ☐ Refused or Unknown	☐ Yes ☐ No ☐ Refused or Unknown	☐ Yes ☐ No ☐ Refused or Unknown
6. Where did you pick up your load? (place/address or nearest intersection and city)			
7. Was that location an inter-modal transfer or custom brokerage site?	☐ Yes ☐ No ☐ Refused or Unknown	☐ Yes ☐ No ☐ Refused or Unknown	☐ Yes ☐ No ☐ Refused or Unknown
8. How was your load transferred at that site (choose from transfer codes)?			
9. Where will you drop your cargo off? (place/address or nearest intersection and city)			
10. Is that location an inter-modal transfer or custom brokerage site?	☐ Yes ☐ No ☐ Refused or Unknown	☐ Yes ☐ No ☐ Refused or Unknown	☐ Yes ☐ No ☐ Refused or Unknown
11. How will the cargo be transferred at that site (choose from transfer codes)?			

Vehicle Classification Options: 1) Single Unit 2-axle (6 wheels) 2) Single Unit 3-axle (10 wheels) 3) Single Unit 4-axle (14 wheels)
4) Semi (all tractor-trailer combinations) 5) Other (specify) 99) Refused/Unknown

Cargo Transfer Options: 1) Truck-to/from-Truck 2) Rail- to/from –Truck 3) Ship- to/from -Truck 4) Airplane- to/from -Truck
5) Warehouse- to/from -Truck 6) Pipeline- to/from –Truck 7) Unknown 99) Refused

NOTE: All cargo transfer options are both ways (i.e., Truck-to-Warehouse should be coded same as Warehouse-to-Truck).

QUESTIONS:

	Vehicle 1	Vehicle 2	Vehicle 3
12. What is the year and gross weight rating of this vehicle ? Gas (leaded, unleaded), diesel, propane or other fuel?	_____ Year _____ Gross Weight Leaded ☐ Unleaded ☐ Diesel ☐ Propane ☐ Other ☐ _____	_____ Year _____ Gross Weight Leaded ☐ Unleaded ☐ Diesel ☐ Propane ☐ Other ☐ _____	_____ Year _____ Gross Weight Leaded ☐ Unleaded ☐ Diesel ☐ Propane ☐ Other ☐ _____
13. What is the mileage on your odometer?			

14. Where are you coming from? (city / state in US or Mexico)			
14a. Is that location in San Angelo? *If No ask:* 14b. Did you stay in San Angelo overnight?	☐ Yes ☐ No ☐ Refused (If yes go to 16) ☐ Yes ☐ No ☐ Refused (If No go to 15)	☐ Yes ☐ No ☐ Refused (If yes go to 16) ☐ Yes ☐ No ☐ Refused (If No go to 15)	☐ Yes ☐ No ☐ Refused (If yes go to 16) ☐ Yes ☐ No ☐ Refused (If No go to 15)
14c. How many nights have you stayed in San Angelo?			
15. Did you enter Texas today? *If No*, what date did you enter Texas?	☐ Yes (if yes, go to 15a) ☐ No _____(date) ☐ Refused	☐ Yes (if yes, go to 15a) ☐ No _____(date) ☐ Refused	☐ Yes (if yes, go to 15a) ☐ No _____(date) ☐ Refused
15a. Where outside of Texas did you travel from? (city / state in US or Mexico)			
15b. What road or bridge did you use to enter Texas?			
16. Where was the last place you got into your vehicle? (place/address or nearest intersection/city)			
16a. What time did you leave that place?	_____a.m. _____p.m.	_____a.m. _____p.m.	_____a.m. _____p.m.
16b. What type of place was this? (choose from type of place options).			
16c. What was your purpose for being at your last location?			
16d. Was that location in San Angelo?	☐ Yes ☐ No ☐ Refused (Yes go to 17)	☐ Yes ☐ No ☐ Refused (Yes go to 17)	☐ Yes ☐ No ☐ Refused (Yes go to 17)
16e. *If not in San Angelo*, what road / bridge did you use to enter San Angelo?			
17. Where is your next destination? (place/address or nearest intersection/city)			
17a. What is your purpose for traveling to this destination? (Choose from trip purpose options.)			
18. Are you going to a location outside of Texas?	☐ Yes ☐ No ☐ Refused (If no go to 18d)	☐ Yes ☐ No ☐ Refused (if No go to 18d)	☐ Yes ☐ No ☐ Refused (If No go to 18d)
If Yes 18a. What city and state are you going to?			
18b. What road / bridge will you use to leave Texas?			
18c. How many more days will you be in Texas?			
If No 18d. What city / county in Texas are you going to?			

Type of Place Options: **1)** Office building   **2)** Retail Shopping/Gas   **3)** Industrial/Manufacturing/Warehouse
   4) Medical   **5)** Educational (12th grade or lower)   **6)** Educational (college, trade, etc.)
   7) Government   **8)** Residential   **9)** Airport   **10)** Eating Establishment
   11) Hotel/Motel   **12)** Other (specify)   **99)** Refused/Unknown

Trip Purpose Options: 1) Base location/return to base location   2) Delivery   3) Pick-up
4) Maintenance   5) Driver needs (lunch, etc.)   6) To Home   7) Buy fuel
8) Other (specify)   99) Refused/Unknown

To measure the amount of travel you made today, we need to know the places you have gone today. Would you please tell us:

19. Where did your first trip today begin? (city/county/landmark)			
20. Where did you go from there? (city/county/landmark)			
21. Where did you go next? (city/county/landmark)			
22. Where did you go next? (city/county/landmark)			
23. Where did you go next? (city/county/landmark)			
24. Where did you go next? (city/county/landmark)			
25. Where did you go next? (city/county/landmark)			
26. How many more places did you stop today?			

NOTE: Address, cross-street, and/or landmark information should be obtained for questions 19 through 25 (including locations in Mexico).

Vehicle Cargo Codes

1 – Farm Products	Livestock, fertilizer, dirt, landscaping, etc.
2 – Forest Products	Trees, sod, etc.
3 – Marine Products	Fresh fish, seafood, etc.
4 – Metals and Minerals	Crude petroleum, natural gas, propane, metals, gypsum, etc.
5 – Food, Health, Beauty Products	Assorted food products, cosmetics, etc.
6 – Tobacco Products	Cigarettes, cigars, and chewing tobacco
7 – Textiles	Clothing, lines, etc
8 – Wood Products	Lumber, paper, cardboard, wood pulp, etc
9 – Printed Matter	Newspapers, magazines, books, etc.
10 – Chemical Products	Soaps, paints, household or industrial chemicals, etc
11 – Refined Petroleum or Coal Products	Gasoline, etc.
12 – Rubber, Plastic, Styrofoam Products	Finished products of rubber, plastic, or Styrofoam
13 – Clay, Concrete, Glass, or Stone	Finished products of clay, concrete, glass, or stone
14 – Manufactured Goods/Equipment	Miscellaneous products such as machinery, appliances, etc
15 – Wastes	Waste products, including scrap and recyclable materials
16 – Miscellaneous Shipments	U.S. Mail, U.P.S., Federal Express, and other mixed cargo
17 – Hazardous Materials	Hazardous chemicals and substances
18 – Transportation	Automobiles, Heavy Equipment, etc.
19 – Unclassified Cargo (specify)	Cargo not falling within one of the above categories
20 – Driver Refused to Answer	Driver refused to answer
21 – Unknown to Driver	Unknown to driver
22 - Empty	Empty