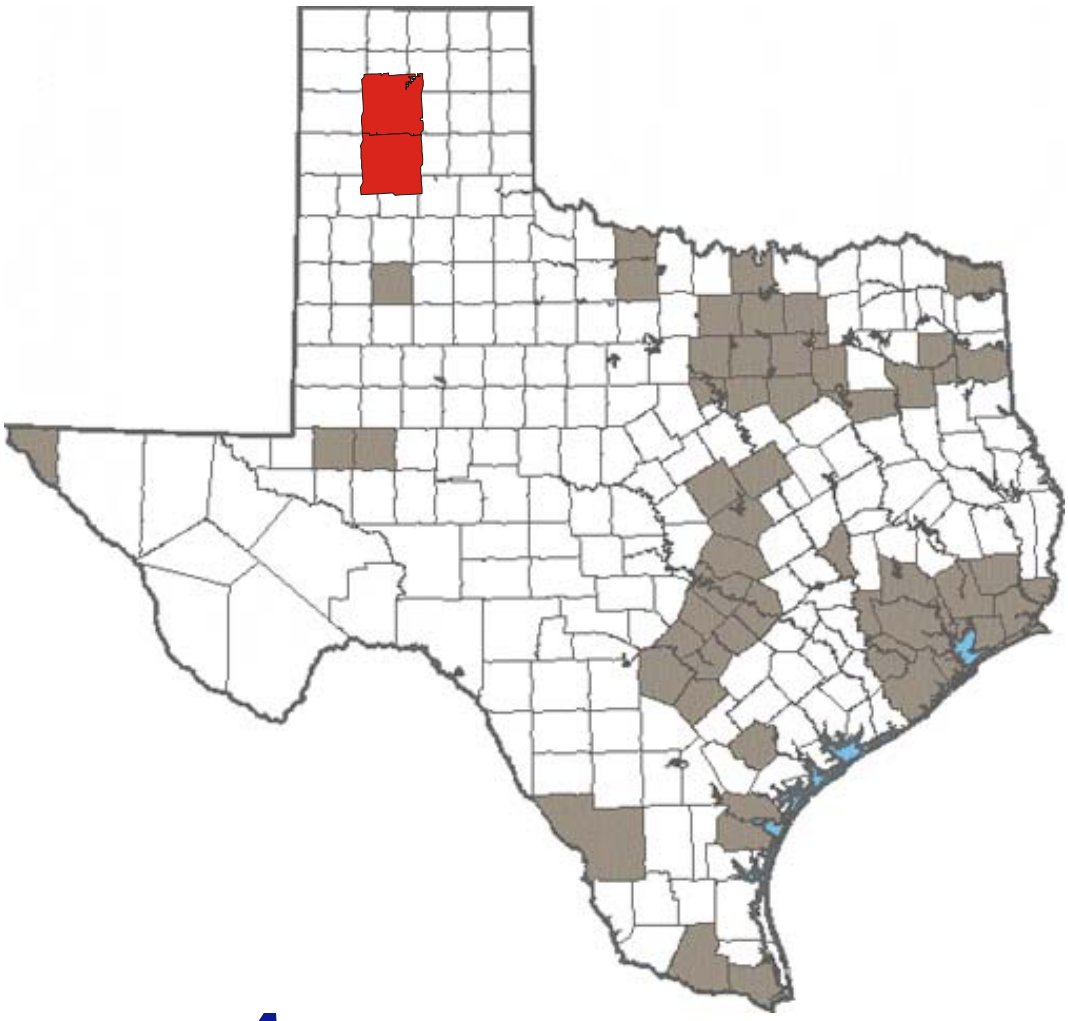
2005 Amarillo External Survey
Technical Summary



Texas Department of Transportation

Prepared by the
Texas Transportation Institute
March 2006

2005 Amarillo External Survey

TECHNICAL SUMMARY

Texas Department of Transportation Travel Survey Program

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March 2006

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INTRODUCTION

In 2005, the Transportation Planning and Programming (TPP) Division of the Texas Department of Transportation (TxDOT) funded an external station travel survey in the Amarillo Metropolitan Planning Organization (MPO) study area. This survey measured and identified travel patterns into, within, and out of Amarillo, which is in Potter and Randall counties. This report presents a Technical Summary of the 2005 Amarillo 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.

AMARILLO STUDY AREA

The study area, as shown in Figure 1, is located in Potter and Randall counties in the panhandle area of Texas. The two counties have a land area of over 1,800 square miles and a population density of approximately 119 persons per square mile. The population center of the two-county area is the city of Amarillo, which according to the 2000 census had a population of approximately 174,000 persons. The boundary established for the Amarillo external survey was determined by the local MPO.

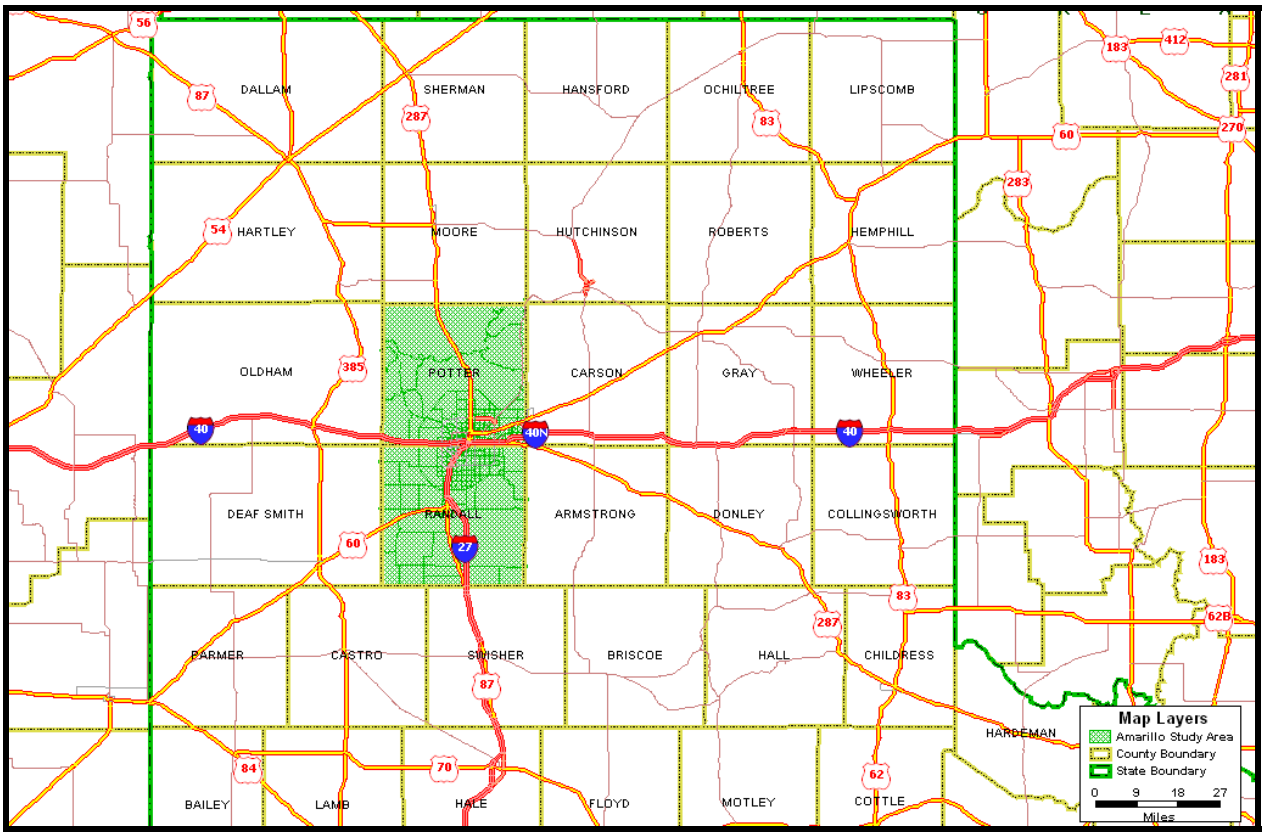

Figure 1. Amarillo Study Area.

EXTERNAL STATIONS

There are 24 locations on the border of the Amarillo 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 24 locations, 12 were selected for travel surveys. Figure 2 shows the location of the external stations in Amarillo 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.

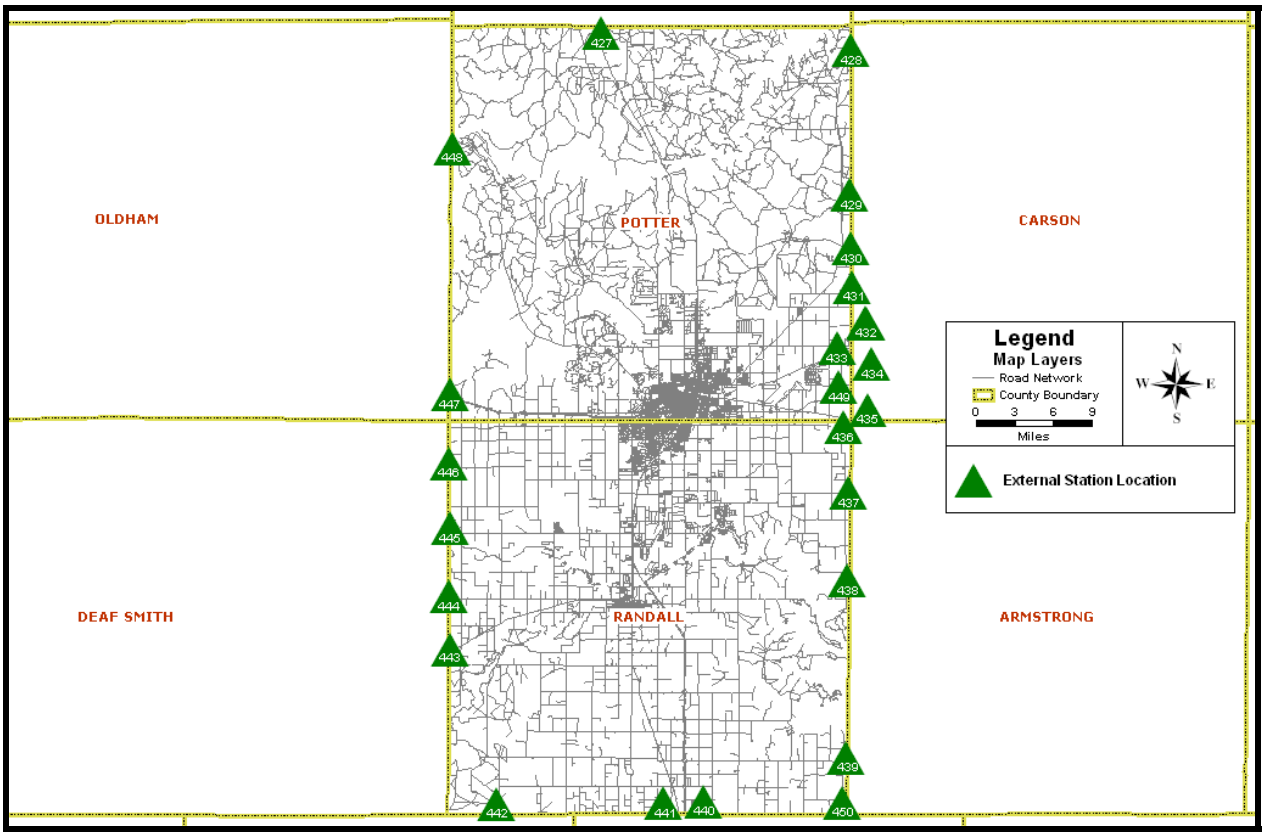

Figure 2. Amarillo External Station Locations.

Table 1. Amarillo External Stations.

Station Number	Facility	Location	Surveyed	24-Hour Vehicle Count		Location Group
				Inbound	Outbound	
427	US 87/287	at Moore Co. line	Yes	4,351	4,039	North
428	SH 136	at Carson Co. line	Yes	2,719	2,522	East
429	FM 1342	at Carson Co. line	No	50	40	
430	FM 293	at Carson Co. line	Yes	143	255	
431	FM 245	at Carson Co. line	No	239	326	
432	St. Francis	at Carson Co. line	No	100	134	
433	US 60	at Carson Co. line	Yes	5,383	4,818	
434	Bus. IH 40	at Carson Co. line	No	162	229	
435	IH 40	at Carson Co. line	Yes	5,829	6,137	
436	US 287	at Carson Co. line	Yes	4,196	3,526	
437	FM 1151	at Armstrong Co. line	Yes	433	283	
438	FM 1258	at Armstrong Co. line	No	71	71	
439	FM 285	at Armstrong Co. line	No	81	73	
449	FM 2575	at Carson Co. line	No	132	142	
450	FM 1075	at Armstrong Co. line	No	70	21	
440	IH 27	at Swisher Co. line	Yes	4,306	4,614	South
441	US 87	at Swisher Co. line	Yes	604	669	
442	FM 168	at Castro Co. lime	No	197	187	
443	US 60	at Deaf Smith Co. line	Yes	3,294	3,640	West
444	FM 1062	at Deaf Smith Co. line	No	127	183	
445	FM 2219	at Deaf Smith Co. line	No	7	8	
446	Farmers Ave.	at Deaf Smith Co. line	No	85	103	
447	IH 40	at Oldham Co. line	Yes	5,525	6,271	
448	FM 1061	at Oldham Co. line	Yes	837	802	
		Total		38,941	39,093	

SURVEY METHODOLOGY

Surveys were conducted using a roadside intercept interview method. 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 intercept interview survey at an external station.

Figure 3. Typical External Survey Station.

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

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 Amarillo, the majority of vehicles surveyed were non-commercial. Nearly 86 percent of the surveys were for non-commercial vehicles. The number of surveys for commercial and non-commercial vehicles by station as well as the outbound traffic volume during the survey period is provided in Table 2. Approximately 20 percent of non-commercial vehicles and 8 percent of

commercial vehicles that traveled through the external stations during survey hours were interviewed.

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

Station Number	Facility	Location	Non-Commercial		Commercial	
			Surveyed	Count*	Surveyed	Count*
427	US 87/287	at Moore Co. line	381	1,731	88	966
428	SH 136	at Carson Co. line	399	1,263	58	366
430	FM 293	at Carson Co. line	56	146	1	4
433	US 60	at Carson Co. line	452	2,231	53	368
435	IH 40	at Carson Co. line	314	2,183	59	1653
436	US 287	at Carson Co. line	374	1,373	56	1070
437	FM 1151	at Armstrong Co. line	128	183	10	19
440	IH 27	at Swisher Co. line	355	2,503	71	691
441	US 87	at Swisher Co. line	120	1,378	12	74
443	US 60	at Deaf Smith Co. line	359	1,966	70	243
447	IH 40	at Oldham Co. line	348	2,405	95	1573
448	FM 1061	at Oldham Co. line	341	515	34	136
Total			3,627	17,877	607	7,163

* Outbound volumes during approximate time of survey (8 a.m. to 7 p.m.)

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 93 percent of non-commercial vehicle trips and nearly 82 percent of commercial vehicle trips 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
427	US 87/287	351	30	381	69	19	88
428	SH 136	387	12	399	51	7	58
430	FM 293	52	4	56	1	0	1
433	US 60	442	10	452	51	2	53
435	IH 40	235	79	314	43	16	59
436	US 287	350	24	374	47	9	56
437	FM 1151	124	4	128	10	0	10
440	IH 27	328	27	355	59	12	71
441	US 87	119	1	120	3	9	12
443	US 60	350	9	359	60	10	70
447	IH 40	309	39	348	69	26	95
448	FM 1061	331	10	341	33	1	34
Total		3378	249	3627	496	111	607

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 the Amarillo study area. A non-resident is a respondent that reported they lived outside of the Amarillo study area. 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 Amarillo 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.

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)
427	US 87/287	381	131	34.38	250	65.62	75
428	SH 136	399	137	34.34	262	65.66	40
430	FM 293	56	39	69.64	17	30.36	7
433	US 60	452	222	49.12	230	50.88	92
435	IH 40	314	54	17.20	260	82.80	52
436	US 287	374	135	36.10	239	63.90	120
437	FM 1151	128	69	53.91	59	46.09	2
440	IH 27	355	178	50.14	177	49.86	68
441	US 87	120	68	56.67	52	43.33	0
443	US 60	359	178	49.58	181	50.42	30
447	IH 40	348	97	27.87	251	72.13	54
448	FM 1061	341	199	58.36	142	41.64	68
Total		3627	1507	41.55	2120	58.45	608

The residency questions were only asked of respondents in non-commercial vehicles. Table 4 illustrates that individuals who do not live in the study area make a sizeable proportion, 58 percent, of the non-commercial travel in and out of Amarillo. The average number of internal trips made by those individuals is 0.29 trips per vehicle.

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 17 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	Overnight Stay		
16	Other		
99	Refused/Do Not Know		

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, 16, and 99

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 at the destination of the trip. Additionally, Table 6 provides the data shown in Figures 4 and 5 in tabular form for comparative purposes. The information is provided for residents, non-residents, and both groups combined. The distribution for the origin purpose shows that the largest percentage of trips for residents (74 percent) began at home, while the most common non-resident trip origin purpose (36 percent) was shopping. For both groups combined, the most common origin purposes were home (33 percent), shopping (25 percent), and personal related (19 percent).

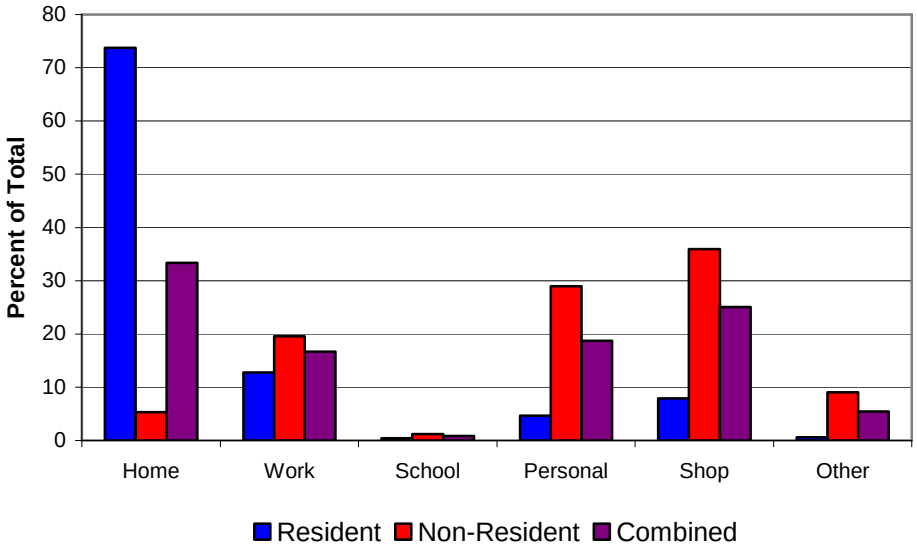

Figure 4. Trip Purpose at Origin for Non-Commercial Vehicles.

Figure 5 shows that the largest distribution of destination purpose for non-residents was home (61 percent). The trip purpose at the destination for residents was primarily comprised of work (58 percent) and personal (36 percent) trips. For both groups combined, home (36 percent), work (29 percent), and personal (25 percent) were the most common trip purposes.

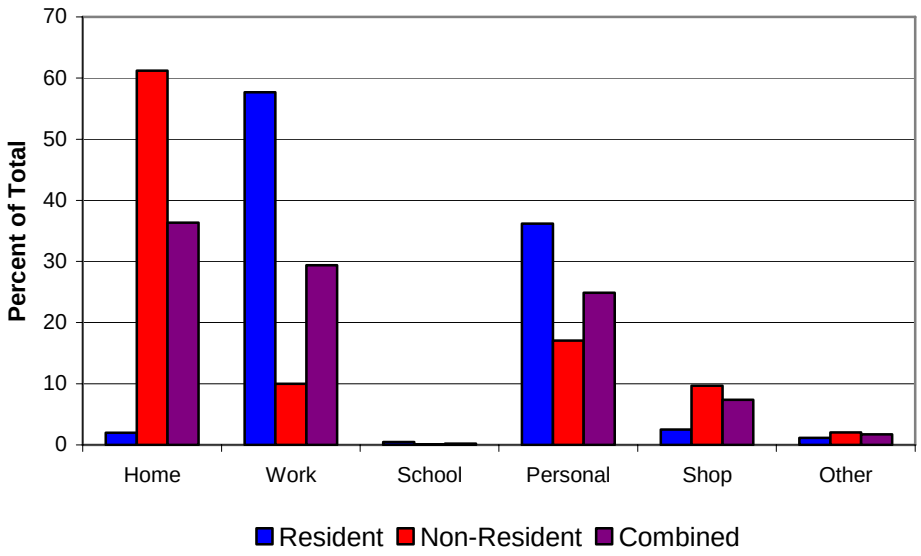

Figure 5. Trip Purpose to Destination for Non-Commercial Vehicles

Table 6. Non-Commercial Vehicle Trip Purpose at Origin and Destination.

Trip Purpose	Origin			Destination		
	Resident	Non-Resident	Combined	Resident	Non-Resident	Combined
Home	73.72	5.28	33.72	1.99	61.18	36.59
Work	12.74	19.58	16.74	57.66	10.00	29.80
School	0.40	1.23	0.88	0.46	0.05	0.22
Personal	4.64	28.96	18.86	36.23	17.08	25.03
Shop	7.90	35.94	24.29	2.52	9.67	6.70
Other	0.60	9.01	5.51	1.13	2.03	1.65

A detailed analysis of specific subsets of the survey data was performed. Approximately 74 percent of the surveyed study area residents began their trip at home. Of that group of respondents, approximately 56 percent of those home-based trips had a destination purpose that was work or work-related. Since the survey was conducted in the outbound direction, this would indicate that a significant percentage of Amarillo study area residents work outside of the Amarillo study area.

Over 61 percent of the surveyed non-residents cited home as the trip purpose for traveling to their destination. Of that group of non-residents, nearly 53 percent of the trip origins were for

personal business or shopping purposes. Only 25 percent of non-residents traveling home cited an origin purpose that was work or work-related. This indicates that a majority of non-residents traveling within the Amarillo study area are making trips for either non-work purposes or people are making personal or shopping trips after leaving work and prior to going home.

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 for residents, non-residents, and both groups combined is provided in Figure 6. For residents, nearly 42 percent of the trips were HBW. For non-residents, HBNW trips accounted for nearly half (49 percent) of the trips. HBNW trips were the most common trip purpose for residents and non-residents combined (43 percent).

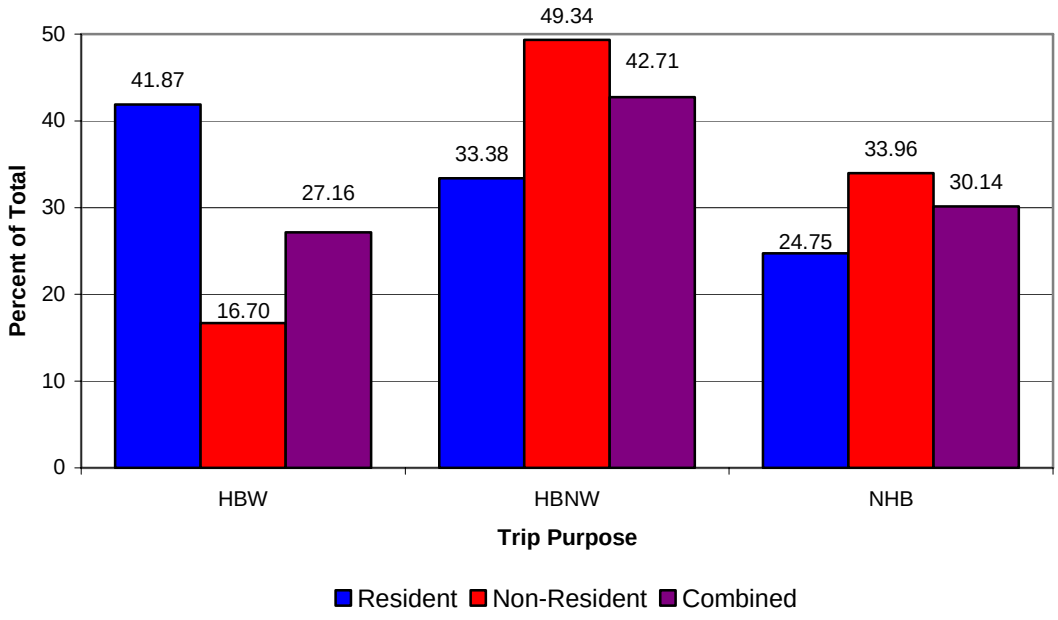

Figure 6. Distribution of Non-Commercial Vehicle Trips by Trip Purpose.

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. At the origin, support functions were the most common origin trip purpose (49 percent). Pick-up (20 percent), delivery (16 percent), and base (14 percent) were the other most commonly cited trip purposes at the origin. The distribution for destination trip purpose shows that the majority of the surveyed vehicles, 54 percent, were destined for delivering cargo and another 19 percent were destined for picking up cargo. Only 18 percent of the trip destinations were for support functions and 8 percent of the destinations were for the base.

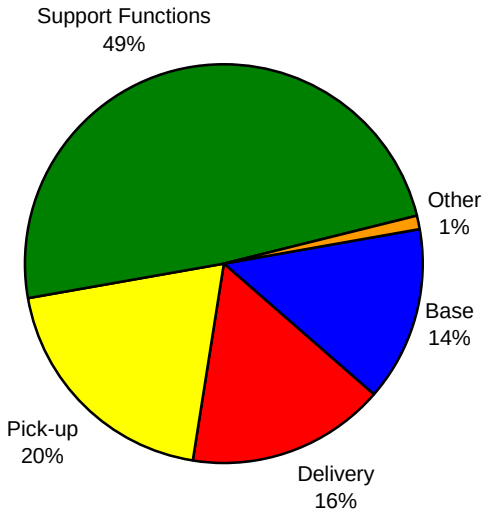

Figure 7. Trip Purpose at Origin for Commercial Vehicles.

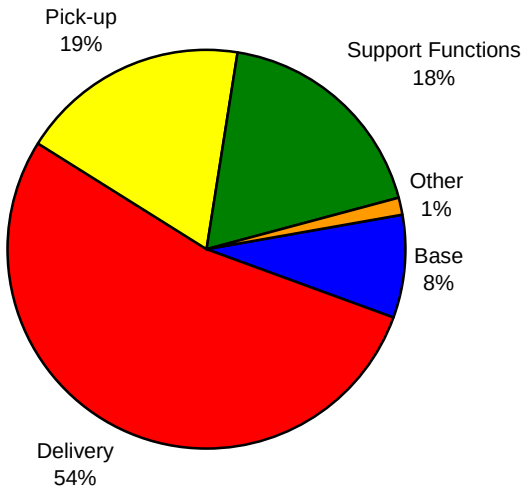

Figure 8. Trip Purpose to Destination for Commercial Vehicles.

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 7 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 (42 percent) as the type of place at the origin. An additional 22 percent of the non-commercial vehicles cited retail/shopping/gas as the type of place. For commercial vehicles, the majority of the respondents (37 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 36 percent.

Table 7. Type of Place at Trip Origin.

Type of Place	Non-Commercial Vehicles		Commercial Vehicles	
	Number	Percent	Number	Percent
Office Building	350	9.65	60	9.88
Retail/Shopping/Gas	811	22.36	220	36.24
Industrial/Manufacturing	151	4.16	226	37.23
Medical	271	7.47	0	0.00
Educational	65	1.79	3	0.49
Government	37	1.02	3	0.49
Residential	1531	42.21	20	3.29
Airport	23	0.63	1	0.16
Eating Establishment	173	4.77	32	5.27
Hotel/Motel	181	4.99	28	4.61
Other	34	0.94	14	2.31
Total	3627	100.00	607	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 4 p.m. and 5 p.m. Commercial vehicle levels increase gradually from the morning peak through 4 p.m. when the amount of commercial vehicles begins to decline. For outbound traffic (Figure 10), the morning peak period for non-commercial vehicles is slightly longer than for the inbound direction, but it also occurs between 7 a.m. and 8 a.m. The afternoon peak for non-commercial vehicles traveling outbound is not as large as the inbound afternoon peak. For outbound commercial vehicles, there appears to be no significant peak. However, the traffic levels are the highest between 9:30 a.m. and 12:30 p.m.

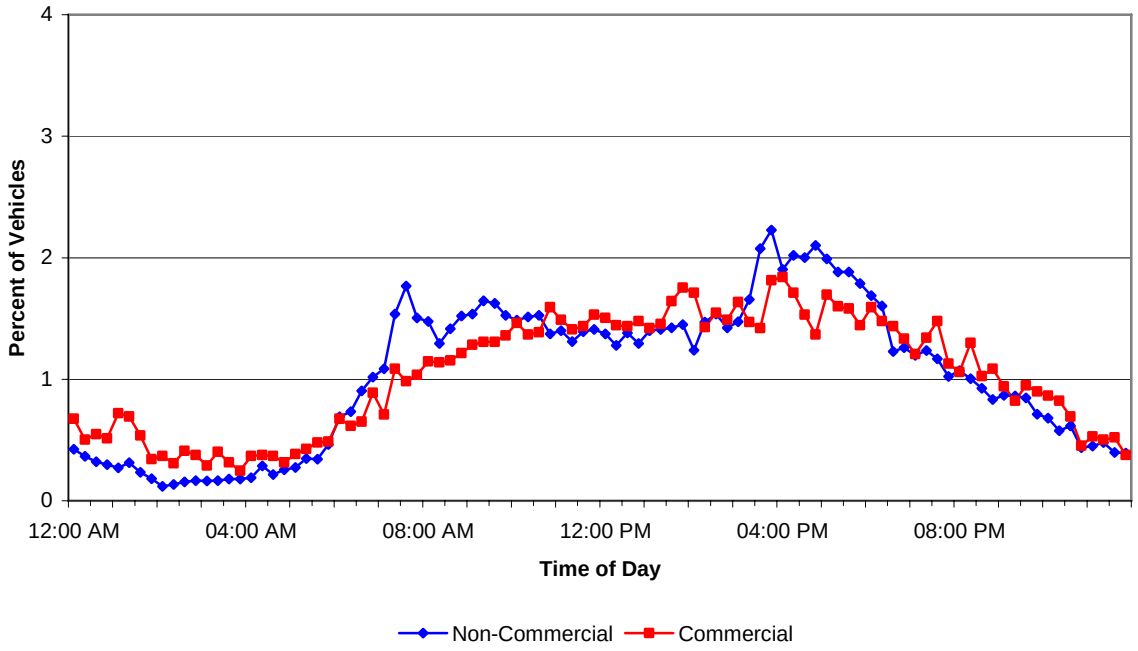

Figure 9. Distribution of Inbound Vehicles by Time-of-Day.

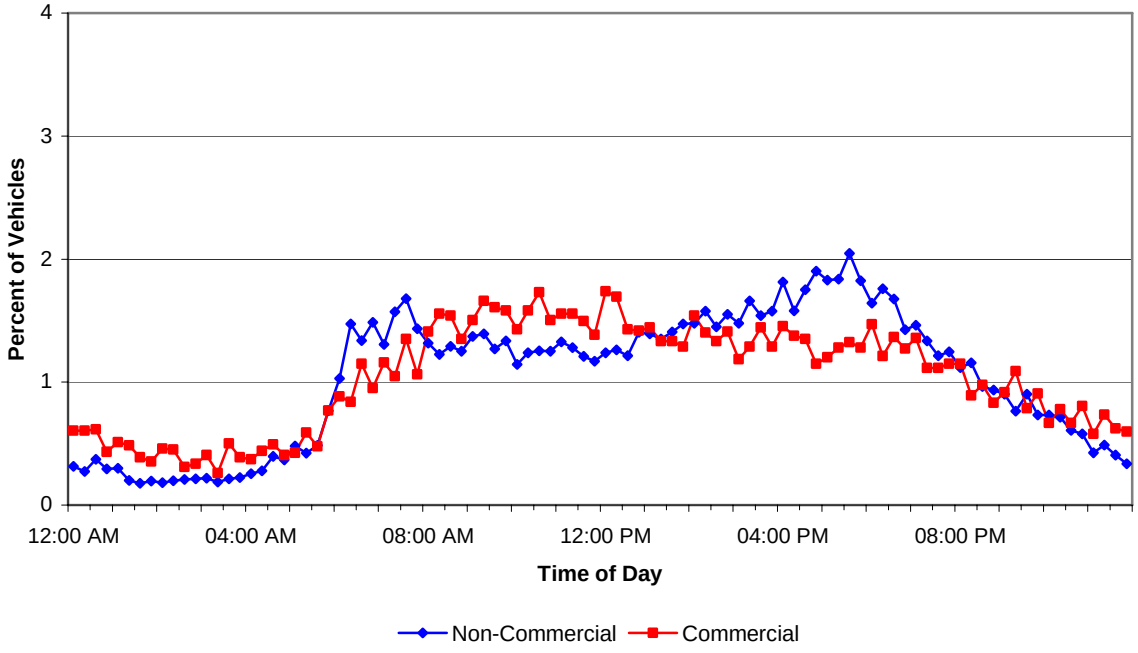

Figure 10. Distribution of Outbound Vehicles by Time-of-Day.

An additional analysis that compared the number of surveys and vehicle counts by time of day was conducted. In this analysis, the percent of vehicles surveyed and the percent of outbound vehicles counted were grouped in hourly increments during the time period in which the survey was conducted. The results for non-commercial vehicles are provided in Figure 11 and commercial vehicles are shown in Figure 12.

For non-commercial vehicles, the percent of surveys completed each hour increased gradually throughout the day, with a peak between 5 p.m. and 6 p.m. The counts for non-commercial vehicles also gradually increased throughout the day. Approximately 21 percent of the non-commercial vehicles that were traveling out of the study area (at surveyed external stations) were successfully interviewed during survey hours. For the 24-hour period, that number was 13 percent.

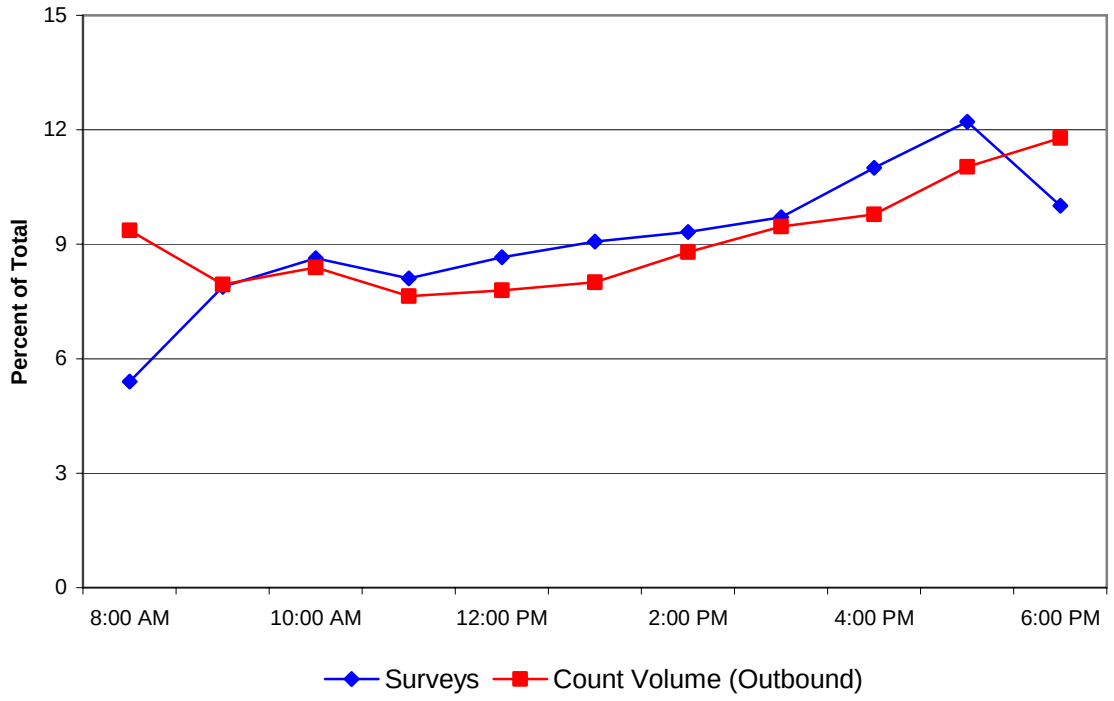

Figure 11. Distribution of Non-Commercial Vehicles and Surveys by Time-of-Day.

There was a noticeably different trend among commercial vehicles. While the percent of vehicles counted was fairly constant throughout the day, the percent of completed surveys peaked around 9 a.m. and then declined throughout the day. Overall, 8 percent of the commercial vehicles that were counted during the survey period were interviewed. For the 24-hour period, 6 percent of the commercial vehicles were surveyed.

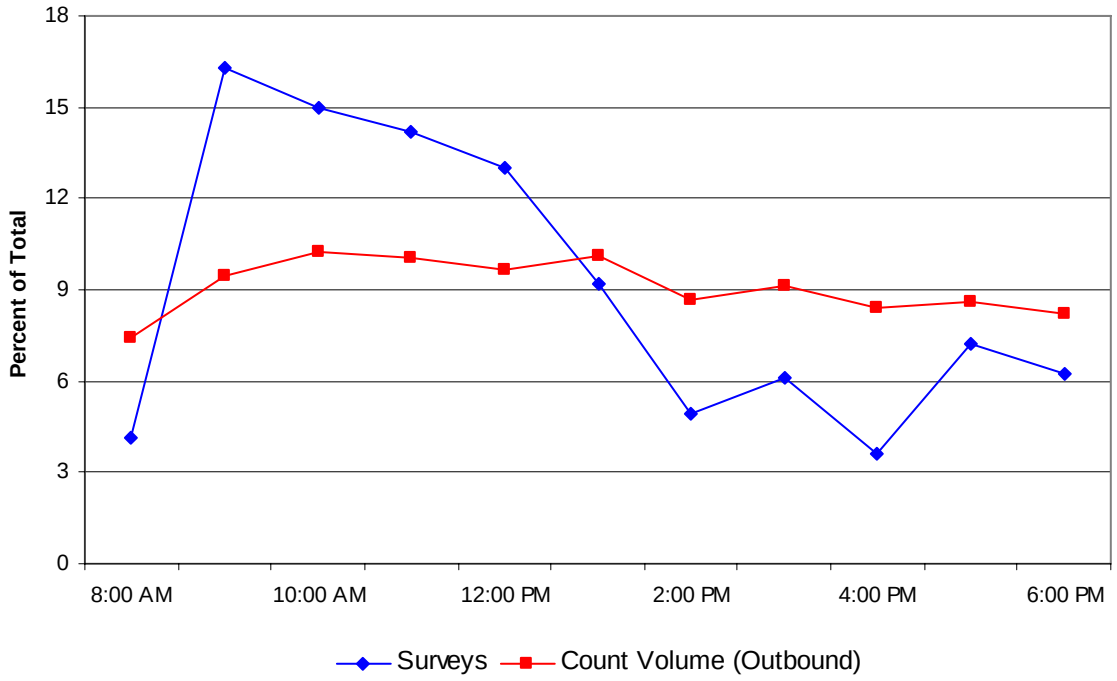

Figure 12. Distribution of Commercial Vehicles and Surveys by Time-of-Day.

A final comparison of the survey and count totals for the survey locations was conducted. In this analysis, the percent of counted vehicles that were surveyed per hour was determined for both non-commercial and commercial vehicles. This data was compared against the total count volumes for the survey period, and the results are provided in Figure 13. A larger percentage of non-commercial vehicles than commercial vehicles were surveyed throughout the day, but the trend lines mirror one another closely. These trend lines compared against the total volumes illustrate that as the count volumes increase, the percentage of surveyed vehicles decrease. This is logical since the number of surveyors was constant during the survey period.

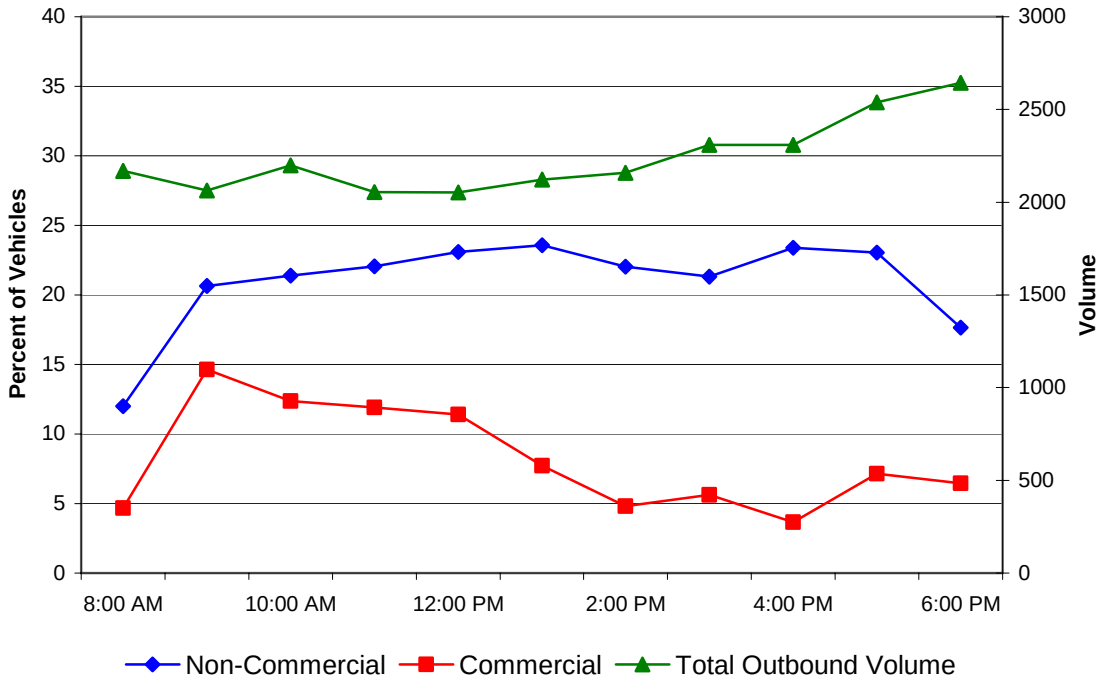

Figure 13. Distribution of Counted Vehicles That Were Surveyed.

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 14 represents the percent distribution of non-commercial and commercial vehicles by age as reported in the surveys. The average age for surveyed vehicles was approximately 5.5 years for non-commercial vehicles and 5.1 years for commercial vehicles. The median vehicle model year was 2001 for both non-commercial and commercial vehicles.

Figure 15 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 total number of observations in the non-commercial and commercial surveys (3,627 and 607, respectively).

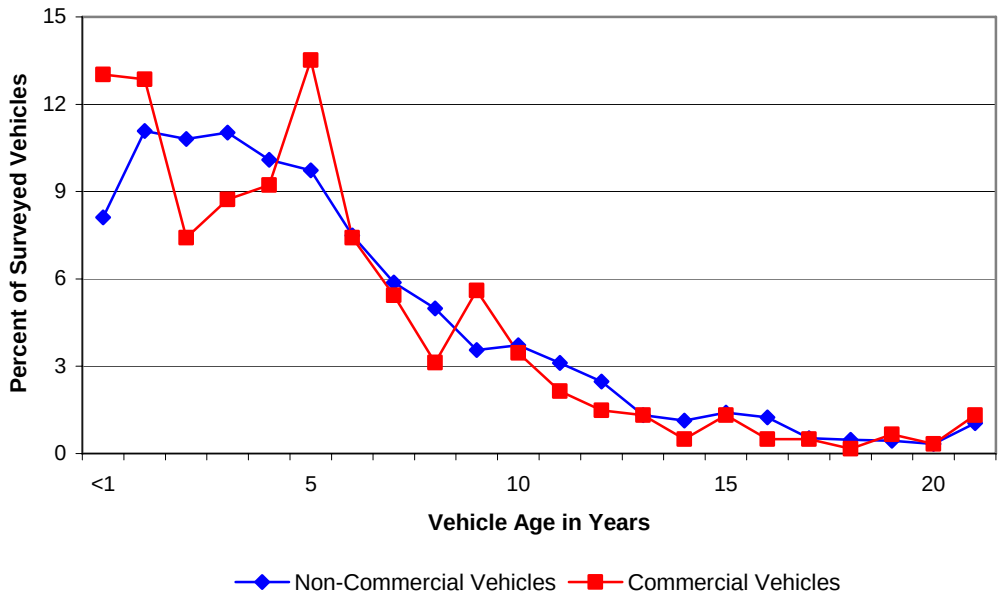

Figure 14. Distribution of Surveyed Vehicles by Age of Vehicle.

For example, for vehicles 14 years old, there were 41 observations for non-commercial vehicles and only 3 for commercial vehicles. One of those three commercial vehicle surveyed had an odometer reading of over 2,000,000 miles, and as a result, the average for the group is higher than a trend would indicate.

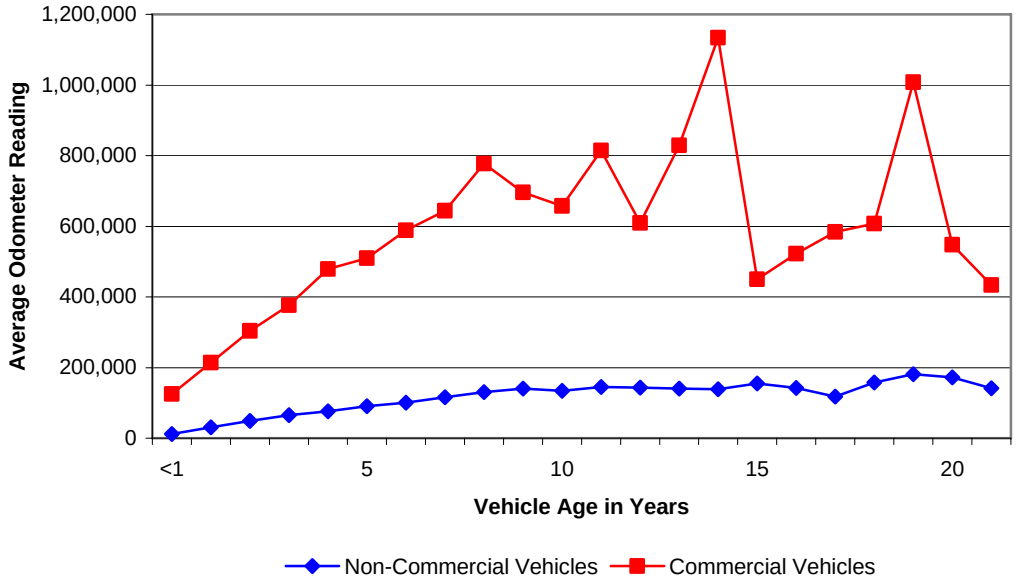

Figure 15. Average Odometer Readings for Vehicles by Age of Vehicle.

The average odometer reading for non-commercial vehicles was 83,996 and the average commercial vehicle odometer reading was 446,529. This information indicates that commercial vehicles accumulated mileage at nearly five times the rate of non-commercial vehicles. For more detailed information, Table 8 presents the numerical values for the non-commercial data plotted in Figures 13 and 14. Table 9 provides similar information for commercial vehicles.

Table 8. Distribution of Non-Commercial Vehicles by Age and Average Odometer Reading.

Age	Number of Vehicles	Percent of Total	Cumulative Percent of Total	Average Reported Odometer Value
<1	294	8.11	8.11	11,787
1	402	11.08	19.19	31,288
2	392	10.81	30.00	48,754
3	400	11.03	41.03	65,053
4	366	10.09	51.12	76,235
5	353	9.73	60.85	90,680
6	272	7.50	68.35	101,060
7	213	5.87	74.22	116,052
8	181	4.99	79.21	130,948
9	129	3.56	82.77	140,902
10	135	3.72	86.49	134,169
11	113	3.12	89.61	145,272
12	90	2.48	92.09	143,449
13	48	1.32	93.41	140,987
14	41	1.13	94.54	138,439
15	51	1.41	95.95	155,110
16	45	1.24	97.19	142,801
17	19	0.52	97.71	117,729
18	17	0.47	98.18	157,554
19	16	0.44	98.62	181,123
20	12	0.33	98.95	172,144
>20	38	1.05	100.00	141,604
Total	3627	100.00		

Table 9. Distribution of Commercial Vehicles by Age and Average Odometer Reading.

Age	Number of Vehicles	Percent of Total	Cumulative Percent of Total	Average Reported Odometer Value
<1	79	13.01	13.01	125,121
1	78	12.85	25.86	214,386
2	45	7.41	33.28	303,481
3	53	8.73	42.01	376,344
4	56	9.23	51.24	478,628
5	82	13.51	64.74	510,006
6	45	7.41	72.16	588,805
7	33	5.44	77.59	643,685
8	19	3.13	80.72	777,145
9	34	5.60	86.33	695,995
10	21	3.46	89.79	657,300
11	13	2.14	91.93	814,653
12	9	1.48	93.41	609,502
13	8	1.32	94.73	829,386
14	3	0.49	95.22	1,133,627
15	8	1.32	96.54	450,013
16	3	0.49	97.03	522,667
17	3	0.49	97.53	583,822
18	1	0.16	97.69	607,853
19	4	0.66	98.35	1,008,116
20	2	0.33	98.68	548,149
>20	8	1.32	100.00	433,889
Total	607	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 into and out of the Amarillo study area. Table 10 presents the number of observed non-commercial and commercial vehicles by class and average occupancy. Nearly all of the non-commercial vehicles (98 percent) were classified as passenger vehicles. The majority of commercial vehicles (76 percent) were semi/tractor-trailer combinations. The overall average occupancy for non-commercial vehicles was 1.48 and 1.09 for commercial vehicles.

Table 10. Distribution of Vehicles by Class and Average Occupancy.

Non-Commercial Vehicles	Observed Vehicles	Average Occupancy	Commercial Vehicles	Observed Vehicles	Average Occupancy
Passenger Vehicle	3570	1.49	Single Unit 2-axle (6 wheels)	70	1.06
Bus	0	—	Single Unit 3-axle (10 wheels)	57	1.21
Taxi/Paid Limo	0	—	Single Unit 4-axle (14 wheels)	21	1.00
School Bus	1	1.00	Semi (tractor-trailer)	459	1.08
Commercial Vehicle (over 1 ton)	3	1.33	Other	0	—
Motorcycle	31	1.06			
Recreational Vehicle	22	1.64			
Other	0	—			
Total	3627	1.48	Total	607	1.09

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 11 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 one-quarter of the vehicles (29 percent) reported not carrying any cargo. Of those vehicles transporting cargo, 98 percent of those cargos were not from or headed to Mexico. Only seven vehicles indicated that their cargo was from or destined to Mexico. For those vehicles carrying a cargo, only 3 percent reported picking their cargo up at an interposal transfer or custom brokerage facility and 3 percent indicated that they would be dropping their cargo off at the same type of facility. Interposal transfer or custom brokerage facilities are sites where cargo may be transferred between several different modes (e.g. rail to truck, ship to truck, etc.).

Table 11. Commercial Vehicles with Cargo from Mexico.

Station Number	Facility	Surveyed Vehicles	Empty Vehicles	Percent Empty	Vehicles with Mexico Cargo	Vehicles without Mexico Cargo
427	US 87/287	88	19	21.59	2	67
428	SH 136	58	22	37.93	0	36
430	FM 293	1	0	0.00	0	1
433	US 60	53	24	45.28	0	29
435	IH 40	59	9	15.25	1	49
436	US 287	56	16	28.57	1	39
437	FM 1151	10	6	60.00	0	4
440	IH 27	71	21	29.58	1	49
441	US 87	12	3	25.00	0	9
443	US 60	70	27	38.57	0	43
447	IH 40	95	12	12.63	2	81
448	FM 1061	34	16	47.06	0	18
Total		607	175	28.83	7	425

A detailed summary of cargo types reported for commercial vehicles is provided in Table 12. Empty vehicles comprised 29 percent of those surveyed. For vehicles with identified cargo types, 20 percent reported that their cargo as food, health, and beauty products, 12 percent reported a cargo of manufactured goods/equipment, and farm products accounted for an additional 7 percent of the cargos.

Table 12. Distribution of Commercial Vehicles by Type of Cargo.

Cargo Description			Number of Vehicles	Percent of Vehicles
1	—	Farm Products	45	7.41
2	—	Forest Products	1	0.16
3	—	Marine Products	0	0.00
4	—	Metals and Minerals	19	3.13
5	—	Food, Health, and Beauty Products	124	20.43
6	—	Tobacco Products	0	0.00
7	—	Textiles	10	1.65
8	—	Wood Products	24	3.95
9	—	Printer Matter	0	0.00
10	—	Chemical Products	5	0.82
11	—	Refined Petroleum or Coal Products	22	3.62
12	—	Rubber, Plastic, and Styrofoam Products	15	2.47
13	—	Clay, Concrete, Glass, or Stone	17	2.80
14	—	Manufactured Goods/Equipment	74	12.19
15	—	Wastes	13	2.14
16	—	Miscellaneous Shipments	37	6.10
17	—	Hazardous Materials	5	0.82
18	—	Transportation	16	2.64
19	—	Unclassified Cargo	1	0.16
20	—	Driver Refused to Answer	2	0.33
21	—	Unknown to Driver	2	0.33
22	—	Empty	175	28.83
Total			607	100.00

Figures 16 and 17 present the distribution of surveyed commercial vehicles by the type of cargo transfer at the origin (point of pick-up) and at the destination (point of delivery). Warehouse-to-truck and truck-to-truck accounted for the majority of cargo transfers at both the origin and destination. At the origin, 80 percent of the transfers were warehouse-to-truck and 11 percent were truck-to-truck. At the destination, warehouse-to-truck (83 percent) and truck-to-truck (10 percent) transfers accounted for the majority of the transfers.

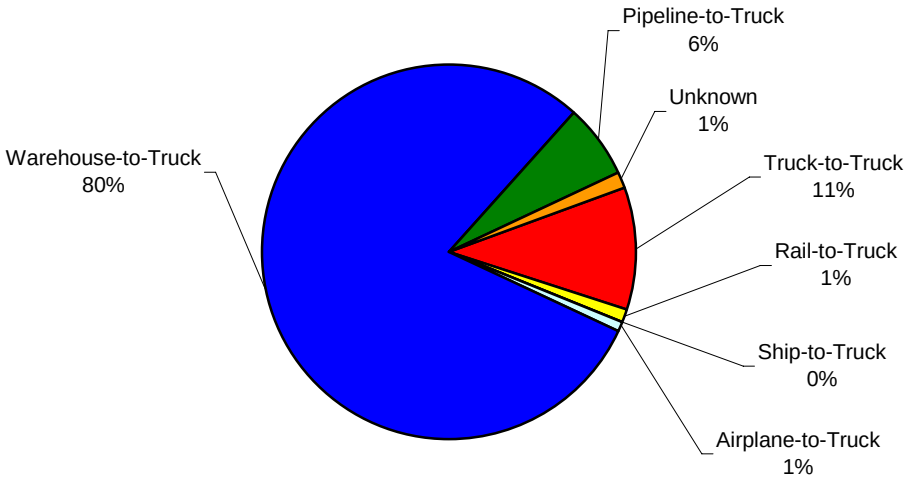

Figure 16. Cargo Transfer at Point of Pick-Up.

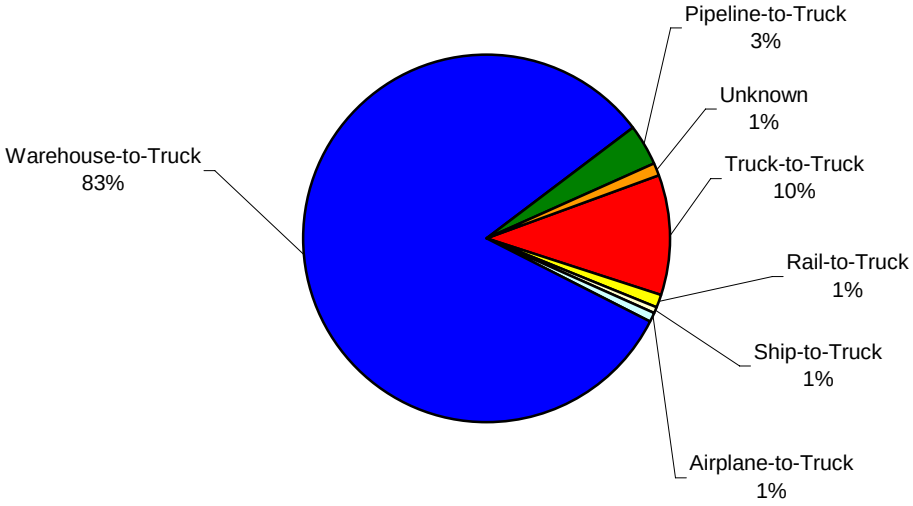

Figure 17. Cargo Transfer at Point of Drop-Off.

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 13 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 13 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 293 (station number 430) was applied to the total number of trips for FM 245 (station number 431), 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 13. Expanded Survey Results by Station.

Station Number	Facility	Non-Commercial Vehicles			Commercial Vehicles			Residents	Visitors
		Local	Through	Total	Local	Through	Total		
427	US 87/287	5704	530	6,234	1615	721	2,336	1961	3743
428	SH 136	4662	162	4,825	317	100	417	1601	3062
429	FM 1342	87	0	87	3	0	3	61	26
430	FM 293	366	23	389	9	0	9	255	111
431	FM 245	553	0	553	12	0	12	385	168
432	St. Francis	208	0	208	26	0	26	145	63
433	US 60	9174	178	9,352	764	86	850	4506	4668
434	Bus. IH 40	332	0	332	59	0	59	231	101
435	IH 40	5825	1160	6,985	3386	1595	4,981	1002	4823
436	US 287	3838	296	4,134	3169	419	3,588	1385	2453
437	FM 1151	611	35	646	70	0	70	329	281
438	FM 1258	129	0	129	13	0	13	70	59
439	FM 285	126	0	126	28	0	28	68	58
449	FM 2575	5966	638	6,604	1648	668	2,316	2992	2975
450	FM 1075	1068	52	1,120	23	130	153	605	463
440	IH 27	319	0	319	65	0	65	181	138
441	US 87	5726	253	5,979	698	257	955	2839	2887
442	FM 168	259	0	259	51	0	51	151	108
443	US 60	11	0	11	4	0	4	6	5
444	FM 1062	143	0	143	45	0	45	84	59
445	FM 2219	5900	1056	6,956	3609	1231	4,840	1644	4255
446	Farmers Ave.	1293	80	1,373	250	16	266	755	538
447	IH 40	263	0	263	11	0	11	183	80
448	FM 1061	85	0	85	6	0	6	46	39
Total		52,648	4,463	57,111	15,880	5,223	21,103	21,483	31,164

Figure 18 shows the estimates of external-local trip movements by direction and location group. The East group had the largest estimated number of external-local trip movements, with over 34,000 total daily trips. The West group had the second highest estimated number of external-local trip movements with nearly 18,000 daily trips.

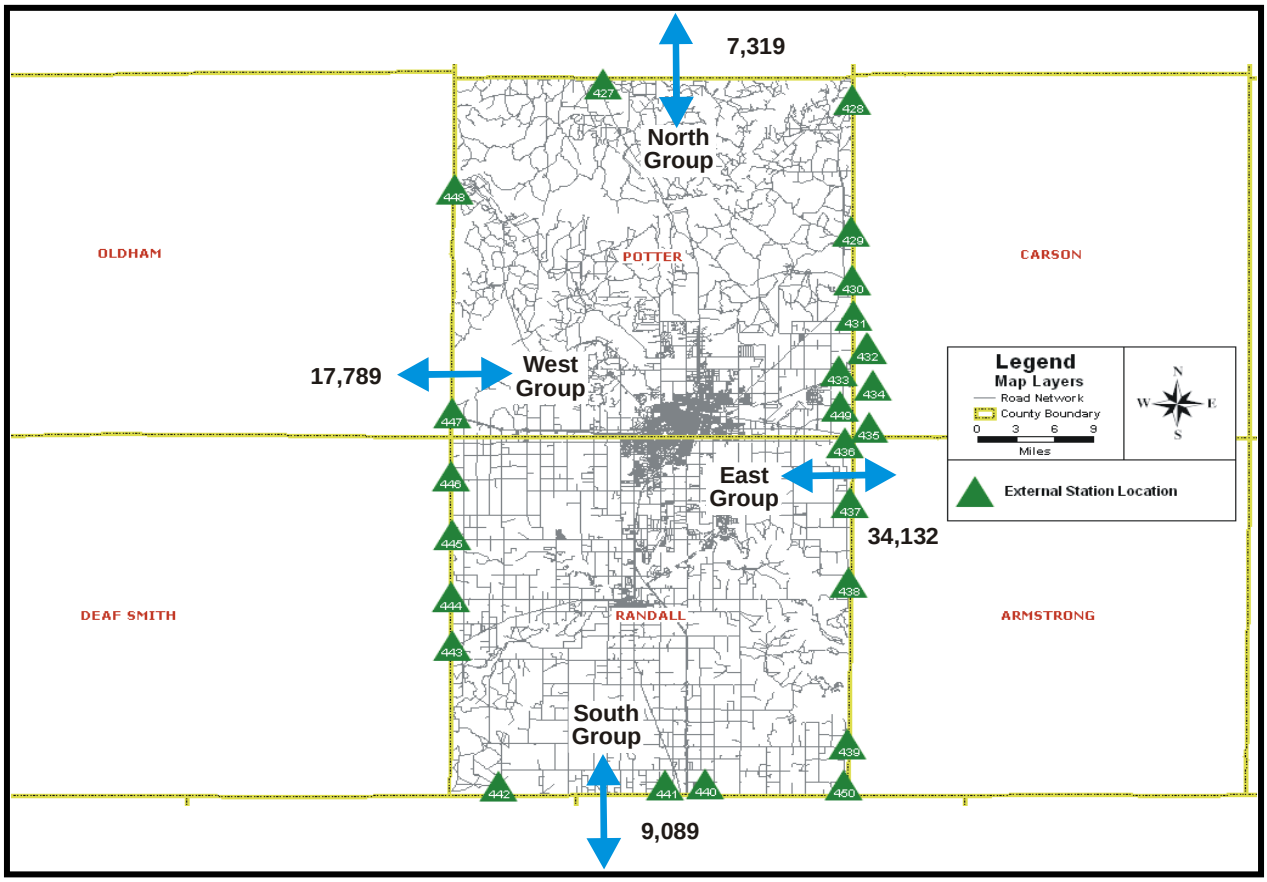

Figure 18. Estimates of External-Local Trip Movements by Location Group.

Figure 19 shows the estimates of external-through trip movements by direction and location group. The most common external-through movements were between the East and West groups. Nearly 2,500 external-through trips are estimated to be made on a daily basis between the east and west sides of the study area. This is logical due to IH 40 running East-West through the study area. East-South external-through trips were the second most common movement.

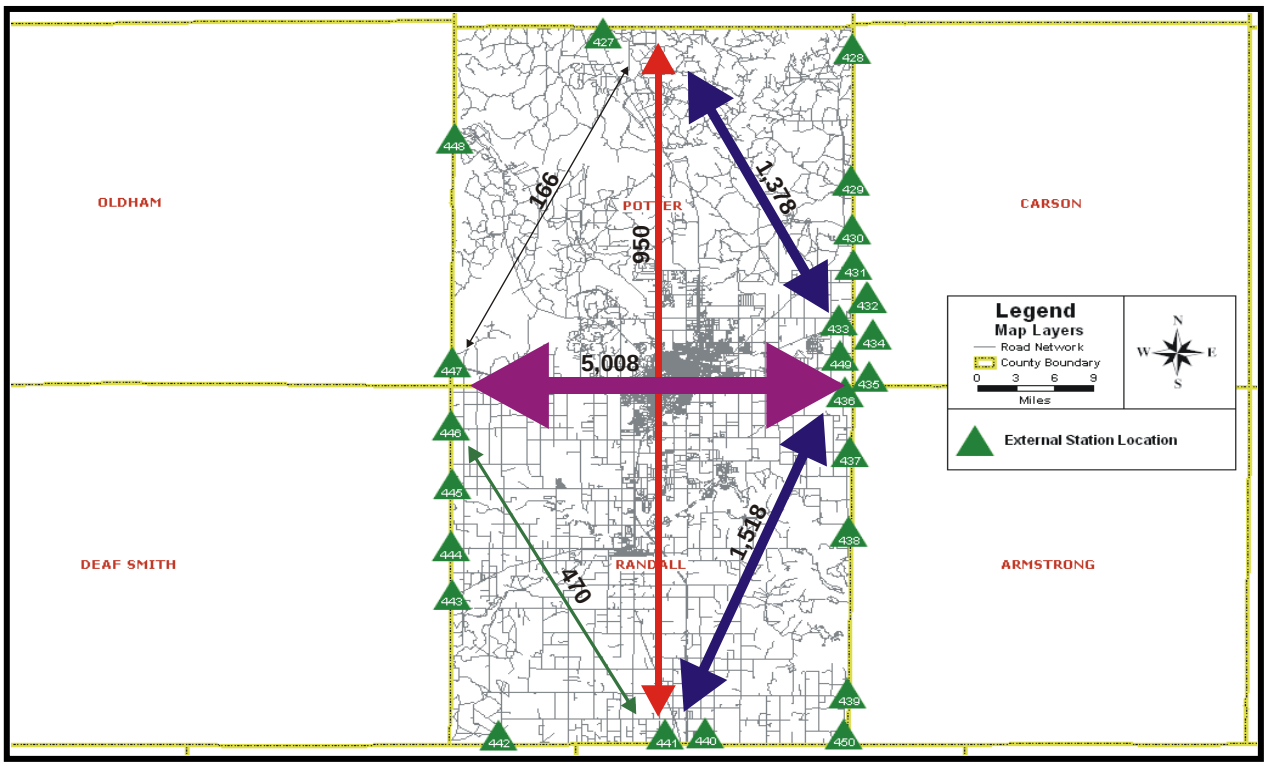

Figure 19. Estimates of External-Through Trip Movements by Location Group.

SURVEY SUMMARY

More than 78,000 vehicles enter and leave the two-county Amarillo study area daily. Nearly 27 percent are commercial vehicles. Nearly 12 percent of the approximate 78,000 vehicles make through trips. Approximately 30 percent of the non-commercial and commercial vehicles enter or leave the Amarillo study area via IH 40. Based on the average vehicle occupancy observed in the survey, an estimated 84,500 persons are entering and leaving the study area daily by non-commercial vehicle and nearly 23,000 persons are entering and leaving by commercial vehicle. The estimated number of non-residents (persons that do not live in the two-county study area) in non-commercial vehicles that enter the study area daily is approximately 46,000. Non-residents account for approximately 8,800 internal trips within the study area.

Approximately 33 percent of non-commercial trip origins were leaving home and 36 percent of non-commercial trip destinations were returning to home. HBNW trips accounted for nearly 43 percent of the non-commercial trips. The percentage of trips that were NHB and HBW were 30 percent and 27 percent, respectively.

Commercial vehicle drivers reported varied trip purposes at the origin and destination ends of their trip. Approximately 49 percent of the trip origin purposes were reported to be for support functions such as maintenance, eating lunch or buying fuel. Picking up cargo accounted for an additional 20 percent of trip origins. Delivering cargo was the stated purpose for 54 percent of the destination trips, while picking up cargo accounted for 19 percent of the destinations. Leaving base operations accounted for 14 percent of the commercial vehicle trip origins and only 8 percent of the trip destinations.

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 largest "spike" for non-commercial vehicles occurred during the afternoon peak for both the inbound and outbound directions. Inbound commercial vehicle travel peaked in the afternoon (around 5 p.m.) and the outbound commercial vehicle travel peaked around noon.

The median vehicle year for non-commercial and commercial vehicles was 2001. The average vehicle age for commercial vehicles was 5.1 years and for non-commercial vehicles it was 5.5 years. The average odometer reading for commercial vehicles was approximately five times higher than that for non-commercial vehicles. Average vehicle occupancy for non-commercial vehicles was 1.48, or nearly 35 percent greater than the 1.09 reported for commercial vehicles.

Commercial vehicles represent 27 percent of the vehicles traveling into and out of the Amarillo study area on a daily basis. Nearly 30 percent of the commercial vehicles are carrying no cargo. Of the commercial vehicles carrying cargo, 98 percent are carrying cargo that is not from or destined to Mexico.

APPENDIX

AMARILLO EXTERNAL STATION

NON-COMMERCIAL VEHICLE SURVEY FORM - A

(Outbound Direction)

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?	_____ Year _____ Make _____ Model	_____ Year _____ Make _____ Model	_____ Year _____ Make _____ Model
Gas (leaded, unleaded), diesel, propane or other fuel?	Leaded ☐ Unleaded ☐ Diesel ☐ Propane ☐ Other ☐ _____	Leaded ☐ Unleaded ☐ Diesel ☐ Propane ☐ Other ☐ _____	Leaded ☐ Unleaded ☐ Diesel ☐ Propane ☐ Other ☐ _____
2. What is the mileage on your odometer?			
3. What county do you live in?	☐Potter ☐Randall ☐ Other	☐Potter ☐Randall ☐ Other	☐Potter ☐Randall ☐ Other
(If other, go to 4) 3a. What city do you live in?	(go to 5)	(go to 5)	(go to 5)
4. What city and state to you live in?	_____ _____ (city / state in US or Mexico) ☐ Refused	_____ _____ (city / state in US or Mexico) ☐ Refused	_____ _____ (city / state in US or Mexico) ☐ Refused
4a. Did you stay overnight as part of your travel?	☐ Yes ☐ Refused ☐ No (go to 4d)	☐ Yes ☐ Refused ☐ No (go to 4d)	☐ Yes ☐ Refused ☐ No (go to 4d)
4b. Where did you stay?	_____ _____ (city / state in US or Mexico) ☐ Refused	_____ _____ (city / state in US or Mexico) ☐ Refused	_____ _____ (city / state in US or Mexico) ☐ Refused
4c. How many nights have you stayed?			
4d. Did you enter Texas today?	☐ Yes ☐ Refused ☐ No (go to 5)	☐ Yes ☐ Refused ☐ No (go to 5)	☐ Yes ☐ Refused ☐ No (go to 5)

4e. Where outside of Texas did you travel from?	_____ _____ (city / state in US or Mexico) ☐ Refused	_____ _____ (city / state in US or Mexico) ☐ Refused	_____ _____ (city / state in US or Mexico) ☐ Refused
4f. What road or highway did you use to enter Texas?			
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 the study area? (see Question 3 for study area counties)	☐ Yes ☐ No ☐ Refused (Yes go to 6)	☐ Yes ☐ No ☐ Refused (Yes go to 6)	☐ Yes ☐ No ☐ Refused (Yes go to 6)
5e What road did you use to enter the study area? (see Question 3 for study area counties)			

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)** Overnight stay/sleep
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 ☐ Refused ☐ No (go to 7d)	☐ Yes ☐ Refused ☐ No (go to 7d)	☐ Yes ☐ Refused ☐ 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. Where did you go next? (city/county/landmark)			
13. How many more places did you stop today?			

AMARILLO EXTERNAL STATION COMMERCIAL VEHICLE SURVEY FORM B
(Outbound Direction)

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)		
4a. If empty, what was the last cargo you delivered?	(go to 12)		
4b. Is your load full or partial? * ***determine 4a and 4b by observation*** *	☐ Full ☐ Partial		
4c. Is cargo being hauled using an multi-modal container/trailer or TEU?	☐ Yes ☐ No (go to 5)		
If Yes 4d Is the container a Reefer or Dry Box?	☐ Reefer ☐ Dry Box		
5. Did your cargo come from or is it going to Mexico?	☐ Yes ☐ No ☐ Refused / Unknown	☐ Yes ☐ No ☐ Refused / Unknown	☐ Yes ☐ No ☐ Refused / 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 / Unknown	☐ Yes ☐ No ☐ Refused / Unknown	☐ Yes ☐ No ☐ Refused / 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 / Unknown	☐ Yes ☐ No ☐ Refused / Unknown	☐ Yes ☐ No ☐ Refused / 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 99) Unknown / Refused

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

QUESTIONS:

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 Texas?	☐ Yes (go to 14d) ☐ No	☐ Yes (go to 14d) ☐ No	☐ Yes (go to 14d) ☐ No
14b. (*If not in Texas*) Did you enter Texas today?	☐ Yes ☐ No (go to 14d)	☐ Yes ☐ No (go to 14d)	☐ Yes ☐ No (go to 14d)
14c. What road or highway did you use to enter Texas?			
14d. Did you stay overnight as part of your travel?	☐ Yes ☐ No (go to 15)	☐ Yes ☐ No (go to 15)	☐ Yes ☐ No (go to 15)
14e. If yes, where did you stay? (city/county/state)			
14f. How many nights have you stayed?			
15. Where was the last place you got into your vehicle? (place/address or nearest intersection/city)			
15a. What time did you leave that place?	_____a.m. _____p.m.	_____a.m. _____p.m.	_____a.m. _____p.m.
15b. What type of place was this? (choose from type of place options).			
15c. What was your purpose for being at your last location?			
15d. Was that location in the study area?	☐ Yes (Go to 16) ☐ No ☐ Refused	☐ Yes (Go to 16) ☐ No ☐ Refused	☐ Yes (Go to 16) ☐ No ☐ Refused
15e. What road did you use to enter the study area?			
16. Where is your next destination? (place/address or nearest intersection/city)			
16a. What is your purpose for traveling to this destination? (Choose from trip purpose options.)			

17. Are you going to a location outside of Texas?	☐ Yes (Go to 17a) ☐ No (go to 17d) ☐ Refused	☐ Yes (Go to 17a) ☐ No (go to 17d) ☐ Refused	☐ Yes (Go to 17a) ☐ No (go to 17d) ☐ Refused
If Yes 17a. What city and state are you going to?			
17b. What road or highway will you use to leave Texas?			
17c. How many more days will you be in Texas?			
If No 17d. 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:

18. Where did your first trip today begin? (city/county/landmark)			
19. Where did you go from there? (city/county/landmark)			
20. Where did you go next? (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. How many more places did you stop today?			

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