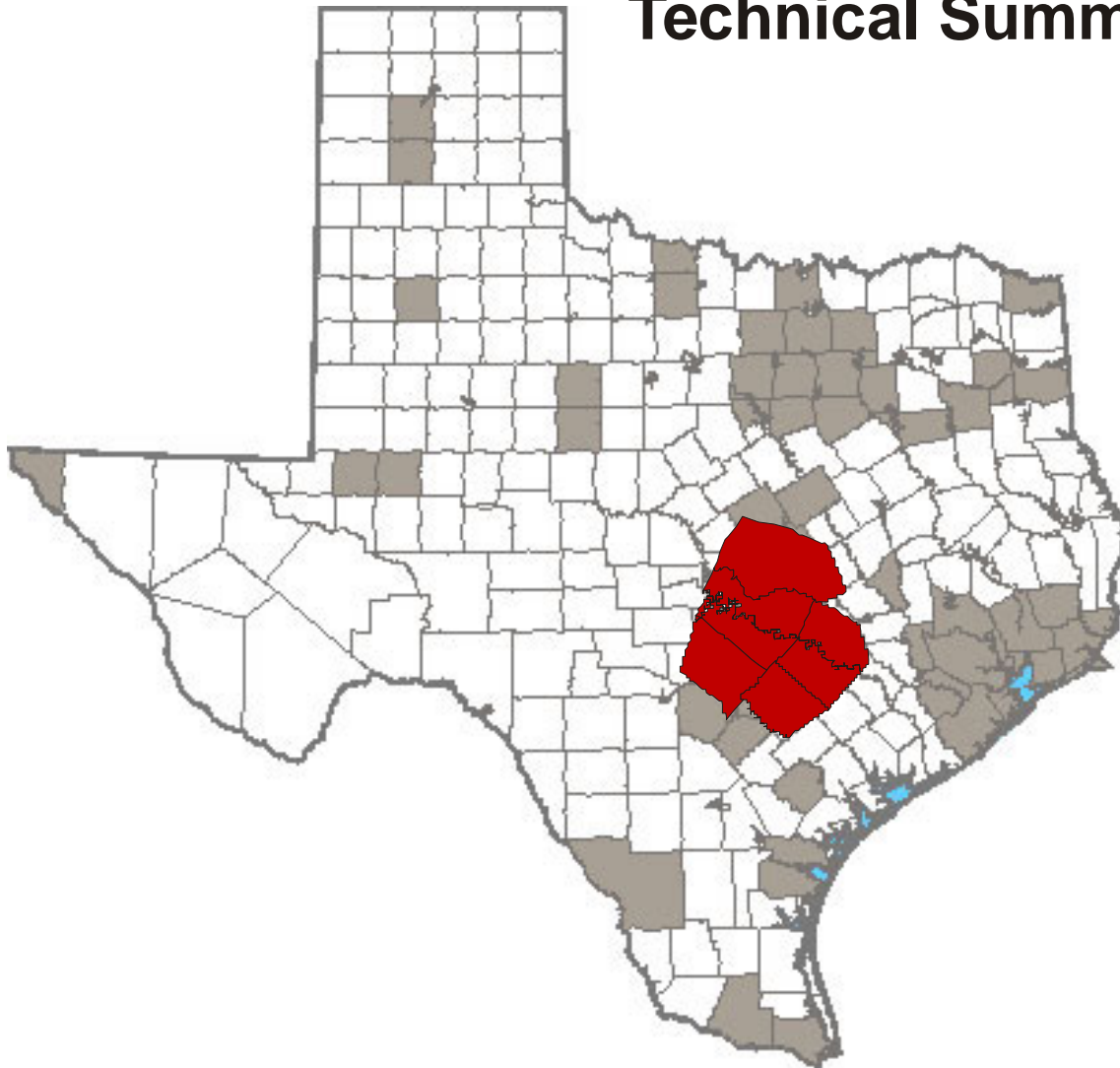


2006 Austin Commercial Vehicle Survey Technical Summary



Prepared by the
Texas Transportation Institute
December 2007
Revised February 2008

2006 Austin Commercial Vehicle Survey

TECHNICAL SUMMARY

Texas Department of Transportation Travel Survey Program

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DISCLAIMER

The contents of this report reflect the views of the author who is responsible for the data, findings, and conclusions presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration or the Texas Department of Transportation (TxDOT). This report does not constitute a standard, specification, or regulation. Stella Amor Nepal and Stephen P. Farnsworth were the authors of this report and David F. Pearson, Ph.D., P.E., was the study supervisor. Charlie Hall of the TxDOT Planning and Programming Division was the project director.

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INTRODUCTION

In 2006, the Texas Department of Transportation (TxDOT) funded a Commercial Vehicle Survey in the Austin Metropolitan Planning Organization (MPO) study area. The purpose of this survey was to provide data that would enable TxDOT to forecast total commercial vehicle travel demand within the urban area.

This report presents a Technical Summary of the 2006 Austin Commercial Vehicle Survey and documents the data collected and the analysis results for the study area. The survey forms used are presented in the Appendix.

The Austin Study Area is located in Central Texas. As Figure 1 shows, the Austin Study Area covers five counties — Williamson, Travis, Bastrop, Hays, and Caldwell. Total land area of this region is 4,200 square miles. Its population density is approximately 296 persons per square mile. The city of Austin is the study area's population center, which has an estimated population of 656,600 based on the 2000 Census.

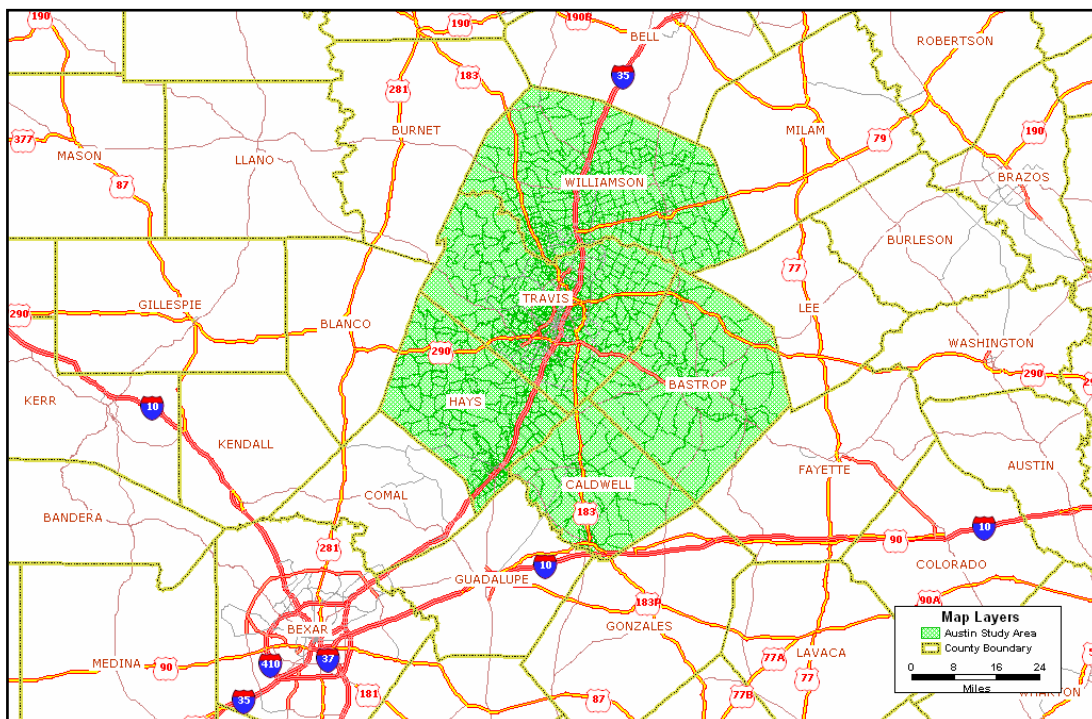


Figure 1. Austin Study Area.

SURVEY METHODOLOGY

The Commercial Vehicle Survey was conducted during the spring (March – April) and fall (November) of 2006. A total of 342 commercial vehicles were surveyed. Field observations were conducted to identify companies operating qualifying commercial vehicles in the study area. The information was then used to supplement the Vehicle Registration, Motor Carrier and Employer databases provided by TxDOT. The combined database was sorted according to a list of random numbers assigned to each record to ensure a random sample (ATG, 2006).

SURVEY SUMMARIES

Vehicle Characteristics

As part of the survey, sample data on the year, make and model, odometer reading, vehicle classification, and fuel type use were collected to examine the type and condition of commercial vehicles traveling within the study area.

In 2006, there were 14,503 diesel-fueled trucks and 4,778 gasoline-fueled trucks registered in the study area (TxDOT, 2007). Approximately 84 percent of the diesel trucks were between 1 and 10 years old, 14 percent were between 11 and 20 years old, and 2 percent were over 20 years old. For gasoline trucks, 68 percent were between 1 and 10 years old, 24 percent were between 11 and 20 years old, and 8 percent were over 20 years old. The average age of the diesel trucks was estimated at 8.9 years old. The average number of vehicles registered per county was estimated at 2,901 diesel-fueled trucks, and 956 gasoline-fueled trucks.

Table 1 and Figure 2 show the distribution of registered trucks in the study area and average per county by age (based on the model year).

Table 1. Distribution of Registered Trucks by Age.

Model Year	Age of Vehicle (Years)	Diesel Trucks	Percent of Total	Gasoline Trucks	Percent of Total	Average Number of Trucks Registered per County	
						Diesel	Gasoline
2007	0	671	4.63	34	0.7	134	7
2006	1	1,921	13.2	369	7.7	384	74
2005	2	2,210	15.2	380	8.0	442	76
2004	3	1,475	10.2	404	8.5	295	81
2003	4	1,131	7.8	243	5.1	226	49
2002	5	927	6.4	227	4.8	185	45
2001	6	1,011	7.0	307	6.4	202	61
2000	7	980	6.8	384	8.0	196	77
1999	8	961	6.6	450	9.4	192	90
1998	9	400	2.8	251	5.3	80	50
1997	10	416	2.9	211	4.4	83	42
1996	11	380	2.6	171	3.6	76	34
1995	12	307	2.1	306	6.4	61	61
1994	13	291	2.0	135	2.8	58	27
1993	14	258	1.8	104	2.2	52	21
1992	15	185	1.3	85	1.8	37	17
1991	16	158	1.1	82	1.7	32	16
1990	17	165	1.1	69	1.4	33	14
1989	18	139	1.0	78	1.6	28	16
1988	19	116	0.8	43	0.9	23	9
1987	20	108	0.7	40	0.8	22	8
Older	>20	293	2.0	405	8.5	59	81
Total		14,503	100	4,778	100.0	2,901	956

Source: TxDOT, 2007

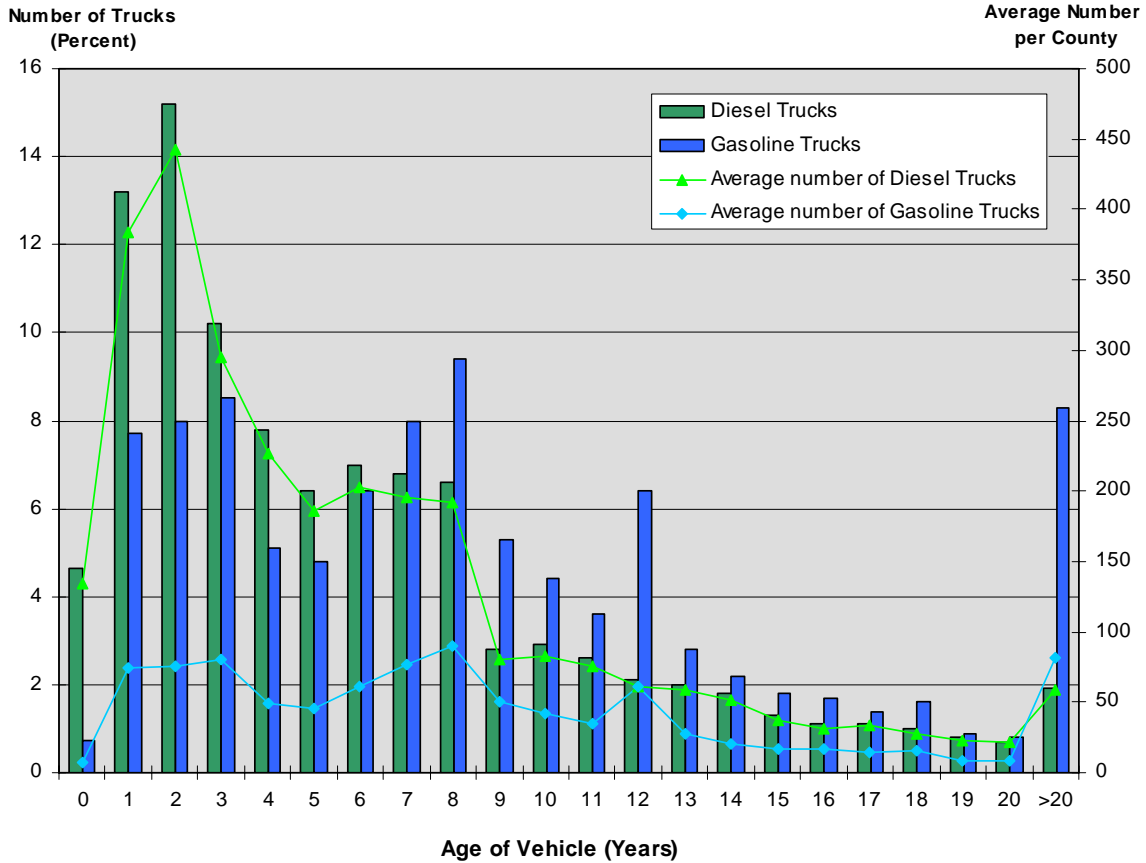


Figure 2. Distribution of Registered Trucks by Age.

Tables 2 and 3 provide the distribution of registered diesel trucks and gasoline trucks in the study area by gross vehicle weight. Nearly half of the diesel trucks (45 percent) had a gross vehicle weight between 8,500 pounds and 10,000 pounds; 18 percent weighed between 10,000 pounds and 19,500 pounds; and 33 percent weighed more than 19,500 pounds but not more than 60,000 pounds. Only 4 percent of the trucks weighed more than 60,000 pounds. For gasoline trucks, the majority (53 percent) had a gross vehicle weight between 8,500 pounds and 10,000 pounds; 32 percent weighed between 10,000 pounds and 19,500; and 15 percent weighed more than 19,500 pounds but not more than 60,000 pounds.

Table 2. 2006 Distribution of Registered Diesel Trucks by Model Year and Gross Vehicle Weight.

Model Year	Number of Diesel Trucks by Gross Vehicle Weight (Thousand Lbs.)									Percent of Total
	>8.5	>10	>14	>16	>19.5	>26	>33	>60	Total	
2007	240	49	38	18	118	67	70	71	671	4.6
2006	1,102	173	111	83	204	76	98	74	1,921	13.2
2005	1,492	131	69	70	200	95	86	67	2,210	15.2
2004	936	101	81	72	144	70	59	12	1,475	10.2
2003	707	85	43	61	79	55	45	56	1,131	7.8
2002	539	83	49	42	85	52	51	26	927	6.4
2001	477	98	44	34	143	78	85	52	1,011	7.0
2000	278	130	99	47	145	88	113	80	980	6.8
1999	313	125	65	43	145	76	125	69	961	6.6
1998	74	30	25	11	110	49	85	16	400	2.8
1997	121	50	38	6	62	43	78	18	416	2.9
1996	60	43	30	9	83	55	83	17	380	2.6
1995	43	31	19	7	66	23	100	18	307	2.1
1994	34	33	10	6	50	30	114	14	291	2.0
1993	21	21	9	8	51	32	103	13	258	1.8
1992	13	21	12	5	33	27	66	8	185	1.3
1991	15	10	4	5	26	32	61	5	158	1.1
1990	13	15	10	6	29	27	61	4	165	1.1
1989	3	8	8	7	23	12	74	4	139	1.0
1988	11	7	1	7	18	20	49	3	116	0.8
1987	0	4	1	1	31	25	40	6	108	0.7
1986	3	3	4	2	12	15	21	1	61	0.4
1985	1	6	1	1	19	10	23	4	65	0.4
1984	5	4	0	2	10	9	20	0	50	0.3
1983	1	0	3	2	5	1	6	1	19	0.1
1982	0	1	0	0	6	4	11	1	23	0.2
Older	0	0	1	3	9	11	50	1	75	0.5
Total	6,502	1,262	775	558	1,906	1,082	1,777	641	14,503	100.0
Percent of Total	44.8	8.7	5.3	3.8	13.1	7.5	12.3	4.4	100.0	

Source: TxDOT, January 2007.

Table 3. 2006 Distribution of Registered Gasoline Trucks by Model Year and Gross Vehicle Weight.

Model Year	Number of Gasoline Trucks by Gross Vehicle Weight (Thousand Lbs.)								Total	Percent of Total
	>8.5	>10	>14	>16	>19.5	>26	>33	>60		
2007	28	1	0	0	1	0	2	2	34	0.7
2006	264	58	19	3	16	6	2	1	369	7.7
2005	259	85	10	6	18	2	0	0	380	8.0
2004	276	90	12	3	18	3	2	0	404	8.5
2003	139	79	10	8	7	0	0	0	243	5.1
2002	147	48	22	1	4	0	5	0	227	4.8
2001	185	74	23	3	10	8	3	1	307	6.4
2000	203	103	38	5	24	2	9	0	384	8.0
1999	233	123	33	9	34	11	6	1	450	9.4
1998	126	46	14	3	40	12	7	3	251	5.3
1997	92	62	22	6	16	8	4	1	211	4.4
1996	81	42	17	4	13	9	5	0	171	3.6
1995	108	75	16	8	41	27	28	3	306	6.4
1994	51	42	10	8	15	3	6	0	135	2.8
1993	56	19	5	2	13	5	3	1	104	2.2
1992	37	8	9	4	20	1	6	0	85	1.8
1991	38	15	4	3	18	2	1	1	82	1.7
1990	22	22	5	2	7	6	5	0	69	1.5
1989	36	14	4	3	6	2	13	0	78	1.6
1988	16	10	3	4	6	2	2	0	43	0.9
1987	13	9	1	7	7	1	2	0	40	0.8
1986	15	7	3	2	10	4	4	0	45	0.9
1985	21	9	2	4	12	2	4	0	54	1.1
1984	20	9	0	4	13	2	2	0	50	1.1
1983	10	7	1	1	7	2	0	0	28	0.6
1982	14	2	0	4	4	1	1	0	26	0.5
Older	52	40	21	15	53	9	12	0	202	4.2
Total	2,542	1,099	304	122	433	130	134	14	4,778	100.0
Percent of Total	53.2	23.0	6.4	2.5	9.1	2.7	2.8	0.3	100.0	

Source: TxDOT, January 2007.

The surveyed vehicle data, on the other hand, shows that only 3.5 percent had a gross vehicle weight between 8,500 pounds and 10,000 pounds; 21 percent weighed between 10,000 pounds and 19,500; and 52 percent weighed more than 19,500 pounds but not more than 60,000 pounds. Approximately 20 percent of the vehicles had a gross vehicle weight over 60,000 pounds. Table 4 shows the distribution of surveyed vehicles in the study area by age and gross vehicle weight.

Table 4. Distribution of Surveyed Vehicles by Model Year and Gross Vehicle Weight.

Model Year	Age of Vehicle (Years)	Number of Vehicles by Gross Vehicle Weight (Thousand Lbs.)									
		<8.5	>8.5	>10	>14	>16	>19.5	>26	>33	>60	Unknown
2006	1	0	1	1	0	2	4	2	4	7	1
2005	2	0	1	2	0	0	8	3	10	10	0
2004	3	1	1	6	2	1	4	5	4	3	0
2003	4	1	3	3	2	1	4	1	3	2	0
2002	5	0	0	1	0	2	7	3	7	5	0
2001	6	0	2	7	2	1	5	2	5	5	1
2000	7	1	0	1	0	2	6	4	8	7	1
1999	8	1	0	3	2	0	2	3	5	6	1
1998	9	0	0	4	3	0	3	1	2	5	0
1997	10	0	0	0	1	3	2	2	4	3	1
1996	11	0	0	1	3	1	2	2	2	0	1
1995	12	1	1	0	0	3	4	4	7	3	1
1994	13	0	1	0	1	0	1	3	7	1	0
1993	14	0	0	1	0	1	0	0	3	0	0
1992	15	0	0	0	0	0	1	1	0	1	0
1991	16	0	0	2	0	2	0	0	0	0	0
1990	17	0	0	0	0	0	0	1	0	3	0
1989	18	0	1	0	0	0	0	2	3	2	0
1988	19	0	0	1	0	0	0	3	1	2	0
1987	20	0	0	0	0	0	2	0	2	1	0
Older	>20	1	1	2	0	0	0	2	3	1	0
Unknown		0	0	0	0	0	0	0	0	0	1
Total		6	12	35	16	19	55	44	80	67	8
Percent of Total		1.7	3.5	10.2	4.7	5.6	16.1	12.9	23.4	19.6	2.3

In terms of age (calculated based on the model year of the vehicle), approximately 72 percent of the vehicles were between 1 and 10 years old, 25 percent were between 11 and 20 years, and 3 percent were over 20 years old. The average age of the vehicles was approximately 8 years old. Nearly 78 percent of the vehicles reported odometer readings at the beginning of the trip survey, indicating an average odometer reading of 177,211 miles. Table 5 and Figure 3 show the distribution by age and odometer reading.

Table 5. Distribution of Vehicles by Age and Average Odometer Reading.

Vehicle Age (Years)	Number of Vehicles	Percent of Total	Cumulative Percent of Total	Number of Vehicles that reported Odometer Readings	Percent of Total	Average of Reported Odometer Readings
1	22	6.4	6.4	18	6.7	18,002
2	34	9.9	16.4	26	9.7	36,930
3	27	7.9	24.3	21	7.8	72,549
4	20	5.8	30.1	18	6.7	110,206
5	25	7.3	37.4	24	9.0	171,272
6	30	8.8	46.2	23	8.6	162,619
7	30	8.8	55.0	21	7.9	235,315
8	23	6.7	61.7	17	6.4	227,754
9	18	5.3	67.0	16	6.0	236,018
10	16	4.7	71.6	14	5.2	235,942
11	12	3.5	75.1	7	2.6	280,599
12	24	7.0	82.2	20	7.5	272,550
13	14	4.1	86.3	9	3.4	360,060
14	5	1.5	87.7	3	1.1	253,187
15	3	0.9	88.6	2	0.8	549,949
16	4	1.2	89.8	1	0.4	297,525
17	4	1.2	90.9	2	0.8	443,180
18	8	2.3	93.3	6	2.3	105,341
19	7	2.0	95.3	7	2.6	233,930
20	5	1.5	96.8	4	1.5	439,178
>20	10	2.9	99.7	8	3	131,874
Unknown	1	0.3	100.0	0	0	-
Total	342	100.0	-	267	100	177,211

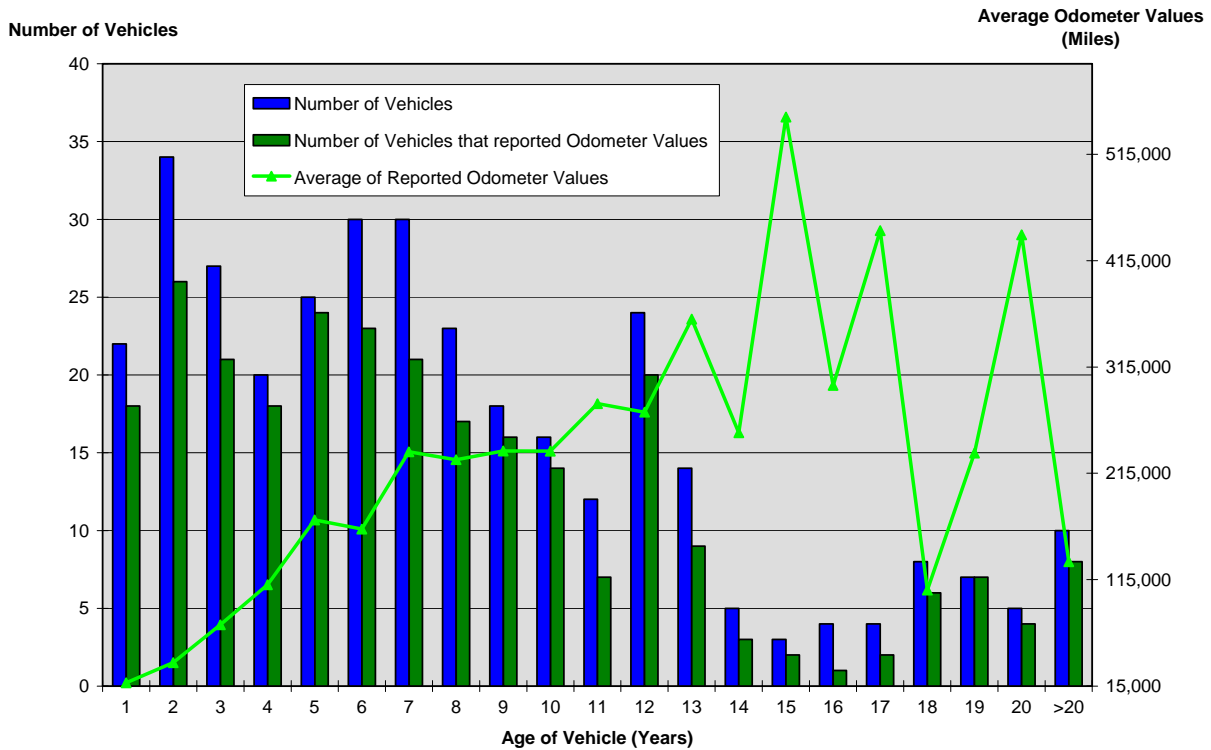


Figure 3: Distribution of Vehicles by Age and Average Odometer Readings.

Table 6 shows the distribution of vehicles based on the Texas 6 classification of vehicles system. Over half of the vehicles were single unit, 2-axle vehicles (55 percent), while the remaining were predominantly single unit, 3-axle vehicles (25 percent) and semi tractor-trailers (18 percent).

Table 6. Distribution of Vehicles by Classification.

Vehicle Classification	Number of Vehicles	Percent of Total	Cumulative Percent of Total
Single Unit, 2-axle (6 wheels)	189	55.3	55.3
Single Unit, 3-axle (10 wheels)	86	25.1	80.4
Single Unit, 4-axle (14 wheels)	4	1.2	81.6
Semi (all Tractor-Trailer Combinations)	61	17.8	99.4
Other	2	0.6	100.0
Total	342	100.0	-

Due to similarities among certain classes of vehicles, the classification groups provided in the above table are aggregated into three new groups. All of the single unit, multi-axle vehicles are classified as “Small and Medium,” semi/tractor-trailer combinations are classified as “Large,” and any vehicles listed as other are classified as “Other.” Figure 4 indicates that nearly 82 percent of the vehicles were small and medium and approximately 18 percent were large.

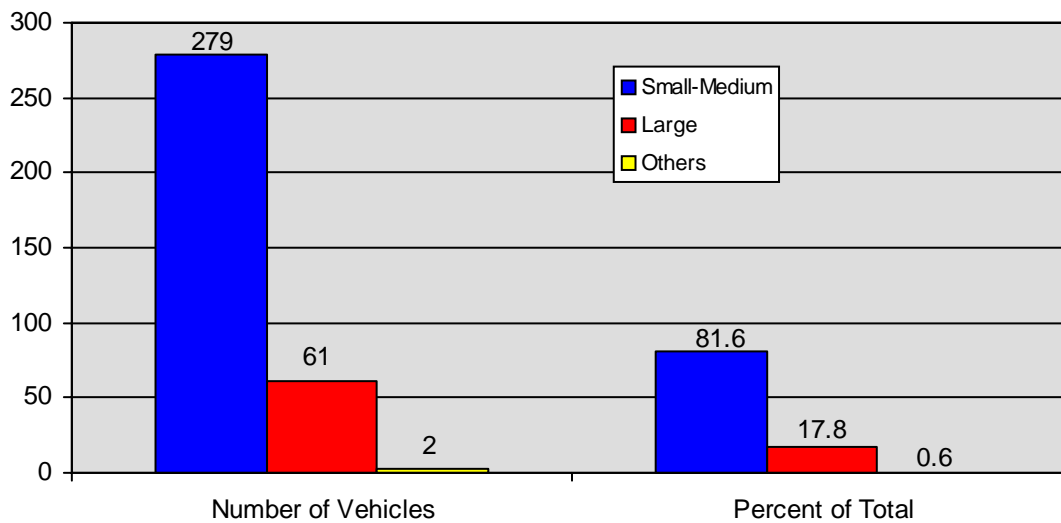


Figure 4. Distribution of Vehicles by Vehicle Classification.

In terms of commercial type, nearly 73 percent of the vehicles were used for cargo or freight transport, and the remaining 27 percent were for local services (see Figure 5).

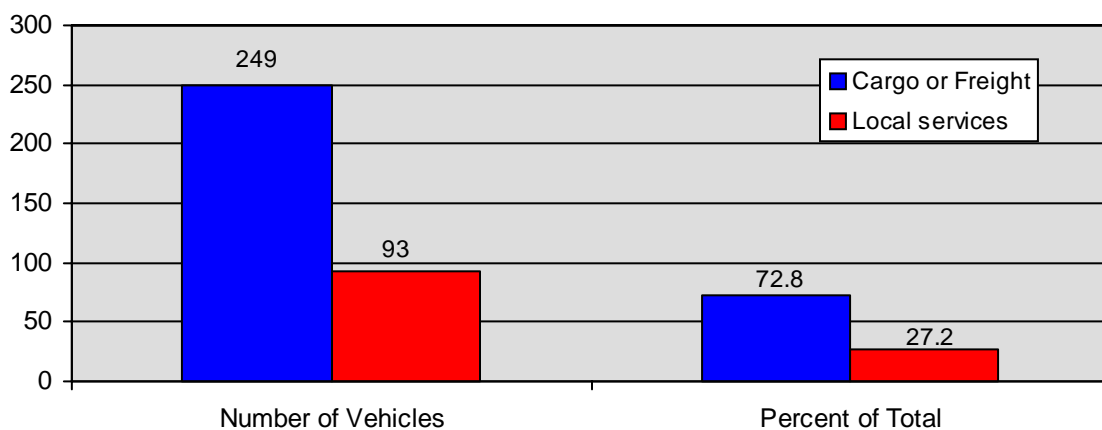


Figure 5. Distribution of Vehicles by Commercial Vehicle Type.

In terms of type of fuel used by the vehicles, the majority (95 percent) used diesel, and only 4 percent used unleaded gasoline and almost 1 percent used propane (see Figure 6).

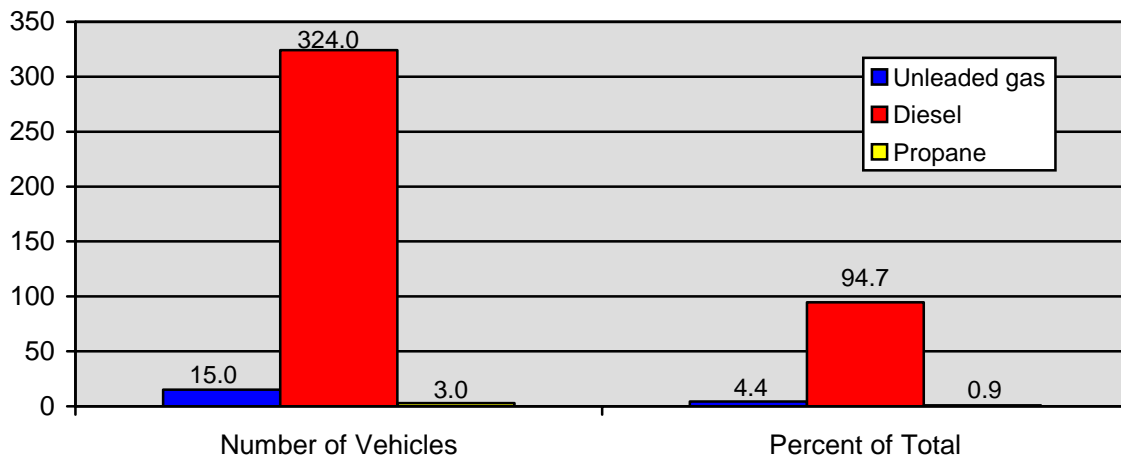


Figure 6. Distribution of Vehicles by Fuel Type.

Trip Frequency

Table 7 shows the total number of trips made by the vehicles during the survey period. Approximately 35 percent of the vehicles averaged 2-to-4 trips per day. About a quarter of the vehicles made more than 10 trips. Overall, 2,551 trips were generated. These included internal trips as well as external trips.

Internal trips were those trips made within the study area. These were further distinguished by travel within or between zones; referred to as inter-zonal trips, those trips made from one zone to another, or intra-zonal, trips made within the same zone. External trips were those trips made outside of the study area.

Approximately 92 percent (2,355 trips) of the total trips generated by the vehicles were internal, and the remaining 8 percent (196 trips) were external travel. Table 8 shows the distribution of internal and external trips made by the surveyed vehicles. Approximately, 84 percent of the internal trips were inter-zonal and 5 percent were intra-zonal. Some of the logged trips made within the study area (3 percent) did not have identified zones. These unknown trips were included in the analysis as internal travel, but were not included in the analyses of travel distances, time, and speed.

In the succeeding sections, the analyses of trips in terms of land use activity, purpose, and cargo, were focused primarily on internal trips. Trip-related characteristics for vehicles making external trips were only included in the analysis of trip tours presented in a latter section of this report.

Table 7. Distribution of Vehicles by Number of Trips.

Number of Trips	Number of Vehicles	Percent of Total	Cumulative Percent of Total	Total Trips	Percent of Total
1	1	0.3	0.3	1	0.0
2	53	15.5	15.8	106	4.2
3	39	11.4	27.2	117	4.6
4	28	8.2	35.4	112	4.4
5	25	7.3	42.7	125	4.9
6	26	7.6	50.3	156	6.1
7	26	7.6	57.9	182	7.1
8	27	7.9	65.8	216	8.5
9	15	4.4	70.2	135	5.3
10	19	5.6	75.7	190	7.5
11	14	4.1	79.8	154	6.0
12	13	3.8	83.6	156	6.1
13	12	3.5	87.1	156	6.1
14	8	2.3	89.5	112	4.4
15	6	1.8	91.2	90	3.5
16	5	1.5	92.7	80	3.1
17	4	1.1	93.9	68	2.7
18	4	1.1	95.0	72	2.8
19	17	5.0	100.0	323	12.7
Total	342	100.0		2,551	100.0

Table 8. Frequency of Internal and External Trips.

Trip Type	Number of Trips	Percent of Total
Inter-zonal	2,140	83.9
Intra-zonal	129	5.1
Unknown zones	86	3.4
Total Internal	2,355	92.3
External	196	7.7
Total Trips	2,551	100.0

Table 9 shows the frequency of internal trips by vehicle classification. Approximately 82 percent of the trips were made by small and medium vehicles, averaging 7.2 trips per vehicle. For large vehicles, which accounted to 17 percent of the trips, the average number of trips was 7.3 (see Figure 7).

Table 9. Frequency of Internal Trips by Vehicle Classification.

Number of Trips	Small and Medium	Percent of Total	Large	Percent of Total	Other	Percent of Total	Total Internal Trips	Percent of Total
1	5	1.9	7	12.5	-	-	12	0.5
2	51	18.8	8	14.2	-	-	118	5.0
3	31	11.4	5	8.9	-	-	108	4.6
4	20	7.4	5	8.9	-	-	100	4.2
5	23	8.5	1	1.8	2	100.0	130	5.5
6	20	7.4	3	5.4	-	-	138	5.9
7	18	6.6	1	1.8	-	-	133	5.6
8	15	5.5	5	8.9	-	-	160	6.8
9	9	3.3	1	1.8	-	-	90	3.8
10	13	4.8	4	7.1	-	-	170	7.2
11	10	3.7	3	5.4	-	-	143	6.1
12	13	4.8	1	1.8	-	-	168	7.1
13	9	3.3	4	7.1	-	-	169	7.2
14	5	1.8	2	3.6	-	-	98	4.2
15	4	1.5	1	1.8	-	-	75	3.2
16	4	1.5	1	1.8	-	-	80	3.4
17	3	1.1	1	1.8	0	0.0	68	2.9
18	4	1.5	0	0.0	0	0.0	72	3.1
19	14	5.2	3	5.4	0	0.0	323	13.7
Total	271	100.0	56	100.0	2	100	2,355	100.0

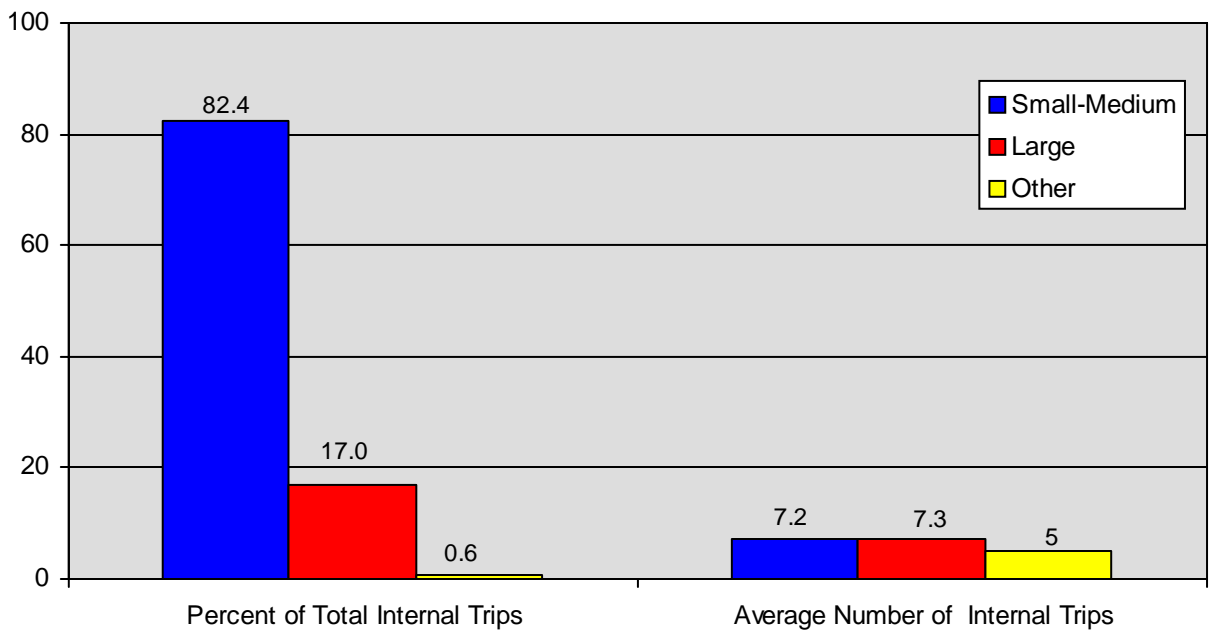


Figure 7. Percent of Total and Average Number of Internal Trips by Vehicle Classification.

Table 10 shows the distribution of internal trips by commercial type. Approximately 71 percent of the trips were made for cargo or freight transport, and the remaining 29 percent were made for local services. Average trips per day were estimated at 7-to-7.5 trips (see Figure 8).

Table 10. Frequency of Internal Trips by Commercial Vehicle Type.

Number of Trips	Cargo or Freight	Percent of Total	Local Services	Percent of Total	Total	Percent of Total
1	10	4.2	2	2.2	12	3.6
2	46	19.4	13	14.1	59	17.9
3	22	9.2	14	15.2	36	10.9
4	19	8.0	6	6.5	25	7.6
5	20	8.4	6	6.5	26	7.9
6	18	7.6	5	5.4	23	7.0
7	12	5.1	7	7.6	19	5.8
8	17	7.2	3	3.3	20	6.1
9	3	1.3	7	7.6	10	3.0
10	13	5.5	4	4.4	17	5.2
11	8	3.4	5	5.4	13	4.0
12	7	3.0	7	7.6	14	4.3
13	10	4.2	3	3.3	13	4.0
14	7	3.0	0	0.0	7	2.1
15	5	2.1	0	0.0	5	1.5
16	5	2.1	0	0.0	5	1.5
17	3	1.3	1	1.1	4	1.2
18	2	0.8	2	2.2	4	1.2
19	10	4.2	7	7.6	17	5.2
Total	237	100.0	92	100.0	329	100.0

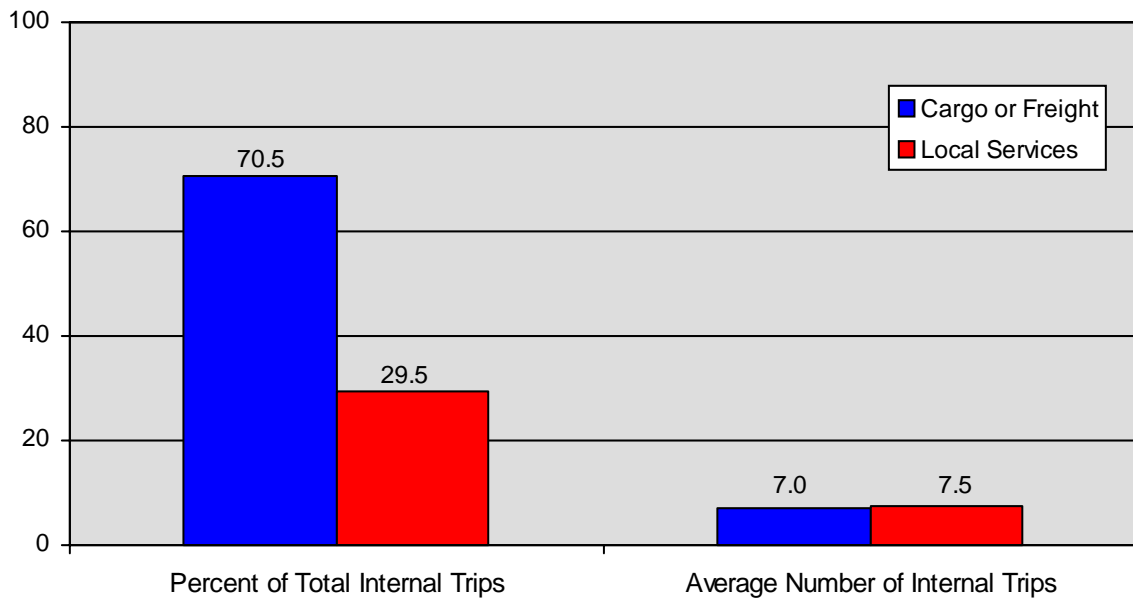


Figure 8. Percent of Total and Average Number of Internal Trips by Commercial Type.

Trip Characteristics

The frequency of trips at origin and destinations, as disaggregated by land use type, indicated the five most common sites were construction site (20 percent), other (18 percent), retail/shopping (15 percent), industrial and manufacturing (13 percent), and residential (12 percent). These comprised a combined total of approximately 78 percent of the internal trips made by the vehicles. Table 11 shows the distribution of trip origins and destinations by land use type. Since the distribution of trips at the origin and destination was similar, the succeeding tables present trips made at the destination only.

Table 11. Distribution of Trip Origins and Destinations by Land Use Type.

Land Use Type	Origin	Percent of Total	Destination	Percent of Total
Office Building (Non-Government)	103	4.4	105	4.4
Retail/Shopping	364	15.5	362	15.4
Industrial/Manufacturing	325	13.8	310	13.2
Medical/Hospital	19	0.8	19	0.8
Education (12th Grade or Less, College, Trade)	43	1.8	44	1.9
Government Office/Building	122	5.2	116	4.9
Residential	286	12.1	287	12.2
Airport	3	0.1	3	0.1
Intermodal Facility	5	0.2	5	0.2
Warehouse	101	4.3	96	4.1
Distribution Center	57	2.4	56	2.4
Construction Site	468	19.9	471	20.0
Other	415	17.6	424	18.0
Refused/Unknown	44	1.9	57	2.4
Total	2,355	100.0	2,355	100.0

As Table 12 shows, the majority (82 percent) of trip origins and destinations were made by small and medium vehicles. The remaining 17 percent were by large vehicles and 1 percent by other vehicles.

Table 12. Distribution of Trips by Vehicle Classification.

Land Use Type	Small and Medium	Percent of Total	Large	Percent of Total	Other	Percent of Total	Total	Percent of Total
Office Building (Non-Government)	88	4.5	16	3.9	1	10.0	105	4.4
Retail/Shopping	346	17.9	15	3.7	1	10.0	362	15.4
Industrial/Manufacturing	207	10.6	103	25.3	0	0.0	310	13.2
Medical/Hospital	17	0.9	2	0.5	0	0.0	19	0.8
Education (12th Grade or Less, College, Trade)	25	1.2	19	4.7	0	0.0	44	1.9
Government Office/Building	115	5.9	1	0.2	0	0.0	116	4.9
Residential	259	13.4	24	5.9	4	40.0	287	12.2
Airport	3	0.2	0	0.0	0	0.0	3	0.1
Intermodal Facility	1	0.1	4	1.0	0	0.0	5	0.2
Warehouse	81	4.2	14	3.4	1	10.0	96	4.1
Distribution Center	40	2.1	16	3.9	0	0.0	56	2.4
Construction Site	325	16.8	146	35.9	0	0.0	471	20.0
Other	380	19.6	41	10.1	3	30.0	424	18.0
Refused/Unknown	51	2.6	6	1.5	0	0.0	57	2.4
Total	1,938	100.0	407	100.0	10	100.0	2,355	100.0
Percent of Total	82.3	-	17.3	-	0.4	-	100.0	-

By commercial type, approximately 71 percent of the trips were made for cargo or freight transport and the remaining 29 percent for local services (see Table 13).

Table 13. Distribution of Trips by Commercial Vehicle Type.

Land Use Type	Cargo or Freight	Percent of Total	Local Services	Percent of Total	Total	Percent of Total
Office Building (Non-Government)	73	4.4	32	4.6	105	4.4
Retail/Shopping	252	15.2	110	15.9	362	15.4
Industrial/Manufacturing	274	16.5	36	5.2	310	13.2
Medical/Hospital	18	1.1	1	0.1	19	0.8
Education (12th Grade or Less, College, Trade)	41	2.5	3	0.4	44	1.9
Government Office/Building	88	5.3	28	4.1	116	4.9
Residential	150	9.0	137	19.7	287	12.2
Airport	2	0.1	1	0.1	3	0.1
Intermodal Facility	4	0.2	1	0.1	5	0.2
Warehouse	69	4.2	27	3.9	96	4.1
Distribution Center	45	2.7	11	1.6	56	2.4
Construction Site	395	23.8	76	11.0	471	20.0
Other	219	13.2	205	29.5	424	18.0
Refused/Unknown	31	1.9	26	3.8	57	2.4
Total	1,661	100.0	694	100.0	2,355	100.0
Percent of Total	70.5	-	29.5	-	100.0	-

Table 14 shows a summary of trip purposes at the origin and destination. The results indicated that delivery (34 percent), service-related business (23 percent), pick up (20 percent), and return to base location (15 percent) were the main purposes, comprising 92 percent of the total trips (see Figure 9).

Table 14. Trip Purposes by Origin and Destination Summary.

Trip Purpose at Origin	Trip Purpose at Destination										Total	Percent of Total
	Base/Return to Base Location	Delivery	Pick Up	Pick Up and Delivery	Maint. (Fuel, Oil, Etc.)	Driver Needs	To Home	Service-Related Business	Other	Unknown		
Base Location/Return to Base Location	3	124	77	12	9	7	1	130	7	2	372	15.8
Delivery	162	278	324	6	8	8	0	4	1	1	792	33.6
Pick Up	29	358	46	13	2	1	1	3	0	1	454	19.3
Pick Up and Delivery	9	22	0	60	1	1	0	1	0	0	94	4.0
Maintenance (Fuel, Oil, Etc.)	16	4	5	0	0	1	1	4	2	0	33	1.4
Driver Needs (Lunch, Etc.)	9	8	2	0	1	4	0	24	0	0	48	2.0
To Home	0	0	0	0	0	0	0	1	0	0	1	0.0
Service-Related Business	115	0	3	0	10	26	0	364	2	0	520	22.1
Other	8	0	0	0	1	2	0	2	17	0	30	1.3
Unknown	3	3	1	2	0	0	0	1	1	0	11	0.5
Total	354	797	458	93	32	50	3	534	30	4	2,355	100.0
Percent of Total	15.0	33.8	19.5	4.0	1.4	2.1	0.1	22.6	1.3	0.2	100.0	-

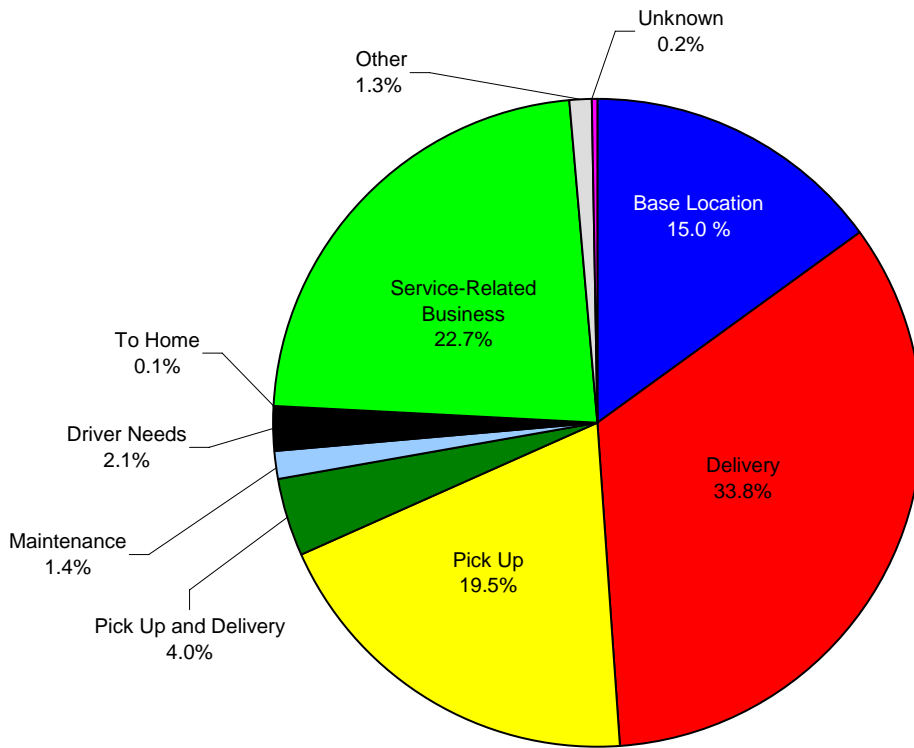


Figure 9. Distribution of Trip Purposes at Destination.

By vehicle classification, small and medium vehicles made 32 percent of the trips for delivery, 28 percent of the trips were for service-related business, and 15 percent of the trips were for picking up cargo (see Table 15 and Figure 10). For large vehicles, delivery (44 percent) and picking up cargo (39 percent) were the main trip purposes (see Table 16 and Figure 11).

Table 15. Distribution of Trip Purposes at Origin and Destination by Small and Medium Vehicles.

Trip Purpose at Origin	Trip Purpose at Destination (Small and Medium Vehicles)											Percent of Total
	Base/Return to Base Location	Delivery	Pick Up	Pick Up and Delivery	Maint. (Fuel, Oil, Etc.)	Driver Needs	To Home	Service-Related Business	Other	Unknown	Total	
Base Location/Return to Base Location	3	99	52	11	9	7	1	129	6	2	319	16.4
Delivery	116	275	194	4	5	6	0	3	1	1	605	31.2
Pick Up	26	213	44	10	1	1	1	3	0	0	299	15.4
Pick Up and Delivery	8	15	0	59	1	1	0	1	0	0	85	4.4
Maintenance (Fuel, Oil, Etc.)	14	3	4	0	0	1	1	4	2	0	29	1.5
Driver Needs (Lunch, Etc.)	8	8	1	0	1	4	0	24	0	0	46	2.4
To Home	0	0	0	0	0	0	0	1	0	0	1	0.1
Service-Related Business	114	0	3	0	10	26	0	364	2	0	519	26.8
Other	7	0	0	0	1	2	0	2	14	0	26	1.3
Unknown	2	1	0	0	0	0	0	0	0	0	3	0.5
Total	299	615	298	86	28	48	3	532	26	3	1,938	100.0
Percent of Total	15.4	31.7	15.4	4.4	1.4	2.5	0.2	27.5	1.3	0.2	100.0	-

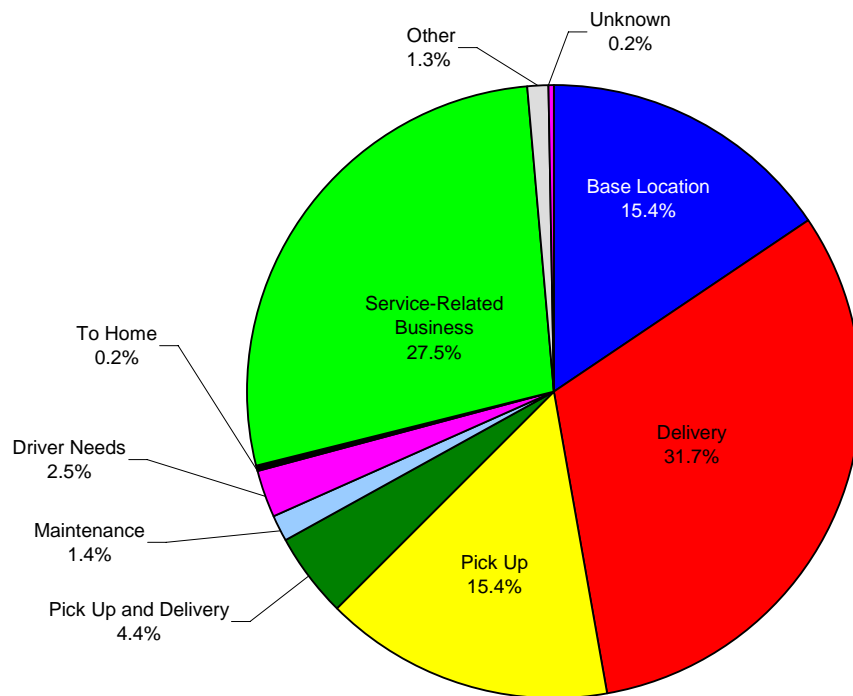


Figure 10. Distribution of Trip Purposes at Destination by Small and Medium Vehicles.

Table 16. Distribution of Trip Purposes at Origin and Destination by Large Vehicles.

Trip Purpose at Origin	Trip Purpose at Destination (Large Vehicles)											
	Base/Return to Base Location	Delivery	Pick Up	Pick Up and Delivery	Maint. (Fuel, Oil, Etc.)	Driver Needs	To Home	Service-Related Business	Other	Unknown	Total	Percent of Total
Base Location/Return to Base Location	0	24	25	1	0	0	0	1	0	0	51	12.5
Delivery	45	2	129	2	3	2		1		0	184	45.2
Pick Up	3	144	2	3	1	0		0		1	154	37.8
Pick Up and Delivery	1	7	0	1	0	0		0		0	9	2.2
Maintenance (Fuel, Oil, Etc.)	2	1	1	0	0	0		0		0	4	1.0
Driver Needs (Lunch, Etc.)	1	0	1	0	0	0		0		0	2	0.5
To Home	0	0	0	0	0	0	0	0	0	0	0	0.0
Service-Related Business	1	0	0	0	0	0		0		0	1	0.3
Other	0	0	0	0	0	0	0	0	0	0	0	0.0
Unknown	0	1	0	0	0	0		0		0	1	0.5
Total	53	179	159	7	4	2	0	2	0	1	407	100.0
Percent of Total	13.0	44.0	39.1	1.7	1.0	0.5	0.0	0.5	0.0	0.2	100.0	-

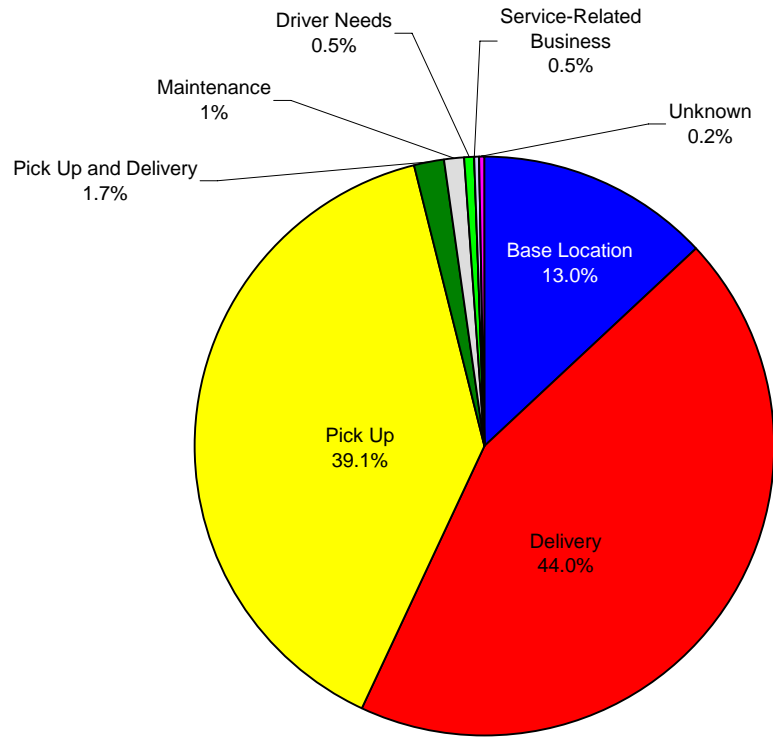


Figure 11. Distribution of Trip Purposes at Destination by Large Vehicles.

By commercial type, delivery (48 percent) and pick up (28 percent) were the main purposes for cargo or freight transport; and for local services, 73 percent of the trips were for service-related business purposes and 18 percent were for return to base location (see Tables 17 and 18, and Figures 12 and 13).

Table 17. Distribution of Trip Purposes at Origin and Destination by Cargo or Freight Transport.

Trip Purpose at Origin	Trip Purpose at Destination (Cargo or Freight)											Percent of Total
	Base/Return to Base Location	Delivery	Pick Up	Pick Up and Delivery	Maint. (Fuel, Oil, Etc.)	Driver Needs	To Home	Service-Related Business	Other	Unknown	Total	
Base Location/Return to Base Location	3	124	76	12	6	1	0	11	5	1	239	14.4
Delivery	162	278	324	6	8	8	0	4	1	1	792	47.7
Pick Up	28	358	46	13	2	1	1	2	0	1	452	27.2
Pick Up and Delivery	9	22	0	60	1	1	0	1	0	0	94	5.7
Maintenance (Fuel, Oil, Etc.)	10	4	5	0	0	0	0	0	1	0	20	1.2
Driver Needs (Lunch, Etc.)	2	8	2	0	1	1	0	1	0	0	15	0.9
To Home	0	0	0	0	0	0	0	0	0	0	0	0.0
Service-Related Business	13	0	2	0	0	2	0	7	1	0	25	1.5
Other	4	0	0	0	1	1	0	1	10	0	17	1.0
Unknown	1	3	1	2	0	0	0	0	0	0	7	0.4
Total	232	797	456	93	19	15	1	27	18	3	1,661	100.0
Percent of Total	14.0	48.0	27.4	5.6	1.1	0.9	0.1	1.6	1.1	0.2	100.0	

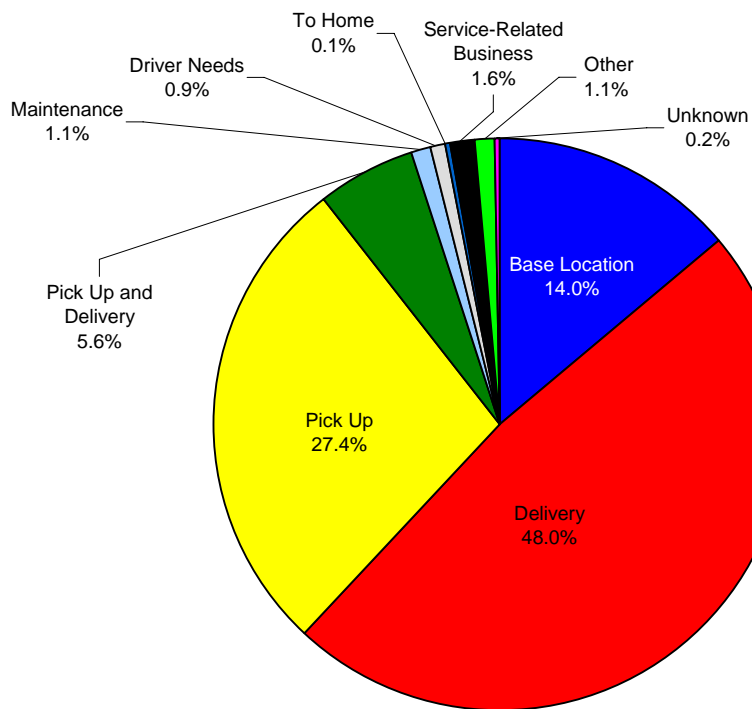


Figure 12. Distribution of Trip Purposes at Destination by Cargo or Freight Transport.

Table 18. Distribution of Trip Purposes at Origin and Destination by Local Services.

Trip Purpose at Origin	Trip Purpose at Destination (Local Services)											
	Base/Return to Base Location	Delivery	Pick Up	Pick Up and Delivery	Maint. (Fuel, Oil, Etc.)	Driver Needs	To Home	Service-Related Business	Other	Unknown	Total	Percent of Total
Base Location/Return to Base Location	0	0	1	0	3	6	1	119	2	1	133	19.1
Delivery	0	0	0	0	0	0	0	0	0	0	0	0.0
Pick Up	1	0	0	0	0	0	0	1	0	0	2	0.3
Pick Up and Delivery	0	0	0	0	0	0	0	0	0	0	0	0.0
Maintenance (Fuel, Oil, Etc.)	6	0	0	0	0	1	1	4	1	0	13	1.9
Driver Needs (Lunch, Etc.)	7	0	0	0	0	3	0	23	0	0	33	4.8
To Home	0	0	0	0	0	0	0	1	0	0	1	0.1
Service-Related Business	102	0	1	0	10	24	0	357	1	0	495	71.3
Other	4	0	0	0	0	1	0	1	7	0	13	1.9
Unknown	2	0	0	0	0	0	0	1	1	0	4	0.6
Total	122	0	2	0	13	35	2	507	12	1	694	100.0
Percent of Total	17.6	0.0	0.3	0.0	1.9	5.0	0.3	73.1	1.7	0.1	100.0	-

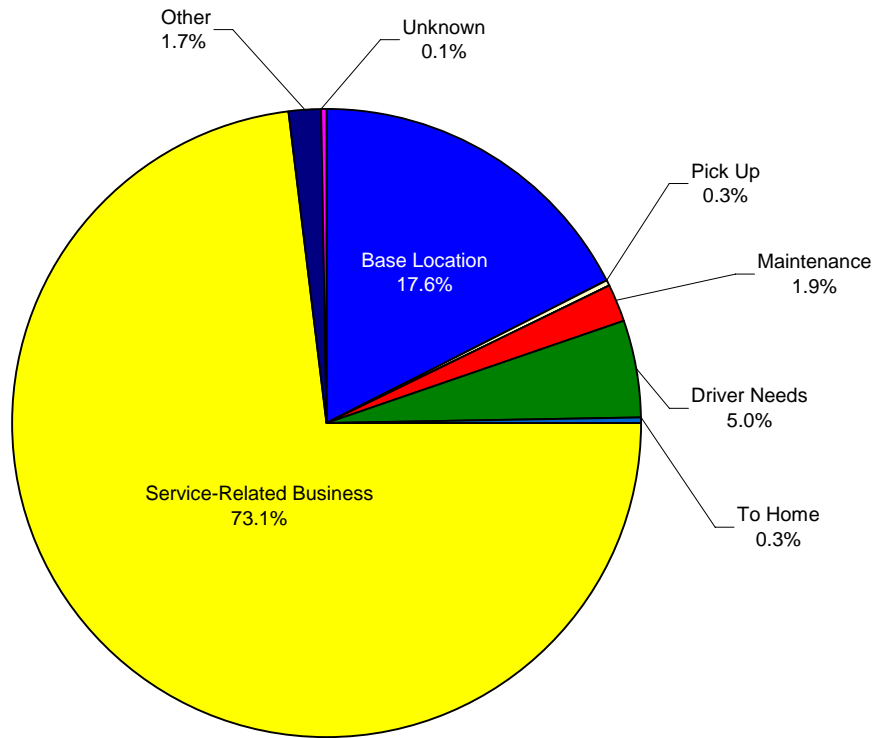


Figure 13. Distribution of Trip Purposes at Destination by Local Services.

Surveyed Cargo Characteristics

Drivers of commercial vehicles were asked to provide the type of cargo being delivered or picked up at each stop. A large portion of the vehicles at origin (36 percent) and destination (33 percent) reported that their vehicles were empty. The more common cargo types included transportation, clay/concrete/glass or stone, manufactured goods and equipment, food/health/beauty products, and farm products, with a combined total of approximately 32 percent of the reported cargo. Approximately 13 percent were unclassified cargo. Table 19 shows a breakdown of the surveyed cargo at the origin and destination locations.

Table 19. Distribution of Cargo by Origin and Destination.

Cargo Type	Number of Trips at Origin	Percent of Total	Number of Trips at Destination	Percent of Total
Farm Products	120	5.1	117	5.0
Forest Products	19	0.8	17	0.7
Marine Products	-	-	-	-
Metals and Minerals	55	2.3	56	2.4
Food, Health and Beauty Products	163	6.9	163	6.9
Tobacco Products	3	0.1	3	0.1
Textiles	49	2.1	51	2.2
Wood Products	23	1.0	21	0.9
Printed Matter	29	1.2	29	1.2
Chemical Products	8	0.3	8	0.3
Refined Petroleum or Coal Products	11	0.5	12	0.5
Rubber, Plastic, and Styrofoam Products	2	0.1	1	0.0
Clay, Concrete, Glass, or Stone	115	4.9	125	5.3
Manufactured Goods/Equip.	142	6.0	154	6.5
Wastes	95	4.0	100	4.2
Miscellaneous Shipments	108	4.6	113	4.8
Hazardous Materials	0	0.0	0	0.0
Transportation	199	8.5	211	9.0
Unclassified/Other Cargo	301	12.8	307	13.0
Driver Refused to Answer	73	3.1	90	3.8
Unknown to Driver/No Data	2	0.1	1	0.1
Empty	838	35.6	776	33.0
Total	2,355	100.0	2,355	100.0

Approximately 40 percent of the transported goods at pick up and 51 percent at drop off locations had cargo weights of less than 10,000 pounds. Figure 14 and Table 20 shows the distribution of cargo weight at pick up and at drop off locations.

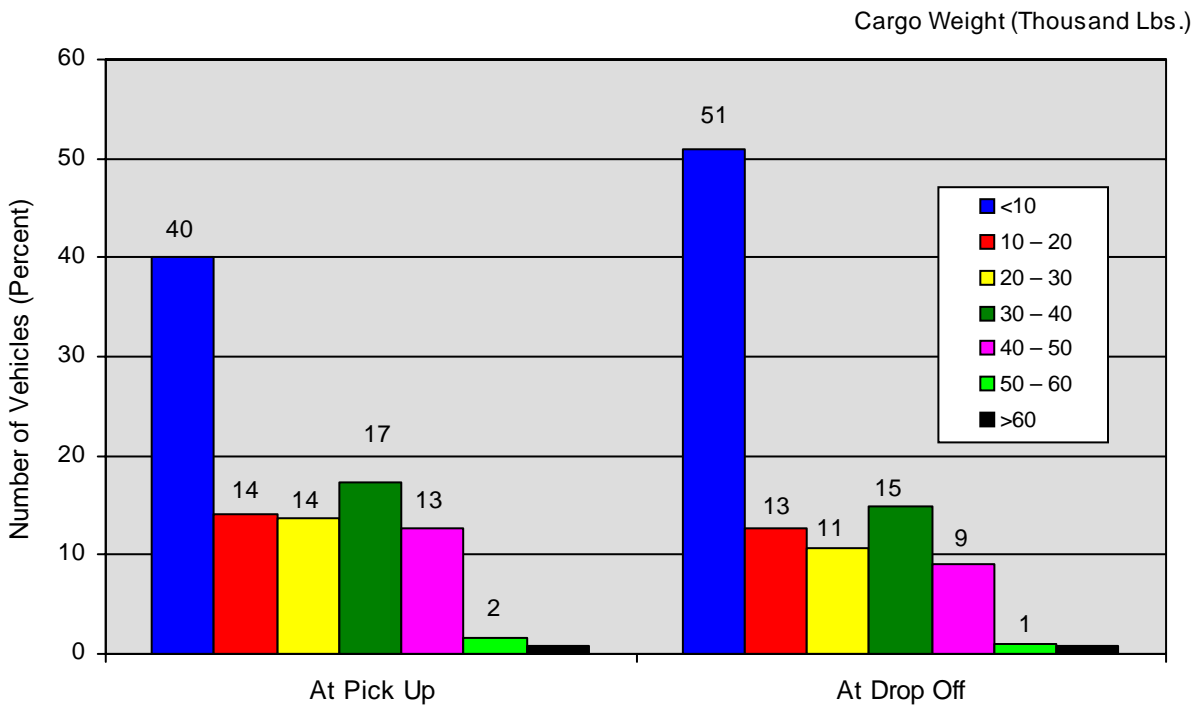


Figure 14. Cargo Weight at Pick Up and Drop Off Locations.

Table 20. Distribution of Cargo Weight at Pick Up and Drop Off Locations.

Cargo Weight (Lbs.)	Number of Trips at Pick Up	Percent of Total	Number of Trips at Drop Off	Percent Of Total
<10,000	206	40.1	385	51.0
10,000 – 20,000	72	14.0	95	12.6
20,000 – 30,000	70	13.6	81	10.7
30,000 – 40,000	89	17.3	112	14.8
40,000 – 50,000	65	12.6	68	9.0
50,000 – 60,000	8	1.6	8	1.1
>60,000	4	0.8	6	0.8
Total	514	100.0	755	100.0

In the analysis of surveyed cargo, the cargo classification was grouped according to the Texas Statewide Analysis Model (SAM) commodity groups (see Table 21), and the land use types were grouped into eight land use categories (see Table 22) to determine the distribution of trips and average cargo weights by commodity group and land use.

Table 21. Equivalency between SAM Commodity Groups and Survey Classifications.

Commodity Group	Survey Cargo Classification
Agriculture	Farm Products, Forest Products, Marine Products
Raw Materials	Metals and Minerals, Chemical Products, Refined Petroleum or Coal Products
Food	Food, Health and Beauty Products, Tobacco Products
Textiles	Textiles, Rubber, Plastic, and Styrofoam Products
Wood	Wood Products, Printed Matter
Building Materials	Clay, Concrete, Glass or Stone Products
Machinery	Manufactured Goods/Equipment
Miscellaneous	Wastes, Miscellaneous Shipments
Secondary	Unclassified Cargo
Hazardous Materials	Hazardous Materials
<i>Transportation</i>	<i>Transportation</i>
<i>Empty</i>	<i>Empty</i>
<i>Unknown</i>	<i>Unknown to Driver/ Driver Refused to Answer</i>

Table 22. Equivalency between Land Use Category and Survey Type of Place Options.

Land Use Category	Type of Place Options
Office	Office Building
Retail	Retail/Shopping
Industrial	Industrial/Manufacturing
Medical	Medical/Hospital
Education	Educational (12th Grade or Less and College, Trade, Etc.)
Government	Government Office/Building
Residential	Residential
<i>Other</i>	<i>Airport, Inter-modal Facility, Warehouse, Distribution Center, Construction Site, Other</i>

The cargo types (in italics) that did not have equivalents in the commodity grouping were still included in the data processing and analysis. The land use types that did not have equivalents in the category were grouped together as “Other.”

As Table 23 shows, almost half (47 percent) of the total cargo was attracted to the “Other” land use type, and only 15 percent was for retail, 13 percent for industrial, and 12 percent for residential land use. By commodity group, secondary (13 percent), miscellaneous (9 percent), food (7 percent), machinery (6.5 percent), and agriculture (5.7 percent), comprised a combined total of approximately 41 percent of the total trips.

Table 23. Distribution of Trips at the Destination by Commodity Group and Land Use.

Commodity Group	Land Use								Total	Percent of Total
	Office	Retail	Ind'l	Med	Edu	Gov't	Res	Other		
Agriculture	1	3	26	2	0	8	33	62	135	5.7
Raw Materials	1	4	6	0	0	2	0	63	76	3.2
Food	0	158	2	1	1	0	0	4	166	7.0
Textile	0	26	9	11	1	0	1	3	51	2.2
Wood	6	4	4	2	0	0	5	29	50	2.1
Building Materials	3	2	7	1	2	0	2	108	125	5.3
Machinery	19	5	22	0	2	3	61	42	154	6.5
Miscellaneous	11	17	29	1	8	28	8	111	213	9.0
Secondary	14	7	33	0	27	5	35	186	307	13.1
Transportation	7	59	17	0	2	6	56	64	211	9.0
Empty	42	69	153	1	1	60	72	378	776	33.0
Unknown	1	8	2	0	0	4	14	62	91	3.9
Total	105	362	310	19	44	116	287	1,112	2,355	100.0
Percent of Total	4.5	15.4	13.2	0.8	1.8	4.9	12.2	47.2	100.0	-

The average weight for all cargo types was estimated at 5,247 pounds at drop off, with building materials showing the highest average cargo weight to retail, industrial, residential and other types of land use (see Table 24). At pick up, the average cargo weight was estimated at 4,353 pounds, with secondary cargo, agriculture, and building materials showing the highest average cargo weight to industrial land use type (see Table 25).

Table 24. Average Cargo Weight at Drop Off by Commodity Group and Land Use.

Commodity Group	Average Cargo Weight at Drop Off by Land Use (Thousand Lbs.)							
	Office	Retail	Ind'l	Med	Educ	Gov't	Res	Other
Agriculture	25.5	4.3	1.2	20.0	0.0	7.0	23.7	20.4
Raw Materials	2.2	0.3	0.4	0.0	0.0	0.3	0.0	20.0
Food	0.0	0.4	0.7	0.1	0.0	0.0	0.0	0.0
Textiles	0.0	0.1	0.4	1.8	0.1	0.0	0.0	0.2
Wood	0.4	1.0	6.0	0.7	0.0	0.0	7.7	1.7
Building Materials	0.0	47.8	20.7	0.0	5.0	0.0	25.5	23.3
Machinery	1.4	10.4	9.7	0.0	24.5	7.6	2.3	9.9
Miscellaneous	0.1	0.2	2.3	0.0	0.0	0.0	0.4	0.5
Secondary	0.1	17.1	4.0	0.0	30.3	17.1	8.6	14.6
Transportation	0.0	0.6	6.3	0.0	1.5	0.0	0.3	0.4
Empty	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Unknown	0.0	0.6	0.6	0.0	0.0	0.0	1.9	5.6

Table 25. Average Cargo Weight at Pick Up by Commodity Group and Land Use.

Commodity Group	Average Cargo Weight at Pick Up by Land Use (Thousand Lbs.)							
	Office	Retail	Ind'l	Med	Educ	Gov't	Res	Other
Agriculture	0.0	0.0	16.9	0.0	0.0	7.0	0.0	2.6
Raw Materials	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.3
Food	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Textile	0.0	0.1	0.0	0.9	0.1	0.0	0.0	0.2
Wood	0.1	1.1	0.0	0.0	0.0	0.0	0.0	0.2
Building Materials	8.0	0.0	11.1	0.0	0.0	0.0	0.0	8.4
Machinery	1.7	4.0	4.9	0.0	0.0	0.0	1.6	4.0
Miscellaneous	0.3	0.5	0.0	1.1	0.3	0.0	3.2	0.1
Secondary	1.0	0.0	17.8	0.0	0.0	0.0	1.6	7.3
Transportation	0.6	0.3	0.2	0.0	0.0	0.0	0.3	0.3
Empty	0.2	0.1	17.5	0.0	0.5	0.9	0.3	8.4
Unknown	0.0	0.0	12.0	0.0	0.0	0.0	0.0	0.7

Trip Length Characteristics

Odometer readings at the beginning and end of the trip would have been useful in estimating the trip lengths of external and intra-zonal trips. However, in the survey, only odometer readings at the beginning of the trip were provided. Therefore, trip length, travel time and speed of the internal trips generated by the vehicles were measured based on network travel time and distance matrices. Only inter-zonal trips made by the vehicles were included in the analysis.

Approximately 35 percent of the trips were less than five miles in length, and a combined total of 51 percent had trip lengths between 6 miles-to-20 miles. These trips accounted for 71 percent of the total trips and were generated by small and medium vehicles. By commercial type, 72 percent were for cargo or freight transport, and 28 percent were for local services. Tables 26 and 27 provide the trip length frequency distribution by vehicle and commercial types.

Table 26. Trip Length Frequency Distribution by Vehicle Classification.

Trip Length (Miles)	Small and Medium	Percent of Total	Large	Percent of Total	Other	Percent of Total	Total	Percent of Total
0-5	695	40.1	59	14.7	-	-	754	35.3
6-10	358	20.7	97	24.3	3	60.0	458	21.4
11-15	311	17.9	104	26.0	1	20.0	416	19.5
16-20	161	9.3	56	14.0	1	20.0	218	10.2
21-25	92	5.3	43	10.7	-	-	135	6.3
26-30	58	3.3	9	2.3	-	-	67	3.1
31-35	24	1.4	19	4.7	-	-	43	2.0
36-40	21	1.2	3	0.8	-	-	24	1.1
41-45	7	0.4	10	2.5	-	-	17	0.8
46-50	6	0.3	0	0.0	-	-	6	0.3
Total	1,733	100.0	400	100.0	5	100.0	2,138¹	100.0

¹ 2 vehicle trips had unknown trip lengths.

Table 27. Trip Length Frequency Distribution by Commercial Vehicle Type.

Trip Length (Miles)	Cargo or Freight	Percent of Total	Local Services	Percent of Total	Total	Percent of Total
0-5	476	31.0	278	46.3	754	35.3
6-10	333	21.7	125	20.8	458	21.4
11-15	332	21.6	84	14.0	416	19.5
16-20	156	10.1	62	10.3	218	10.2
21-25	112	7.2	23	3.8	135	6.3
26-30	50	3.3	17	2.8	67	3.1
31-35	37	2.4	6	1.0	43	2.0
36-40	21	1.4	3	0.5	24	1.1
41-45	16	1.0	1	0.2	17	0.8
46-50	4	0.3	2	0.3	6	0.3
Total	1,537	100.0	601	100.0	2,138	100.0

Figures 15 and 16 show the distribution of the trip lengths by vehicle classification and commercial types. Table 28 shows the ungrouped trip length frequency distribution.

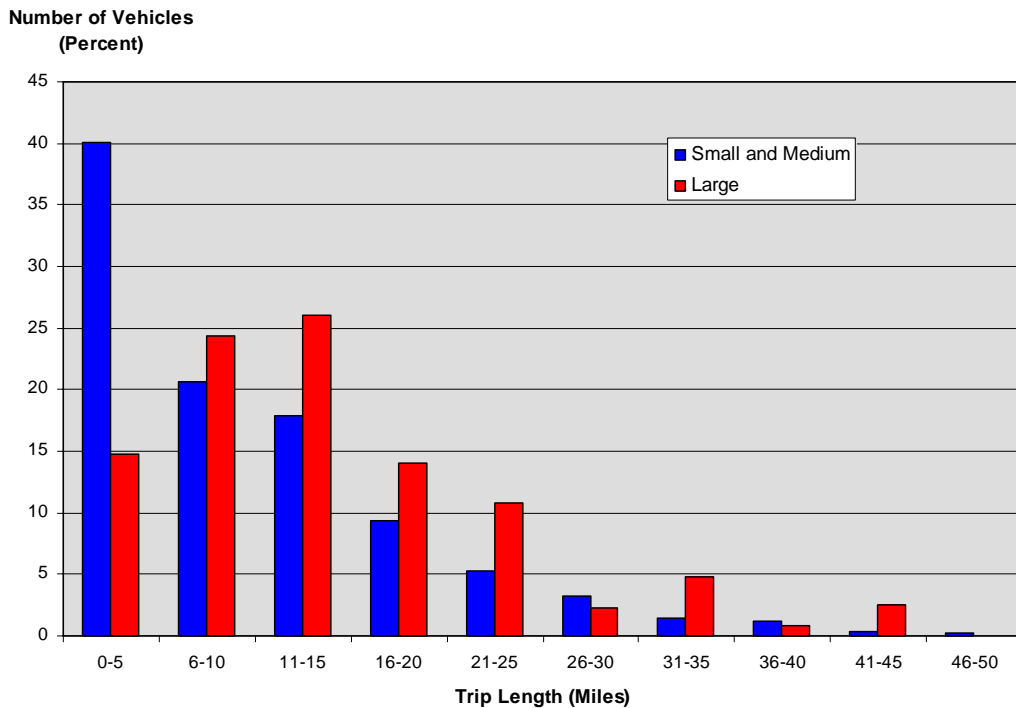


Figure 15. Trip Length Frequency Distributions by Vehicle Classification.

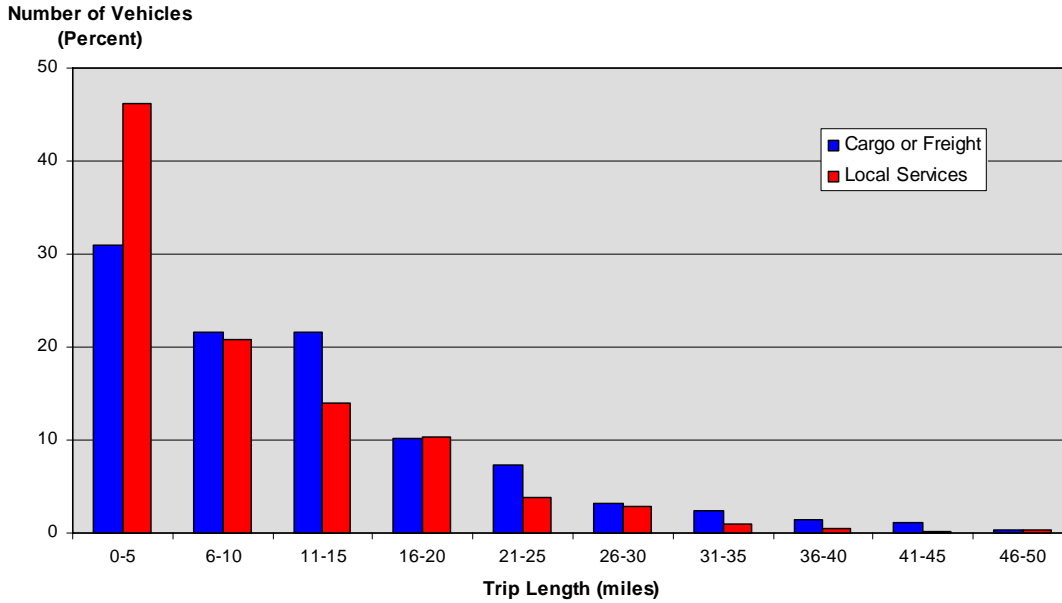


Figure 16. Trip Length Frequency Distributions by Commercial Vehicle Type.

Table 28. Trip Length Frequency Distributions (Ungrouped).

Trip length (Miles)	Number of Trips	Percent of Total	Trip Length (Miles)	Number of Trips	Percent of Total	Trip Length (Miles)	Number of Trips	Percent of Total
-	2	0.1	21	24	1.1	41	2	0.1
1	202	9.4	22	26	1.2	42	5	0.2
2	137	6.4	23	18	0.8	43	1	0.1
3	114	5.3	24	31	1.5	44	5	0.2
4	132	6.2	25	36	1.7	45	4	0.2
5	169	7.9	26	15	0.7	46	1	0.1
6	108	5.1	27	11	0.5	47	0	0.0
7	120	5.6	28	16	0.8	48	0	0.0
8	82	3.8	29	10	0.5	49	3	0.1
9	71	3.3	30	15	0.7	50	2	0.1
10	77	3.6	31	9	0.4	Total	2,140	100.0
11	95	4.4	32	7	0.3			
12	82	3.8	33	12	0.6			
13	71	3.3	34	11	0.5			
14	108	5.1	35	4	0.2			
15	60	2.8	36	4	0.2			
16	39	1.8	37	7	0.3			
17	57	2.7	38	9	0.4			
18	45	2.1	39	3	0.1			
19	40	1.9	40	1	0.1			
20	37	1.7						

Overall, the average distance traveled by all vehicles was 11.4 miles, 10.6 miles for small and medium vehicles, and 14.9 miles for large vehicles (Table 29). By commercial type, the distance traveled for cargo or freight transport averaged at 12.2 miles and 9.3 miles for local services (Table 30).

Table 29. Mean Trip Length to Destination by Land Use Type and Vehicle Classification.

Land Use Type	Overall Mean Trip Length (Miles)	Mean Trip Length (Miles)		
		Small and Medium	Large	Other
Office Building (Non-Government)	10.2	8.3	19.9	-
Retail/Shopping	7.6	7.3	14.3	-
Industrial/Manufacturing	12.6	12.4	12.8	-
Medical/Hospital	7.7	6.0	20.2	-
Education (12th Grade or Less)	12.6	12.7	12.5	-
Education (College, Trade)	23.5	23.5	-	-
Government Office/Building	15.7	15.7	17.6	-
Residential	11.9	11.1	20.7	11.5
Airport	5.6	5.6	-	-
Intermodal Facility	9.8	7.4	10.5	-
Warehouse	11.8	11.8	11.9	13.0
Distribution Center	13.6	11.8	18.2	-
Construction Site	12.4	11.4	14.4	-
Other	10.9	10.1	18.2	-
Refused/Unknown	10.9	10.2	15.5	-
Average	11.4	10.6	14.9	11.8

Table 30. Mean Trip Length to Destination by Land Use Type and Commercial Vehicle Type.

Land Use Type	Overall Mean Trip Length (Miles)	Mean Trip Length (Miles)	
		Cargo or Freight	Local Services
Office Building (Non-Government)	10.2	11.4	7.2
Retail/Shopping	7.6	6.9	9.3
Industrial/Manufacturing	12.6	12.8	10.8
Medical/Hospital	7.7	8.0	2.3
Education (12th Grade or Less)	12.6	11.9	26.2
Education (College, Trade)	23.5	.	23.5
Government Office/Building	15.7	16.4	13.3
Residential	11.9	15.0	8.6
Airport	5.6	4.4	7.9
Intermodal Facility	9.8	10.5	7.4
Warehouse	11.8	13.1	8.6
Distribution Center	13.6	14.3	10.8
Construction Site	12.4	12.7	10.1
Other	10.9	12.6	9.1
Refused/Unknown	10.9	12.9	8.4
Average	11.4	12.2	9.3

Table 31 shows the distribution of average travel distance by commodity group. The results indicate that building materials, agriculture, machinery, secondary, and raw materials types of cargo exceeded the overall mean trip length, with travel distances averaging between 12 miles-to-17 miles.

Table 31. Mean Trip Length by Commodity Group.

Commodity Group	Mean Trip Length (Miles)
Agriculture	14.1
Raw Materials	12.2
Food	5.4
Textiles	5.8
Wood	8.5
Building Materials	17.1
Machinery	13.4
Miscellaneous	10.8
Secondary	13.2
Transportation	10.0
Empty	11.2
Unknown/Refused	10.3
All Combined	11.4

Travel Time and Speed Characteristics

Survey respondents were also asked to provide arrival and departure times for each logged trip on the day of the survey. The travel logs could be compared to travel times provided in network travel time and distance matrices. However, in this analysis, reported travel time data were not used due to some inconsistencies observed during data processing. Hence, all travel time results were based on network and travel time matrices for inter-zonal trips. Results of this analysis are shown by vehicle classification (Table 32) and by commercial type (Table 33).

The majority of trips took less than half an hour, of which approximately 39 percent occurred within 10 minutes, 26 percent of the trips were between 10-and-20 minutes and 19 percent of the trips were between 20-and-30 minutes. Over 83 percent of these trips were made by small and medium vehicles. By commercial type, these trips comprised 70 percent for cargo or freight, and 30 percent were for local services.

Table 32. Frequency Distribution of Travel Time by Vehicle Classification.

Travel Time (Minutes)	Small and Medium	Percent of Total	Large	Percent of Total	Other	Percent of Total	Total Number of Trips	Percent of Total
0-5	339	19.5	29	7.3	0	0.0	368	17.2
6-10	388	22.4	83	20.7	0	0.0	471	22.0
11-15	230	13.3	36	9.0	1	20.0	267	12.5
16-20	238	13.7	56	14.0	2	40.0	296	13.8
21-25	189	10.9	68	17.0	1	20.0	258	12.1
26-30	109	6.3	31	7.7	1	20.0	141	6.6
31-35	68	3.9	27	6.7	0	0.0	95	4.4
36-40	64	3.7	20	5.0	0	0.0	84	3.9
41-45	38	2.2	15	3.8	0	0.0	53	2.5
46-50	25	1.4	17	4.3	0	0.0	42	2.0
51-55	26	1.5	4	1.0	0	0.0	30	1.4
56-60	9	0.5	4	1.0	0	0.0	13	0.6
>60	12	0.7	10	2.5	0	0.0	22	1.0
Total	1,735	100.0	400	100.0	5	100.0	2,140	100.0

Table 33. Frequency Distribution of Travel Time by Commercial Vehicle Type.

Travel Time (Minutes)	Cargo or Freight	Percent of Total	Local Services	Percent of Total	Total	Percent of Total
0-5	226	14.7	142	23.6	368	17.2
6-10	326	21.2	145	24.1	471	22.0
11-15	188	12.2	79	13.1	267	12.5
16-20	217	14.1	79	13.1	296	13.8
21-25	210	13.7	48	8.0	258	12.1
26-30	99	6.4	42	7.0	141	6.6
31-35	69	4.5	26	4.4	95	4.4
36-40	71	4.6	13	2.2	84	3.9
41-45	45	2.9	8	1.3	53	2.5
46-50	33	2.1	9	1.5	42	2.0
51-55	23	1.5	7	1.2	30	1.4
56-60	12	0.8	1	0.2	13	0.6
>60	20	1.3	2	0.3	22	1.0
Total	1,539	100.0	601	100.0	2,140	100.0

Figures 17 and 18 show the distribution of travel time by vehicle classification and by commercial vehicle type. Table 34 shows the ungrouped distribution of travel time.

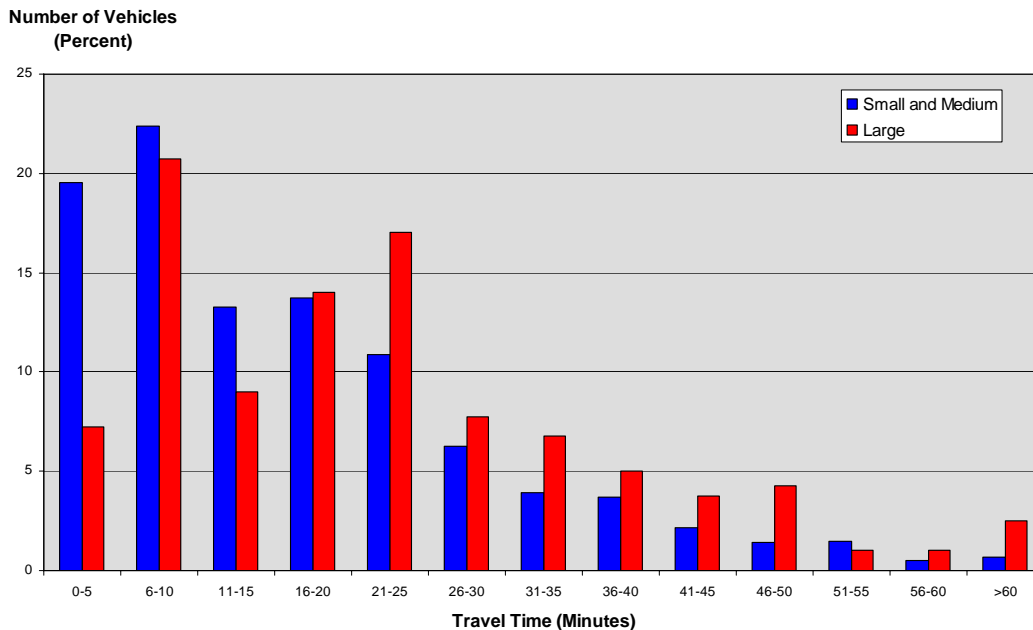


Figure 17. Frequency Distribution of Travel Time by Vehicle Classification.

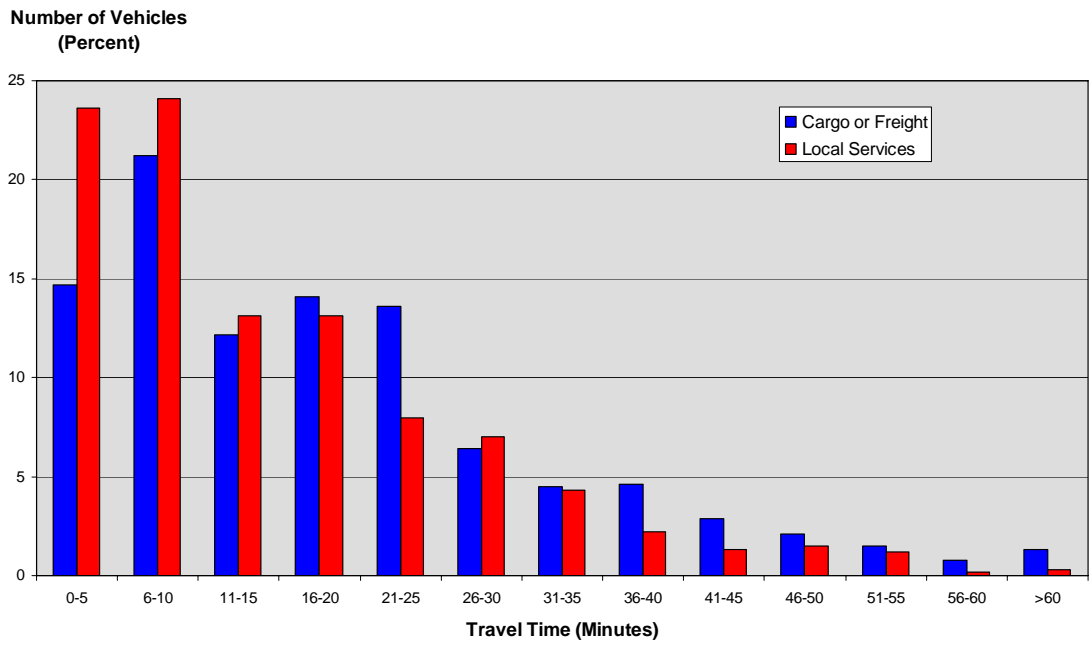


Figure 18. Frequency Distribution of Travel Time by Commercial Vehicle Type.

Table 34. Frequency Distribution of Travel Time (Ungrouped).

Travel Time (Minutes)	Number of Trips	Percent of Total	Travel Time (Minutes)	Number of Trips	Percent of Total	Travel Time (Minutes)	Number of Trips	Percent of Total
1	47	2.2	25	42	2.0	49	8	0.4
2	64	3.0	26	25	1.2	50	15	0.7
3	87	4.1	27	43	2.0	51	7	0.3
4	107	5.0	28	35	1.6	52	2	0.1
5	63	2.9	29	27	1.3	53	15	0.7
6	53	2.4	30	11	0.5	54	5	0.2
7	82	3.8	31	19	0.9	86	1	0.1
8	124	5.8	32	23	1.1	56	2	0.1
9	115	5.4	33	15	0.7	57	2	0.1
10	97	4.5	34	24	1.1	58	2	0.1
11	69	3.2	35	14	0.7	59	7	0.3
12	42	1.9	36	6	0.3	61	1	0.1
13	59	2.7	37	15	0.7	62	3	0.1
14	56	2.6	38	15	0.7	63	4	0.2
15	41	1.9	39	14	0.6	64	1	0.1
16	46	2.2	40	34	1.6	65	2	0.1
17	76	3.5	41	22	1.0	66	4	0.2
18	60	2.8	42	5	0.2	68	1	0.1
19	75	3.5	43	13	0.6	69	1	0.1
20	39	1.8	44	8	0.4	71	2	0.1
21	65	3.0	45	5	0.2	74	1	0.1
22	65	3.0	46	9	0.4	75	2	0.1
23	46	2.2	47	6	0.3	Total	2,140	100.0
24	40	1.9	48	4	0.2			

Overall, the mean travel time to the destination was estimated at 18 minutes; 17 minutes for small and medium vehicles, and 23 minutes for large vehicles. By commercial type, the average travel time was 19 minutes for cargo or freight transport and 15 minutes for local services (see Tables 35 and 36).

Table 35. Mean Travel Time to Destination by Land Use Type and Vehicle Classification.

Land Use Type	Overall Mean Travel Time (Minutes)	Mean Travel Time (Minutes)		
		Small and Medium	Large	Other
Office Building (Non-Government)	17.1	14.3	31.5	-
Retail/Shopping	12.8	12.2	23.8	-
Industrial/Manufacturing	19.8	19.9	19.5	-
Medical/Hospital	12.7	10.6	28.1	-
Education (12th Grade or Less)	18.5	18.8	18.2	-
Education (College, Trade)	37.4	37.4	-	-
Government Office/Building	24.3	24.3	25.6	-
Residential	19.6	18.4	32.5	19.7
Airport	10.5	10.5	-	-
Intermodal Facility	17.1	14.9	17.7	-
Warehouse	19.1	18.9	19.8	21.0
Distribution Center	21.9	19.7	27.5	-
Construction Site	19.5	18.1	22.2	-
Other	17.5	16.3	28.0	-
Refused/Unknown	17.7	16.9	23.3	-
Average	18.2	17.1	23.0	19.9

Table 36. Mean Travel Time to Destination by Land Use Type and Commercial Vehicle Type.

Land Use Type	Overall Mean Travel Time (Minutes)	Mean Travel Time (Minutes)	
		Cargo or Freight	Local Services
Office Building (Non-Government)	17.1	18.9	12.7
Retail/Shopping	12.8	11.7	15.1
Industrial/Manufacturing	19.8	20.0	17.9
Medical/Hospital	12.7	13.1	5.6
Education (12th Grade or Less)	19.0	17.8	41.8
Education (College, Trade)	37.4	-	37.4
Government Office/Building	24.3	25.2	21.0
Residential	19.6	24.0	14.5
Airport	10.5	8.5	14.6
Intermodal Facility	17.1	17.7	14.9
Warehouse	19.1	21.1	13.9
Distribution Center	21.9	22.9	17.9
Construction Site	19.5	19.8	16.6
Other	17.5	19.8	15.1
Refused/Unknown	17.7	20.7	14.1
Average	18.2	19.4	15.4

Table 37 shows the mean travel time by commodity group. The results indicate that the average travel time varied from 9.5 minutes for the food type of cargo to 27.5 minutes for building materials.

Table 37. Mean Travel Time by Commodity Group.

Commodity Group	Mean Travel Time (Minutes)
Agriculture	22.4
Raw Materials	18.4
Food	9.5
Textiles	10.2
Wood	14.7
Building Materials	27.5
Machinery	21.3
Miscellaneous	17.5
Secondary	20.7
Transportation	16.5
Empty	17.7
Unknown/Refused	16.8
All Combined	18.2

Table 38 shows an average travel speed of 36 mph for all vehicles; approximately 35 mph for small and medium vehicles, and 39 mph for large vehicles. By commercial type, the average speed was 36 mph for cargo or freight transport and 34 mph for local services (Table 39).

Table 38. Mean Travel Speed to Destination by Land Use Type and Vehicle Classification.

Land Use Type	Overall Mean Travel Speed (mph)	Mean Travel Speed (mph)		
		Small and Medium	Large	Other
Office Building (Non-Government)	33.2	32.3	37.6	-
Retail/Shopping	32.8	32.7	35.7	-
Industrial/Manufacturing	37.6	36.5	39.7	-
Medical/Hospital	31.2	29.6	43.2	-
Education (12th Grade or Less)	39.4	37.7	41.3	-
Education (College, Trade)	37.8	37.8	-	-
Government Office/Building	36.8	36.7	41.2	-
Residential	34.7	34.5	36.8	34.7
Airport	31.2	31.2	-	-
Intermodal Facility	33.2	29.8	34.1	-
Warehouse	35.2	35.2	35.0	37.2
Distribution Center	35.0	33.4	39.0	-
Construction Site	37.7	36.8	39.3	-
Other	35.7	35.3	39.1	-
Refused/Unknown	34.4	33.6	39.5	-
Average	35.7	34.9	39.0	35.2

Table 39. Mean Travel Speed to Destination by Land Use Type and Commercial Vehicle Type.

Land Use Type	Overall Mean Travel Speed (mph)	Mean Travel Speed (mph)	
		Cargo or Freight	Local Services
Office Building (Non-Government)	33.2	33.5	32.5
Retail/Shopping	32.8	32.4	33.8
Industrial/Manufacturing	37.6	38.0	34.1
Medical/Hospital	31.2	31.7	24.4
Education (12th Grade or Less)	39.4	39.5	37.7
Education (College, Trade)	37.8	-	37.8
Government Office/Building	36.8	37.3	34.7
Residential	34.7	36.0	33.3
Airport	31.2	30.5	32.4
Intermodal Facility	33.2	34.1	29.8
Warehouse	35.2	35.5	34.3
Distribution Center	35.0	35.2	34.2
Construction Site	37.7	38.0	34.8
Other	35.7	36.7	34.7
Refused/Unknown	34.4	35.9	32.5
Average	35.7	36.3	34.0

Table 40 shows the mean travel speed by commodity group. The results indicate that the average travel speed ranged from approximately 31 miles per hour for wood cargo, to 39 miles per hour for raw materials.

Table 40. Mean Travel Speed by Commodity Group.

Commodity Group	Mean Travel Speed (mph)
Agriculture	36.7
Raw Materials	39.2
Food	31.5
Textiles	31.8
Wood	31.3
Building Materials	37.0
Machinery	36.0
Miscellaneous	34.6
Secondary	37.2
Transportation	34.0
Empty	36.2
Unknown/Refused	37.0
All Combined	35.7

Trip Tour Characteristics

Trip tours may be defined as a combination (or chaining) of trips in which a vehicle leaves and returns to a common point, typically its base location. To accurately analyze the trip tours, external trips had to be included in the analysis. This was performed since it was possible for trip tours to begin within the study area, travel outside of the study area, and return back during the one-day survey period. Therefore, to exclude the external trip data would significantly reduce the accuracy of the trip tour analysis.

For each trip recorded, information was provided on whether or not the trip origin location was the vehicle's base location. This served as the basis for determining if the trip was a base trip or a non-base trip. For a trip to be a base trip, either the origin or destination of the trip had to be at the base location. If neither trip end was at the base location, then the trip was considered a non-base trip.

Table 41 shows the distribution of base and non-base trips by vehicles. The results indicate that 57 percent of the total trips made by the vehicles were non-base and 43 percent were base trips. Nearly 81 percent of the non-base trips were made by small and medium vehicles.

Table 41. Number of Base and Non-Base Trips by Vehicle Classification.

Trip Type	Small and Medium		Large		Other		Total	
	Number of Trips	Percent of Total	Number of Trips	Percent of Total	Number of Trips	Percent of Total	Number of Trips	Percent of Total
Base	879	42.7	215	44.5	4	40.0	1,098	43.0
Non-Base	1,179	57.3	268	55.5	6	60.0	1,453	57.0
Total	2,058	100.0	483	100.0	10	100.0	2,551	100.0

In the analysis of trips made by the surveyed vehicles, the number of trip tours was counted to determine how many of the trips that started at the base location indeed ended at the base location. The results indicated that of the total 342 vehicles, 322 (94 percent) made 537 trip tours and 20 open tours (those trips that did not start and end at the base location).

The number of trip tours ranged between 1 and 9, of which approximately 65 percent of the vehicles only made one tour. This comprised 42 percent of the total number of trip tours. Table 42 shows a breakdown of the number of trip tours per vehicle.

Table 42. Number and Percent of Trip Tours per Vehicle.

Number of Trip Tours	Number of Vehicles	Percent of Total Number of Vehicles	Total Number of Trip Tours	Percent of Total Number of Trip Tours
0	20	5.8	0	0.0
1	223	65.2	223	41.5
2	46	13.5	92	17.1
3	22	6.4	66	12.3
4	16	4.6	64	11.9
5	6	1.8	30	5.6
6	6	1.8	36	6.7
8	1	0.3	8	1.5
9	2	0.6	18	3.4
Total	342	100.0	537	100.0

Several inconsistencies were observed during the analysis of trip data. For instance, there were 3 vehicles that reported one trip that started and ended at the base location. These trips were included in the analysis with the presumption that the respondent failed to log in the location it stopped prior to returning to the base location. There were several cases (7 trucks) where trip origins were logged in as non-base but the address information and destination addresses indicated these to be the base location. The data were corrected in these instances.

By vehicle classification, approximately 65 percent of small and medium vehicles made 1 tour, and 26 percent made 2-to-4 tours. For large vehicles, 66 percent made 1 tour and 21 percent made 2-to-4 tours (see Table 43).

Table 43. Number and Percent of Trip Tours by Vehicle Classification.

Number of Trip Tours	Small and Medium		Large		Other	
	Number of Vehicles	Percent of Total	Number of Vehicles	Percent of Total	Number of Vehicles	Percent of Total
0	17	6.1	3	4.9	0	0.0
1	181	64.9	40	65.6	2	100.0
2	38	13.6	8	13.2	0	0.0
3	20	7.2	2	3.3	0	0.0
4	13	4.6	3	4.9	0	0.0
5	4	1.4	2	3.3	0	0.0
6	5	1.8	1	1.6	0	0.0
8	0	0.0	1	1.6	0	0.0
9	1	0.4	1	1.6	0	0.0
Total	279	100.0	61	100.0	2	100.0
Percent of Total	81.6	-	17.8	-	0.6	-

By commercial type, approximately 67 percent of the trips were for cargo or freight transport, and 61 percent of the trips for local services had 1 trip tour (see Table 44).

Table 44. Number and Percent of Trip Tours by Commercial Vehicle Type.

Number of Trip Tours	Cargo or Freight		Local Services	
	Number of Vehicles	Percent of Total	Number of Vehicles	Percent of Total
0	14	5.6	6	6.5
1	166	66.7	57	61.3
2	31	12.4	15	16.1
3	13	5.2	9	9.7
4	11	4.4	5	5.4
5	6	2.4	0	0.0
6	5	2.0	1	1.0
8	1	0.4	0	0.0
9	2	0.8	0	0.0
Total	249	100.0	93	100.0
Percent of Total	72.8		27.2	

In the analysis of trip tours, the number and type of trips that were made within a tour had to be measured to examine the total amount and type of travel that occurred during the course of the tour. Therefore, the review of trip tour data was divided into three components — the number of non-base trips within trip tours, the number of external trips within trip tours, and the number of inter-zonal and intra-zonal trips within trip tours.

Figure 19 shows the distribution of these trips by trip type and Tables 45 through 48 show the detailed breakdown of these trips.

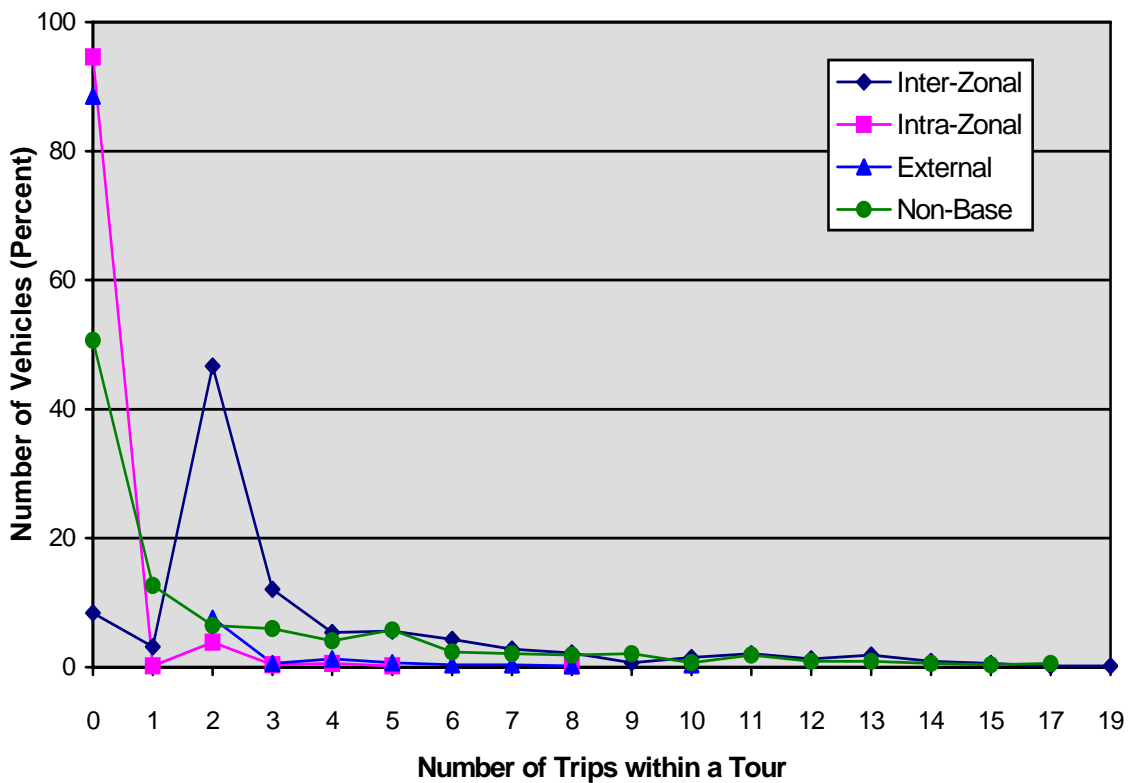


Figure 19. Distribution of Trips within Trip Tours by Trip Type.

The results indicate that 49 percent of the trips that occurred within the trip tours were non-base, and the number of trips made by the vehicles varied from 1 trip to 17 trips (see Table 45).

Table 45. Number and Percent of Non-Base Trips within Trip Tours.

Number of Non-Base Trips	Number of Vehicle Trips	Percent of Total	Cumulative Number of Vehicle Trips	Cumulative Percent of Total
0	272	50.7	272	50.7
1	68	12.6	340	63.3
2	35	6.5	375	69.8
3	32	6.0	407	75.8
4	22	4.1	429	79.9
5	31	5.8	460	85.7
6	13	2.4	473	88.1
7	11	2.0	484	90.1
8	10	1.9	494	92.0
9	11	2.1	505	94.1
10	4	0.7	509	94.8
11	10	1.8	519	96.6
12	5	0.9	524	97.5
13	5	0.9	529	98.4
14	3	0.6	532	99.1
15	2	0.4	534	99.4
17	3	0.6	537	100

The data also shows that 89 percent of the trips were not external. Only 8 percent of the trips that occurred within the trip tour had 2 external trips, and 3 percent of the tours that occurred include 3-to-10 trips (see Table 46).

Table 46. Number and Percent of External Trips within Trip Tours.

Number of External Trips	Number of Vehicle Trips	Percent of Total	Cumulative Number of Vehicle Trips	Cumulative Percent of Total
0	475	88.4	475	88.4
2	41	7.6	516	96.1
3	3	0.6	519	96.7
4	7	1.3	526	98.0
5	4	0.7	530	98.7
6	2	0.4	532	99.1
7	2	0.4	534	99.4
8	1	0.2	535	99.6
10	2	0.4	537	100.0

The results also indicate that only 8 percent of the trips that occurred within the internal trip tour were not inter-zonal, and nearly 95 percent of the trips were not intra-zonal trips. Approximately 47 percent of the vehicles made 2 inter-zonal trips. Only 21 vehicles (4 percent) made 2 intra-zonal trips within the trip tour (see Tables 47 and 48).

Table 47. Number and Percent of Inter-zonal Trips within Internal Trip Tours.

Number of Inter-zonal Trips	Number of Vehicle Trips	Percent of Total	Cumulative Number of Vehicle Trips	Cumulative Percent of Total
0	45	8.4	45	8.4
1	17	3.2	62	11.6
2	251	46.7	313	58.3
3	65	12.1	378	70.4
4	29	5.4	407	75.8
5	30	5.6	437	81.4
6	23	4.2	460	85.6
7	15	2.8	475	88.5
8	12	2.2	487	90.7
9	4	0.7	491	91.4
10	8	1.5	499	92.9
11	11	2.1	510	95.0
12	7	1.3	517	96.3
13	10	1.9	527	98.1
14	5	0.9	532	99.1
15	3	0.6	535	99.6
17	1	0.2	536	99.8
19	1	0.2	537	100.0

Table 48. Number and Percent of Intra-zonal trips within Internal Trip Tours.

Number of Intra-Zonal Trips	Number of Vehicle Trips	Percent of Total	Cumulative Number of Vehicle Trips	Cumulative Percent of Total
0	508	94.6	508	94.6
1	1	0.2	509	94.8
2	21	3.9	530	98.7
3	2	0.3	532	99.0
4	3	0.6	535	99.6
5	1	0.2	536	99.8
8	1	0.2	537	100.0

Figure 20 shows the location of the trips made by the vehicles within the study zones. The points indicate the base locations of the surveyed vehicles, and the colored polygons denote the active zones where these vehicle trips were made.

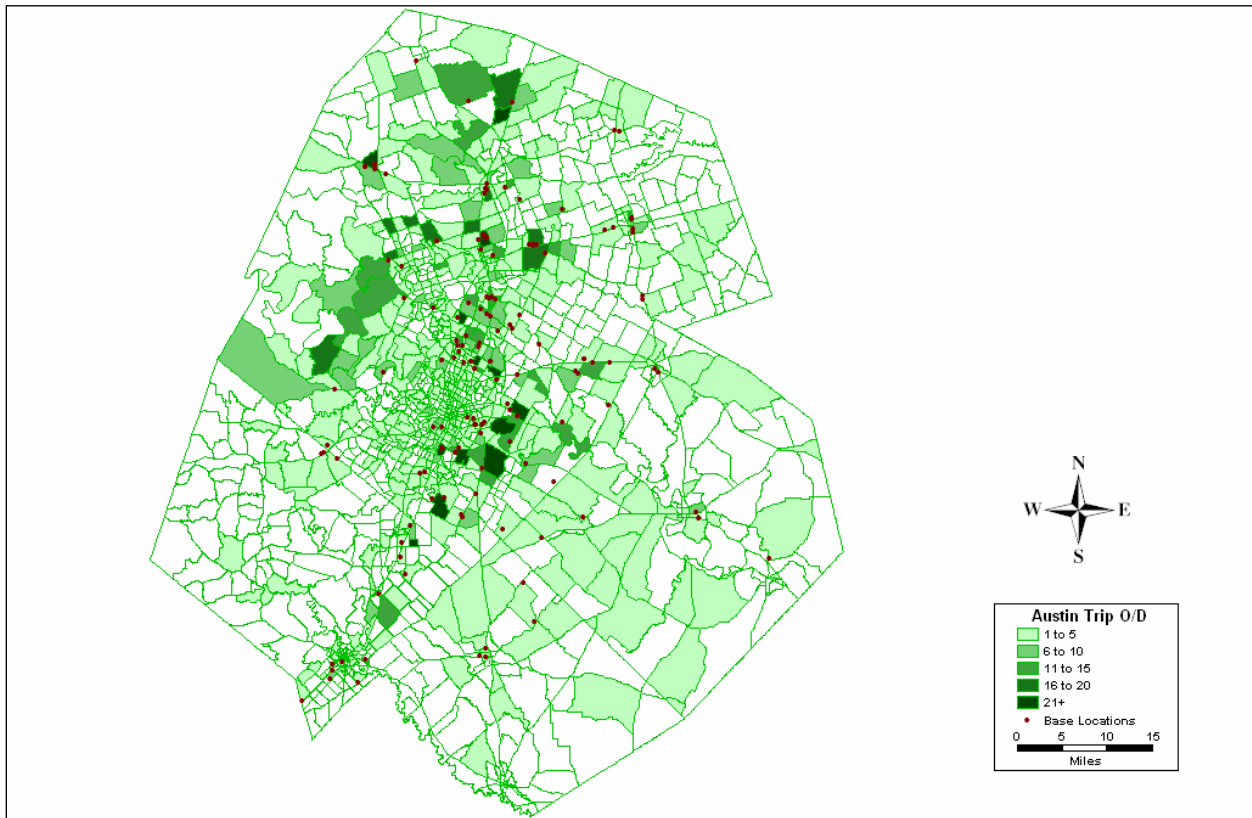


Figure 20. Location of Trip Origins and Destinations.

Survey Expansion

Expansion of the commercial vehicle survey data was performed in an indirect manner. Typically, an estimate of the population being sampled is known and the survey data are expanded to represent that population. However, the total number of commercial vehicles operating in the Austin study area is not known. While vehicle registration may not be a viable basis to estimate the number of commercial vehicles in the study area, considering that other vehicles operating within the area may be registered in neighboring counties, this information was still used to determine how the survey data compared with the vehicle registration data.

The methodology used for expanding the survey data was vehicle miles of travel (VMT) estimates from the Highway Performance Monitoring System (HPMS), combined with vehicle classification counts by functional classification. Essentially, an estimate of the commercial VMT is developed from the HPMS data and is then used to expand the VMT observed from sampled commercial vehicles. HPMS data contains annual average daily traffic (AADT) estimates of the total VMT by functional class facilities. Since AADT includes weekend traffic, a correction factor is applied to the data to obtain average weekday VMT by functional classification (freeway, arterial, collector and local).

Table 49 provides the adjusted 2005 HPMS VMT estimates for the study area.

Table 49. 2005 HPMS Estimates of Weekday VMT.

Functional Classification	Total Weekday VMT
Freeway	13,967,559
Arterial	14,847,330
Collector	7,790,981
Local	3,263,160
Total	39,869,030

Commercial vehicle counts from the 2005 External Survey and vehicle classification counts conducted in 251 randomly selected locations within the Austin study area were used to determine the percentage of commercial and non-commercial vehicles by functional classification. This was determined separately for external sites and internal sites. The percentage of commercial vehicles for internal sites for each functional classification was combined with the corresponding percentage for external sites based on the percentage of regional VMT estimated to be external travel. External VMT was estimated to be 31 percent of the HPMS estimate of total VMT. Hence, it was assumed that 69 percent of the total VMT was internal. These percentages were applied to obtain the weighted average for internal and external sites for each functional classification. Table 50 provides the internal, external, and weighted percentage of commercial and non-commercial vehicles by functional classification as determined from the vehicle classification counts performed in 2005.

Table 50. Vehicle Classification Counts by Functional Classification.

Functional Classification	Percent of Commercial Vehicles			Percent of Non-Commercial Vehicles		
	Internal Sites (69%)	External Sites (31%)	Weighted Average	Internal Sites (69%)	External Sites (31%)	Weighted Average
Freeway	7.10	22.20	11.78	92.90	77.80	88.22
Arterial	7.69	14.95	9.94	92.31	85.05	90.06
Collector	5.54	12.56	7.72	94.46	87.44	92.28
Local	2.91	N/A	2.91	97.09	N/A	97.09

The weighted percentage of commercial and non-commercial vehicles by functional classification as shown in Table 50 was then applied to the HPMS estimated weekday VMT to calculate the total VMT for commercial and non-commercial vehicles operating in the study area. The resulting estimate was 3,817,625. Table 51 provides the estimated VMT for commercial and non-commercial vehicles operating in the study area.

Table 51. Estimated VMT for Commercial and Non-Commercial Vehicles.

Functional Classification	Commercial VMT	Non-Commercial VMT
Freeway	1,645,378	12,322,180
Arterial	1,475,825	13,371,505
Collector	601,464	7,189,517
Local	94,958	3,168,202
Total	3,817,625	36,051,404

This estimate represented all commercial vehicles. To properly expand the data, it was necessary to remove the VMT estimates obtained in the external survey to avoid double counting. The VMT estimated for commercial vehicles in the external station survey was 1,509,652. This estimate was subtracted from the total commercial vehicle VMT to calculate the internal commercial VMT. The resulting estimate was 2,307,973.

The internal VMT observed in this survey was 24,373. This was based on 2,138 observed internal trips (those where the trip length could be estimated), multiplied by the average trip length made by the surveyed vehicles, estimated at 11.4 miles.

To estimate the total internal commercial vehicle trips, the survey expansion factor was then calculated by dividing the total VMT (2,307,973) by the sample internal VMT (24,373). The resulting expansion factor was 94.69, which was then multiplied by the survey internal trips (2,138) producing 202,454 total internal commercial vehicle trips. With the average trip per vehicle estimated at 7.2 trips, the number of commercial vehicles operating in the Austin region on a daily basis was estimated at 28,276, slightly higher than the 19,281 estimated registered trucks in the study area in 2006.

Data Comparison

To assess the changes that occurred in terms of commercial vehicle flow in the study area, a comparison was made with the VMT estimates from the commercial vehicle survey conducted in 1997. The previous study reported the VMT estimate for commercial vehicles at 2,089,334 miles. This estimate included VMT from other surveys conducted during that period — 128,448 from a household survey, and 659,977 from an external survey. Removing these estimates from the total resulted in an estimated 1,300,909 of commercial vehicle VMT. The internal VMT observed in the 1997 survey was 26,937, based on a total of 2,935 observed internal trips, and average trip length of 9.28 miles. The expansion factor was calculated at 48.93. The average trip per vehicle was estimated at 6.93. The total internal commercial vehicle trips were estimated at 141,746; which generated 20,454 commercial vehicles operating on a daily basis in the Austin region (Pearson, 1999).

It is important to note that comparing the data results from these two survey periods may not provide accurate conclusions, given the difference in area coverage and sample size. The commercial vehicle survey conducted in 1997 only covered three counties – Williamson, Travis, and Hays, while the current study covered five, which included two additional counties – Bastrop and Caldwell. However, despite the additional coverage, the survey sample was only 342 vehicles, compared to the 500 vehicles sampled in the previous 1997 study. There was also a significant increase observed in the VMT for commercial vehicles from the external survey. The current study showed an increase from 659,977 to 1,509,652. It was difficult to assess any change between 1997 and 2006 due to the difference in the study area between those time periods.

In terms of average trip length and average trips per vehicle per day, however, the data showed reasonable and comparable results. Table 52 shows a summary of the data results between the two commercial vehicle survey periods.

Table 52. Commercial Vehicle Survey Data Comparison.

Survey Indicator	1997 Commercial Vehicle Survey	2006 Commercial Vehicle Survey
Study Area Coverage	Three Counties – Hays, Travis, Williamson	Five Counties – Hays, Travis, Williamson, Bastrop, Caldwell
Sample Size	500	342
Observed Internal Trips	2,935	2,138
Average Trip Length (miles)	9.28	11.40
Average Trips per Vehicle	6.93	7.16
Total Commercial VMT	2,089,334	3,817,625
External Commercial VMT	659,977	1,509,652
Total Commercial VMT (Excluding External VMT)	1,300,909	2,307,973
Observed Internal VMT	26,937	24,373
Expansion Factor	48.30	94.69
Total Internal Commercial Vehicle Trips	141,746	202,454
Average Daily Traffic	20,454	28,276

CONCLUSIONS

This Commercial Vehicle Survey has provided information on the characteristics and distribution of commercial vehicles operating in the Austin study area. Through the analysis of 342 vehicles that participated in the survey, key indicators such as vehicle age, fuel use, truck classification, commercial type, cargo type, trip purposes, land use, trip length, travel time, travel speed, and types of trips being made, were evaluated and quantified. Estimates on the total number of internal trips, average number of trips per vehicle, and average travel distance, combined with HPMS data on VMT by functional classification, facilitated the estimation of the volume of commercial vehicle traffic operating in the study area on a daily basis.

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1. Alliance Transportation Group (ATG), Inc. *Austin/San Antonio Commercial Vehicle Survey Final Report*. December 2006.
2. Farnsworth, Stephen P. *2005 Austin External Survey Technical Summary*. Texas Department of Transportation (TxDOT) Report 407032-05. Texas Transportation Institute, The Texas A&M University System, College Station, TX, July 2007.
3. Pearson, David. *Austin Commercial Vehicle Survey*. Memorandum. Texas Transportation Institute, The Texas A&M University System, December 16, 1999.
4. Texas Department of Transportation (TxDOT). *Diesel and Gas Truck Counts by County using Gross Weight*. January 2007.
5. Texas Department of Transportation (TxDOT). *Rural, Small Urban, and Urbanized Mileage by County and Functional System*. December 2005.

APPENDIX

COMMERCIAL VEHICLE TRAVEL SURVEY

VEHICLE LICENSE #: _____

PART 2: Travel Log

THE PLACE MY TRAVEL BEGAN TODAY WAS:

At Work / Base Location? - YES - NO What Type of Place is This? (See Options Below) _____

 (Street address or nearest intersection for place travel began)

TRAVEL DATE _____
 Month / Day

 (City, state, zip co)

am
 DEPARTURE TIME: _____ pm

When you left the above location was your vehicle: Fully Loaded Partially Loaded Empty

If loaded, what is the weight of the cargo being transported? _____ (pounds/lbs.)

	RECORD the following information about each place <i>NAME of Place: Address including city, state, and zip OR Nearest street intersection or Landmark</i>	What time did you arrive and depart this location? <small>(record exact times)</small>	Activity – What are you doing at this location? <small>(see options below)</small>	Is this the work / base location for this vehicle? <input type="checkbox"/> - YES <input type="checkbox"/> - NO	What type of place is this? <small>(see options below)</small>	Type of Cargo What is it?	Cargo Weight (in pounds/lbs)
PLACE 1		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			Picked-Up _____ Dropped-Off _____
PLACE 2		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			Picked-Up _____ Dropped-Off _____
PLACE 3		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			Picked-Up _____ Dropped-Off _____

ACTIVITY OPTIONS	TYPE OF PLACE OPTIONS					
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> (1) Base Location / Return to Base Location (2) Delivery (3) Pick-up (4) Pick-up and Delivery (5) Maintenance (fuel, oil, etc.) </td> <td style="width: 50%; vertical-align: top;"> (6) Driver Needs (lunch, etc.) (7) Other (8) To Home (9) Service Related (to job or work site) (99) Refused / Unknown </td> </tr> </table>	(1) Base Location / Return to Base Location (2) Delivery (3) Pick-up (4) Pick-up and Delivery (5) Maintenance (fuel, oil, etc.)	(6) Driver Needs (lunch, etc.) (7) Other (8) To Home (9) Service Related (to job or work site) (99) Refused / Unknown	<table style="width: 100%; border: none;"> <tr> <td style="width: 33%; vertical-align: top;"> (1) Office Building (2) Retail / Shopping (3) Industrial/Manufacturing (4) Medical / Hospital (5) Education (12th grade or less) </td> <td style="width: 33%; vertical-align: top;"> (6) Educational (college, trade) (7) Government Office/Building (8) Residential (9) Airport (10) Intermodal Facility </td> <td style="width: 33%; vertical-align: top;"> (11) Warehouse (12) Distribution Center (13) Construction Site (14) Other (specify) (99) Refused / Unknown </td> </tr> </table>	(1) Office Building (2) Retail / Shopping (3) Industrial/Manufacturing (4) Medical / Hospital (5) Education (12 th grade or less)	(6) Educational (college, trade) (7) Government Office/Building (8) Residential (9) Airport (10) Intermodal Facility	(11) Warehouse (12) Distribution Center (13) Construction Site (14) Other (specify) (99) Refused / Unknown
(1) Base Location / Return to Base Location (2) Delivery (3) Pick-up (4) Pick-up and Delivery (5) Maintenance (fuel, oil, etc.)	(6) Driver Needs (lunch, etc.) (7) Other (8) To Home (9) Service Related (to job or work site) (99) Refused / Unknown					
(1) Office Building (2) Retail / Shopping (3) Industrial/Manufacturing (4) Medical / Hospital (5) Education (12 th grade or less)	(6) Educational (college, trade) (7) Government Office/Building (8) Residential (9) Airport (10) Intermodal Facility	(11) Warehouse (12) Distribution Center (13) Construction Site (14) Other (specify) (99) Refused / Unknown				

COMMERCIAL VEHICLE TRAVEL SURVEY (con't)

VEHICLE LICENSE #: _____

RECORD the following information about each place		What time did you arrive and depart this location? <small>(record exact times)</small>	Activity – What are you doing at this location? <small>(see options below)</small>	Is this the work / base location for this vehicle? <input type="checkbox"/> - YES <input type="checkbox"/> - NO	What type of place is this? <small>(see options below)</small>	Type of Cargo What is it?	Cargo Weight <small>(in pounds/lbs)</small>
<i>NAME of Place:</i>	<i>Address including city, state, and zip OR Nearest street intersection or Landmark</i>						
PLACE 4 PLACE 5 PLACE 6 PLACE 7 PLACE 8 PLACE 9		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off

ACTIVITY OPTIONS		TYPE OF PLACE OPTIONS		
(1) Base Location / Return to Base Location	(6) Driver Needs (lunch, etc.)	(1) Office Building	(6) Educational (college, trade)	(11) Warehouse
(2) Delivery	(7) Other	(2) Retail / Shopping	(7) Government Office/Building	(12) Distribution Center
(3) Pick-up	(8) To Home	(3) Industrial/Manufacturing	(8) Residential	(13) Construction Site
(4) Pick-up and Delivery	(9) Service Related (to job or work site)	(4) Medical / Hospital	(9) Airport	(14) Other (specify)
(5) Maintenance (fuel, oil, etc.)	(99) Refused / Unknown	(5) Education (12 th grade or less)	(10) Intermodal Facility	(99) Refused / Unknown

COMMERCIAL VEHICLE TRAVEL SURVEY (con't)

VEHICLE LICENSE #: _____

RECORD the following information about each place		What time did you arrive and depart this location? <small>(record exact times)</small>	Activity – What are you doing at this location? <small>(see options below)</small>	Is this the work / base location for this vehicle? <input type="checkbox"/> - YES <input type="checkbox"/> - NO	What type of place is this? <small>(see options below)</small>	Type of Cargo What is it?	Cargo Weight (in pounds/lbs)
<i>NAME of Place:</i>	<i>Address including city, state, and zip OR Nearest street intersection or Landmark</i>						
PLACE 10 PLACE 11 PLACE 12 PLACE 13 PLACE 14 PLACE 15		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off

ACTIVITY OPTIONS		TYPE OF PLACE OPTIONS		
(1) Base Location / Return to Base Location	(6) Driver Needs (lunch, etc.)	(1) Office Building	(6) Educational (college, trade)	(11) Warehouse
(2) Delivery	(7) Other	(2) Retail / Shopping	(7) Government Office/Building	(12) Distribution Center
(3) Pick-up	(8) To Home	(3) Industrial/Manufacturing	(8) Residential	(13) Construction Site
(4) Pick-up and Delivery	(9) Service Related (to job or work site)	(4) Medical / Hospital	(9) Airport	(14) Other (specify)
(5) Maintenance (fuel, oil, etc.)	(99) Refused / Unknown	(5) Education (12 th grade or less)	(10) Intermodal Facility	(99) Refused / Unknown

COMMERCIAL VEHICLE TRAVEL SURVEY (con't)

VEHICLE LICENSE #: _____

PLACE #	RECORD the following information about each place	What time did you arrive and depart this location?	Activity – What are you doing at this location?	Is this the work / base location for this vehicle?	What type of place is this?	Type of Cargo	Cargo Weight
	NAME of Place: Address including city, state, and zip OR Nearest street intersection or Landmark	(record exact times)	(see options below)		(see options below)	What is it?	(in pounds/lbs)
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off
		Arrive: _____ am/pm Depart: _____ am/pm		<input type="checkbox"/> - YES <input type="checkbox"/> - NO			_____ Picked-Up _____ Dropped-Off

ACTIVITY OPTIONS		TYPE OF PLACE OPTIONS		
(1) Base Location / Return to Base Location	(6) Driver Needs (lunch, etc.)	(1) Office Building	(6) Educational (college, trade)	(11) Warehouse
(2) Delivery	(7) Other	(2) Retail / Shopping	(7) Government Office/Building	(12) Distribution Center
(3) Pick-up	(8) To Home	(3) Industrial/Manufacturing	(8) Residential	(13) Construction Site
(4) Pick-up and Delivery	(9) Service Related (to job or work site)	(4) Medical / Hospital	(9) Airport	(14) Other (specify)
(5) Maintenance (fuel, oil, etc.)	(99) Refused / Unknown	(5) Education (12 th grade or less)	(10) Intermodal Facility	(99) Refused / Unknown