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16. Abstract As toll road usage increases to finance new road infrastructure or add capacity to existing road infrastructure, the question of who does and does not use toll roads becomes increasingly important to toll road developers, financiers, Traffic and Revenue consultants, and investors, among others. Although a number of previous studies have attempted to characterize toll road users and sub-sets of toll road users, this study presents a first attempt to differentiate the auto users and non-users of the Central Texas toll roads. Respondents (1,507) to a telephone survey that was conducted in the Spring of 2008 were categorized as users and non-users of toll roads and statistical analysis was conducted to provide insight into the demographic and trip characteristics of the auto users and non-users of the Central Texas toll roads. The report also includes a detailed analysis of actual transaction data from the Central Texas Turnpike System. This actual data coupled with the preferences expressed in the surveys provides a detailed look into the characteristics of the auto users and non-users of the Central Texas area toll roads.					
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Chapter 1. Introduction

Initiated in 2002, the Central Texas Turnpike Project (CTTP) consists of 65 miles of new roadway in the Austin area. The 2002 CTTP includes three elements:

- SH 130 (49 miles), which begins north of Georgetown, Texas and extends to US 183 in southeast Travis County (and to be extended to IH 10 when funding becomes available),
- SH 45N (approximately 13 miles), from Ridgeline Boulevard west of US 183 to SH 130, and
- the Loop 1 Extension (approximately three miles), which extends from FM 734 (Parmer Lane) to SH 45N.

The system as it existed at the time of this study can be seen in Figure 1.1. TxDOT manages all three toll roads. The 183A toll road that is located in Northwest Austin is not part of the CTTP and is managed and operated by the Central Texas Regional Mobility Authority.



Figure 1.1: Central Texas Turnpike Project

The first sections of the system (North Loop 1, SH 45 from Loop 1 to SH 130, and SH 130 from US 79 to SH 71) opened to traffic in November 2006. To encourage usage and to get drivers more familiar with the toll road and where it goes, each section was free to all users for the first two months after opening, free to TxTag users in the third month, and half price for TxTag users during the fourth month. The opening dates of the CTTP main lanes are provided in Table 1.1. The TxTag is an electronic toll collection (ETC) device that can be used to pay the tolls on all four Central Texas toll roads. TxTag users receive a 10% discount on all tolls charged on the Central Texas toll roads. It can also be used on toll roads in Houston and Dallas.

Table 1.1: Opening Dates of CTTP Main Lanes (ML)

	ML1*	ML2	ML3	ML5	ML6	ML7	ML8	Comments
Opened	1-Nov-06	1-Nov-06	27-Apr-07	13-Dec-06	1-Nov-06	6-Sep-07		ML3WB opened April 27, 2007
1 st Month	1-Dec-06	1-Dec-06	27-May-07	13-Jan-07	1-Dec-06	6-Oct-07		Free to all customers
2 nd Month	1-Jan-07	1-Jan-07	27-Jun-07	13-Feb-07	1-Jan-07	6-Nov-07		Free to all customers
3 rd Month	1-Feb-07	1-Feb-07	27-Jul-07	13-Mar-07	1-Feb-07	6-Dec-07		Free to TxTag
4 th Month	1-Mar-07	1-Mar-07	27-Aug-07	13-Apr-07	1-Mar-07	6-Jan-08		*50% discount for TxTag

Notes: ML 1 is Loop 1 Extension; ML2 and ML3 are SH 45; and ML5, ML6, ML7, and ML8 are SH 130.

1.1 The Objectives of this Report

A key objective of TxDOT Research Study 0-6044 was to characterize the users and non-users of the Central Texas Turnpike System (CTTS) in an effort to inform decisions about level of service and strategies to increase market share. A comprehensive literature review and survey data analysis was thus conducted to provide insight into the demographic and trip characteristics of the auto users and non-users of Central Texas toll roads. This report documents the research team's review of the literature on the characteristics of auto toll road users and the findings from a telephone survey administered to both toll road and non-toll road auto users in Central Texas. The report is structured as follows: Chapter 2 highlights the salient findings of the literature review. Chapter 3 provides information about the survey approach, details the sample characteristics, and describes the statistical tests that were conducted to characterize the users and non-users of the CTTS. Chapter 4 summarizes the survey data analysis in terms of the demographic characteristics of the toll road users and non-toll road users, and the results of the statistical tests that were conducted to determine the dependence of toll road usage on specific demographic variables (e.g., ethnicity, gender, household structure, household type, vehicle ownership, etc.) at a 95% confidence level. Chapter 5 summarizes the responses and analysis that were conducted in an effort to characterize the trip characteristics of the toll road auto users and non-toll road auto users in Central Texas, including trip profile, trip frequency, transportation mode, trip times, and reasons for using or not using toll roads by trip type. Chapter 6 documents the analysis of the transaction data that was obtained for one week in November 2007. The transaction data reflected actual toll road usage and provided insight into the day and time of the transaction, commercial and non-commercial use, axle distributions, and the billing zip code where the toll tag is registered. Finally, Chapter 7 highlights the salient findings of the analysis

conducted in the preceding chapters. The results of this study can inform toll road developers and Traffic and Revenue consultants about the factors that determine auto usage of toll roads, which can lead to better traffic and revenue predictions and improved marketing of toll facilities.

Chapter 2. Background

A number of studies have been conducted in an effort to characterize the users of toll facilities in various U.S. states, including Texas. This section of the report highlights the salient findings of a number of different types of studies that have been conducted by researchers in an effort to understand and delineate the characteristics of toll facility users.

2.1 California State Route 91

A number of surveys and reports have been conducted to characterize users of the Express Toll Lanes of State Route 91 (SR-91) in Orange County, California (see Figure 2.1) and to determine customer satisfaction. A paper by Mastako, Rillet, and Sullivan (1998) focuses on commuters in particular. Using a survey conducted by Cal Poly in the Fall of 1996, the authors concluded that SR-91 commuters tended to:

- be in their 30s and 40s,
- be male,
- earn more than \$60,000,
- work in professional careers, and
- come from larger households.

In fact over 50% came from households of more than 3 people and owned at least 2 cars. They tended to be regular commuters who commuted 5 days/week and had relatively long journeys (25–44 miles, or 40–71 km).

In addition, a very comprehensive study into the demographic characteristics of SR 91 toll road users was performed in 2000. A telephone survey was conducted of 1,290 single occupant vehicle (SOV) commuters using the facility, 355 high occupancy vehicle commuters with two occupants per vehicle (HOV2), and 135 HOV3+ commuters.



Source: Daniel R. Blume, May 9th, 2007

Figure 2.1: Express Toll Lanes of State Route 91 (SR-91) in Orange County, California

An analysis of the responses revealed the following in terms of facility usage and income, age, education, household structure, and gender:

- *Income:* 21% of the respondents in the lowest income level indicated frequent usage¹ of the toll roads compared to 51% for the highest income levels. This could be partly attributable to the fact that the route traverses a moderately high income area.
- *Age:* The analysis revealed comparatively lower toll road usage among the lowest and highest age brackets.
- *Education:* Higher levels of education correlated with higher usage. Users with only a high school education or less only comprised 22% of the SR 91 commuters, compared with 36% with a bachelor's degree and higher.
- *Household structure:* The study revealed no correlation between household structure and toll road usage.
- *Gender:* In terms of gender, 45% of the female respondents indicated that they preferred the tolled lanes compared to 31% of the male respondents. In reality, however, 65% of the corridor's users have been male. So although women respondents revealed a higher preference for using the roads, males make up a larger share of actual users. The authors offered as an explanation that women's preference for the toll lanes might be attributable to women having a higher value of time compared to men when it comes to travel commute times. Despite this higher preference though, usage was dominated by men—suggesting circumstances that would give them a higher probability of usage² (Sullivan, 2000).

More recently, in 2007, the Orange County Transportation Authority (OCTA) conducted a customer survey. The main objective of the survey was to gain insight into how drivers perceive the system, but a substantial amount of demographic data was also collected. That data provides a profile of the toll road users in the Orange County region and how that profile has changed over the years that OCTA has been conducting annual surveys. Table 2.1 summarizes the demographic data gathered in by OCTA between 2004 and 2007.

¹ Frequent usage comprised commuters who use the facility for at least half of their peak trips.

² A study done in 1998 by Small and Parkany regarding the marketability of the corridor found that the primary advantage perceived by toll road users was travel time savings, whereas the main concern was the toll rate. The study also found that users making longer trips were more inclined to use the facility. Finally, the study found that women responded with a higher preference to use the facility than men, citing child-care and shopping as reasons for using the facility, as well as reduced travel time (Small and Parkany, 1998).

Table 2.1: Characteristics of Orange County Survey Respondents

	2004	2005	2006	2007
Average Age	30	45	54	48
Percent Male	50%	55%	52%	62%
Percent Female	50%	45%	48%	38%
Average Annual Household Income	\$71,000	\$77,325	\$78,000	\$95,200
Percent with Some College Education	78%	86%	82%	83%
Percent Employed Full Time	50%	52%	43%	58%
Ethnicity				
Caucasian	69%	78%	73%	70%
Hispanic	12%	9%	7%	13%
African American	5%	2%	5%	4%
Asian				6%

Table 2.1 reveals substantial differences between the demographic characteristics of toll road users in Orange County in 2004 compared to 2007. The exception is the ethnicity profile of users, which is similar between 2004 and 2007. Average recorded age of toll road users, however, was 48 years in 2007 compared to 30 years in 2004. Similarly, a 50-50 gender share in 2004 was recorded compared to a 62% male share in 2007. Finally, average household income in 2004 was recorded as \$71,000 compared to \$95,200 in 2007—an increase of over \$20,000.

2.2 North Texas Tollway Authority

The two major tollways in Dallas, Texas—i.e., the Dallas North Tollway and the President George Bush Turnpike—are managed by the North Texas Tollway Authority (NTTA). These two commuter toll expressways run north-south and east-west respectively through the heart of the Dallas Metropolitan area (see Figure 2.2). The Dallas North Tollway, which was primarily constructed by 1968, is surrounded by dense urban development. The President George Bush Turnpike, on the other hand, has been constructed in the last decade and is still experiencing development along the corridor.

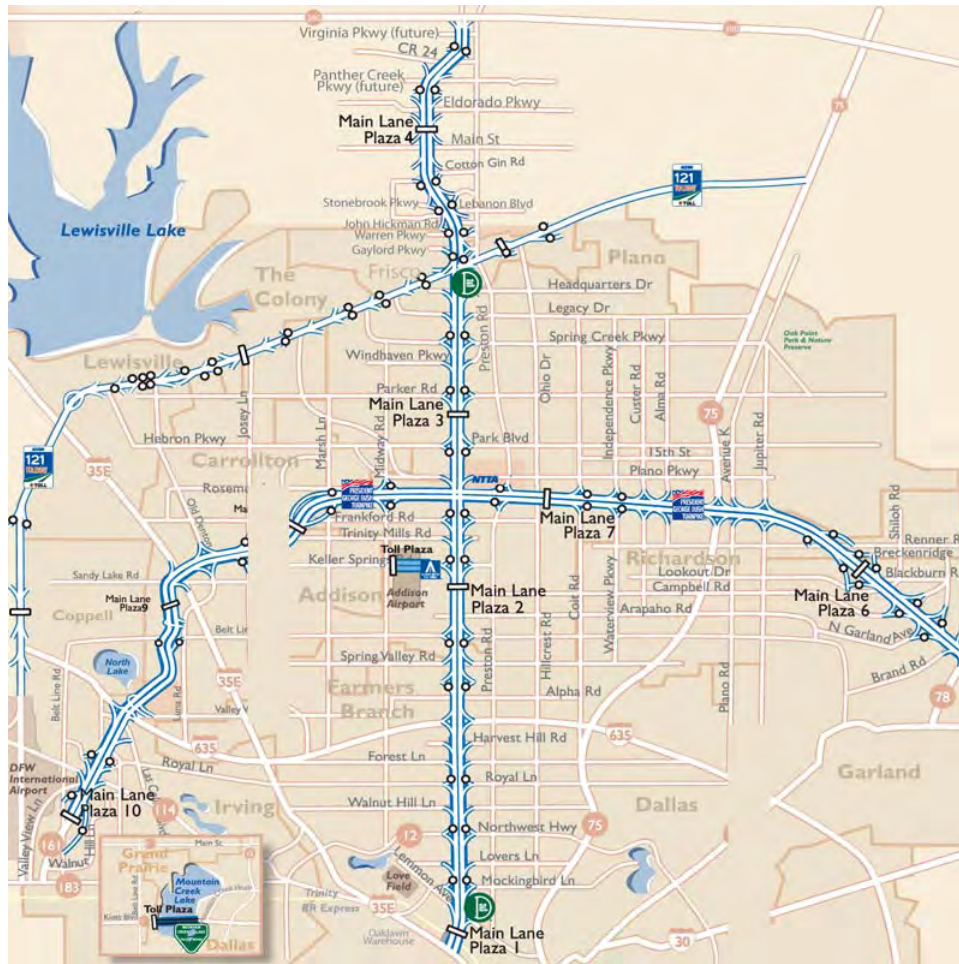


Figure 2.2: North Texas Tollway Authority Toll Roads

In 2005, the NTTA conducted an email survey of their TollTag customers to obtain information regarding user demographics and opinions. The e-mail survey was distributed to 350,000 NTTA TollTag customers and approximately 38,000 responses were acquired, yielding a margin of error of 0.5% at a 95% confidence level (Tammer, 2005). Forty thousand survey forms were also distributed to cash users at toll plazas, of which slightly more than 8,000 were returned. Figures 2.3 to 2.7 characterize the cash and TollTag customers of the NTTA in terms of income, ethnicity, gender, education, and age.

Figure 2.3 illustrates the income characteristics of NTTA’s cash and TollTag customers.

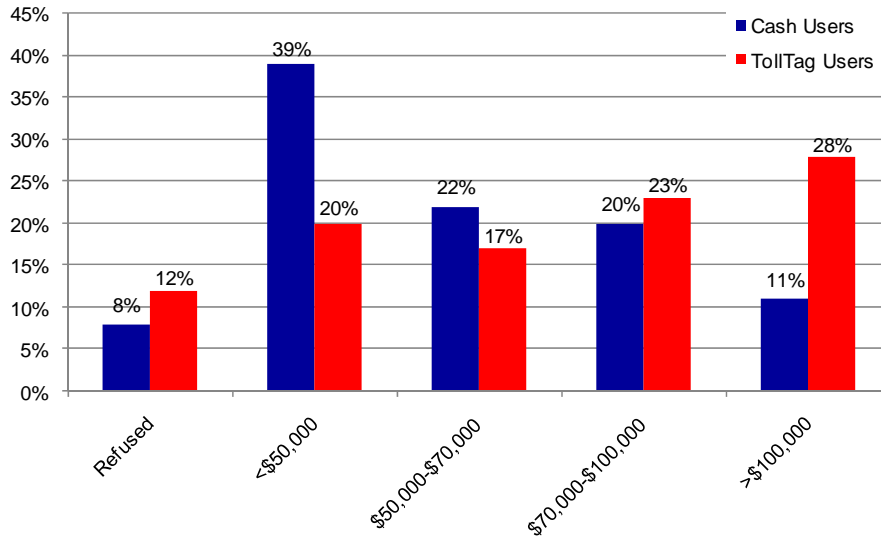


Figure 2.3: NTTA Respondent Breakdown by Annual Income

From Figure 2.3 it is evident that almost 40% of NTTA’s cash customers earn less than \$50,000 per year compared to 20% of its TollTag customers. On the other hand, approximately 28% of NTTA’s TollTag customers earn more than \$100,000 per year, compared to about 11% of its cash customers. Statistics such as these seems to suggest that low income users will be impacted by a policy to move to all-electronic tolling.

Figure 2.4 illustrates the ethnicity characteristics of NTTA’s cash and TollTag customers.

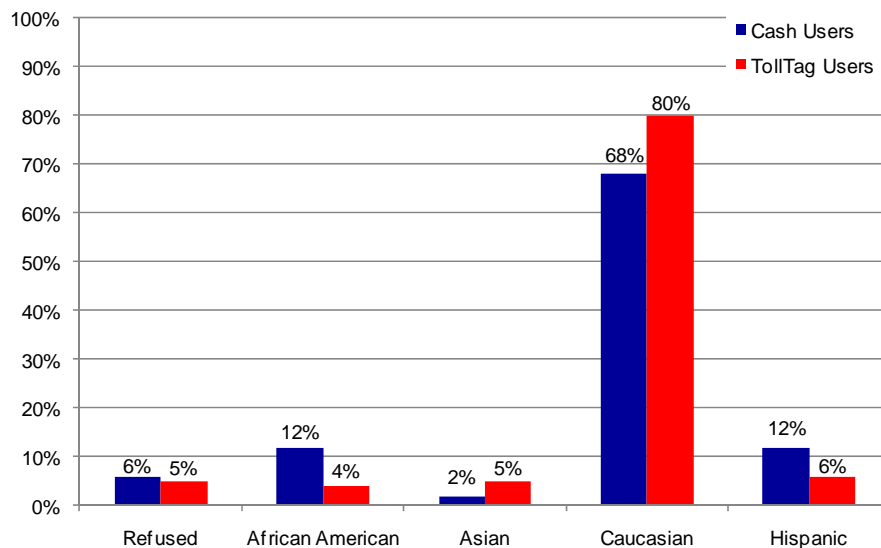


Figure 2.4: NTTA Respondent Breakdown by Ethnicity

Of those that use the Dallas tollway system and pay with TollTags, an overwhelming majority (i.e., 80%) tend to be Caucasian. The remaining 20% of TollTag users are almost evenly divided among the remaining minority groups. In terms of cash-paying users of the system, a higher percentage of African Americans (12% vs. 4 %) and Hispanics (12% vs. 6%)

was observed and a lower percentage of Caucasians (68% vs. 80%) and Asians (2% vs. 5%) was observed.

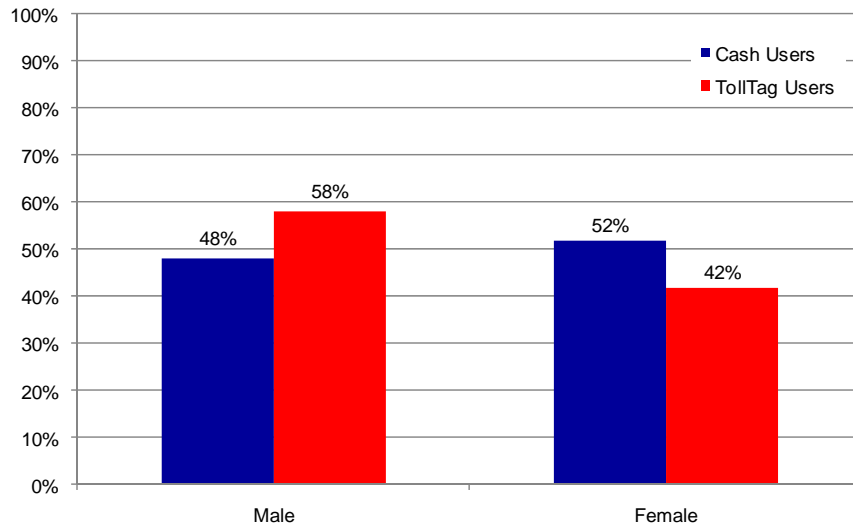


Figure 2.5: NTTA Respondent Breakdown by Gender

Of TollTag customers, the majority is male (58%). Cash customers yielded a 52% to 48% ratio in favor of females, which is within the margin of error of the cash customer sample (4%) (Tammer, 2005).

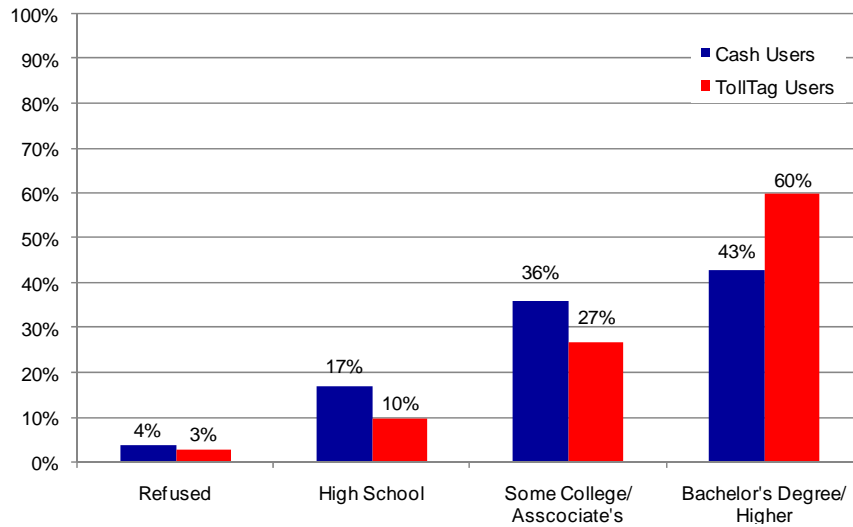


Figure 2.6: NTTA Respondent Breakdown by Education

The majority of TollTag customers (60%) reported an education level of at least a bachelor's degree. Cash customers revealed a lower percentage of respondents with a bachelor's degree or higher (43%).

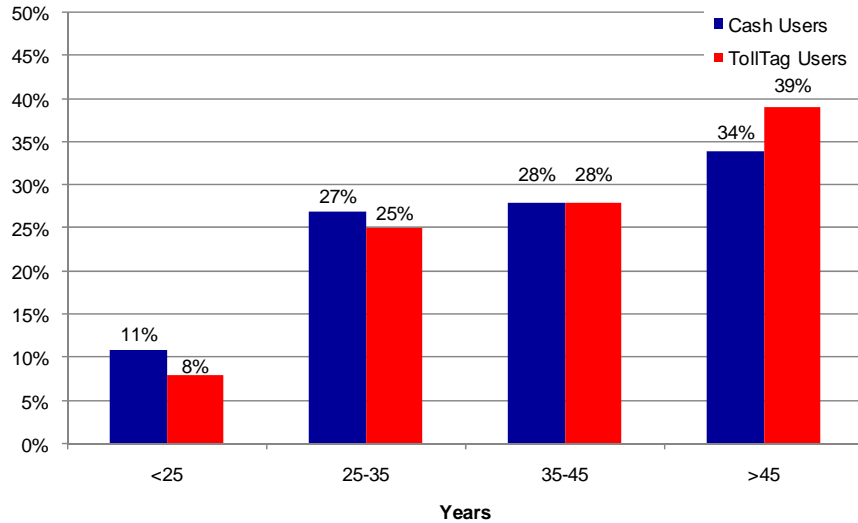


Figure 2.7: NTTA Respondent Breakdown by Age

TollTag and cash customers revealed a similar percentage breakdown in terms of the age of users (see Figure 2.7). Both groups reported that more than a third of the respondents were over the age of 45, 55% and 53% reported to be between 25 and 45 in the case of cash users and TollTag users, respectively, while 11% and 8% of cash and TollTag users, respectively reported to be less than 25 years old.

From these statistics, it appears that a Dallas TollTag user is typically older, Caucasian, has a higher level of education, and relatively higher income level. Gender preference for the system trends neutral for cash customers who responded and a slightly higher share of TollTag users are male. These attributes can be ascribed to both the demographics of the Dallas area and the nature of the tollways. Both the Dallas North Turnpike and President George Bush Turnpike are commuter thoroughfares that run from the edge of the suburban outskirts into the city center. They are likely often frequented by Dallas commuters, who would arguably exhibit similar demographic characteristics as found in this survey sample.

2.3 Georgia 400 (GA-400)

The GA-400 is a non-Interstate 6.2-mile four-to-eight lane toll road in Atlanta, Georgia. Owned and operated by the Georgia State Road and Tollway Authority (GSTA), the toll road has been open since August 1993. Toll rates on the GA-400 are a function of the distance traveled and the axle count of vehicles. The toll pricing mechanism is a combination of cash and ETC. Currently ETC users do not receive a discount. The average cost per trip is estimated to be \$0.50.

In 2004 revenue data relating to the usage of the GA-400 tollway was mapped using the billing addresses of cruise card users. Figure 2.8 illustrates an area's contribution to the revenue of the facility (i.e., based on the billing address) and thus usage of the facility. The primary purpose of this report was to inform policy makers about who uses the toll road when considering the redistribution of toll revenues (Bachman & Drake, 2004).

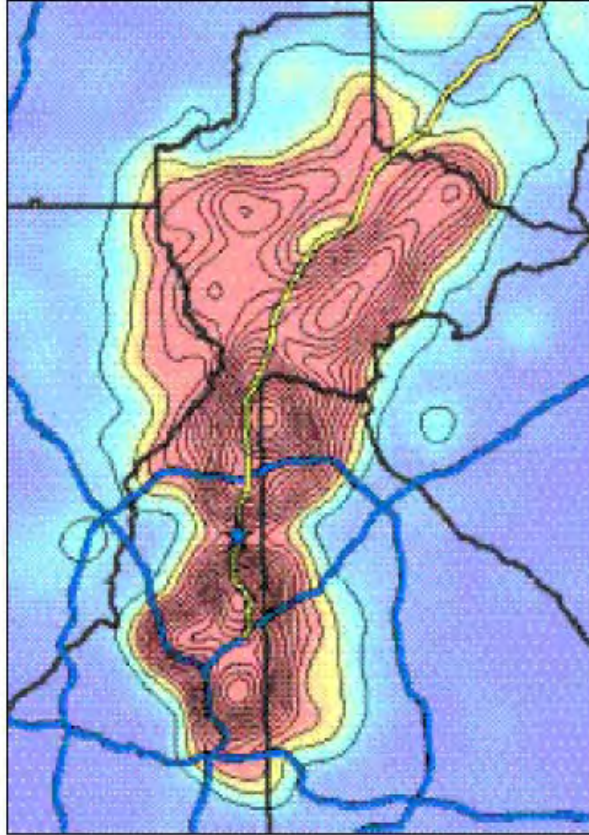


Figure 2.8: Origins of GA-400 Cruise Card Revenues

Visual maps are effective in illustrating the origins (assuming that most of the trips originate at the billing addresses of the cruise card users) and usage of toll facilities spatially. As can be seen in the case of GA-400 in Atlanta, the majority of the users have billing addresses along the corridor, with greater concentrations along the northern end. In the Atlanta metropolitan area, higher income households tend to live in the northern suburbs of the city and commute downtown using GA-400. The three major nodes along the system serve the three major business and residential centers of the city. This data provides valuable insight into the usage of the facility.

2.4 Pennsylvania Turnpike

The Pennsylvania Turnpike system comprises 532 miles and serves most of Pennsylvania's major urban areas, including Pittsburgh, Harrisburg, Philadelphia, Allentown/Bethlehem, and Scranton/Wilkes-Barre (see Figure 2.9). Its main section is 359 miles and extends from the Ohio state line in the west to the New Jersey state line in the east. The Northeast Extension extends from Plymouth Meeting in the southeast to Wilkes-Barre and Scranton in the northeast and is 110 miles. There are also various access segments in Western Pennsylvania totaling 62 miles. Though the turnpike was originally opened in 1940 and was the first long-distance rural highway, several additions were constructed in the 1950s and have continued to be constructed since the 1980s. Users are able to pay either cash or using E-ZPass.



Figure 2.9: Pennsylvania Turnpike

In 2003 Penn State University performed a study of the Pennsylvania Turnpike system. This study was conducted by distributing surveys to both passenger and commercial motorists who had stopped at service plazas along the toll route. The study captured responses from 1,528 passenger and commercial motorists, achieving slightly higher than 95% confidence level (Patten Pribyl, and Goulias, 2003).

The demographic information obtained from passenger motorists on the Pennsylvania Turnpike system allows for a comparison of the turnpike system users to the demographics of the state. The comparison can be seen in Table 2.2.

Table 2.2: Pennsylvania Turnpike Motorist Demographics

Demographic		Survey Respondents	Pennsylvania Demographics*
Median Age		46	38
Gender	Male	55.8%	48.3%
	Female	39.5%	51.7%
	No Answer	1.7%	N/A
Ethnicity	White	91.4%	85.4%
	African American	2.4%	10.0%
	Other	3.7%	4.6%
	No Answer	2.6%	N/A

* Based on Census 2000 counts

Source: Patten Pribyl, and Goulias, 2003

Several observations can be made from the data included in Table 2.2. For example, it is evident that Pennsylvania Turnpike users are older than the Pennsylvania population. Also, usage

is dominated by Whites (approximately 91%) and a higher percentage of males (almost 56%) use the Turnpike compared to females (almost 40%).

Of further interest is information pertaining to income and education. The survey found that 99% of respondents reported graduating from high school (versus 82% for the Pennsylvania population) and that 58.2% of respondents had at least a bachelor’s degree (versus 22.4% for the state population). In the case of income, the 2000 census revealed a median household income of \$40,106 for Pennsylvania. The Penn State University study, however, reported that approximately 48% of the Pennsylvania Turnpike users earn between \$50,000 and \$99,999. In addition, around 27% of the Turnpike users reported household incomes in excess of \$100,000. It thus appears that Turnpike users tend to have higher incomes than the state population (Patten Pribyl, and Goulias, 2003).

2.5 Central Texas Traveler Information Study

In a study conducted by Wang, Persad, and Walton entitled “*The Impact of Traveler Information on Commuter’s Travel Behavior and Toll Road Choice*” (2005), an online survey of 473 Austin commuters was used to identify toll road choice characteristics for the Austin area. The overall objective of this study was to determine the changes in behavior of commuters based upon the availability of various levels of traveler information regarding potential routes of travel. An analysis of the sample data revealed that willingness to pay (WTP) for toll facilities—if toll road information is provided—is directly related to household income. For the highest household income level (\$150,000 to \$199,999), 61.9% of the respondents in that income category were WTP for a toll facility. This compares to a 39% WTP for the lowest household income level (\$25,000 to \$34,999). However, the relationship between income and WTP does not linearly increase given higher income categories. WTP for usage of the toll road ranged from 39% to 47.1% for the four income categories between \$35,000 and \$149,999—thereby not reaching the 62% indicated by the highest household income level. Interestingly, respondents in the \$75,000 to \$99,999 income category revealed a higher WTP for toll road usage than the respondents in the \$100,000 to \$149,999 income category. These results are summarized in Table 2.3. The authors also calculated a travel value of time—based upon the reported WTP for toll facilities—of about \$10.50 per hour for Austin commuters.

Table 2.3: Austin Commuters’ Willingness to Choose Toll Roads by Income Levels

Household Income Level	Willingness to Choose Toll Roads if Information is Provided		Total
	No	Yes	
\$25,000 to \$34,999	61.0% (25 respondents)	39.0% (16 respondents)	100.0%
\$35,000 to \$49,999	56.9% (29 respondents)	43.1% (22 respondents)	100.0%
\$50,000 to \$74,999	61.0% (61 respondents)	39.0% (39 respondents)	100.0%
\$75,000 to \$99,999	52.9% (55 respondents)	47.1% (49 respondents)	100.0%
\$100,000 to \$149,999	55.5% (48 respondents)	44.8% (39 respondents)	100.0%
\$150,000 to \$199,999	38.1% (8 respondents)	61.9% (13 respondents)	100.0%

The authors also explored the relationship between gender and WTP to use toll roads if information is provided. Males reported a 46.9% WTP versus a 40.6% WTP for females (see Table 2.4). This finding contradicted the survey results at other toll facilities—specifically the

SR 91 express lanes in California that indicated a higher support of toll facilities by female respondents - but the authors did not elaborate on these findings.

Table 2.4: Austin Commuters’ Willingness to Choose Toll Roads by Gender

Gender	Willingness to Choose Toll Roads if Information is Provided		Total
	No	Yes	
Male	53.1%	46.9%	100.0%
Female	59.4%	40.6%	100.0%

Another finding from this research effort informs the marketing of toll facilities. When asked if the respondent would choose a toll road when traveler information indicated that he/she could save time on the toll road, 45% of respondents indicated that they would choose a toll road, while 55% said using the toll road was not an option. The primary reason cited for not choosing toll roads was “*tax already paid*” (Wang, Persad & Walton, 2004).

2.6 Potential Central Texas Turnpike System Users

In the summer of 2005, TxDOT funded NuStats to perform surveys of potential Central Texas Turnpike System (CTTS) users. This survey, conducted prior to the completion of the CTTS, aimed primarily to obtain information regarding users’ knowledge of the Central Texas road facilities, their support of different methods to fund transportation improvements, and their likelihood of using the CTTS once completed. Specifically, the survey sought to obtain information regarding knowledge of toll road locations, transportation funding sources, and the respondents’ sources of daily traffic information. Respondents were also asked about their inclination to acquire an electronic toll tag and factors influencing that decision.

The study was conducted during the month of May 2005. The survey of 60 questions was administered via telephone in both English and Spanish to 1,500 individuals. The survey area was defined as the Capital Area Metropolitan Planning Organization (CAMPO) planning area that comprises the following five counties: Bastrop, Caldwell, Hays, Travis, and Williamson. An attempt was made to ensure that the respondent totals by county represented the resident distribution by county.

Due to discrepancies between the sample respondents and the 2000 census data, both income and ethnicity were weighted in the final analysis. Specifically, Hispanics and lower income households were found to be under-represented in the sample. Education exhibited a similar under-representation, but because this variable is related to income it was not weighted. Other under-representations occurred among males and the lower age brackets. However, these were not weighted because of the relatively small margin of under-representation and legal restrictions on road usage of the lower age demographic, respectively. For additional information about the survey methodology, see Nustats report entitled *Central Texas Toll Road Baseline Marketing Survey, Final Report* (2006).

Given the objectives of the survey, the conclusions and recommendations revolved primarily around knowledge of transportation issues, the attitudes towards potential tolling facilities in Central Texas, and alternatives to these facilities. The study found that most respondents were knowledgeable of transportation issues and the Central Texas toll projects, but were evenly split regarding the need for toll roads. The most supported traffic relief strategy among those surveyed was the creation of high occupancy toll (HOT) lanes, while the least

favorable was an increase in local gas taxes. Most respondents had a positive perception of the TxTag. The primary reason given for not acquiring a TxTag was that there were no toll road alternatives for their current route. The study found that those most likely to use toll roads are more inclined to acquire information online than those that indicated that they would not use a toll road. Finally, the study found that television is the best medium for disseminating information and marketing of toll roads, especially when targeting ethnic minorities.

Most of the study recommendations pertained to marketing toll roads. It was proposed that TxDOT concentrated their marketing efforts on Williamson County because of its high proportion of toll road supporters and potential users. Marketing efforts should also target those with moderate to higher income levels (i.e., \$25,000 and above) with the highest potential users having an income ranging between \$25,000 and \$75,999. The study also recommended that the TxTag be used for more applications than just paying tolls and that TxDOT communicates the need for toll roads due to budget constraints and the need for additional infrastructure sooner. Finally, it was considered important that the message be conveyed that all toll road revenues will stay in the area.

2.7 Concluding Remarks

The literature review revealed a number of studies that attempted to characterize toll facility users. The most comprehensive studies uncovered have been for California's SR 91 Express Lanes. These studies provided a number of interesting observations as to the typical characteristics of the SR 91 toll road user. In addition, information for the North Texas Turnpike System, Pennsylvania Turnpike, and the Georgia 400 users, as well as the potential Central Texas Turnpike users, has provided some insight and offered interesting approaches to analyzing the demographic characteristics of toll road users.

Based on these studies, there seems to be a correlation between toll road usage and higher incomes, as well as higher education levels. The findings relating to toll road usage and gender seem to be less conclusive. CA SR-91 suggested a higher level of female users, whereas more males used the Pennsylvania Turnpike. Data for the Dallas tollways seem to suggest an equal gender split of cash users, but more male electronic TollTag users than female TollTag users. Also, the studies that collected information about the ethnicity profile of toll road users concluded that the majority of the users were White/Caucasian.

Chapter 3. Survey and Study Methodology

In the Spring of 2008, the research team worked with the Texas Turnpike Authority in administering a survey to Central Texas residents about their usage and non-usage of the CTTS. The administered survey included questions about respondent's trip types, toll road usage for different trip types, preferred payment method, and reasons for using or not using the Central Texas toll roads, as well as numerous questions about the demographic characteristics of both users and non-users of the system. This chapter provides information about the survey approach, details the sample characteristics, and describes the statistical tests that were conducted in subsequent chapters to characterize the users and non-users of the CTTS.

3.1 Survey Methodology

In the Spring of 2008, a telephone survey was developed by the research team in consultation with the Texas Turnpike Authority. The survey comprised 80 questions (see Appendix A) about respondents' trips and their usage and non-usage of the CTTS. In terms of the trip questions, three different trip purposes were considered: commute trips to and from work, non-work related or recreational trips (i.e., going to school, shopping or running errands, going to church, etc.), and business trips (all work trips that are not part of one's commute, i.e., business travel). Respondents answered only questions that corresponded to their toll road usage and/or trip purposes (e.g., those that did not commute to work were not asked about their usage of toll roads on their commute). The trip purpose questions aimed to collect information as to why respondents use or do not use toll roads for the different trip types. All respondents were also asked detailed demographic information, including county of residence, race, gender, income, employment, and household structure. The survey was administered by Harris Interactive and resulted in 1,507 completed surveys of Central Texas residents in five counties (i.e., Bastrop, Caldwell, Hays, Travis, and Williamson).

3.2 Survey Weights

An analysis of the collected data revealed that the sample was not representative of the population in Central Texas regarding certain population characteristics, i.e., income and ethnicity. Harris Interactive thus calculated weights to apply to the responses to account for the representation concerns in terms of race and income by county of residence of the obtained responses. Table 3.1 shows the weights that were used to weigh the sample responses.

Table 3.1: TxDOT User Survey Weights

County Strata	Recorded Imputed Income	Ethnicity Recode	Non Normalized Demographic Balancing Weight	Non Normalized Sample Weight	Final Non Normalized Sample Weight
Bastrop/Caldwell	<\$50k	White-Asian-Other	1.532073	0.610000	0.934565
Bastrop/Caldwell	\$50k-\$100k	White-Asian-Other	0.736578	0.610000	0.449313
Bastrop/Caldwell	>\$100k	White-Asian-Other	0.460942	0.610000	0.281174
Bastrop/Caldwell	<\$50k	Black	1.551520	0.610000	0.946427
Bastrop/Caldwell	\$50k-\$100k	Black	2.014498	0.610000	1.228843
Bastrop/Caldwell	>\$100k	Black	1.000000	0.610000	0.610000
Bastrop/Caldwell	<\$50k	Hispanic	2.185884	0.610000	1.333389
Bastrop/Caldwell	\$50k-\$100k	Hispanic	1.050736	0.610000	0.640949
Bastrop/Caldwell	>\$100k	Hispanic	0.637700	0.610000	0.388997
Hays	<\$50k	White-Asian-Other	1.452865	0.710000	1.031534
Hays	\$50k-\$100k	White-Asian-Other	0.715724	0.710000	0.508164
Hays	>\$100k	White-Asian-Other	0.478159	0.710000	0.339493
Hays	<\$50k	Black	1.000000	0.710000	0.710000
Hays	\$50k-\$100k	Black	1.211933	0.710000	0.860473
Hays	>\$100k	Black	1.000000	0.710000	0.710000
Hays	<\$50k	Hispanic	2.941203	0.710000	2.088254
Hays	\$50k-\$100k	Hispanic	1.566651	0.710000	1.112322
Hays	>\$100k	Hispanic	0.735530	0.710000	0.522226
Travis	<\$50k	White-Asian-Other	1.475765	1.500000	2.213647
Travis	\$50k-\$100k	White-Asian-Other	0.717045	1.500000	1.075567
Travis	>\$100k	White-Asian-Other	0.504037	1.500000	0.756056
Travis	<\$50k	Black	2.622595	1.500000	3.933892
Travis	\$50k-\$100k	Black	0.995479	1.500000	1.493219
Travis	>\$100k	Black	0.780898	1.500000	1.171348
Travis	<\$50k	Hispanic	3.137218	1.500000	4.705827
Travis	\$50k-\$100k	Hispanic	1.289135	1.500000	1.933702
Travis	>\$100k	Hispanic	0.607422	1.500000	0.911133
Williamson	<\$50k	White-Asian-Other	1.291854	0.570000	0.736357
Williamson	\$50k-\$100k	White-Asian-Other	0.659442	0.570000	0.375882
Williamson	>\$100k	White-Asian-Other	0.545654	0.570000	0.311023
Williamson	<\$50k	Black	2.612174	0.570000	1.488939
Williamson	\$50k-\$100k	Black	1.060380	0.570000	0.604417
Williamson	>\$100k	Black	0.954930	0.570000	0.544310
Williamson	<\$50k	Hispanic	2.630967	0.570000	1.499651
Williamson	\$50k-\$100k	Hispanic	1.479013	0.570000	0.843037
Williamson	>\$100k	Hispanic	0.621400	0.570000	0.354198

The *non-normalized demographic balancing weight* was derived using the RIM weighting method. The RIM weighting method is an iterative process that balances the weights of multiple variables—e.g., income and ethnicity—to certain target proportions for each variable. Harris Interactive thus calculated the non-normalized demographic balancing weight to weigh the responses to be representative of the population—those age 16+ living in the five counties—in terms of education, race, age, gender, and income. The RIM weighting was run using a program called Quantum. The weights were, however, capped at .2 and 5 to avoid extreme

weighting. The original targets are summarized in Table 3.2, although the data may differ from these targets due to the capping that was done.

Table 3.2: Initial Specified Target Weights

Demographic Variable		Specified Target (%)
Education	High School Graduate or Less	35
	Some College	23
	College Degree (4 years)	30
	Post Graduate	12
Age	16-24 years	20
	25-34 years	24
	35-44 years	23
	45-54 years	16
	55-64 years	8
	65+ years	9
Gender	Male	51
	Female	49
Race/Ethnicity	Hispanic	26
	Black (Not Hispanic)	8
	All Other (Not Hispanic)	66
Income	\$15,000 - \$24,999	18.4
	\$25,000 - \$49,999	22.4
	\$50,000 - \$74,999	16.8
	\$75,000 - \$99,999	9.6
	\$100,000 or more	12.8
	Decline to Answer	20.0

Source: Harris Interactive

The non-normalized sample weights were computed by taking the target percentage for each county and dividing it by the actual percentage in the weighted data (see Table 3.3).

Table 3.3: Non Normalized Sample Weight Factors

	Targets (%)	Actual (%)	Weight Factor
Bastrop/Caldwell	7.0	11.4	0.61
Hays County	7.9	11.2	0.71
Travis County	66.3	44.3	1.50
Williamson County	18.8	33.1	0.57

The final weight that is applied to the data is the final non-normalized sample weight which is calculated by multiplying the non-normalized demographic balancing weight and the non-normalized sample weight. All subsequent analysis of the survey data was done using the weighted sample data.

3.3 Sample Characteristics

This section of the report characterizes the weighted sample profile, which includes both respondents that use toll roads and those that do not use toll roads.

Figure 3.1 illustrates the county of residence of the respondents. As can be seen, the majority of the respondents resided in Travis (59.3%) county and Williamson county (25.3%), with Bastrop (4.8%), Caldwell (3.2%), and Hays (7.3%) County also represented.

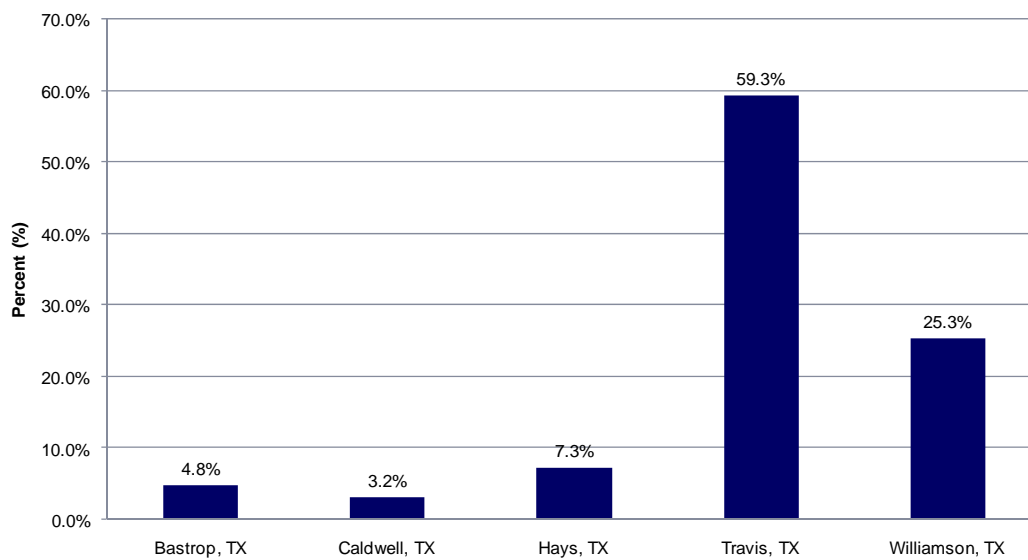


Figure 3.1: County of Residence (1,507 responses)

Figure 3.2 illustrates the gender distribution of the respondents. Male and female survey participants was split almost 50-50 with 50.7% males and 49.3% females.

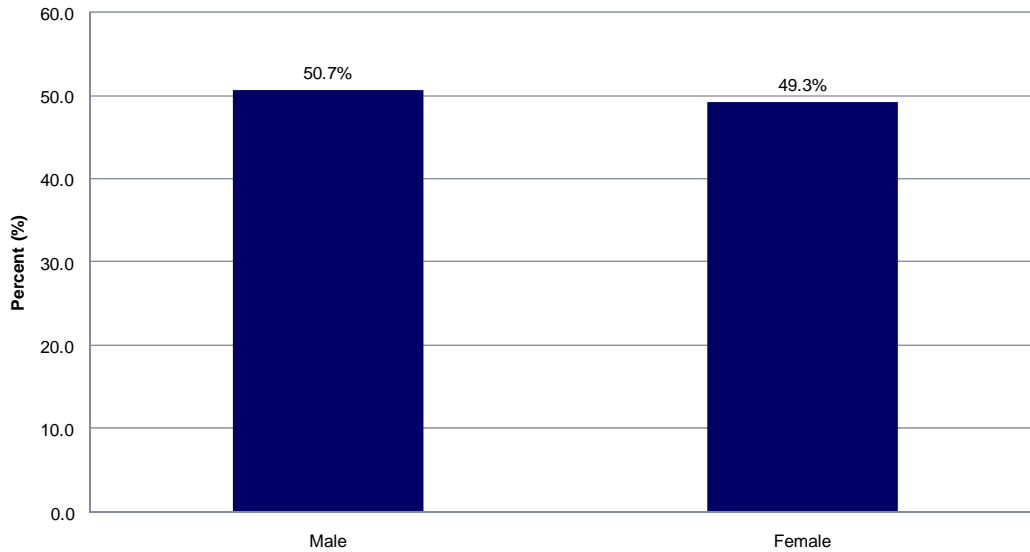


Figure 3.2: Respondent Sex (1,507 responses)

Figure 3.2 illustrates the ethnicity profile of the respondents. As can be seen, the respondents were primarily white or Caucasian (56.4%) followed by Hispanic or Latino (27.5%), African-American (8.8%), Asian American (3.4%), and other (3.8%).

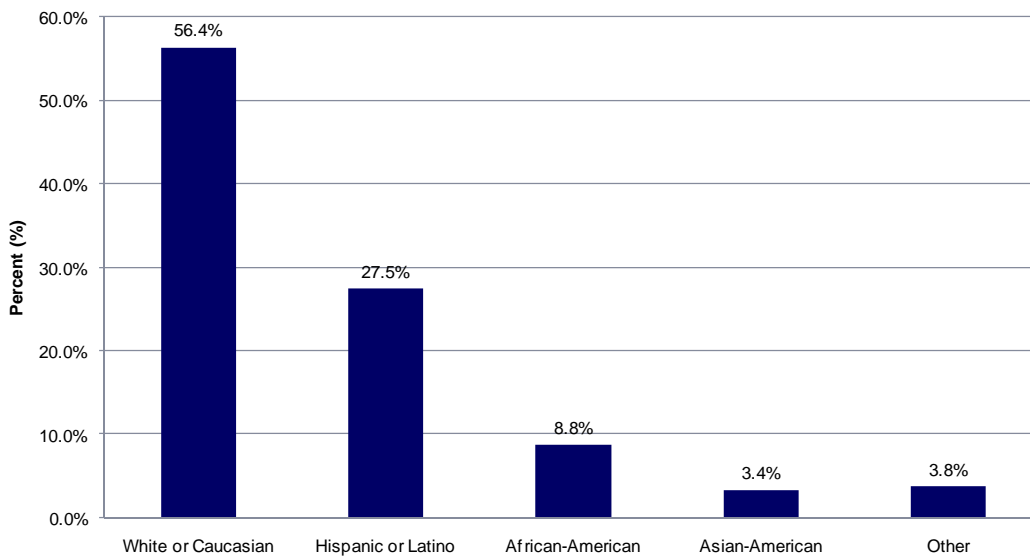


Figure 3.3: Ethnicity (1,436 responses)

Figure 3.4 illustrates the age profile of the respondents. As can be seen, the respondents were primarily between 26 and 35 years (28.1%) and 36 to 45 years (21.3%), followed by 46 to 55 years (15.7%), 55 to 65 years (12.2%), 16 to 25 years (11.6%), and more than 65 years (11.1%).

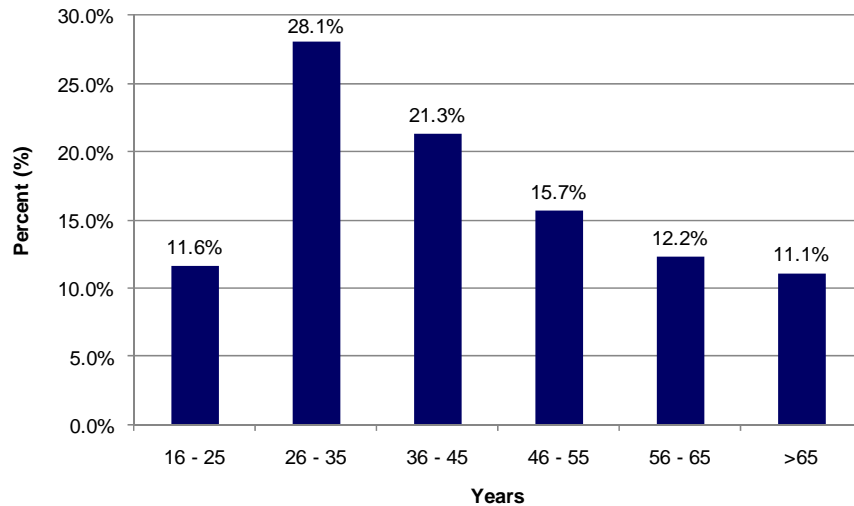


Figure 3.4: Age (1,507 responses)

Respondents live primarily in two person households (29.2%), followed by four-person households (20.4%), three-person households (17.5%), households with more than five people (17.4%), and finally living by themselves (15.5%) as can be seen in Figure 3.5.

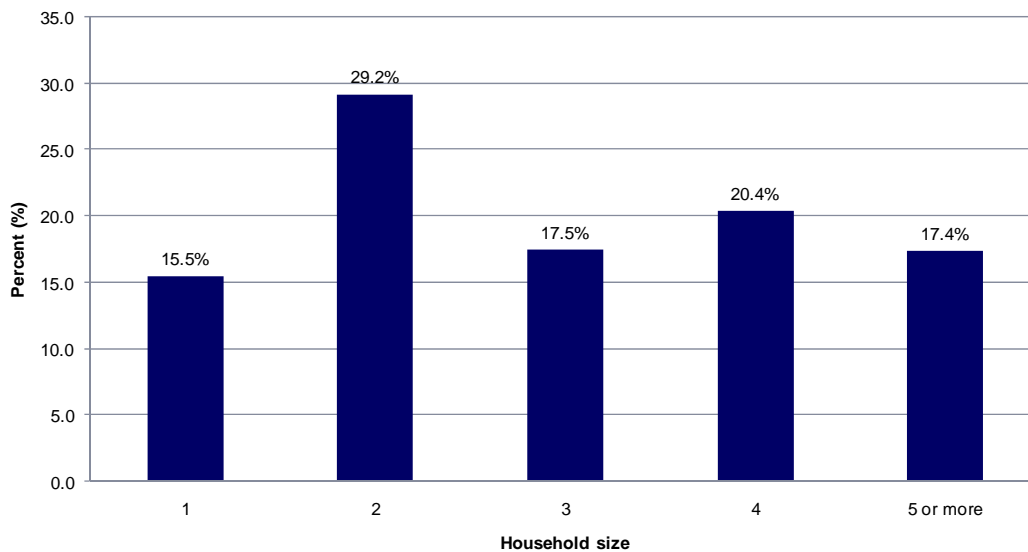


Figure 3.5: Household Size (1,507 responses)

When asked to describe the household type, the majority of the respondents were married with children (46.6%) as compared to married without children (16.6%), single (12.1%), single parents (7.7%), or living with unrelated adults (7.7%) (see Figure 3.6).

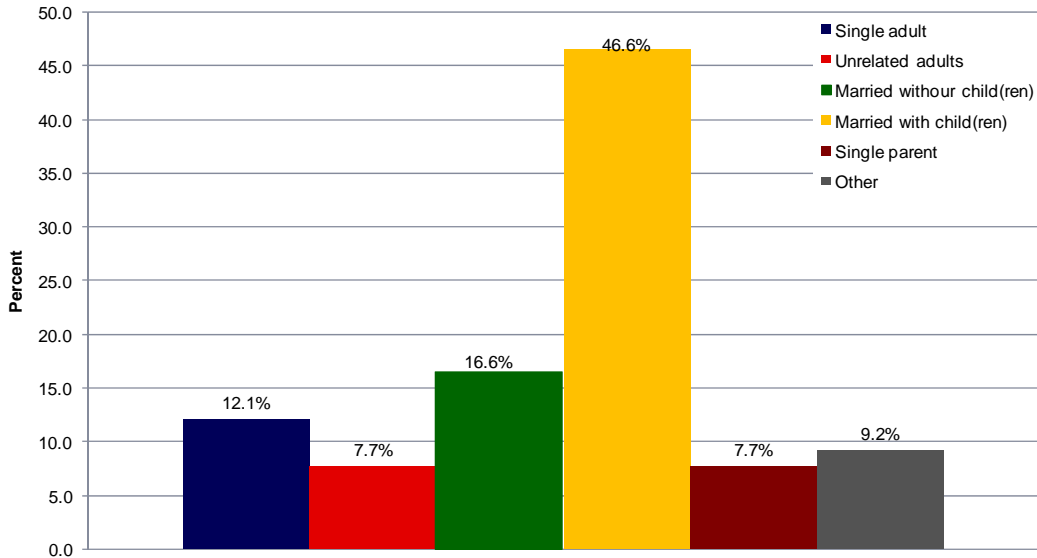


Figure 3.6: Household Type (1,464 responses)

When asked how many vehicles (including trucks, cars, and motorcycles) are available for use in the household, the respondents on average reported 3.03 vehicles. Most of the respondents (45.3%) reported two vehicles available for household use. On the other hand, a small percentage of the respondents 2.6% reported not having any vehicles available for use in their household (see Figure 3.7).

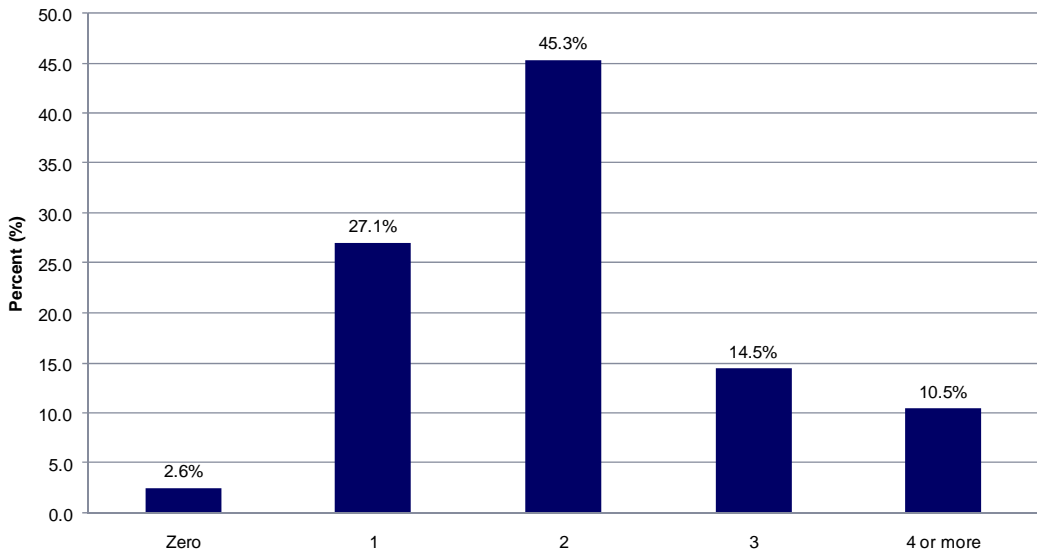


Figure 3.7: Number of Vehicles Available for Household Use (1,507 responses)

Figure 3.8 illustrates the income categories that the respondents reported for their 2007 annual household income. As can be seen, most of the respondents (23.1%) reported an annual 2007 household income of \$25,000 to \$49,999, 18.4 % reported less than \$25,000, and 13.9%

reported an annual household income of more than \$100,000. Finally, 17.7% of the respondents refused to answer this question.

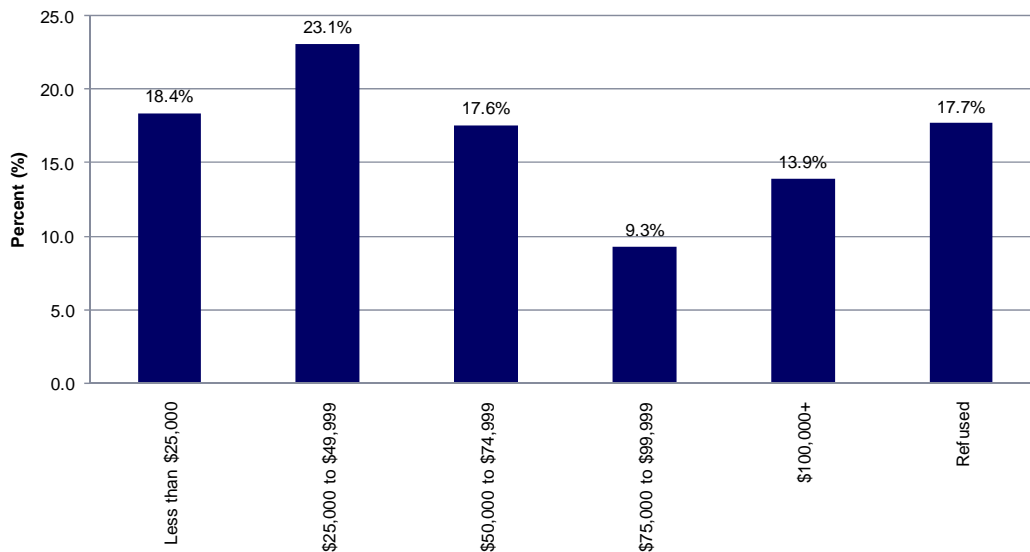


Figure 3.8: 2007 Household Income (1,507 responses)

Excluding the respondents that refused to answer the household income question resulted in 1,216 valid responses. A cross tabulation of income and ethnicity revealed that 39% of the White respondents and 41% of the Asian American respondents earned \$75,000 or more. In comparison, 12% of the Hispanic and 12% of the African American respondents earned \$75,000 or more. On the other hand, approximately 71% of the Hispanic and 65% of the African American respondents earned less than \$50,000 compared to 38% of the White and 46% of the Asian American respondents (see Table 3.4).

Table 3.4: Ethnicity by Income

Income	Ethnicity					Total
	White	Hispanic	African American	Asian American	Other	
Less than \$25,000	15%	35%	31%	14%	25%	22%
\$25,000 - \$49,999	23%	36%	34%	32%	13%	28%
\$50,000 - \$74,999	23%	18%	23%	14%	33%	21%
\$75,000 - \$99,999	14%	8%	4%	14%	13%	11%
\$100,000 and above	25%	4%	8%	27%	18%	17%

% within Ethnicity

Number of respondents = 1,216 data

In terms of education levels, 26.4% of the participants have a GED or high school qualification. Similarly 26.7% are college graduates, while 21.8% have at least some college or vocational education. Finally about 16.6% have a graduate degree (see Figure 3.9).

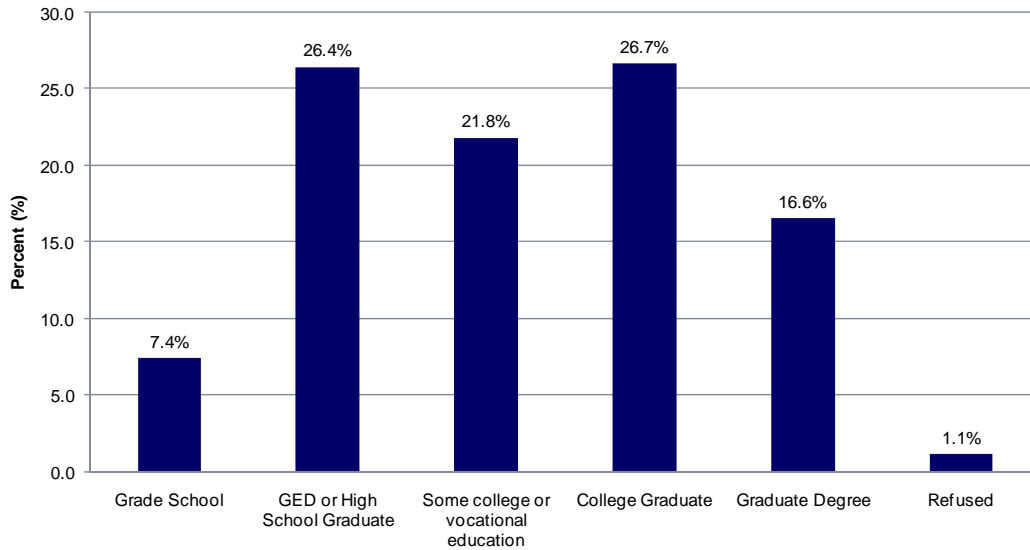


Figure 3.9: Education of Respondents (1507 responses)

Further analysis of the data revealed that 77% of those earning more than \$100,000 have a college degree or higher. On the other hand 62% of the respondents earning less than \$25,000 have a grade or high school education (see Table 3.5).

Table 3.5: Income by Education

Education	Income Categories					Total
	<\$25k	\$25-49.9k	\$50-74.9k	\$75-99.9k	>\$100k	
Grade School	15%	9%	9%	0%	1%	8%
High School	47%	37%	18%	13%	7%	27%
Some College	23%	26%	21%	26%	15%	22%
College Degree	12%	18%	32%	39%	44%	26%
Graduate Degree	4%	10%	21%	23%	33%	16%

% within Facility
 Number of respondents = 1,240

Finally, respondents were asked to indicate which Central Texas toll roads they are familiar with. Figure 3.10 shows that the majority of the respondents are familiar with the four toll road projects in the Central Austin area, particularly Loop 1 North and 183A, which more than 75% of the respondents indicated a familiarity with.

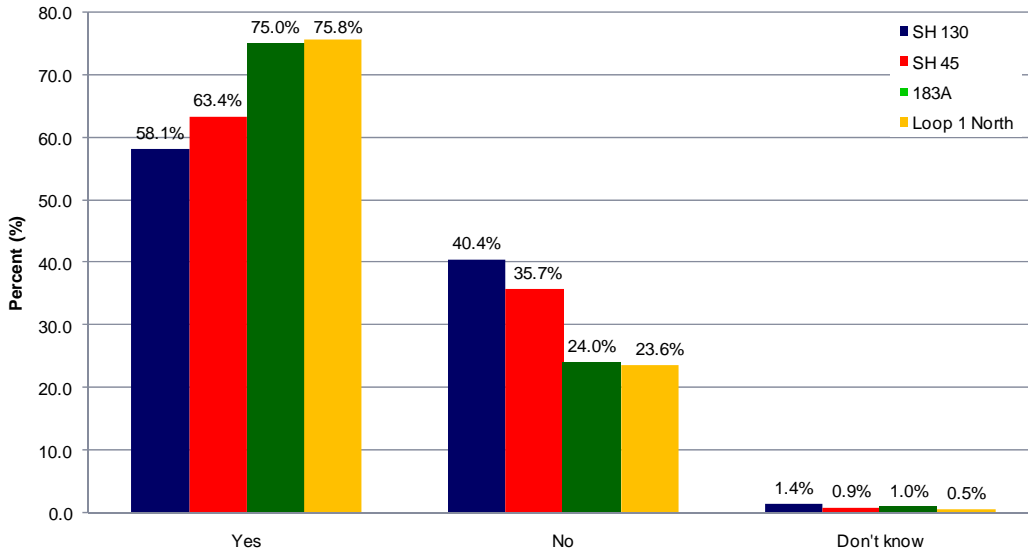


Figure 3.10: Toll Road Familiarity (1,507 responses)

Respondents were also asked whether they have used any of the four toll roads in the Central Texas area: i.e., SH 130, Loop 1 North, SH 45 North, or 183A. Of the total 1,507 respondents, 824 indicated that they have used a toll road in Central Texas and 683 indicated that they have not used any toll road in Central Texas. Respondents that indicated that they have used toll roads were asked to indicate which toll road they use most frequently. The responses are illustrated in Figure 3.11. As can be seen, SH 45, 183 A and Loop1 North are frequently used by about 25% respondents, while SH 130 is used less frequently (19.8% of the respondents).

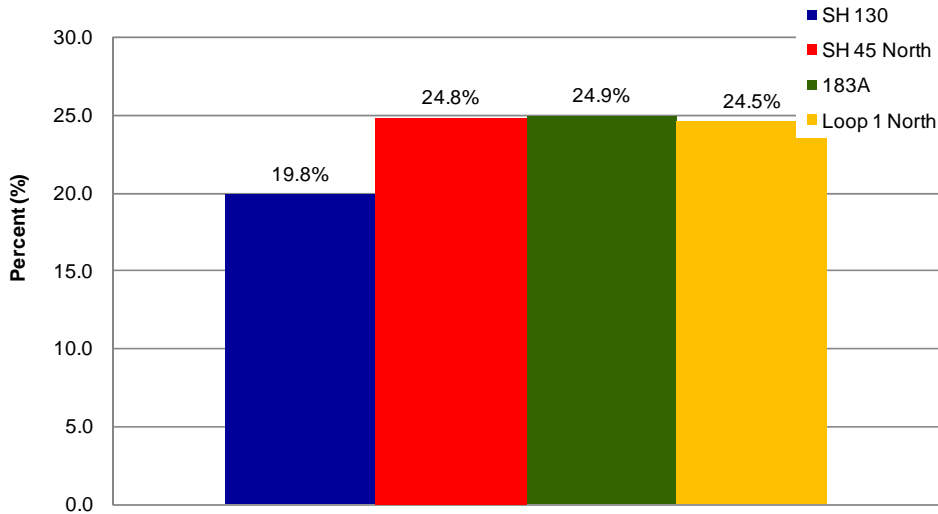


Figure 3.11: Toll Roads Used Frequently (824 respondents)

3.4 Statistical Tests

Finally, two statistical tests were conducted to analyze the relationship between specific demographic variables and toll road usage (i.e., Pearson chi-square test) and to determine if there

was any statistical difference between those that use toll roads and those that do not use toll roads (i.e., inferences concerning a difference between population proportions).

The Pearson's chi-square test was used as a “test of independence” to assess whether toll road usage is independent of specific demographic variables (e.g., ethnicity, gender, household structure, household type, vehicle ownership, etc.) at a 95% confidence level. The null hypothesis was thus that “*toll road usage is independent of the demographic variable (e.g., ethnicity).*” Subsequently, the Chi-square statistic (χ^2) was calculated as follows:

$$\chi^2 = \sum_{i=1}^n \frac{(O_i - E_i)^2}{E_i},$$

Where,

χ^2 = the test statistic that asymptotically approaches a χ^2 distribution,

O_i = the observed frequency,

E_i = the expected (theoretical) frequency, asserted by the null hypothesis, and

n = the number of possible outcomes of each event.

If the calculated value of χ^2 is smaller than the critical value at a 95% confidence level, the null hypothesis cannot be rejected. Therefore the data do not support any claims that there is an association between toll road usage and the demographic variable. However, if the calculated value of χ^2 is greater than the critical value at a 95% confidence level, the null hypothesis can be rejected, meaning that the data supports the claim that there is an association between toll road usage and race.

The inferences concerning a difference between sample proportions statistical test was conducted to assess whether the proportions (distribution) of responses differ between toll road users and non-toll road users. For example, the test was used to assess whether the gender profile (proportions) of toll road and non-toll road users is statistically different. The null hypothesis was that the proportion is the same for toll and non-toll road users, or $H_0: p_1 = p_2$, where p_1 and p_2 denotes the population proportions who possess a particular characteristic. For this test a Z-score is calculated as follows:

$$z = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\frac{\bar{p}\bar{q}}{n_1} + \frac{\bar{p}\bar{q}}{n_2}}}$$

Where,

$p_1 - p_2 = 0$ (assumed in the null hypothesis)

$\hat{p}_1 = \frac{x_1}{n_1}$ and $\hat{p}_2 = \frac{x_2}{n_2}$ are the sample proportions or alternatively stated the number of successes in the sample divided by the size of the sample, and

$$\bar{p} = \frac{x_1 + x_2}{n_1 + n_2}, \bar{q} = 1 - \bar{p}$$

The Z-score is subsequently converted to a P-value. The P-value is compared to the alpha value. When the P-value is smaller or equal to the alpha value, the null hypothesis is rejected and it can be concluded that the difference between the proportions (distribution) is significantly different.

3.5 Concluding Remarks

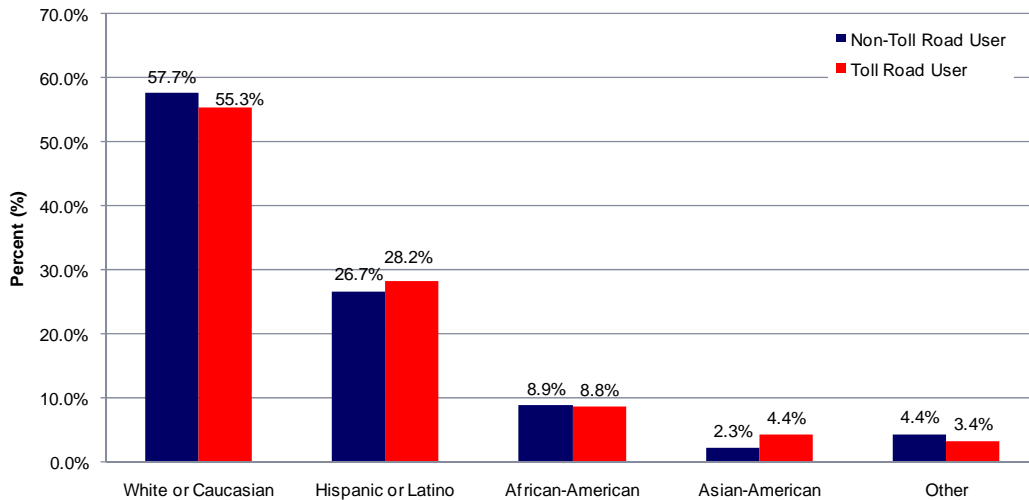
This Chapter described the survey method, detailed the sample characteristics, and described the statistical tests that were conducted as part of this study. As mentioned, the survey questions were developed in such a manner as to differentiate between the users and non-users of the CTTS. This allowed for the characterization of both the users and non-users in terms of their demographic attributes (see Chapter 4) and trip types (see Chapter 5).

Chapter 4. Demographic Characteristics of Users and Non-Users of Central Texas Toll Roads

One of the first survey questions asked was whether the respondent has used any of the four toll roads in Central Texas: SH 130, Loop 1 North, SH 45 North, or 183A. Respondents who indicated that they have used a toll road in Central Texas were categorized as toll road users (824 respondents). Respondents that reported that they have not used any toll road in Central Texas were categorized as non-toll road users (683 respondents). This Chapter summarizes the salient findings of this survey in terms of the demographic characteristics of those using and not using the Central Texas toll roads, and the results of the statistical tests that were conducted to determine the dependence of toll road usage on specific demographic variables (e.g., ethnicity, gender, household structure, household type, vehicle ownership, etc.) at a 95% confidence level.

4.1 Ethnicity

Figure 4.1 compares the ethnicity profile of the users and non-users of toll roads in the four counties surveyed in Central Texas. From Figure 4.1, the ethnicity profile of toll and non-toll road users appears similar. For example, the majority of toll road users and non-toll road users are White or Caucasian, i.e., 55.3% and 57.7%, respectively.



Toll road users: 781 responses
 Non-toll road users: 654 responses

Figure 4.1: Ethnicity Profile of Toll Road Users and Non-Toll Road Users

A chi-square test was thus conducted to assess whether there is an association between toll road usage and ethnicity. The null hypothesis was that toll road usage is independent of ethnicity at the 95% confidence level ($\alpha=0.05$). A chi-square analysis revealed that the test statistic is $\chi^2=6.2$. The critical value of χ^2 is 9.5. Because the test statistic is smaller than the critical value, there is not sufficient evidence to reject the null hypothesis. Thus the data do not support the claim that there is an association between toll road usage and ethnicity.

An analysis was also conducted to explore the ethnic profile of respondents by toll road. Table 4.1 illustrates the ethnicity profile by individual toll road, i.e., SH130, Loop 1 North, SH45 North, and 183A. From Table 4.1, it is evident that the users of SH130, Loop 1 North, and SH 45 North exhibit a similar ethnic profile. On the other hand, the users of 183A exhibit a very different ethnic profile with 54% of the users being White, 31% Hispanic, and 9% African American.

Table 4.1: Ethnicity Profile by Toll Road

Ethnicity	SH 130	Loop 1 N	SH 45 N	183A
White	70%	64%	68%	54%
Hispanic	18%	21%	18%	31%
African American	8%	7%	6%	9%
Asian American	3%	4%	6%	5%
Other	2%	5%	3%	2%

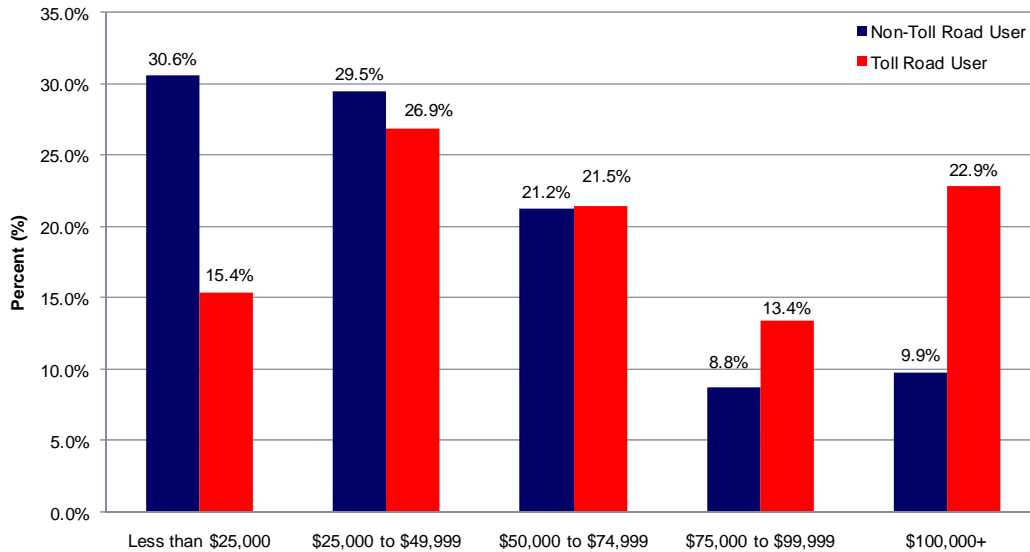
% within Facility

Number of responses = 1,575

A chi-square analysis was thus conducted to assess whether there is an association between individual toll road usage and ethnicity. The null hypothesis was that toll road usage by individual toll road is independent of ethnicity at the 95% confidence level ($\alpha=0.05$). A chi-square analysis revealed that the test statistic is $\chi^2=42.4$. The critical value of χ^2 is 21.0. Because the test statistic is larger than the critical value, there is sufficient evidence to reject the null hypothesis. Thus the data reveal that there is an association between individual toll road usage and ethnicity.

4.2 Income

In terms of income, a clear difference is evident in the profile of toll road users and non-users in Central Texas. As can be seen from Figure 4.2, 36.3% of the toll road users earned more than \$75,000 in 2007 compared to 18.7% of the non-users. Also, 60.1% of the non-users earn less than \$50,000 compared to 42.3% of the Central Texas toll road users. This finding corresponds to earlier study findings that reported toll roads being largely used by higher income households.



Toll road users: 670 responses
 Non-toll road users: 569 responses

Figure 4.2: Income Profile of Toll Road Users and Non-Toll Road Users

A chi-square test was conducted to assess whether there is an association between toll road usage and income. The null hypothesis was that toll road usage is independent of income at the 95% confidence level ($\alpha=0.05$). A chi-square analysis revealed that the test statistic is $\chi^2=69.3$. The critical value of χ^2 is 9.5. Because the test statistic is larger than the critical value, there is sufficient evidence to reject the null hypothesis. Thus the data support the claim that there is an association between toll road usage and income.

An analysis was also done to explore the income profile of respondents by Central Texas toll road (see Table 4.2).

Table 4.2: Income Profile by Toll Road

Income	SH 130	Loop 1 N	SH 45 N	183A
less than \$25,000	10%	10%	12%	18%
\$25,000 to \$49,999	20%	22%	17%	28%
\$50,000 to \$74,999	26%	26%	24%	18%
\$75,000 to \$99,999	15%	12%	17%	13%
\$100,000 or more	29%	30%	30%	23%

% within Facility
 Number of responses = 1,330

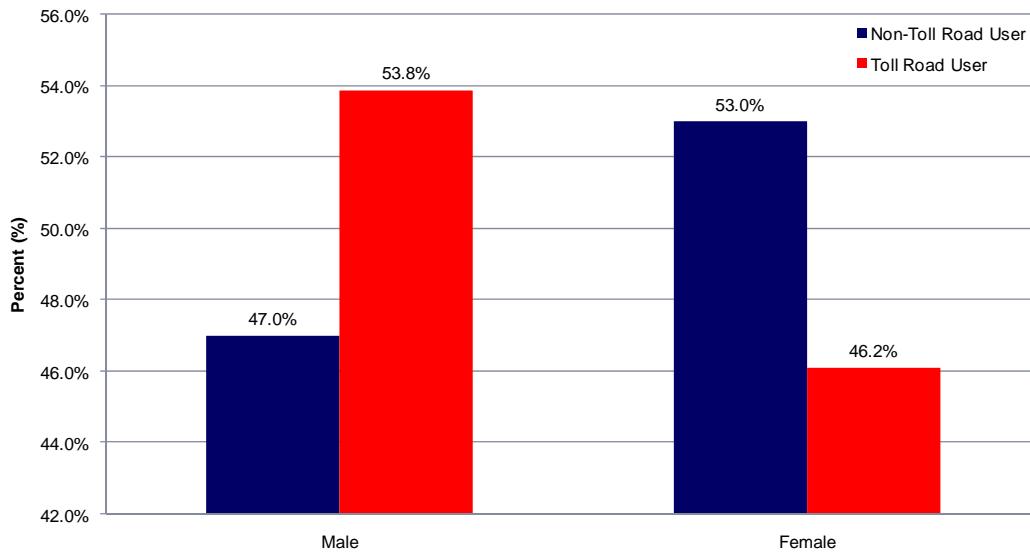
The income profile of the users of SH 130, Loop 1 North, and SH 45 North appears very similar with 29%, 30%, and 30% of the users respectively earning \$100,000 or more. Similarly, 10%, 10%, and 12% of the users of SH 130, Loop 1 North, and SH 45 North, respectively earned less than \$25,000. In the case of 183A, however, 23% of the users earn \$100,000 or more and 18% earn less than \$25,000.

A chi-square analysis was thus conducted to assess whether there is an association between individual toll road usage and income. The null hypothesis was that toll road usage by

individual road is independent of income at the 95% confidence level ($\alpha=0.05$). A chi-square analysis revealed that the test statistic is $\chi^2=36.8$. The critical value of χ^2 is 21.0. Because the test statistic is larger than the critical value, there is sufficient evidence to reject the null hypothesis. Thus the data reveal that there is an association between individual toll road usage and income.

4.3 Gender

Figure 4.3 illustrates the gender profile of toll road users and non-toll road users in Central Texas. It is interesting to note that a higher percentage of the toll road users are male (53.8%) compared to female (46.2%). On the other hand, in the case of non-toll road users, 53.0% were female and 47% were male.



Toll road users: 824 responses
 Non-toll road users: 683 responses

Figure 4.3: Gender Profile of Toll Road Users and Non-Toll Road Users

A sample proportion statistical test was conducted to assess whether the gender proportions (profile) of toll road and non-toll road users is statistically different. The null hypothesis is that the proportions are the same for toll and non-toll road users at the 95% confidence level ($\alpha=0.05$). The calculated Z-score is 2.661 and the associated p-value is 0.004. Because the p-value is smaller than 0.05, there is sufficient evidence to reject the null hypothesis. Thus it can be concluded that the gender profile of toll road and non-toll road users is statically different.

An analysis was also done to explore the gender profile of respondents by individual toll road. Table 4.3 illustrates the gender profile of individual toll roads in Central Texas.

Table 4.3: Gender Profile by Toll Road

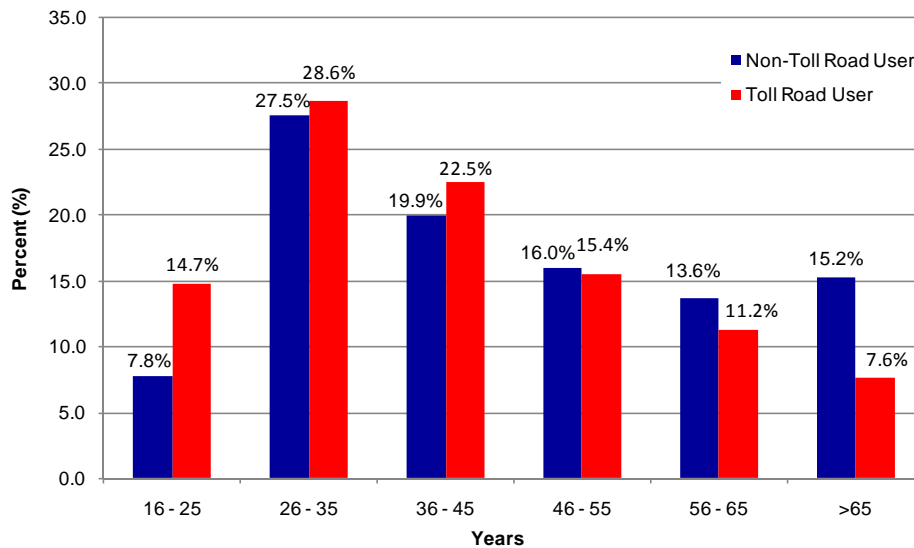
Gender	SH 130	Loop 1 N	SH 45 N	183A
Male	58%	54%	51%	55%
Female	42%	46%	49%	45%

% within Facility
 Number of responses = 1,662

As is evident from Table 4.3, in the case of SH 130, Loop 1 North, and 183A higher percentages of the individual toll road users are males. However, in the case of the SH 45 North users almost half the respondents were female (49%). A chi-square analysis was thus conducted to assess whether there is an association between individual toll road usage and gender. The null hypothesis was that toll road usage by individual road is independent of gender at the 95% confidence level ($\alpha=0.05$). A chi-square analysis revealed that the test statistic is $\chi^2=7.0$. The critical value of χ^2 is 7.8. Because the test statistic is smaller than the critical value, there is not sufficient evidence to reject the null hypothesis. Thus the data reveal that there is no association between individual toll road usage and gender.

4.4 Age

In terms of age, a difference seemed to exist in the profile of the Central Texas toll road users and non-users—i.e., toll road users appeared to be younger than non-toll road users. As can be seen from Figure 4.4, 65.8% of the Central Texas toll road users are younger than 46 years compared to 55.2% of the non-users. Also, only 7.6% of the toll road users are older than 65 years compared to 15.2% of the non-toll road users.



Toll road users: 824 responses
 Non-toll road users: 683 responses

Figure 4.4: Age Profile of Toll Road Users and Non-Toll Road Users

A chi-square test was subsequently conducted to assess whether there is an association between toll road usage and age. The null hypothesis was that toll road usage is independent of age at the 95% confidence level ($\alpha=0.05$). A chi-square analysis revealed that the test statistic is

$\chi^2=38.0$. The critical value of χ^2 is 11.1. Because the test statistic is larger than the critical value, there is sufficient evidence to reject the null hypothesis. Thus the data support the claim that there is an association between toll road usage and age.

An analysis was also done to explore the age profile of respondents by individual toll road. Table 4.4 illustrates the age profiles of SH 130, Loop 1 North, SH 45 North, and 183A.

Table 4.4: Age Profile by Toll Road

Age	SH 130	Loop 1 N	SH 45 N	183A
16 to 25	12.3%	7.4%	8.6%	16.6%
26 to 35	22.4%	26.4%	27.8%	29.8%
36 to 45	23.8%	27.9%	24.5%	20.3%
46 to 55	19.9%	17.9%	19.4%	14.4%
56 to 65	12.6%	12.6%	13.1%	12.6%
>65	9.0%	7.9%	6.5%	6.3%

% within Facility

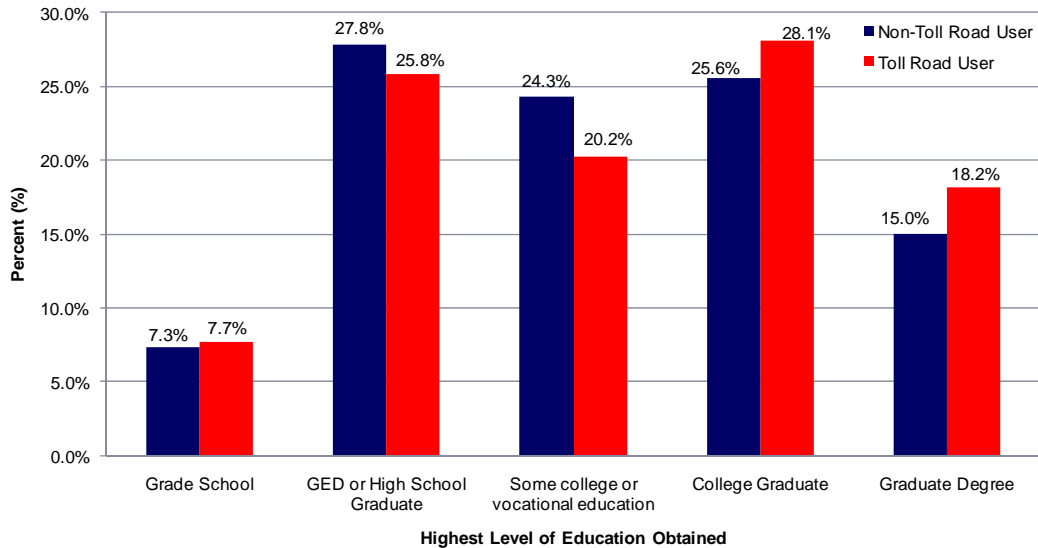
Number of responses = 1,664

As expected, the individual toll road users also tended to be younger than 46 years. In the case of SH 130, 58.5% of the respondents were younger than 46 years, for Loop 1 North 61.7% of the respondents were younger than 46 years, and for SH 45 North and 183A 61.0% and 66.7%, respectively of the respondents were younger than 46 years.

A chi-square analysis was also conducted to assess whether there is an association between individual toll road usage and age. The null hypothesis was that toll road usage by individual toll road is independent of age at the 95% confidence level ($\alpha=0.05$). A chi-square analysis revealed that the test statistic is $\chi^2=36.6$. The critical value of χ^2 is 25.0. Because the test statistic is larger than the critical value, there is sufficient evidence to reject the null hypothesis. Thus the data reveal that there is an association between individual toll road usage and age.

4.5 Education

Figure 4.5 illustrates the education profile of the users and non-users of Central Texas toll roads. From Figure 4.5, it appears that toll road users might have a higher level of education than non toll road users—i.e., 46.3% of toll road users have a college or graduate degree compared to 40.6% of non-toll road users.



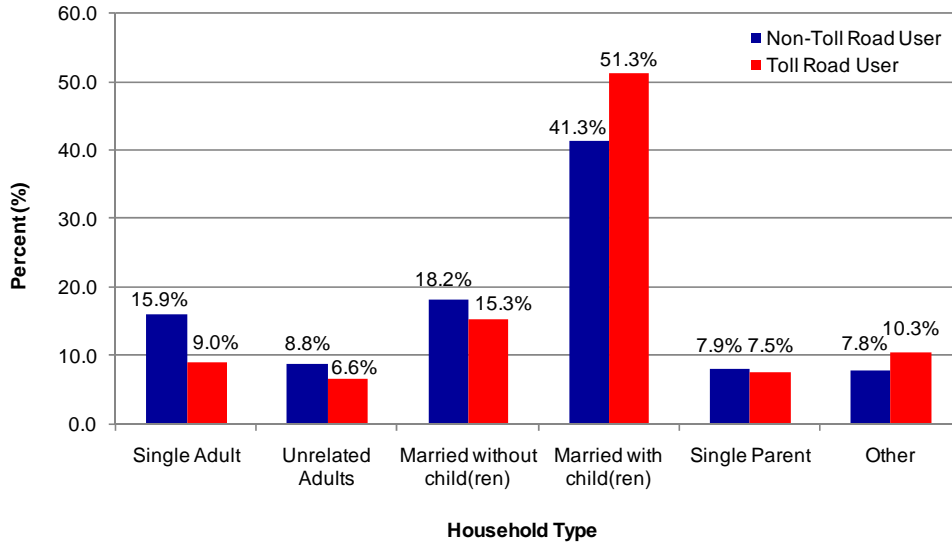
Toll road users: 809 responses
 Non-toll road users: 680 responses

Figure 4.5: Education Profile of Toll Road Users and Non-Toll Road Users

A chi-square test was thus conducted to assess whether there is an association between toll road usage and education. The null hypothesis was that toll road usage is independent of education at the 95% confidence level ($\alpha=0.05$). A chi-square analysis revealed that the test statistic is $\chi^2=6.5$. The critical value of χ^2 is 9.5. Because the test statistic is smaller than the critical value, there is not sufficient evidence to reject the null hypothesis. Thus the data do not support the claim that there is an association between toll road usage and education.

4.6 Household Structure

From Figure 4.6, it is clear that about half of the Central Texas toll road users are married with children compared to 41.3% of the non-toll road users. Also, of interest is the fact that 15.9% of the non-toll road users were single adults compared to 9.0% of the toll road users.



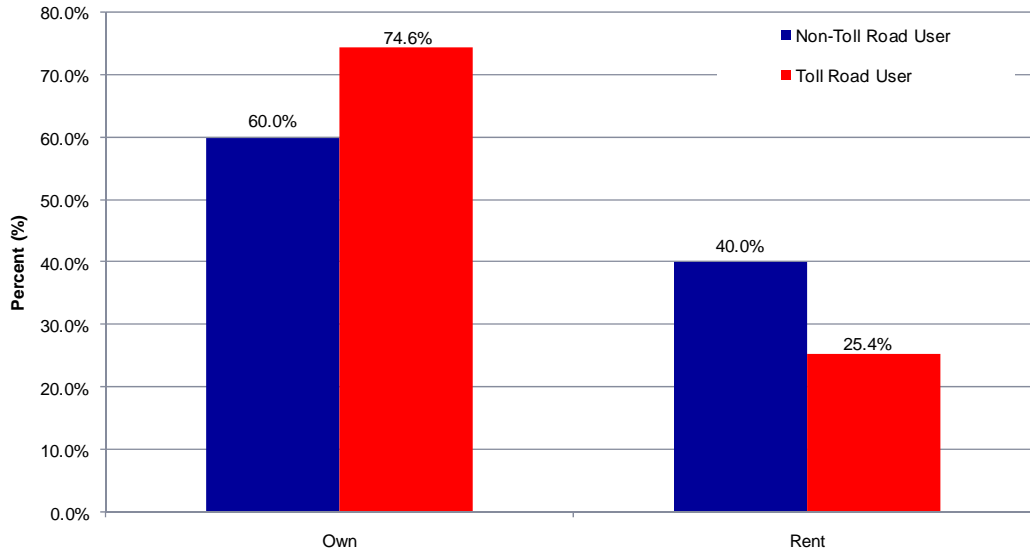
Toll road users: 813 responses
 Non-toll road users: 692 responses

Figure 4.6: Household Structure Profile of Toll Road Users and Non-Toll Road Users

A chi-square test was thus conducted to assess whether there is an association between toll road usage and household structure. The null hypothesis was that toll road usage is independent of household structure at the 95% confidence level ($\alpha=0.05$). A chi-square analysis revealed that the test statistic is $\chi^2=29.6$. The critical value of χ^2 is 11.1. Because the test statistic is larger than the critical value, there is sufficient evidence to reject the null hypothesis. Thus the data supports the claim that there is an association between toll road usage and household structure.

4.7 Home Ownership

The literature review conducted suggested that home ownership is a significant indicator of people’s adoption of electronic toll collection (ETC) and that it has some impact on their choice to use toll roads. The home ownership profiles of Central Texas toll road users and non-toll road users are shown in Figure 4.7. From Figure 4.7 it is evident that almost 75% of Central Texas toll road users own homes compared to 60% of the non-toll road users.



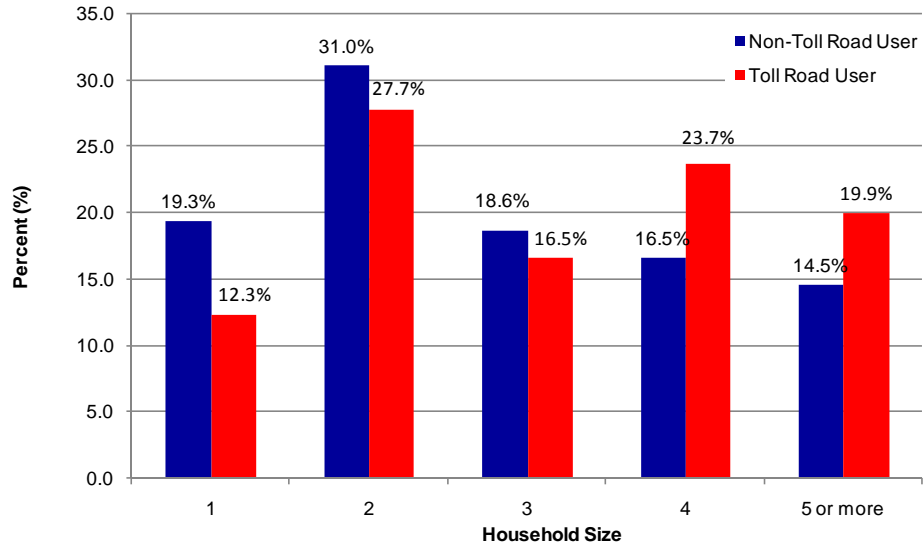
“Other Responses” have been excluded
 Toll road users: 786 responses
 Non-toll road users: 670 responses

Figure 4.7: Home Ownership Profile of Toll Road Users and Non-Toll Road Users

A sample proportion statistical test was conducted to assess whether the home ownership proportions (profile) of toll road and non-toll road users is statistically different. The null hypothesis is that the proportions are the same for toll and non-toll road users at the 95% confidence level ($\alpha=0.05$). The calculated Z-score is 5.927 and the associated p-value is 0. Because the p-value is smaller than 0.05, there is sufficient evidence to reject the null hypothesis. Thus it can be concluded that the household ownership profile of toll road and non-toll road users is statistically different.

4.8 Household Size

From the analysis of the household structure data, it was anticipated that at least 50% of the toll road users would live in households of at least three people (see Figure 4.6). Figure 4.8 illustrates the household size profile of toll road and non-toll road users in Central Texas. From Figure 4.8 it is evident that 27.7% of the toll road users in Central Texas are from two-person households, while 60.1% of toll road users are from households with three or more members. In comparison, 31.0% of non-toll road users are from two-person households and 49.6% are from households with three or more members.



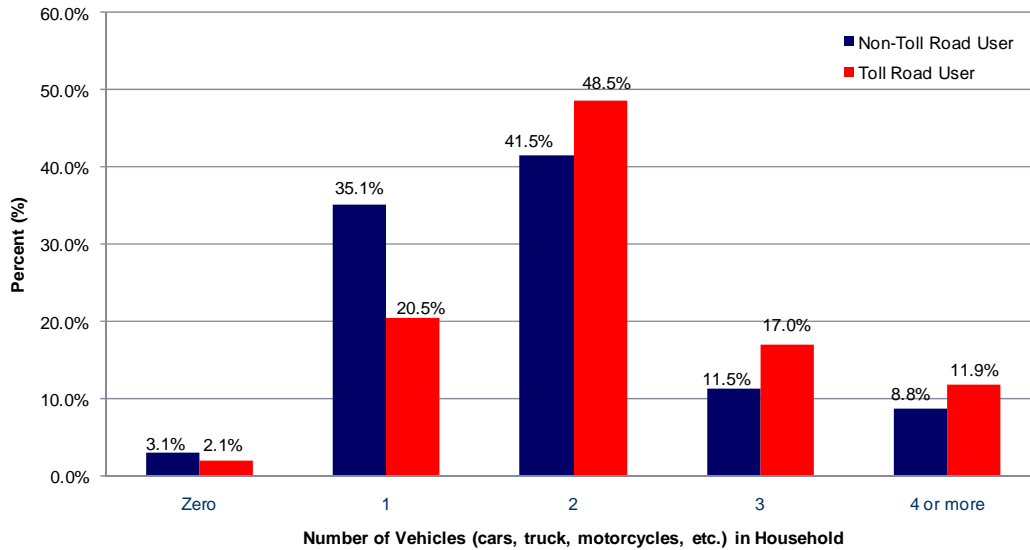
Toll road users: 824 responses
 Non-toll road users: 683 responses

Figure 4.8: Household Size Profile Toll Road Users vs. Non-toll Road Users

A chi-square test was thus conducted to assess whether there is an association between toll road usage and household size. The null hypothesis was that toll road usage is independent of household size at the 95% confidence level ($\alpha=0.05$). A chi-square analysis revealed that the test statistic is $\chi^2=30.0$. The critical value of χ^2 is 9.5. Because the test statistic is larger than the critical value, there is sufficient evidence to reject the null hypothesis. Thus the data support the claim that there is an association between toll road usage and household size.

4.9 Number of Vehicles

Figure 4.9 illustrates the number of vehicles (e.g., cars, trucks, motorcycles) available to toll road users and non-toll road users in Central Texas. From Figure 4.9 it is evident that 77.4% of toll road users reported to have access to two or more vehicles—compared to 61.8% of non-toll road users. It is also interesting that 2.1% (17 toll road users) reported to have zero vehicles available for use in their household. Approximately 35% of non-toll road users and 20.5% of toll road users reported to have access to only one vehicle.



Toll road users: 824 responses
 Non-toll road users: 683 responses

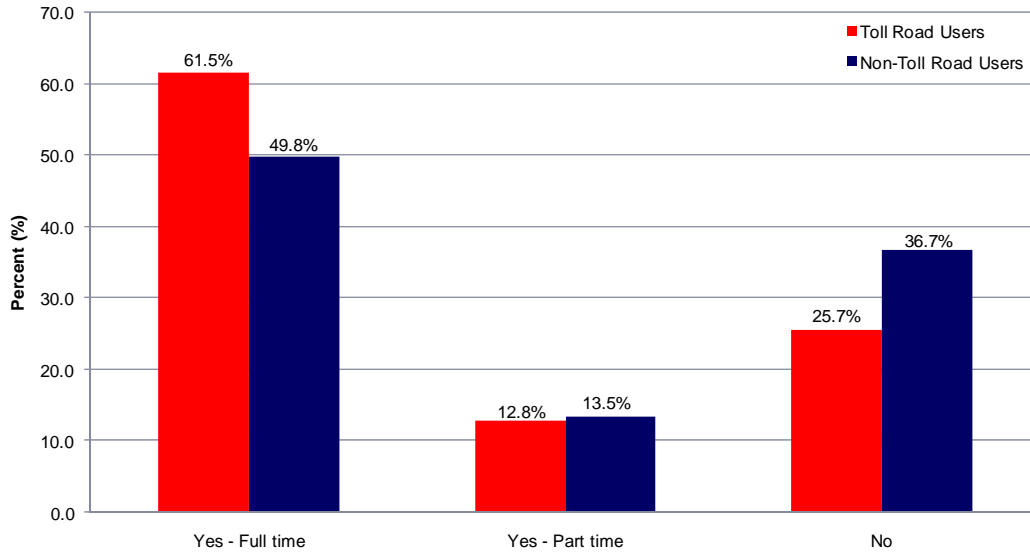
Figure 4.9: Vehicle Profile of Toll Road and Non-toll Road Users

A chi-square test was thus conducted to assess whether there is an association between toll road usage and the number of vehicles available to households. The null hypothesis was that toll road usage is independent of the number of vehicles that households have access to at the 95% confidence level ($\alpha=0.05$). A chi-square analysis revealed that the test statistic is $\chi^2=46.4$. The critical value of χ^2 is 9.5. Because the test statistic is larger than the critical value, there is sufficient evidence to reject the null hypothesis. Thus the data support the claim that there is an association between toll road usage and the number of vehicles available to households.

4.10 Employment³

Figure 4.10 provides the employment profile of toll road users and non-toll road users in Central Texas. From Figure 4.10, it is evident that 74.3% of toll road users are employed compared to 63.3% of the non-toll road users. Furthermore, 61.5% of the toll road users reported to be employed full time compared to 49.8% of the non-toll road users.

³ The responses were verified by conducting a cross tabulation of employment by commuter usage of toll roads in Central Texas. The analysis revealed that no toll road user that reported not being employed used a toll road for any work-related trips—all their reported toll trips were non-work related.



Toll road users: 823 responses
 Non-toll road users: 683 responses

Figure 4.10: Employment Profile of Toll Road and Non-toll Road Users

A chi-square test was thus conducted to assess whether there is an association between toll road usage and employment. The null hypothesis is that toll road usage is independent of employment at the 95% confidence level ($\alpha=0.05$). A chi-square analysis revealed that the test statistic is $\chi^2=24.4$. The critical value of χ^2 is 6.0. Because the test statistic is larger than the critical value, there is sufficient evidence to reject the null hypothesis. Thus the data support the claim that there is an association between toll road usage and employment.

4.11 Concluding Remarks

A number of important insights were obtained from the statistical tests that were conducted to determine the association between toll road usage and specific demographic variables. Some of the salient findings include the statistical association at the 95% confidence level between toll road usage and household income, age, household structure, household size, the number of vehicles available to households, and employment. In addition, no statistical association was found between ethnicity and toll road usage or education and toll road usage at the 95% confidence level. Finally, the data analysis revealed a statistically significant difference between the gender profile and home ownership profile of toll road and non-toll road users. Specifically, a higher percentage of males use toll roads and a higher percentage of home owners use toll roads. The next chapter provides insight into the trip characteristics of toll road users and non-users in Central Texas.

Chapter 5. Trip Characteristics of Users and Non-Users of Central Texas Toll Roads

Although respondents were categorized as toll road users and non-toll road users, it needs to be pointed out that this does not translate in those characterized as toll road users using toll roads for all trip purposes or for all trips of a particular trip type. This chapter summarizes the responses and analysis that were conducted in an effort to characterize the trip characteristics of toll road users and non-toll road users in Central Texas, including trip profile, trip frequency, transportation mode, trip times, and reasons for using or not using toll roads by trip type.

5.1 Commuter Trips

The literature review revealed that commuters often find toll roads an attractive alternative, because commuting travel typically occurs during the congested AM and PM peak periods and the commuter typically needs to be at their destination by a specific time. Typically, the majority of trips made on urban toll roads are thus commute trips to and from work. Survey respondents that work full or part time were thus asked whether they commute to work. Figure 5.1 illustrates that 72.2% of the toll road users⁴ and 83.1% of the non-toll road users, who are employed full or part time, commute to work.

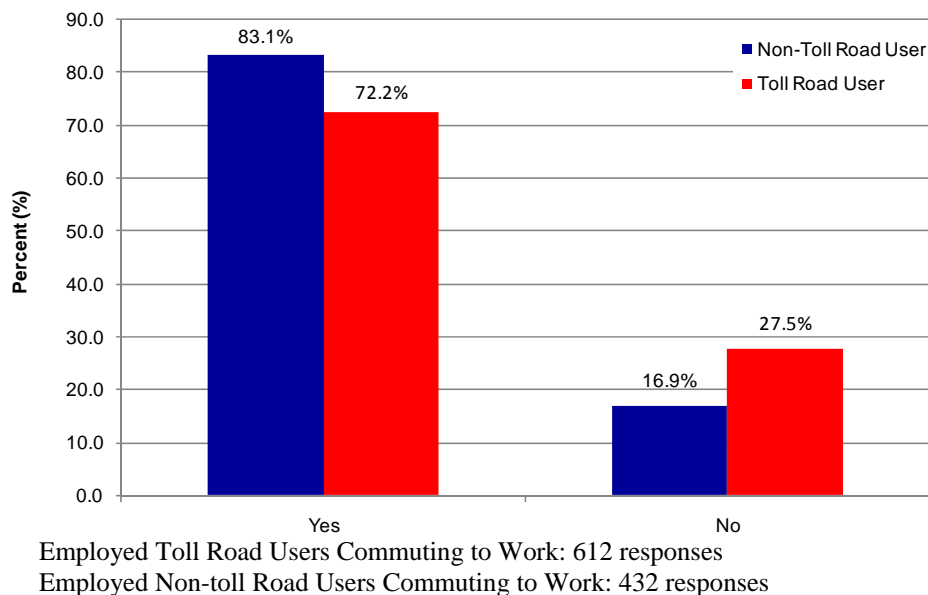


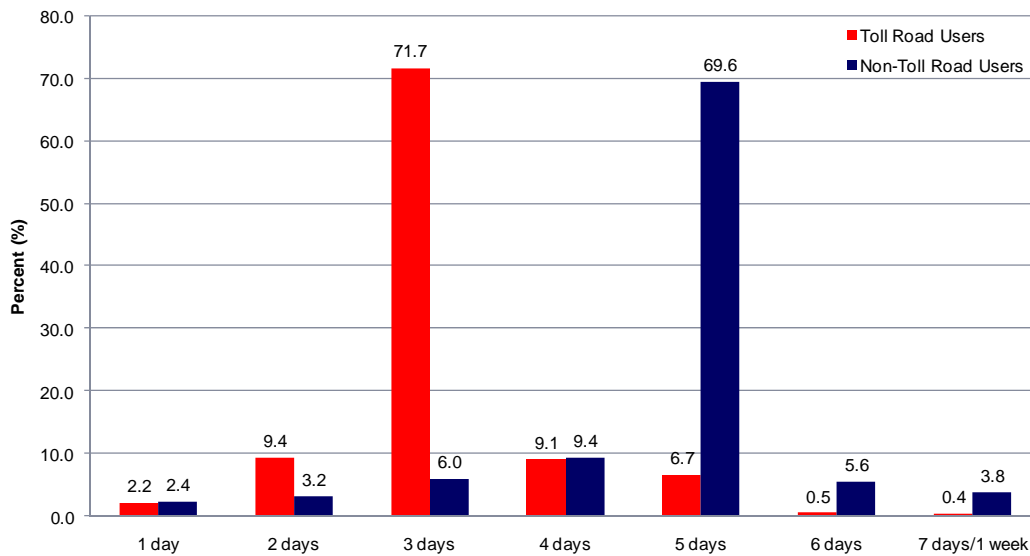
Figure 5.1: Commuting Profile of Toll Road and Non-Toll Road Users

A sample proportion statistical test was conducted to assess whether the commuting proportions (profile) of toll road and non-toll road users is statistically different. The null

⁴ Toll road users are respondents who indicated that they have used a toll road in Central Texas and respondents that reported that they have not used any toll road in Central Texas were categorized as non-toll road users. Toll road users in this case do not necessarily use a toll road for commuting purposes.

hypothesis is that the proportions are the same for toll and non-toll road users at the 95% confidence level ($\alpha=0.05$). The calculated Z-score is 4.1 and the associated p-value is 0.000. Because the p-value is smaller than 0.05, there is sufficient evidence to reject the null hypothesis. Thus it can be concluded that the commuting profile of toll road and non-toll road users is statistically different.

Respondents who commute to work were also asked how many days/week they commute to work. Figure 5.2 illustrates the commute frequency of toll roads users and non-toll road users. From Figure 5.2 it is evident that 71.7% of toll road users commute three days per week while 69.6% of non-toll road users commute five days per week. It thus appeared that toll road users commute less frequently than non-toll road users.



Toll road users who commute to work: 442 responses
 Non-toll road users who commute to work: 361 responses

Figure 5.2: Commute Frequency (days/week) of Toll Road and Non-Toll Road Users

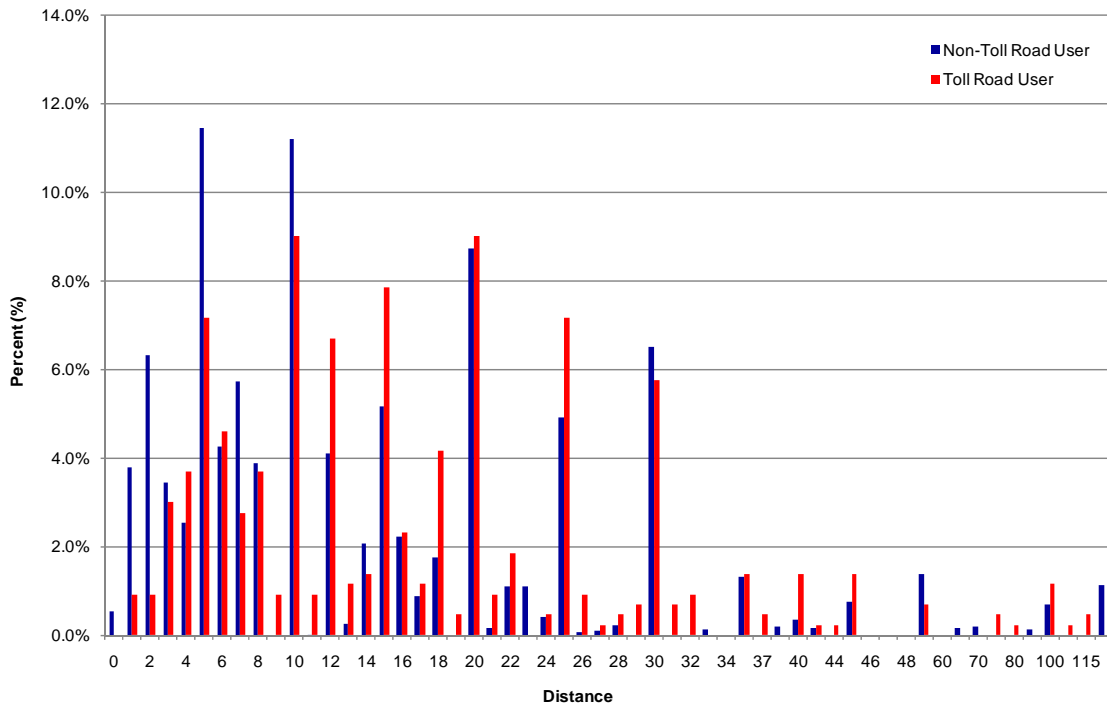
Toll road users who commute to work were subsequently asked to indicate how many days per week they use a toll road to commute to work. Commute frequency was then cross-tabulated with toll road users' usage of toll roads for commuting. As can be seen from Table 5.1, 100% of the respondents that commute once per week use a toll road for their commuting trips. Of those that commute three days per week, approximately 35% of the respondents don't use a toll road, 31% use a toll road one day per week, and approximately 17% use a toll road two and three days per week to commute to work. Finally, approximately 30% of respondents that commute to work seven days per week use a toll road each of the seven days. Most toll road users that commute to work, however, do not use a toll road for every commute trip.

Table 5.1: Percentage (%) of Commuting Days Using Toll Roads

Number of Days Using Toll Road for Commute	Number of Commuting Days/Week						
	1	2	3	4	5	6	7
0		50.0%	34.5%	60.0%	63.5%	56.1%	60.0%
1	100.0%		31.0%	17.5%	6.0%	12.2%	10.0%
2		50.0%	17.2%	2.5%	3.8%	4.9%	
3			17.2%		5.7%	7.3%	
4				20.0%	2.5%	4.9%	
5					18.6%	4.9%	
6						9.8%	
7							30.0%

% within Days/Week Commute
 Number of respondents = 442

Respondents that commute to work were asked to indicate how many miles their work location was from their home. Figure 5.3 illustrates the responses from the toll road users and the non-toll road users. On average, toll road users live 18.2 miles from their place of employment compared to non-toll road users who live, on average, 15.5 miles from their place of employment.



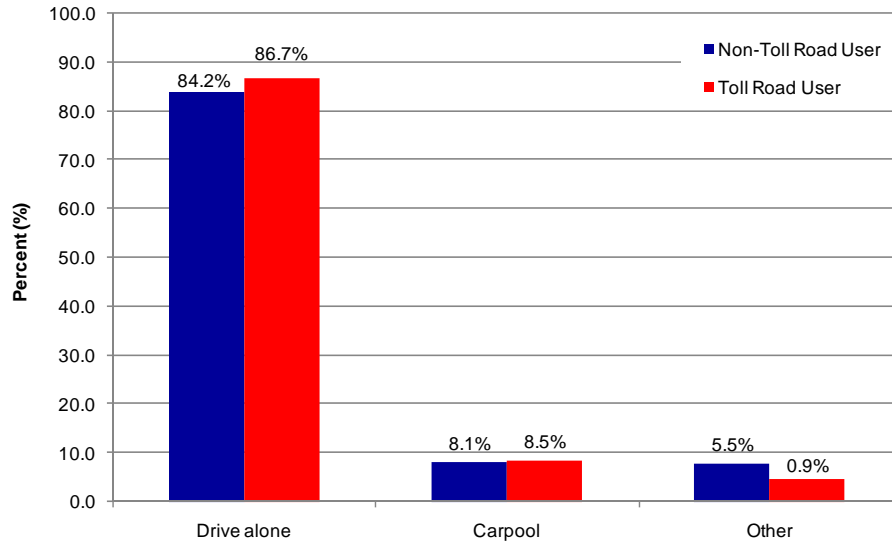
Note: Responses of a commute distance in excess of 120 miles were considered outliers and were subsequently deleted from the data set.

Toll Road Users who Commute to Work: 434 responses

Non-toll Road Users who Commute to Work: 350 responses

Figure 5.3: Distance to Work Profile for Toll Road and Non-Toll Road Users

Respondents that commute to work were also asked about the transportation mode used for the commute trip. From Figure 5.4, it is evident that the majority of toll road users (86.7%) and non-toll road users (84.2%) reported to drive alone, compared to 8.5 and 8.1 % that carpool, and 0.9 and 5.5% that take the bus, respectively.

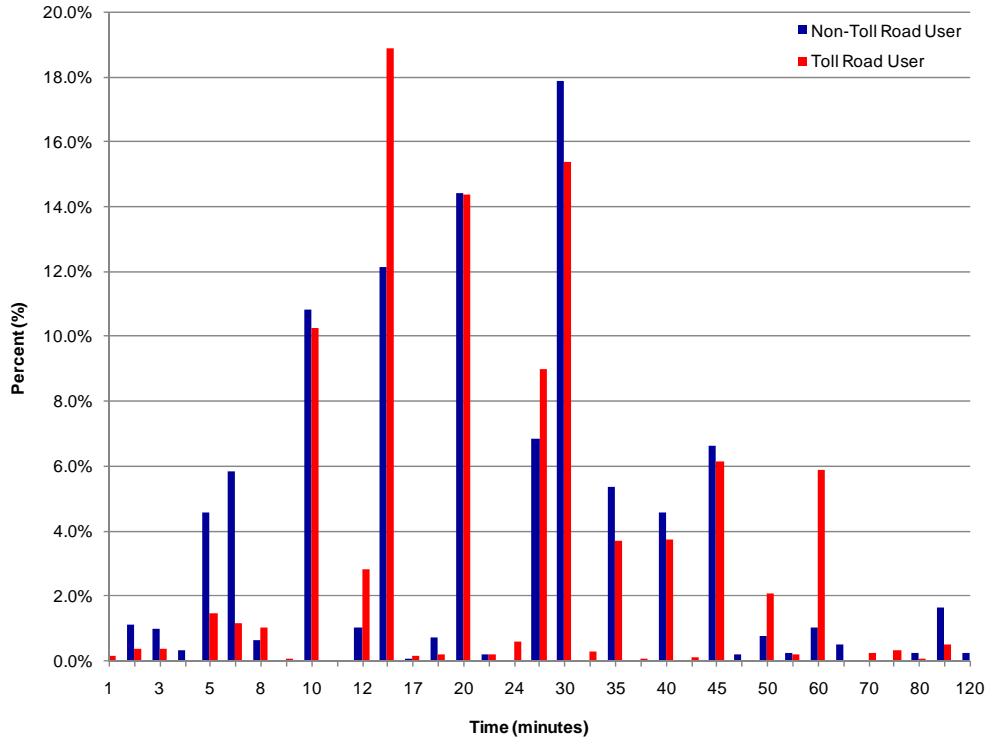


“Other” includes respondents that reported walk, bicycle, and take a bus
Toll road users who commute to work: 457 responses
Non-toll road users who commute to work: 395 responses

Figure 5.4: Mode of Transportation to Work for Toll Road and Non-Toll Road Users

A chi-square test was thus conducted to assess whether there is an association between toll road usage and transportation mode used to commute to work. The null hypothesis was that toll road usage is independent of transportation mode used to commute to work at the 95% confidence level ($\alpha=0.05$). A chi-square analysis revealed that the test statistic is $\chi^2=14.6$. The critical value of χ^2 is 6.0. Because the test statistic is larger than the critical value, there is sufficient evidence to reject the null hypothesis. Thus the data support the claim that there is an association between toll road usage and the transportation mode used to commute to work.

One of the reasons commuters use toll roads is to save travel time and therefore all respondents were asked what their average commute times to and from work were. Toll road users who commute to work reported an average commute time to work of 35.4 minutes and non-toll road users reported an average commute time to work of 24.28 minutes. Figure 5.5 illustrates the commute time to work profile of toll road users and non-toll road users.



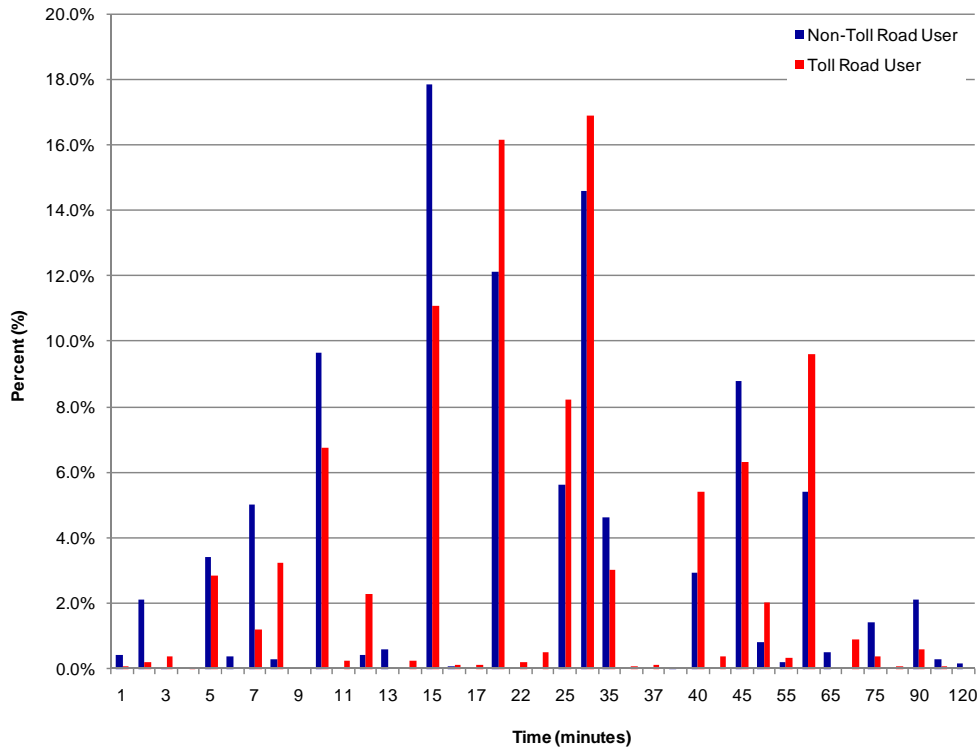
Note: Responses of a commute time in excess of 120 minutes were considered outliers and were subsequently deleted from the data set.

Toll road users who commute to work: 441 responses

Non-toll road users who commute to work: 358 responses

Figure 5.5: Commute Time To Work Profile of Toll Road and Non-Toll Road Users

Similarly, toll road users reported an average commute time to home of 32.65 minutes and non-toll road users reported an average commute time to home of 26.96 minutes. Figure 5.6 illustrates the commute time to home profile of toll road users and non-toll road users.



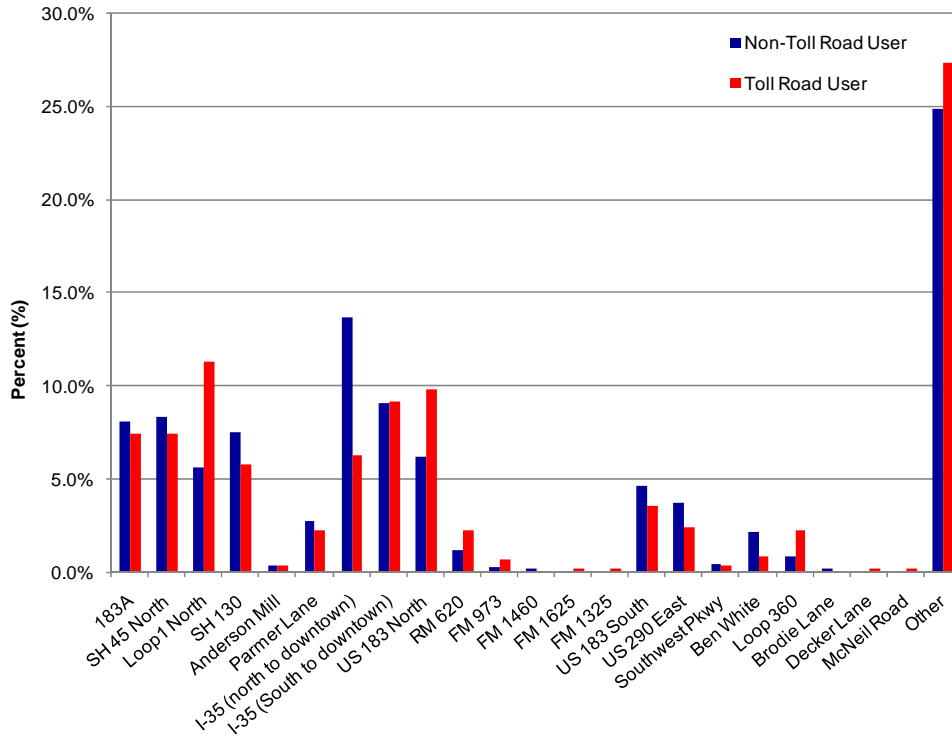
Note: Responses of a commute time in excess of 120 minutes were considered outliers and were subsequently deleted from the data set.

Toll road users who commute to work: 441 responses

Non-toll road users who commute to work: 359 responses

Figure 5.6: Commute Time from Work Profile of Toll Road and Non-Toll Road Users

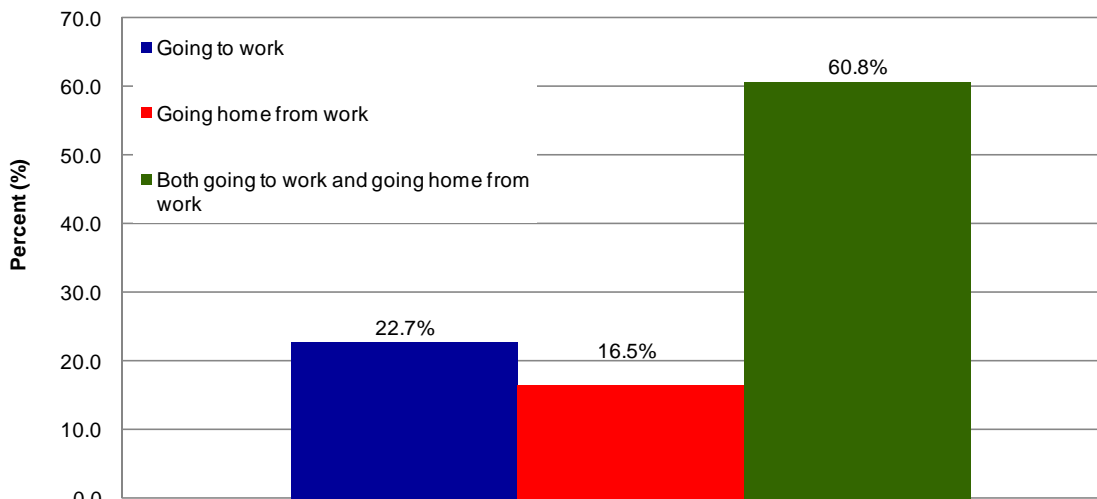
A number of questions were also included to gain a better understanding of the roads used by respondents, specifically when and which toll roads are used for commuting purposes, and the reasons why respondents use or don't use toll roads. Figure 5.7 illustrates the reported roads that toll road users and non-toll road users typically use to commute *to work*. Figure 5.7 illustrates the importance of IH 35, 183 (A and North), SH 45 North, Loop 1 North, and SH 130 as commuting routes for both toll road and non-toll road users in Central Texas.



Toll road users who commute to work by driving alone or carpool: 621 responses
 Non-toll road users who commute to work by driving alone or carpool: 694 responses

Figure 5.7: Routes Used to Work of Toll Road and Non-Toll Road Users

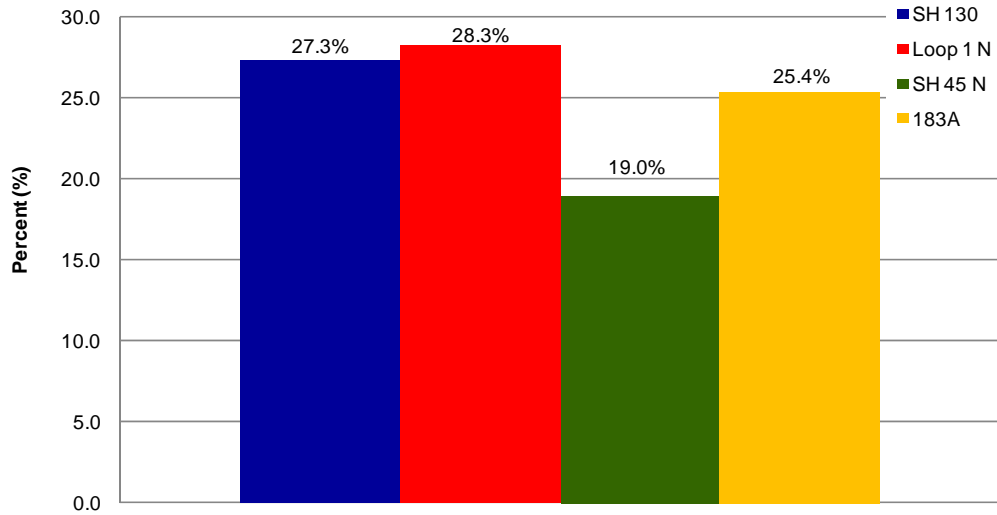
Toll road users who use toll roads for commuting to work were specifically asked to indicate when they use the toll road. As is evident from Figure 5.8, almost 61% of the respondents that use a toll road for the commuting trip use it both for going to work and going home from work.



Toll road users who commute to work using a toll road: 176 responses

Figure 5.8: Commute Trip for Which Toll Roads are Used

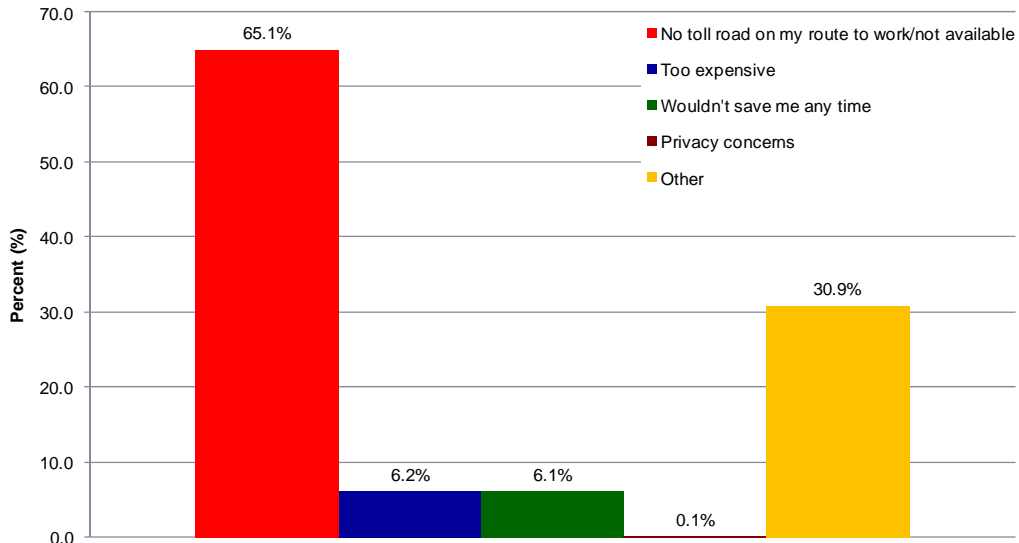
Toll road users who commute to work and use toll roads were also asked to specifically indicate which toll roads they use most often to commute to work. As is evident from Figure 5.9, SH 130 and Loop 1 North were the most frequently mentioned, representing 27.3% and 28.3% of the responses, respectively.



Toll road users who commute to work using a toll road: 205 responses

Figure 5.9: Commute Trip for Which Toll Roads are Used

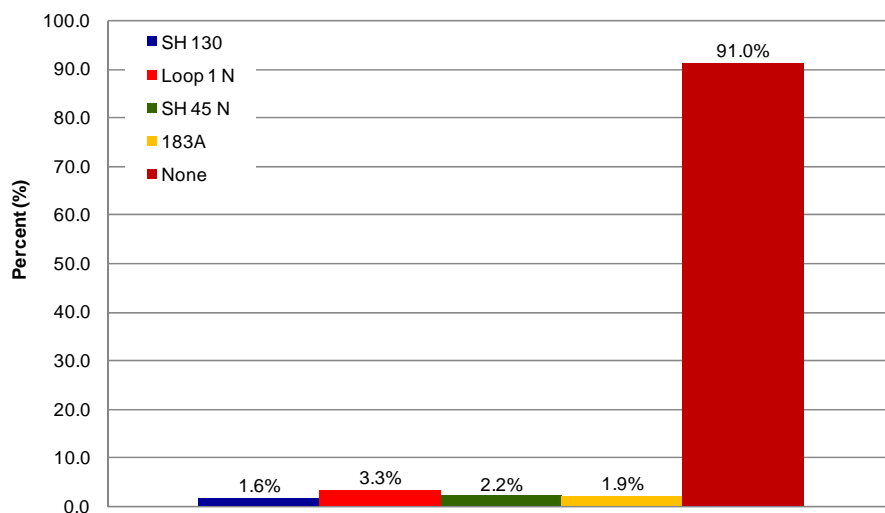
Toll road users who commute to work and do not use a toll road for the commute trip and non-toll road users who have the option of using a toll road for their commute trip were asked the reasons for not using a toll road to commute the work. Figure 5.10 illustrates the reasons provided by toll road users who commute to work for not using a toll road for the commute trip. As is evident from Figure 5.10, the majority of toll road users (about 65%) do not use a toll road to commute to work because no toll road alternative is available for their commuting route. A comparatively lower percentage does not use a toll road for the commute trip because it is too expensive (6.2%) and it would not save any travel time (6.1%). As mentioned earlier, unfortunately the “other” responses were not recorded.



Toll road users who commute to work, but do not use toll roads for commute trip: 287 responses

Figure 5.10: Toll Road Users' Reasons for Not Using Toll Road

Non-toll road users who commute to work were asked if a toll road alternative was available for their commute trip. Figure 5.11 illustrates the toll road alternatives available to non-toll road users for their commute trip. From Figure 5.11, it is evident that almost 91% of the respondents felt that none of the existing toll roads provide a viable alternative to their current route for their commute trip.

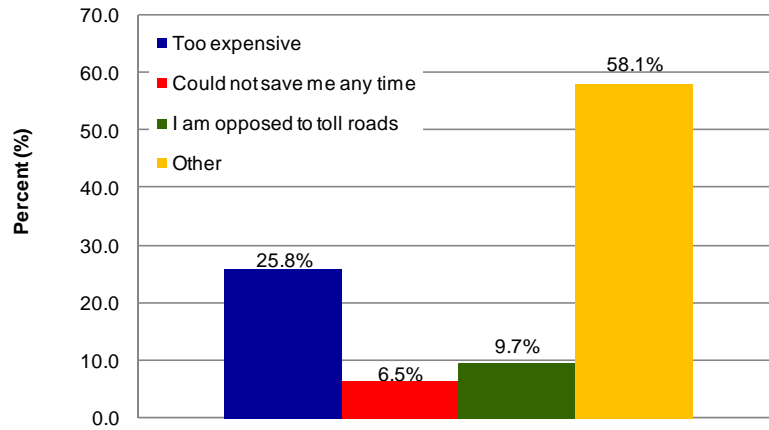


Non-toll road users who commute to work: 366 responses

Figure 5.11: Available Toll Roads to Non-Toll Road Users for Commute Trip

The 33 respondents for whom a toll road alternative was available were subsequently asked the reason for not using a toll road for the commute trip. Figure 5.12 provides the responses of 31 non-toll road users as to why they are not using a toll road for the commute trip.

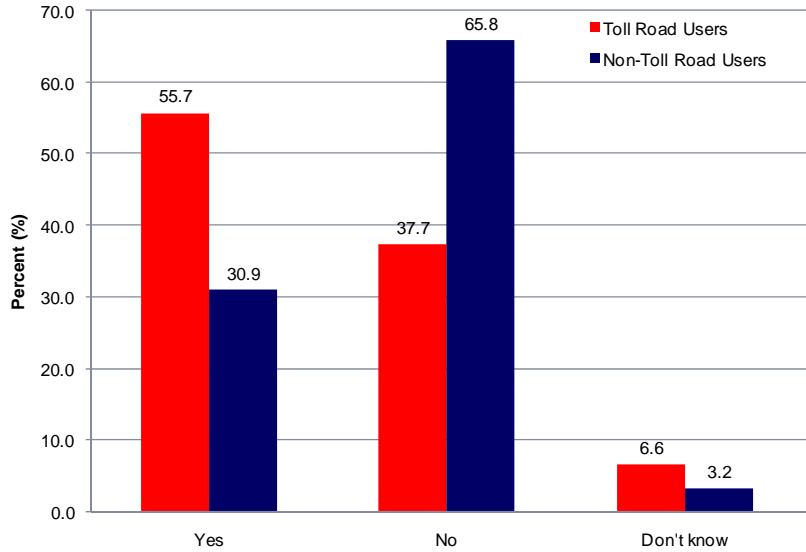
As can be seen from Figure 5.12, 31% of the respondents indicated that the available toll roads were too expensive. Also, it should be pointed out that no respondents indicated “privacy concerns” or “distrust of the government” as a reason for not using the available toll roads.



Non-toll road users who commute to work and for whom a toll alternative is available: 31 responses

Figure 5.12: Reasons Why Non-Toll Road Users Do Not Use Available Toll Roads for Commute Trip

Because the main reason commuters did not use toll roads for their commute was that there were no toll road alternatives available (see Figure 5.10 and 5.11), both toll road users who do not use toll roads for their commute trip and non-toll road users who commute to work, were subsequently asked whether they would use a toll road if the alternative existed. Figure 5.13 illustrates that almost 56% of the toll road users indicated that they would use a toll road if the alternative existed. On the other hand, almost 66% of the non-toll road users indicated that they would not use a toll road if it were available.



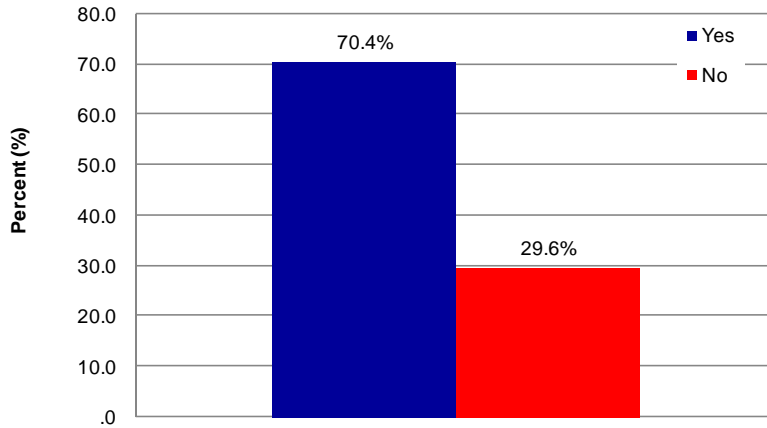
Toll road users who commute to work and do not use a toll road due to unavailability: 172 responses
 Non-toll road users who commute to work and do not have a toll road alternative route: 333 responses

Figure 5.13: Willingness to Use Toll Road if Available for Commute Trip

A sample proportion statistical test was conducted to assess whether toll road users' and non-toll road users' willingness to use a toll road if available for the commute trip is statistically different. The null hypothesis is that the proportions willing to use a toll road, if available, for the commute trip are the same for toll and non-toll road users at the 95% confidence level ($\alpha=0.05$). The calculated Z-score is 5.818 and the associated p-value is 0.000. Because the p-value is smaller than 0.05, there is sufficient evidence to reject the null hypothesis. Thus it can be concluded that the willingness of toll road and non-toll road users to use a toll road, if available, for the commute trip is statistically different.

5.2 Non-work Related Trips

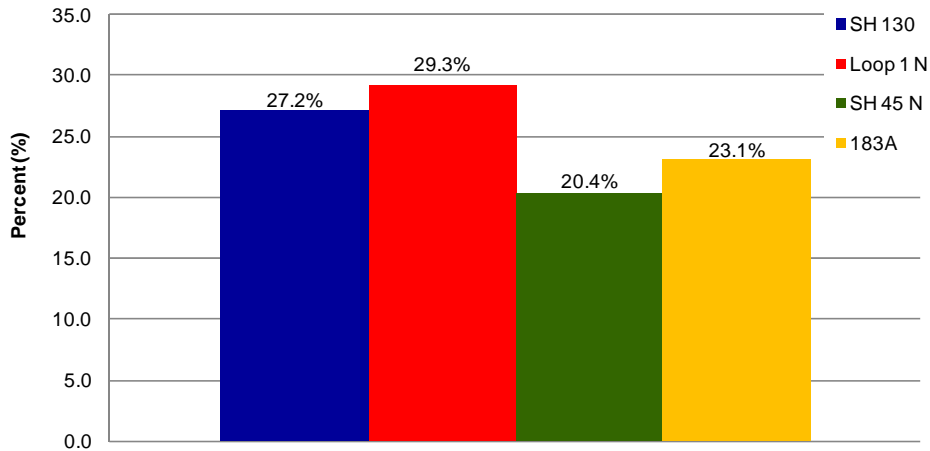
Non-work related trips were defined as trips to school, to buy groceries or to shop, to visit friends, and to go to church. In other words, it excluded trips to and from work or work-related trips. Toll road users were thus asked a number of questions in an effort to characterize their use of toll roads for non-work related trips. It needs to be emphasized again that toll road users are respondents who indicated that they have used a toll road in Central Texas and respondents that reported that they have not used any toll road in Central Texas were categorized as non-toll road users. Toll road users thus do not necessarily use a toll road for non-work related trips (as is evident in Figure 5.14). Figure 5.14 illustrates that 70% of the respondents use toll roads for non-work related trips, while almost 30% of the respondents do not use toll roads for non-work related trips.



Toll road users who make non-work related trips: 824 respondents

Figure 5.14: Toll Road Usage for Non-Work Related Trips

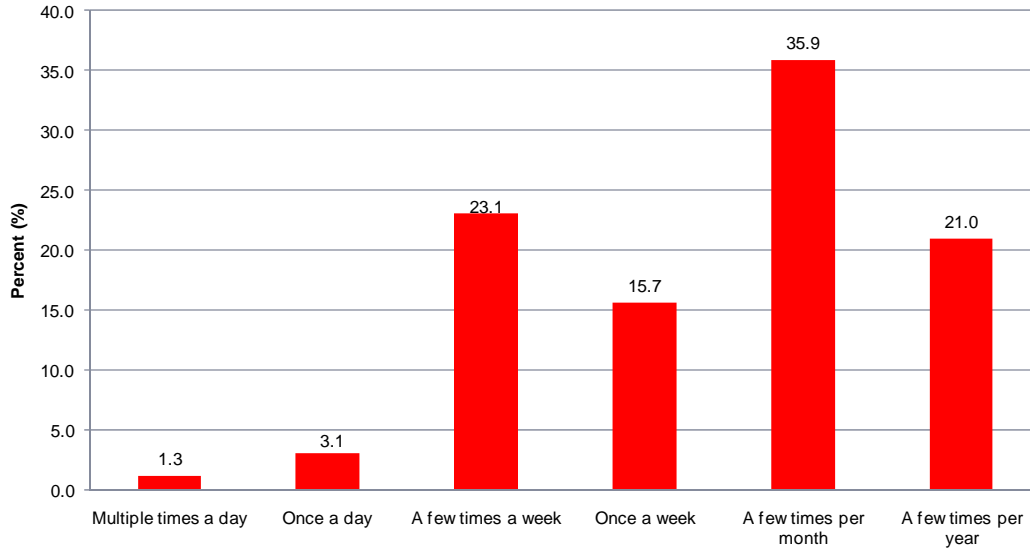
Toll road users who use toll roads for non-work related trips were subsequently asked to indicate which toll road they use most often for non-work related trips. As is evident from Figure 5.15, Loop 1 North and SH 130 were the most frequently mentioned, representing 29.3% and 27.2% of the responses, respectively.



Toll road users who use a toll road for non-work related trips: 731 responses

Figure 5.15: Toll Roads Used for Non-work Related Trips

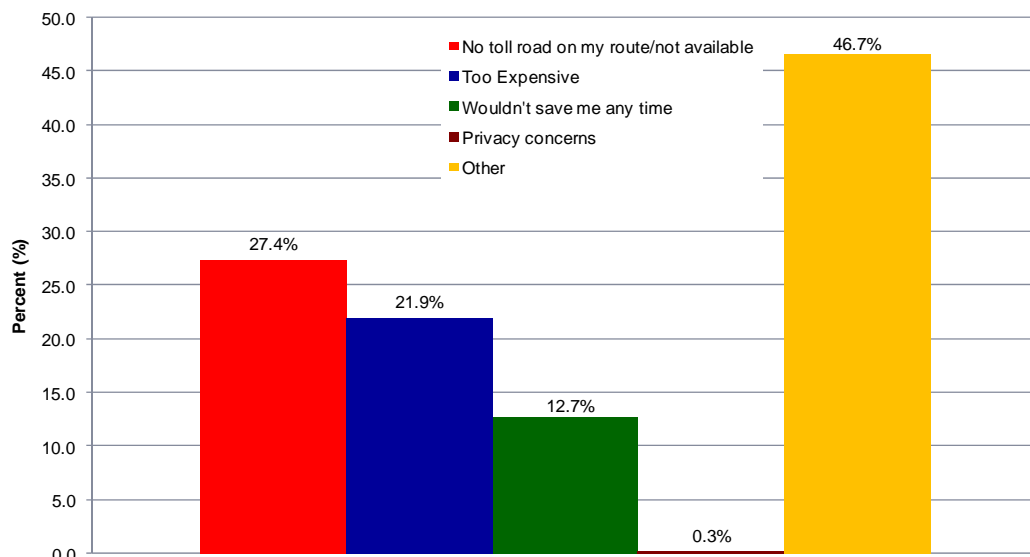
The majority of toll road users indicated that they use toll roads infrequently for non-work related trips, with almost 60% of the respondents using the toll roads for this trip purpose a few times per month or a few times per year—i.e., almost 36% of the respondents use the toll roads a few times per month for non-work related trips and 21% of the respondents used toll roads a few times per year for non-work related trips. On the other hand, a sizeable proportion of respondents use toll roads for non-work related trips a few times a week (23.1%) and once a week (15.7%).



Toll road users who use toll roads for non-work related trips: 580 responses

Figure 5.16: Usage Frequency of Toll Roads for Non-work Related Trips

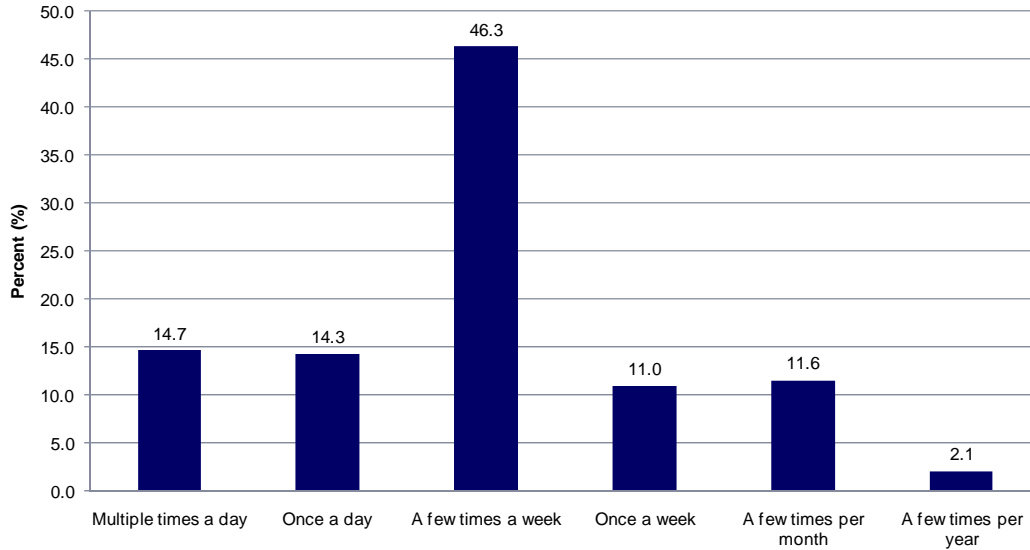
Toll road users, who do not use toll roads for non-work related trips were subsequently asked to indicate the reason for not using a toll road. From Figure 5.17, it is evident that no toll road on route/not available was the most frequently reported reason (27.4%) for not using the toll road for non-work related trips, followed by too expensive (21.9%) and wouldn't save any time (12.7%). A very small percentage of respondents (0.3%) indicated that they did not use the toll roads for non-work related trips due to privacy concerns. The latter thus does not appear to be an issue for toll road users that do not use a toll road for non-work related trips.



Toll roads users that do not use toll roads for non-work related trips: 266 responses

Figure 5.17: Toll Road Users' Reasons for Not Using Toll Roads for Non-Work Related Trips

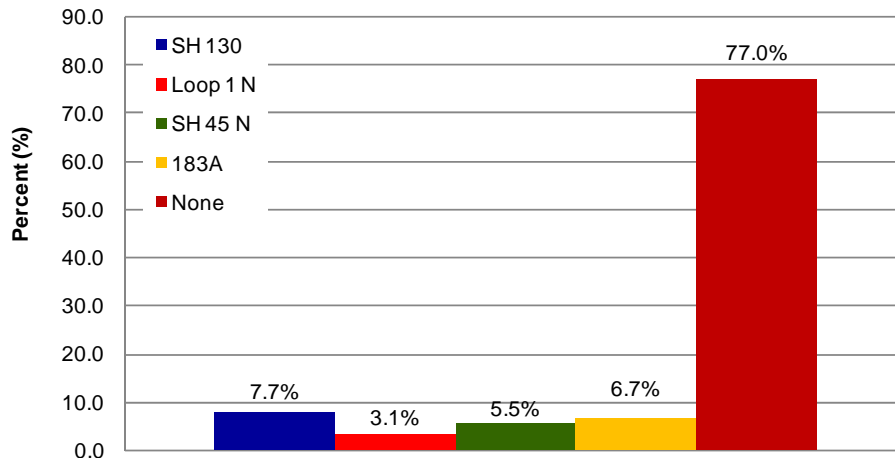
Non-toll road users were asked about the frequency with which they make non-work related trips. Almost half of the non-toll road users (46.3%) reported to make non-work related trips a few times per week. On the other hand, approximately 15% reported to make non-work related trips multiple times a day and 2.1% reported to make non-work related trips a few times per year (see Figure 5.18).



Non-toll road users' recreational trip frequency: 683 respondents

Figure 5.18: Non-work Related Trip Frequency of Non-Toll Road Users

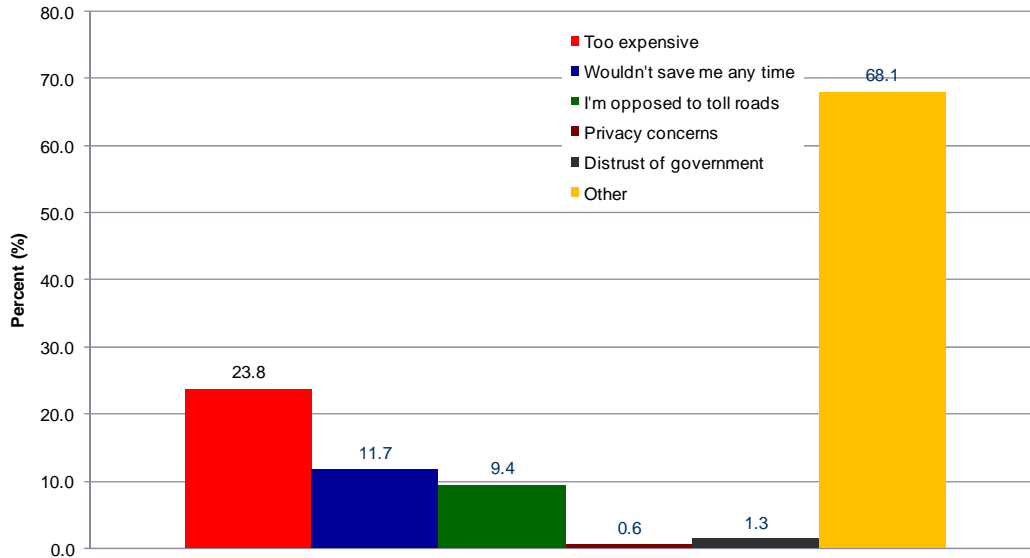
Non-toll road users were subsequently asked to indicate which toll roads provide an alternative to the current roads they use for their non-work related trips. As can be seen from Figure 5.19, the majority of respondents (77%) did not view any of the existing toll roads as viable alternatives to the current roads they use to make non-work related trips.



Non-toll road users: 731 responses

Figure 5.19: Available Toll Roads to Non-Toll Road Users for Non-Work Related Trips

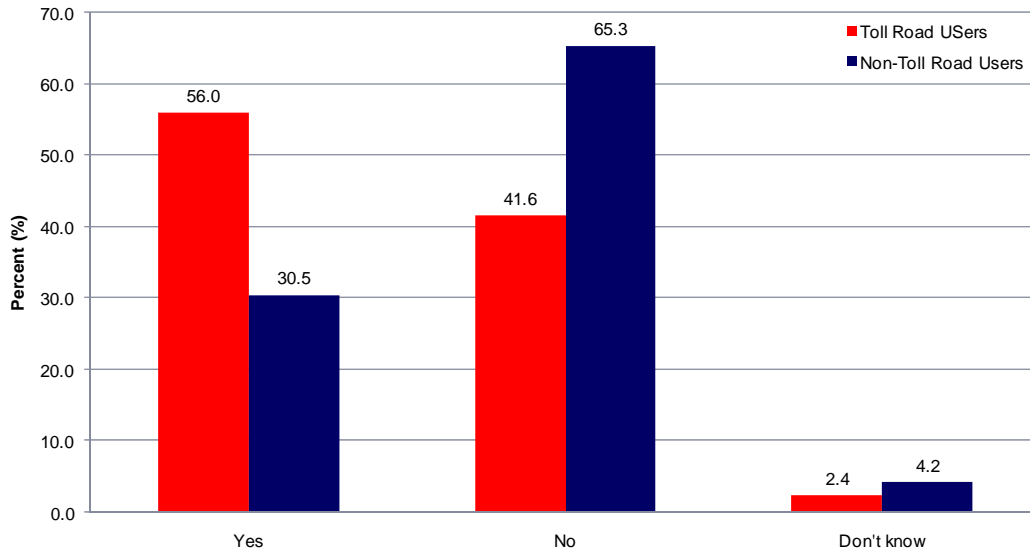
Non-toll road users for whom a toll road was a viable alternative to their current route were asked the reason for not using the toll road for non-work related trips. As can be seen from Figure 5.20, 23.8% of the respondents indicated that the toll roads were too expensive, 11.7% indicated that it would not save any time, 9.4% indicated that they were opposed to toll roads, and a relatively minor percentage indicated privacy concerns (0.6%) and distrust of the government (1.3%), respectively as reasons for not using the available toll road alternative for non-work related trips. Unfortunately, the “other” reasons, which represent 68.1% of the responses, were not recorded.



Non-toll road users who have the option of using toll roads for non-work related trips: 120 responses

Figure 5.20: Non-Toll Road Users' Reasons for Not Using Toll Roads for Non-Work Related Trips

Toll road users and non-toll road users who indicated that a toll road was not an alternative to their current route taken for non-work related trips were subsequently asked if they would use a toll road if it was available. Figure 5.21 illustrates the responses recorded. From Figure 5.21 it is evident that 56% of the toll road users indicated that they would use a toll road for non-work related trips if it is available compared to 30.5% of the non-toll road users. It thus appears that respondents that use toll roads for other trip purposes would be more willing to use toll roads for non-work related trips if available.



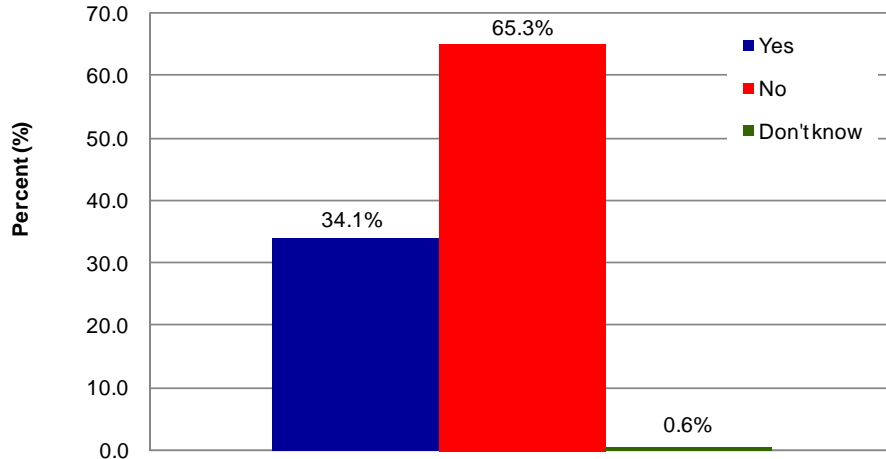
Toll road users who do not use toll roads for non-work related trips due to unavailability: 67 responses
 Non-toll road users who do not have a toll road alternative route: 563 responses

Figure 5.21: Willingness to Use Toll Roads if Available for Non-Work Related Trips

A sample proportion statistical test was conducted to assess whether toll road users' and non-toll road users' willingness to use a toll road if available for non-work related trips is statistically different. The null hypothesis is that the proportions willing to use a toll road, if available, for non-work related trips are the same for toll and non-toll road users at the 95% confidence level ($\alpha=0.05$). The calculated Z-score is 4.005 and the associated p-value is 0.000. Because the p-value is smaller than 0.05, there is sufficient evidence to reject the null hypothesis. Thus it can be concluded that the willingness of toll road and non-toll road users to use a toll road, if available, for non-work related trips is statistically different.

5.3 Business Trips

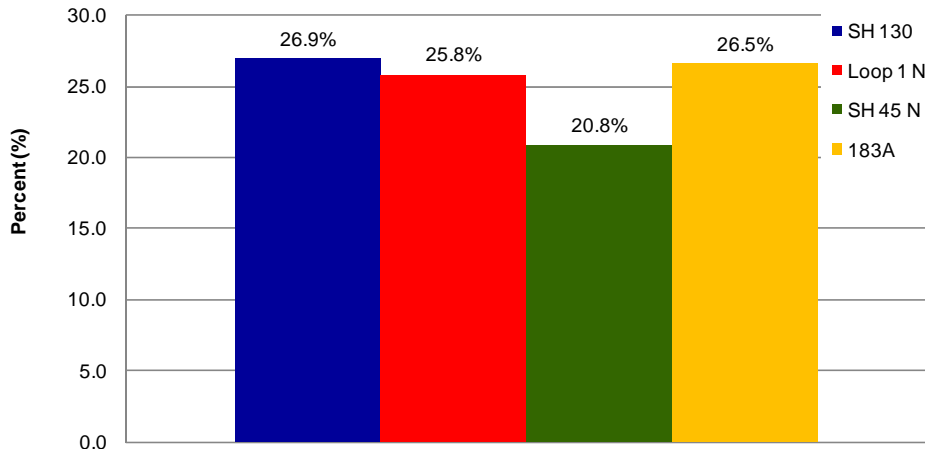
Business trips were defined as trips for work purposes other than commuting to or from work. Business trips thus include trips to meetings or service calls. Toll road users who are employed were asked about their use of toll roads for work purposes. Figure 5.22 illustrates the responses received by toll road users to the question whether they ever use a toll road for work purposes other than their commute. As can be seen from Figure 5.22, the majority of respondents (65.3%) indicated that they do not use a toll road for work-related trips.



Toll road users who are employed: 612 respondents

Figure 5.22: Toll Road Usage for Work-related Trips

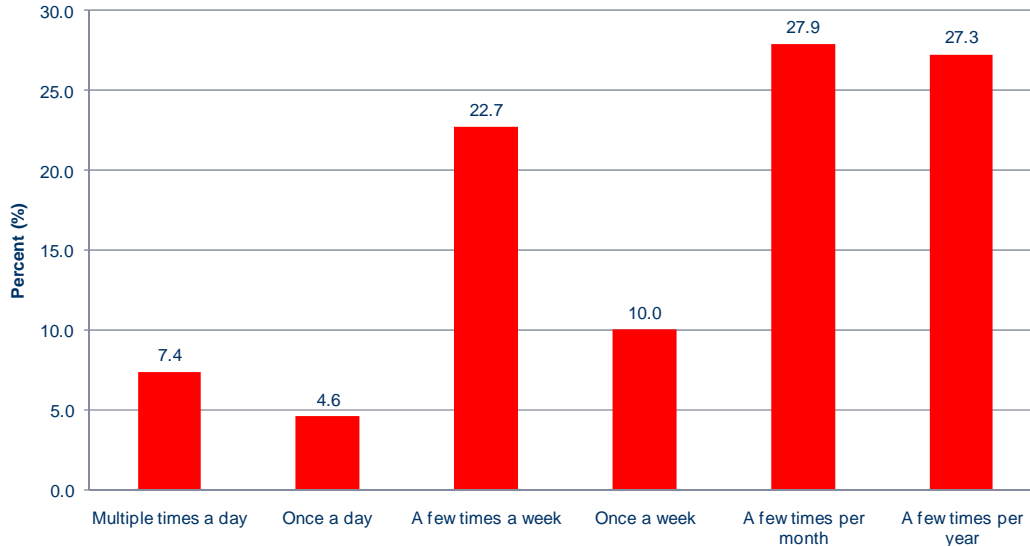
Respondents that indicated that they use toll roads for work-related trips were asked to identify which toll road(s) they use most often for these business trips. Figure 5.23 illustrates the responses received. As can be seen from Figure 5.23, the most frequently mentioned toll roads were SH 130, 183A, and Loop 1 N, representing 26.9%, 26.5%, and 25.8% of the responses respectively.



Toll road users who are employed and use toll roads for work-related trips other than commute: 283 responses

Figure 5.23: Toll Road Usage for Work-related Trips

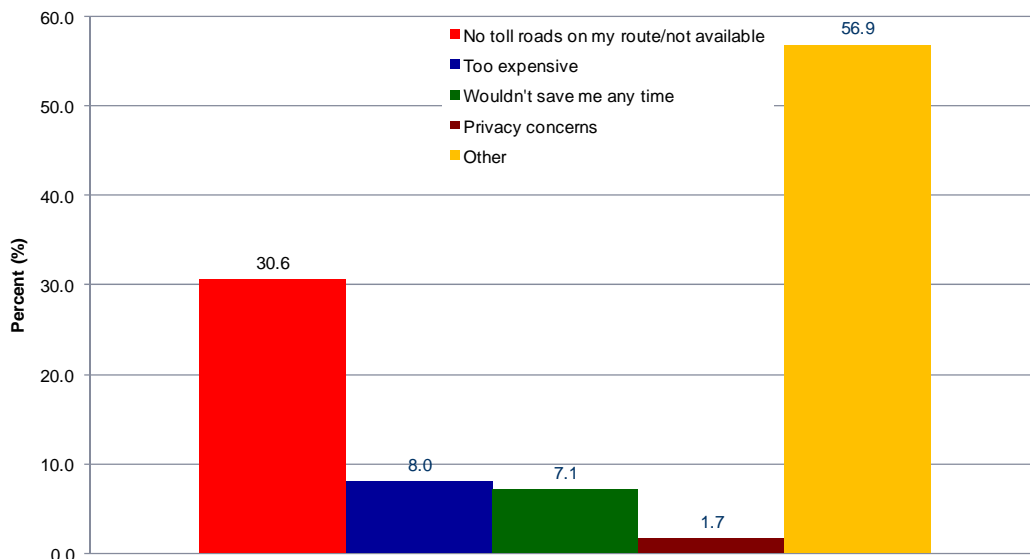
Figure 5.24 illustrates how often toll road users that use toll roads for work-related trips use the toll roads. Similar to the responses for non-work related trips, more than half of the respondents indicated infrequent use of the toll roads for business trips—i.e., they use the toll roads for business trips a few times per month (27.9%) or a few times per year (27.3%). On the other hand, 22.7% of the respondents use the toll roads a few times a week, 4.6% use the toll roads once a day, and 7.4% use the toll roads multiple times a day for work-related trips.



Toll road users who are employed and use toll roads for work-related trips other than commute: 209 respondents

Figure 5.24: Usage Frequency of Toll Roads for Work-related Trips

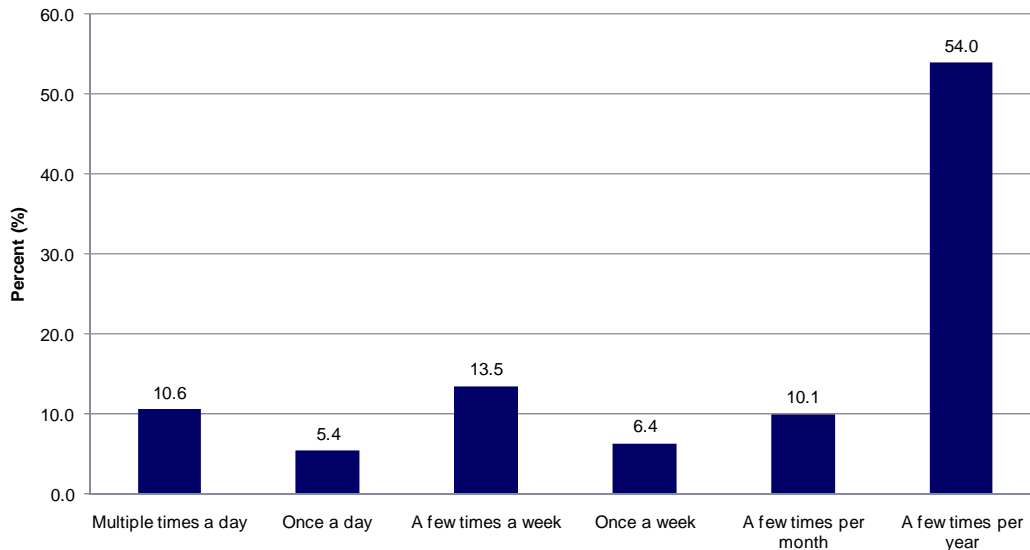
Toll road users who do not use the toll roads for business trips were asked to provide a reason for not using the toll roads. As can be seen from Figure 5.25, approximately 30% of the respondents indicated that no toll road was available as an alternative to the current route used for work-related trips, 8% of the respondents indicated that it was too expensive, and 7% indicated that it would not save them any time. Interestingly, 1.7% of the respondents reported privacy as a reason for not using the toll roads for work-related trips. Privacy thus seems to be more of a concern for work-related trips than was the case for recreational trips (i.e., 1.7% vs. 0.3%).



Toll road users who are employed and do not use toll roads for work-related trips: 400 responses

Figure 5.25: Toll Road Users' Reasons for Not Using Toll Roads for Work-related Trips

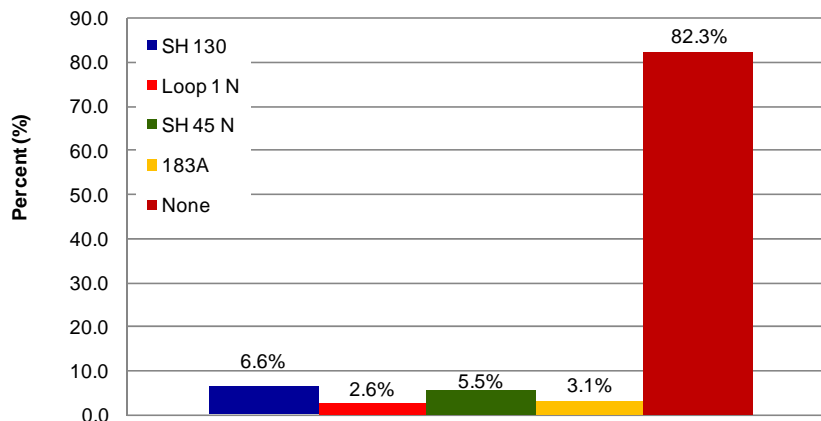
Non-toll road users who were employed were asked to indicate how often they made trips for work purposes other than their commute. The majority of the respondents (54.0%) reported to make business trips only a few times per year. Only 10.6% reported to make business trips multiple times per day, 5.4% reported to make business trips once a day, and 13.5% reported to make business trips a few times a week.



Non-toll road users who are employed and make business related trips: 432 responses

Figure 5.26: Business Trip Frequency of Non-Toll Road Users

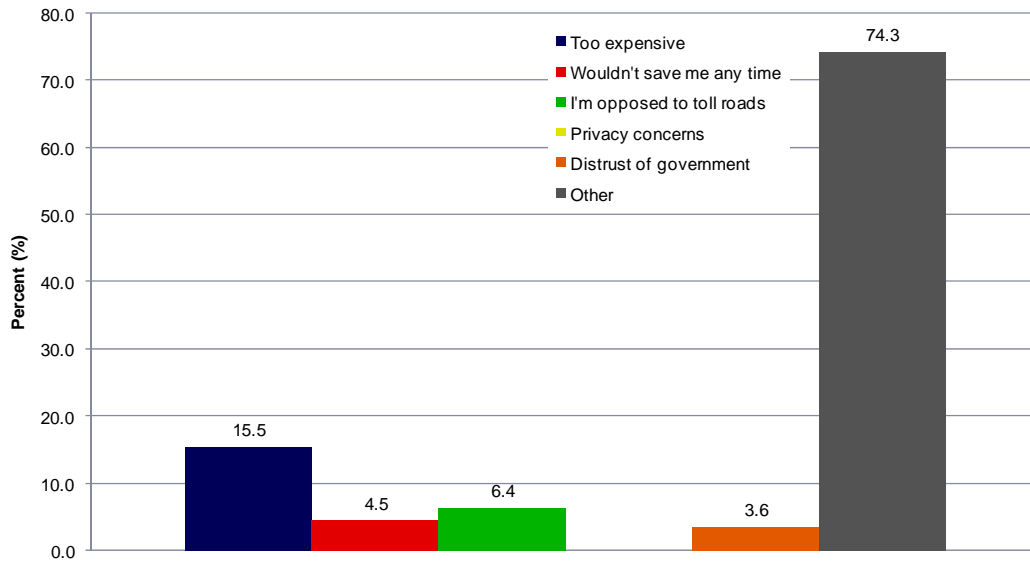
Non-toll road users who are employed and make business trips were subsequently asked whether any toll road provides an alternative to the current routes they use for their business trips. Similar to the toll road users, a large percentage of non-toll road users (82.3%) indicated that none of the current toll roads provide an alternative to their current route. On the other hand, the most frequently mentioned toll roads to provide an alternative to the current routes used for business trips were SH 130, SH 45 North, and 183A, representing 6.6%, 5.5%, and 3.1% of the responses respectively.



Non-toll road users who are employed and make business related trips: 458 responses

Figure 5.27: Available Toll Roads to Non-Toll Road Users for Work-related Trips

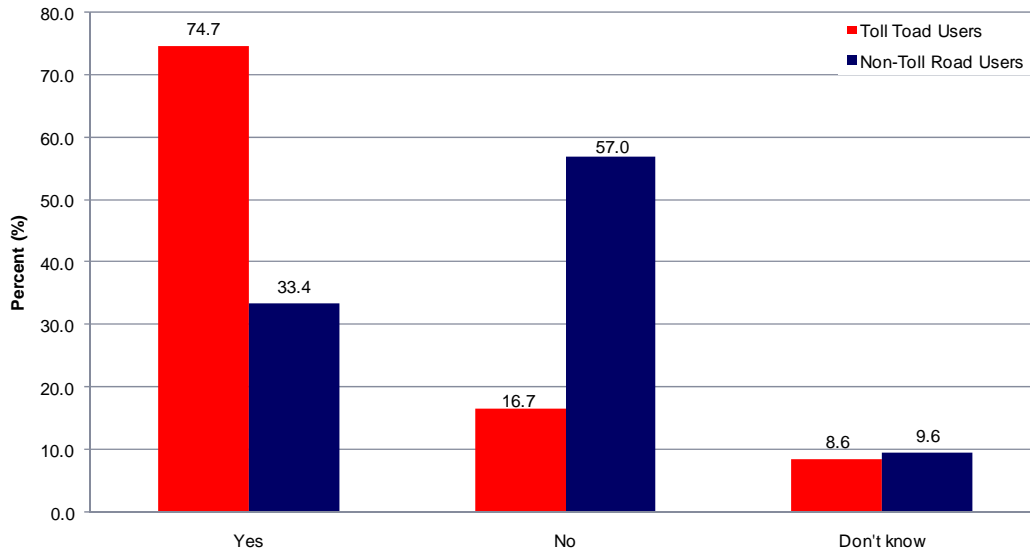
Non-toll road users who indicated that a toll road was an alternative for the current routes used for work-related purposes were asked the reasons for not using the toll road for business trips. Most of the respondents (74.3%) indicated “other reasons,” but the specific responses were unfortunately not recorded. The most frequently mentioned reasons for not using the toll road were, however, too expensive (15.5% of the responses), opposition to toll roads (6.4% of the responses), and would not save any time (4.5% of the responses). For business trips, 3.6% of the responses indicated a distrust of the government as the reason for not using toll roads for business trips—the highest percentage for any trip type. None of the respondents indicated privacy concerns as a reason for not using the toll roads for business trips.



Non-toll road users who make business trips and have the option of using a toll road(s): 56 responses

Figure 5.28: Non-Toll Road Users' Reasons for Not Using Toll Roads for Work-related Trips

Respondents—both toll road and non-toll road users—who indicated that a toll road was not an available alternative for their business trips were asked whether they would use a toll road if they could take it for work-related trips. From Figure 5.29 it is evident that existing toll road users are more willing to use a toll road for business trips if available than non-toll road users with 74.7% of existing toll road users indicating that they would use a toll road if it was available and only 33.4% of non-toll road users indicating that they would use an available toll road.

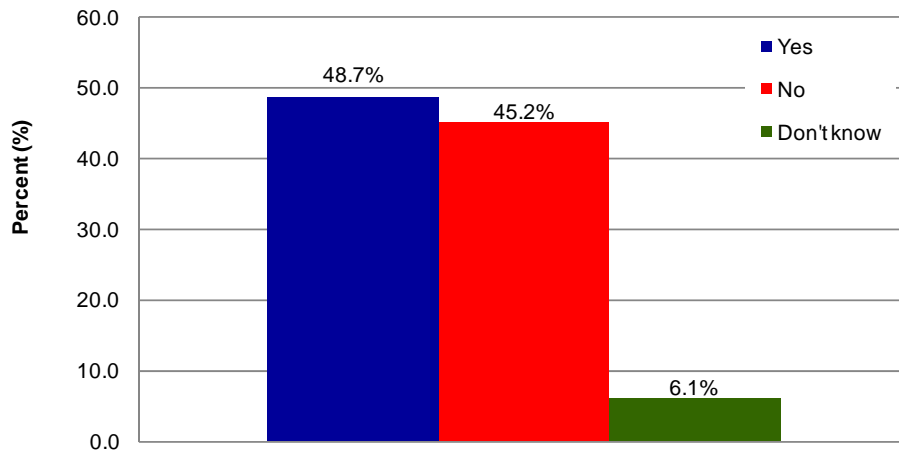


Toll road users who do not use toll roads for business trips because of unavailability: 122 responses
 Non-toll road users who make business related trips and do not have the option of using toll roads: 376 responses

Figure 5.29: Willingness to Use Toll Roads if Available for Work-related Trips

A sample proportion statistical test was conducted to assess whether toll road users' and non-toll road users' willingness to use a toll road if available for work-related trips is statistically different. The null hypothesis is that the proportions willing to use a toll road, if available, for work-related trips are the same for toll and non-toll road users at the 95% confidence level ($\alpha=0.05$). The calculated Z-score is 21.35 and the associated p-value is 0.000. Because the p-value is smaller than 0.05, there is sufficient evidence to reject the null hypothesis. Thus it can be concluded that the willingness of toll road and non-toll road users to use a toll road, if available, for work-related trips is statistically different.

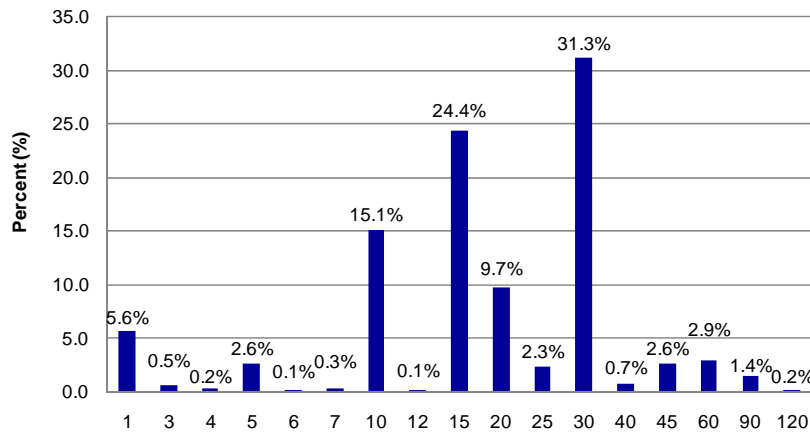
Finally, all non-toll road users were asked whether they would be willing to use a toll road if it would save travel time. Figure 5.30 illustrates that 48.7% of the respondents indicated that they would use a toll road if it saved them travel time.



Number of respondents: 683

Figure 5.30: Willingness to Use Toll Road Given Travel Time Savings

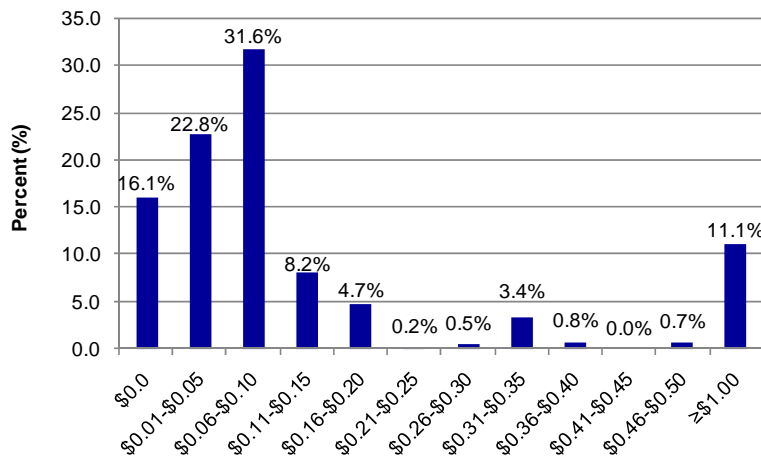
Non-toll road users that were willing to pay a toll if it saved travel time were subsequently asked how much time needed to be saved before they would be willing to use a toll road. The responses received are illustrated in Figure 5.31. From Figure 5.31, it is evident that 31.3% of the respondents indicated that they need to save 30 minutes of travel time before they would consider using a toll road, 24.4% indicated that they need to save 15 minutes, and 15.1% indicated that they needed to save 10 minutes of travel time. The majority of respondents (92.2%) thus need to save 30 minutes of travel time or less before they would be willing to use a toll road. The average travel time savings needed were 21.9 minutes for a non-toll road user to be willing to use a toll road.



Number of respondents: 333

Figure 5.31: Time Needed to be Saved (minutes)

Finally, these respondents were asked to indicate how much they would be willing to pay for the travel time savings they indicated in the previous question. From the responses to the questions on the amount of time (minutes) that needs to be saved for the non-toll road respondent to be willing to use the toll road and the amount that the respondent would be willing to pay for that travel time saving, the toll/minute was calculated. The toll/minute of time saved that these respondents are willing to incur is illustrated in Figure 5.32. From Figure 5.32 it is evident that most respondents (54.4%) are prepared to pay between 1 and 10 cents per minute of travel time saved, with 31.6% of the respondents prepared to pay between 6 and 10 cents per minute of travel time saved and 22.8% prepared to pay between 1 and 5 cents per minute of travel time saved. Almost 16.1%, however, indicated that they were not prepared to pay for the travel time saved—thereby contradicting their earlier response. On average, non-toll road users are prepared to pay \$0.48/minute of travel time saved.



Note: One response of \$167/minute was considered an outlier and was deleted from the data set.
 Number of respondents: 332

Figure 5.32: Amount Willing to Pay for Time Saved

5.4 Concluding Remarks

This chapter aimed to characterize the trip characteristics of toll road and non-toll road users in Central Texas by type of trip, i.e., commuter trips, non-work related trips, and work-related trips. It should, however, be noted that although respondents were characterized as toll road users it did not equate to those users using toll roads for all trip purposes or for all trips of a particular trip type. Rather, toll road users were respondents that indicated that they have used Central Texas toll roads. Some of the salient insights were the statistically significant difference between the commuting profile of toll road and non-toll road users. Furthermore it appeared that toll road users commute less frequently than non-toll road users and most toll road users that commute to work do not use a toll road for every commute trip. Also, a major reason for not using toll roads by both toll road users and non-toll road users for all three trip types were that no toll road alternative was available or a viable alternative to existing routes used. Finally, the data revealed that a higher percentage of toll road users that do not use a toll road because it was not available indicated a willingness to use a toll road alternative if one were available. The next

chapter provides insight into the actual usage of Central Texas toll roads that were obtained from analyzing a one-week sample of toll transactions that occurred in November 2007.

Chapter 6. Toll Transaction Data Analysis

Toll roads are unique in that a substantial amount of information can be gathered from each tag that crosses a toll plaza. Acquiring and analyzing this data provides insight into the usage of the toll facility. For example, available data from toll transactions include the registered billing address, type of account (commercial or non-commercial), axle count, payment method, and time of day that the transaction occurred. Such data can thus be used to characterize the users of specific toll facilities in terms of these attributes. On the other hand, because of the nature of the available data there are some limitations to the analysis. For example, specific demographic characteristics, such as income, are often not linked to toll tag records nor are reasons for using the toll roads. These types of information can only be obtained from surveys.

A sample of 931,360 toll transactions was analyzed for the Central Texas Turnpike System (CTTS)—specifically, Loop 1, SH 130, and SH 45. All transactions occurred during the week of November 5 to November 11, 2007. The transaction data included the day and time of the transaction, the plaza where recorded, account type (i.e., commercial or non-commercial), axle count, and the billing zip code where the toll tag is registered. The results of this data analysis are summarized in this chapter⁵.

6.1 Type of Account

The CTTS can currently be regarded as mostly a commuter system. Both Loop 1 and SH 45 are relatively short sections that aim to provide congestion relief to commuters, while SH 130, which will eventually serve as a bypass around Austin, was not fully constructed at the time of this study. At the time the data was obtained, SH 130 only went as far south as TX 71. Given the characteristics of the CTTS at the time the sample was collected, the commercial transactions as a percentage of total transactions thus appear reasonable (see Table 6.1). Commercial accounts are registered as such when applying for an account⁶. From Table 6.1 it is evident that about 98,460 (or 11%) of the transactions were conducted by commercial account holders.

Table 6.1: CTTS Transactions by Account Type

Account Type	Transactions
Commercial	98,460 (10.6%)
Non-Commercial	832,900 (89.4%)
Total	931,360 (100%)

Table 6.2 provides the breakdown of commercial and non-commercial transactions by toll facility.

⁵ In addition, the CD included in the back of the report (Appendix B) contains the actual transaction data obtained during the first two years of operation of the CTTS. The data was analyzed to reveal trends in the overall use of the toll routes, time-of-day variability, day-of-week variability, and month-of-year variability by vehicle class and payment type.

⁶ Commercial accounts are for commercial vehicles with more than two axles or for accounts with more than five vehicles with a single billing address.

Table 6.2: Percentage of Total Transactions by Toll Road

Account Type	% of Transactions		
	Loop 1	SH 45	SH 130
Commercial	6.70%	8.20%	18.70%
Non-Commercial	93.30%	91.80%	81.30%

As was anticipated, commercial transactions represent less than 10% of total transactions on the mostly commuter toll roads, i.e., on Loop 1 (6.7%) and SH 45 (8.2%). On the other hand, commercial transactions represent almost 20% of total transactions on SH 130. This percentage is anticipated to increase when the road is completed further to the south, thereby forming a bypass around Austin.

6.2 Day-of-Week/Time-of-Day Usage

The transaction data was also analyzed in terms of day-of-week of travel by commercial and non-commercial accounts (see Table 6.3). As can be seen, approximately 80% of non-commercial transactions occur on a weekday and 90% of commercial transactions occur on a weekday. Interesting, however, is the fact that non-commercial weekend transactions comprise almost 20% of total non-commercial transactions.

Table 6.3: Day-of-Week Travel by Account Type

Account Type	Weekday	Weekend
Non-Commercial	80.70%	19.30%
Commercial	90.79%	9.21%
Total	81.77%	18.23%

Also of interest is whether a transaction occurred during a peak hour or off-peak hour. Peak hours were defined as the hours between 6:00 and 10:00 a.m. and 3:00 and 7:00 p.m. on a week day. Overall for the CTTS, 62.3% of the transactions occurred during peak hours and 37.7% during off-peak hours. Table 6.4 illustrates the percentage of total transactions in the peak and off-peak hours by account type.

Table 6.4: Time-of-Day Travel by Account Type

Account Type	Off Peak	Peak
Non-Commercial	37.20%	62.80%
Commercial	41.79%	58.21%
Total	37.68%	62.32%

From Table 6.4, it is evident that a slightly higher percentage of commercial transactions occur during off-peak hours compared to non-commercial transactions. Substantial toll road usage during off-peak hours suggest that users use toll roads for reasons other than time savings, because it has been pointed out that the parallel non-toll roads are typically less congested during the off-peak hours. The latter has to be further explored through additional data analysis.

6.3 Axle Distributions

The transaction data obtained also recorded the number of axles associated with each toll transaction. Table 6.5 summarizes the percentage of total transactions by number of axles for each toll facility and the CTTS.

Table 6.5: Axle Distributions by Toll Facility and the CTTS

Axles	Loop 1	SH 45	SH 130	CTTS
0*	0.77%	0.89%	0.93%	0.87%
2	97.53%	96.39%	91.30%	95.36%
3	1.05%	1.59%	3.71%	2.00%
4	0.39%	0.52%	1.35%	0.71%
5	0.21%	0.50%	2.50%	0.94%
6	0.04%	0.07%	0.11%	0.07%
7	0.01%	0.03%	0.09%	0.04%
8	0.00%	0.00%	0.00%	0.00%
9	0.00%	0.00%	0.00%	0.00%
10	0.00%	0.00%	0.01%	0.00%

* Axle counts of 0 are likely due to reader errors, but are negligible (0.87%).

As can be seen from Table 6.5, two-axle vehicles account for the majority of transactions recorded on the CTTS (95.36%)—specifically on Loop 1 (97.53%) and SH 45 (96.39%). A slightly lower percentage of two axle transactions were recorded on SH 130 (91.3%) compared to Loop 1 and SH 45, which seems to correspond to the slightly higher percentage of commercial transactions recorded on SH 130 (see Table 6.2).

Table 6.6 summarizes the percentage of total transactions in each axle category by account type.

Table 6.6: Percentage Transactions by Axle Category

Axles	Non-Commercial	Commercial
0	89.12%	10.88%
2	92.19%	7.81%
3	19.37%	80.63%
4	41.48%	58.52%
5	6.65%	93.35%
6	1.15%	98.85%
7	0.00%	100.00%
8	0.00%	100.00%
9	25.00%	75.00%
10	19.05%	80.95%
Total	89.43%	10.57%

Though a small percentage of the two-axle transactions are commercial transactions (7.81%), more interesting to note is the fairly high percentages of the 3+ axle transactions that are non-commercial transactions—for example, 41% of the four-axle transactions are non-

commercial transactions. This is likely vehicles towing a two-axle trailer (for example, with a boat) that are registered to non-commercial accounts.

Table 6.7 provides the percentage of total non-commercial and commercial transactions by axle category.

Table 6.7: Axle Distributions by Account Type

Axles	Non-Commercial	Commercial
0	0.87%	0.90%
2	98.30%	70.48%
3	0.43%	15.25%
4	0.33%	3.90%
5	0.07%	8.34%
6	0.00%	0.70%
7	0.00%	0.41%
8	0.00%	0.01%
9	0.00%	0.00%
10	0.00%	0.02%

Also interesting to note is that 70.48% of the commercial transactions are 2-axle transactions, 15.25% are 3-axle transactions, and about 3.9% are 4-axle transactions. The 5-axle commercial vehicles only comprised 8.34% of the total commercial transactions on the system (see Table 6.7).

6.4 Zip Code Distribution

The transaction data also captured the zip code of the billing address of each electronic toll tag account. This data allowed for a geographical analysis of the transactions by the zip codes of the registered account holders in the Central Texas area. Though this data represents a one-week period during November, some inferences can be deduced about the residence or base location of users of the system.

Initially, the data was analyzed in terms of the number of transactions per zip code to identify those zip codes with the highest number of toll transactions. However, because zip codes vary in size, the transaction data was normalized by the size of the zip code. Table 6.8 summarizes the top ten zip codes in terms of the number of toll transactions per square mile.

Table 6.8: Zip Codes with Highest CTTS Toll Transactions

Zipcode	Transactions/Mile²
78717	5,825
78664	4,967
78728	3,140
78660	2,564
78681	2,145
78727	2,105
78613	1,759
78759	1,534
78634	1,375

Table 6.8 shows that the highest transactions per square mile were recorded in billing zip codes that are relatively close to SH 45, with 78634 (Hutto) in the East and 78613 (Cedar Park) in the West. The billing zip code with the highest transactions per square mile was 78717 located in the Cedar Park area just northeast of the intersection of SH 45 and US 183 (see Figure 6.1). In terms of the number of transactions, 44,587 transactions were billed to 78717 in the one-week period, representing 4.8% of the total transactions during the sample period. Zip code 78664, which had the second highest transactions per square mile, recorded the most transactions, i.e., 155,479 transactions or 16.7% of the system's total. Zip code 78664 is located in Round Rock, just north of SH 45 and between IH 35 and SH 130.

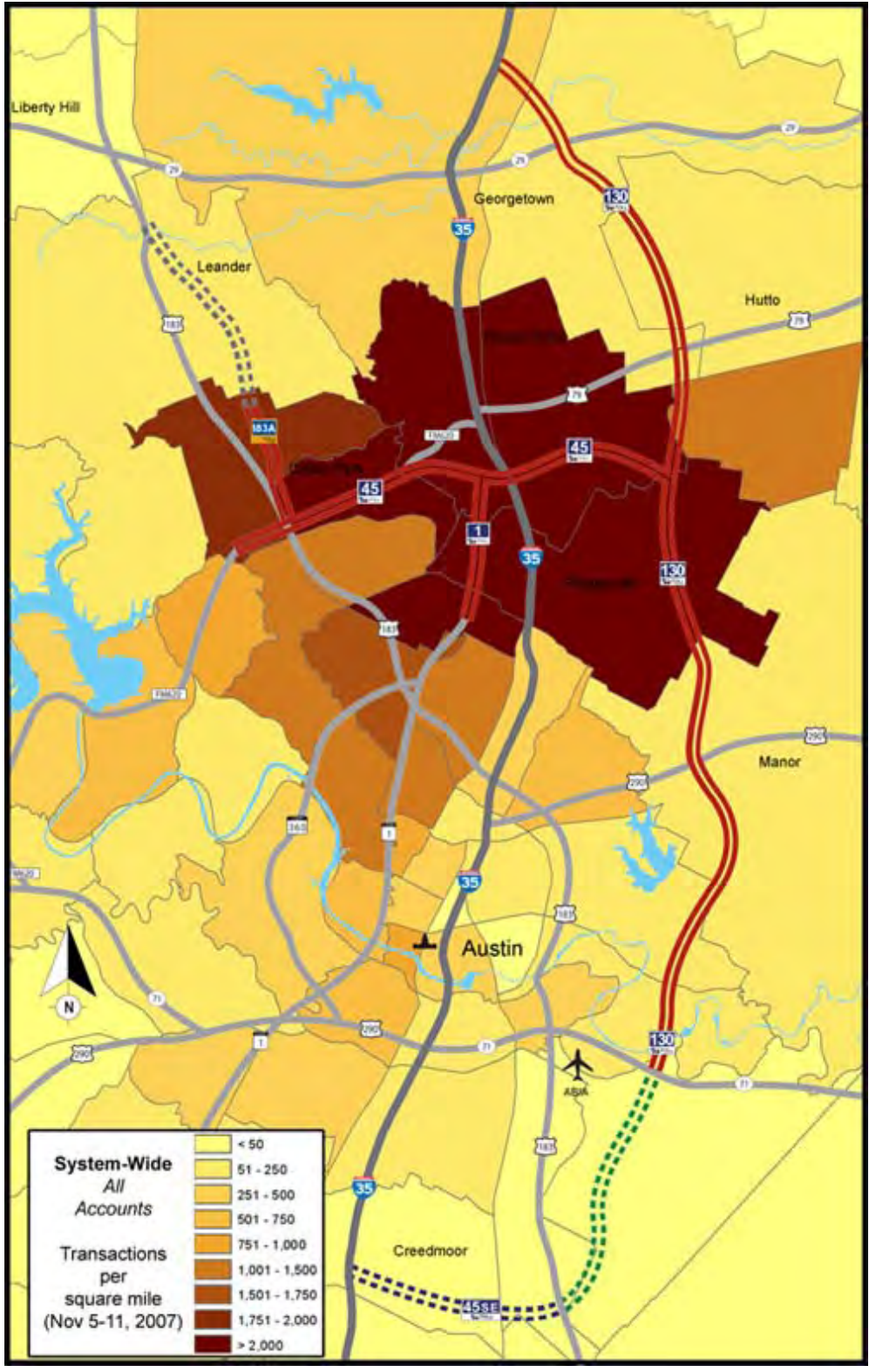


Figure 6.1: CTTs Toll Transactions/Mile²

The same analysis was conducted to identify the zip codes with the highest number of transactions per square mile for non-commercial transactions. The results were similar to the results for the total toll transactions, because non-commercial transactions account for almost 90% of the transactions on the CTTS.

The associated demographic information of these zip codes can reveal some interesting characteristics of the account holders. As per the City of Austin's ethnicity maps, all these zip codes are predominantly middle to upper middle class, White neighborhoods—although the ethnic and income distributions vary among the zip codes. Zip code 78717 comprises 76% White residents and has a median household income of \$87,290. Also, 59.1% of the residents have a bachelor's or higher education. Zip code 78664, on the other hand, is 62.9% White (23.7% Hispanic), has a median household income of \$59,829, and only 29.4% of the residents have a bachelor's or higher education.

6.4.1 Spatial Data Analysis

The above analysis provided the number of toll transactions per square mile in the Central Texas zip codes. Figure 6.1 used colors to graphically represent the total transactions per square mile by zip code. However, zip codes vary in size and the transaction concentrations are not necessarily the same throughout the area. An alternative method for representing this data is through interpolation of zip code centroid point data. Thus, instead of shading an entire zip code based on its transaction concentrations, zip codes are instead represented as points on the map. These points are determined by calculating the centroid (or essential middle) of the zip code area. Because the latitudinal and longitudinal references are known for zip code centroids from the United States census, these data points can then be associated with the corresponding transaction concentrations, i.e., number of transactions per square mile.

Given the zip code point data, it is possible to interpolate the areas between the points using Tobler's First Law of Geography: "*Everything is related to everything else, but near things are more related than distant things.*" This law is used to illustrate the transaction densities of the areas between the centroid point data. Specifically, the technique used in determining these values between centroid points is "*Inverse Distance Weighting (IDW).*" IDW interpolates estimates based on values at nearby locations weighted by distance from the interpolation location. The only assumption is that points near the interpolation location are more closely related than points more distant from the interpolation location.

This technique allows for the generation of interpolated maps of Austin, showing the billing address concentrations of the users of the CTTS. This technique was used to geographically display the concentrations of all transactions, commercial and non-commercial transactions, transactions for individual toll facilities, weekend and weekday transactions, and peak and off-peak transactions.

6.4.2 Geographic Profile of Toll Transactions

Figure 6.2 illustrates that the billing addresses of CTTS users are concentrated in the north portion of the city around SH 45 and in the Pflugerville area between SH 130 and Loop 1 (i.e., Far West area). The lowest concentrations are observed on the southwest side of the city and on the southeast side between the airport and downtown. The demographic and land use characteristics of these two areas are quite different—the southwest being mostly middle to upper middle class residential, and the southeast being lower income and less developed residentially. The latter could explain the low concentration of billing addresses on the east, and

distance from the CTTS could explain that of the west. An anomaly that is present entails zip code 78681 in Round Rock just northwest of SH 45 and IH 35. The fifth highest transactions per square mile for the CTTS are billed to this zip code, yet it does not appear as such on the map. This is due to a large number of small, PO Box type zip codes that are concentrated in that area with associated low levels of transactions. The low transaction values per square mile calculated and the spatial approach adopted seems to under-represent the transaction concentrations billed to 78761.

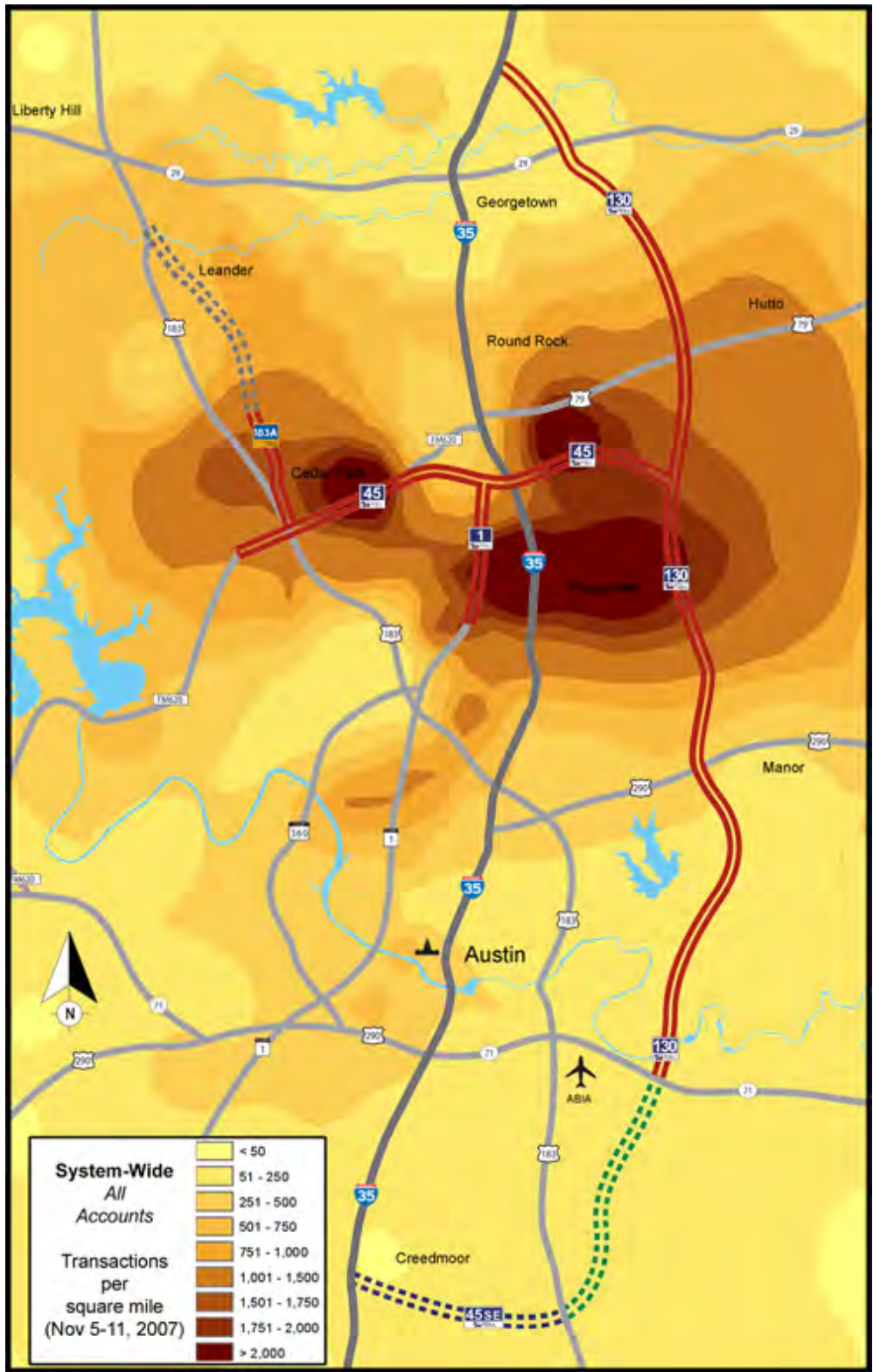


Figure 6.2: CTTs Transactions/Mile²

As mentioned earlier, non-commercial transactions account for nearly 90% of the total transactions and therefore there appears to be little difference between the total transaction and the non-commercial transaction profiles (see Figure 6.3).

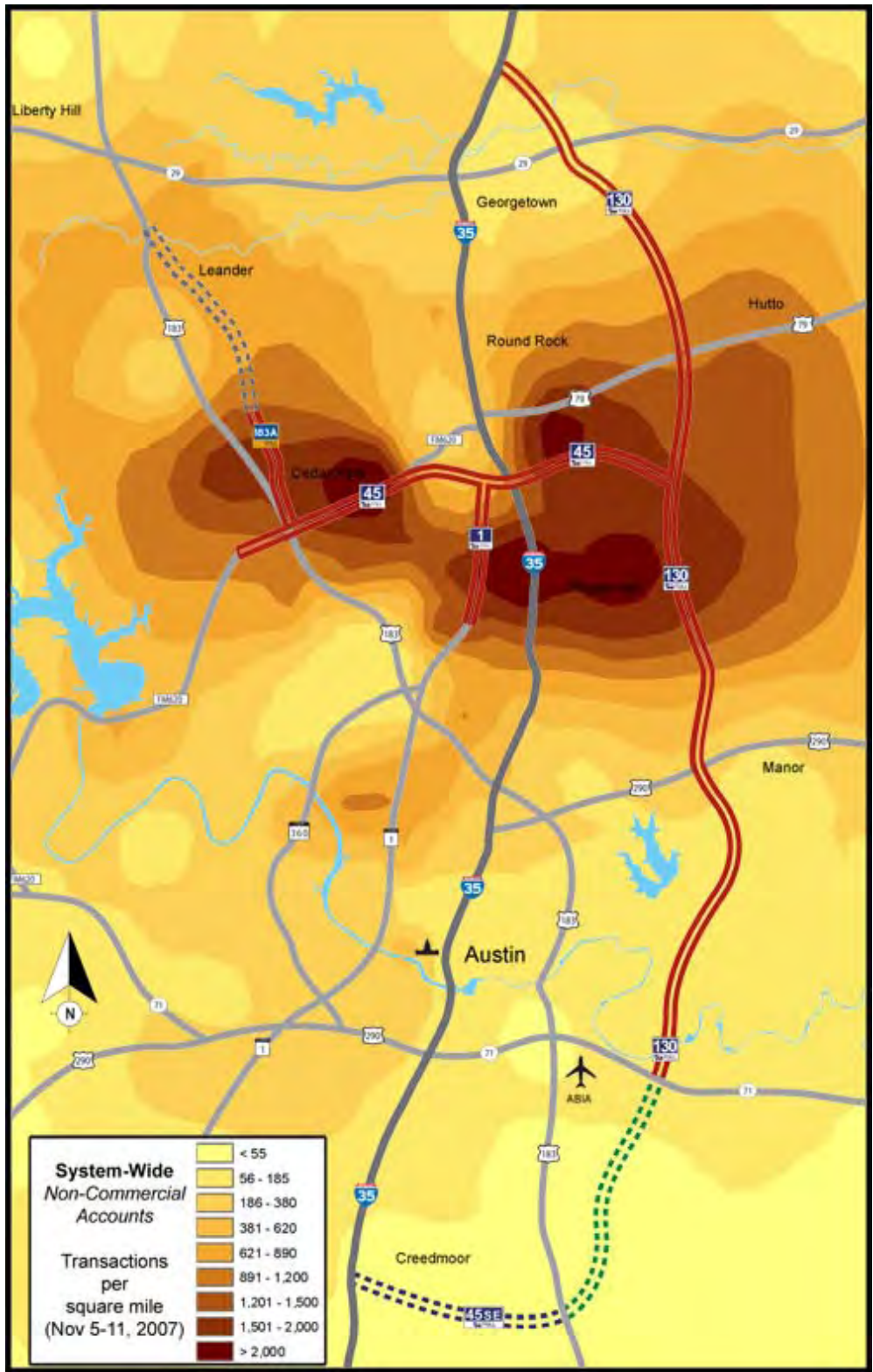


Figure 6.3: Non-Commercial CTTS Transactions/Mile²

Figures 6.4 and 6.5 illustrate the billing address concentrations of the weekday and weekend day non-commercial transactions, respectively. As can be seen, the billing profiles look fairly similar for weekday and weekend day transactions. However, the billing addresses of the weekday transactions seem to be more concentrated in the Pflugerville area compared to the weekend transactions.

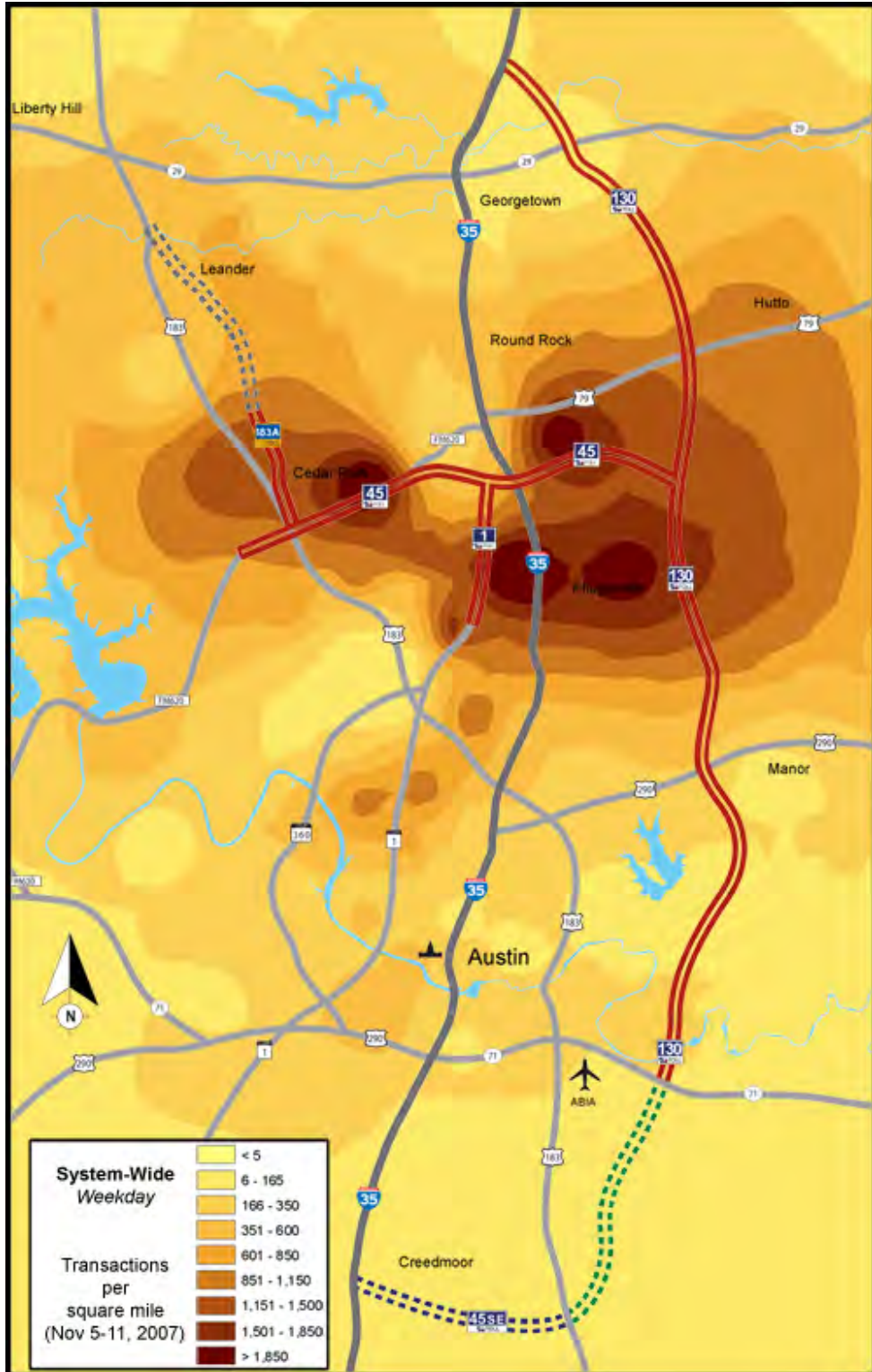


Figure 6.4: Weekday CTTs Transactions/Mile²

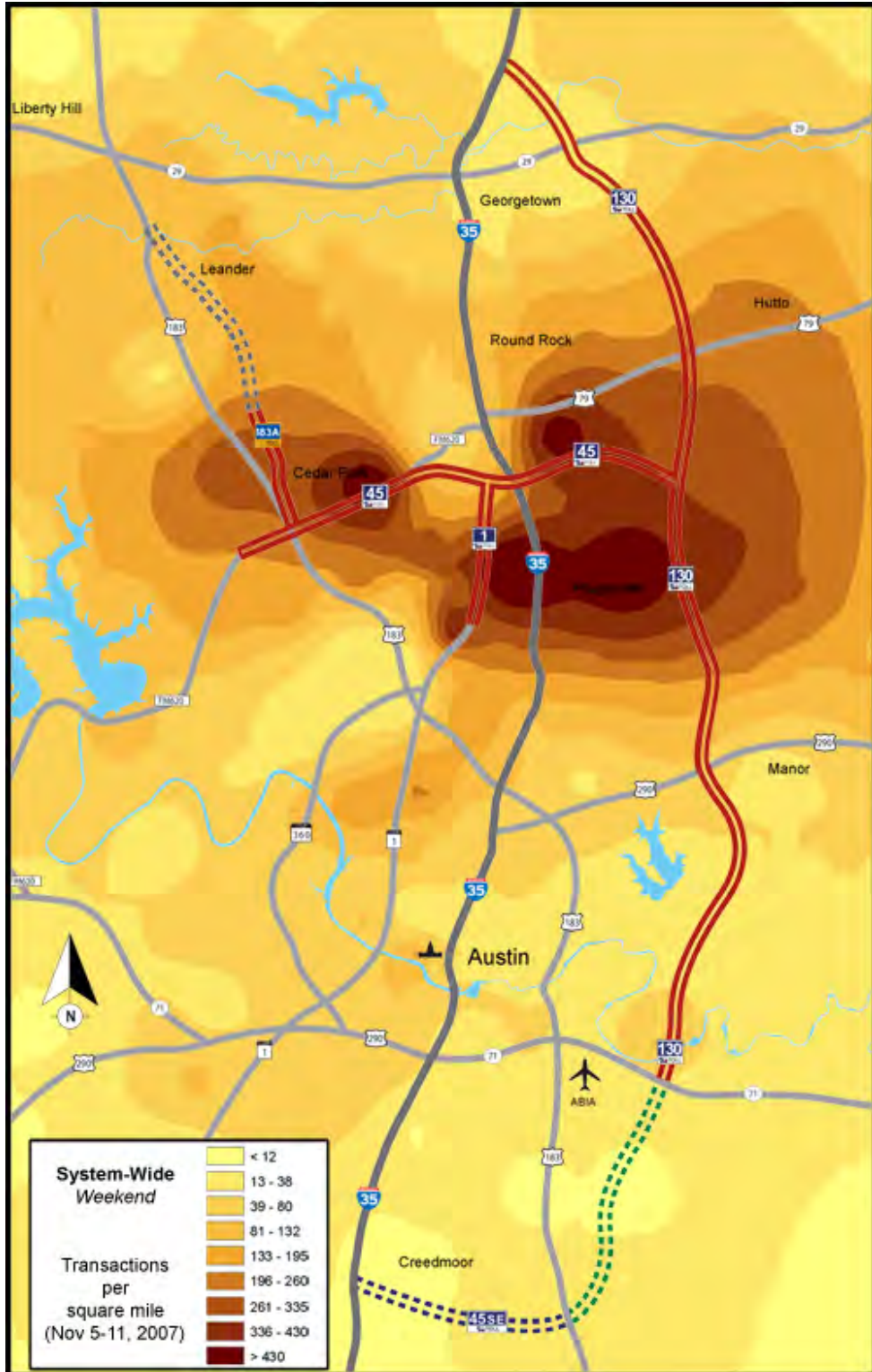


Figure 6.5: Weekend Day CTTS Transactions/Mile²

Figure 6.6 and 6.7 illustrate the billing address concentrations of the weekday peak hour and weekday off-peak hour transactions, respectively. As can be seen, the billing profiles look fairly similar for weekday peak hour and weekday off-peak hour transactions.

However, the billing addresses of the peak hour transactions seems to be more narrowly concentrated in Cedar Park, just north of SH 45, and west of IH 35 in the Pflugerville area.

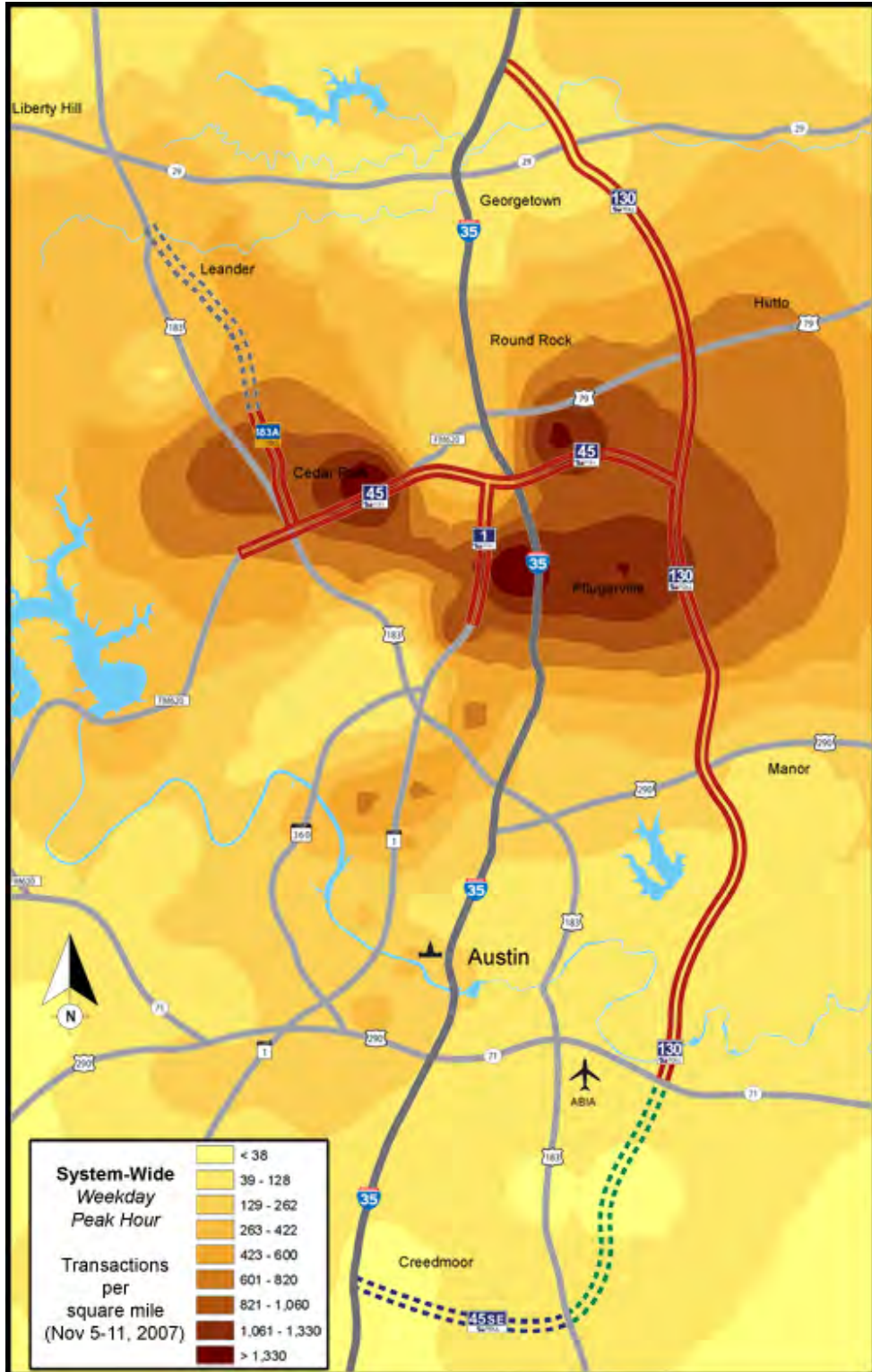


Figure 6.6: Weekday Peak Hour CTTS Transactions/Mile²

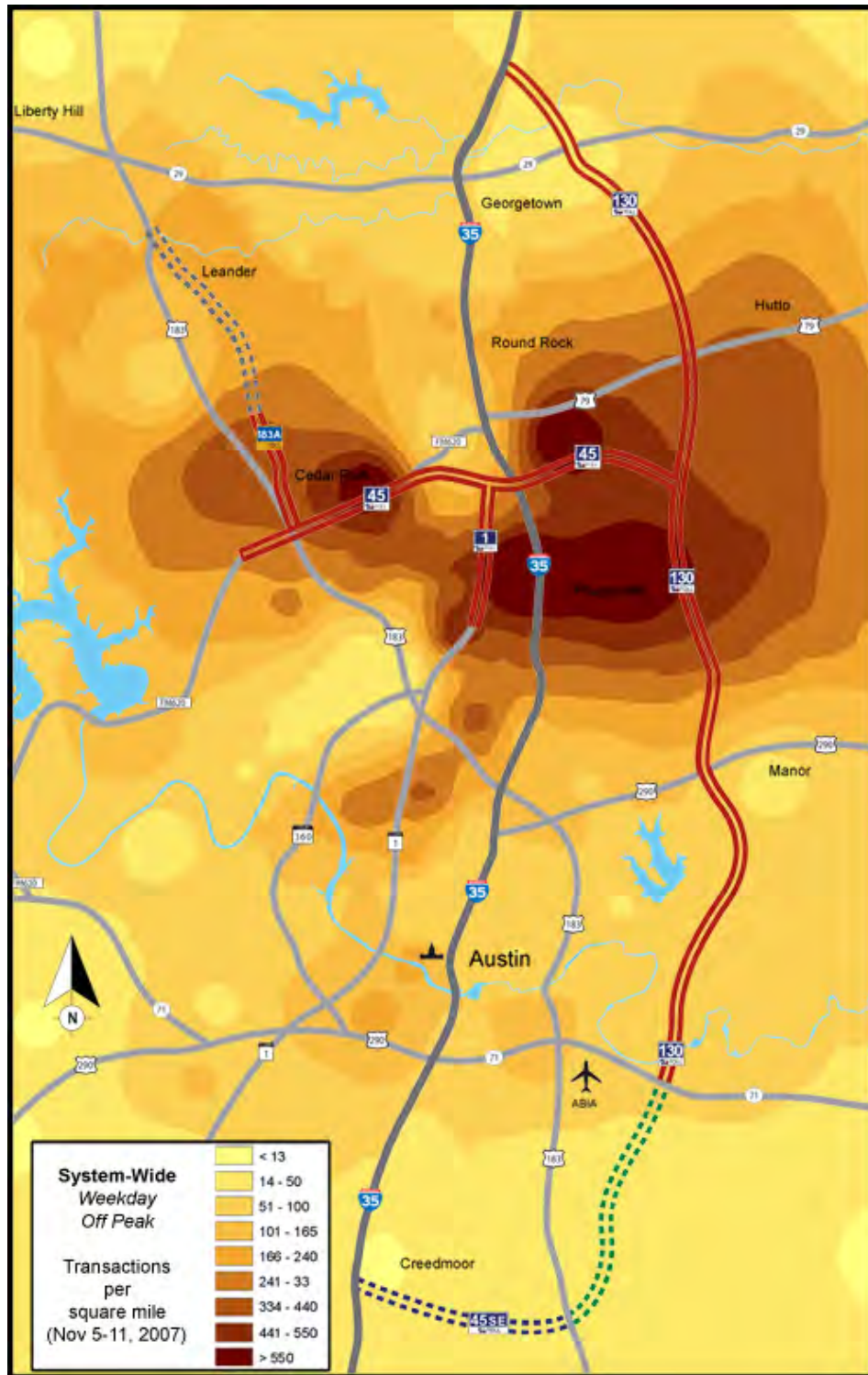


Figure 6.7: Weekday Off-peak Hour CTTs Transactions/Mile²

Finally, Figures 6.8, 6.9, and 6.10 illustrate the billing addresses for the non-commercial transactions on Loop 1, SH 45, and SH 130, respectively. As can be seen, the billing addresses for the non-commercial transactions on Loop 1 are concentrated in the Pflugerville area, between IH 35 and Loop 1 (see Figure 6.8). On the other hand, from Figure 6.9 it is evident that the billing addresses for the non-commercial transactions on SH 45 are concentrated in the Cedar Park area with a substantially lower concentration in the Pflugerville and Round Rock areas. Finally, from Figure 6.10 it is evident that the billing addresses for the non-commercial transactions on SH 130 are concentrated in the Hutto and Pflugerville areas.

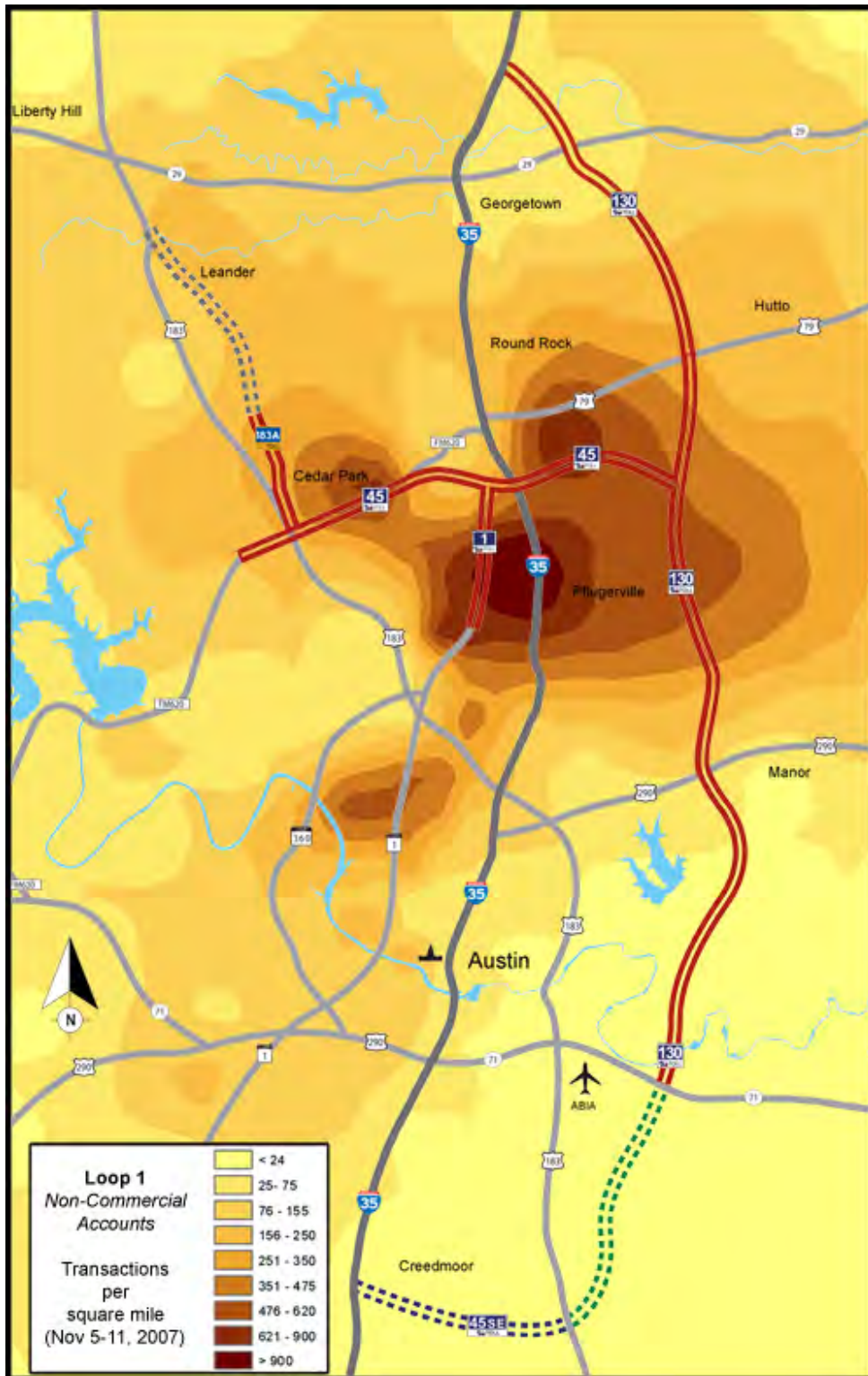


Figure 6.8: Non-Commercial Transactions/Mile² on Loop 1

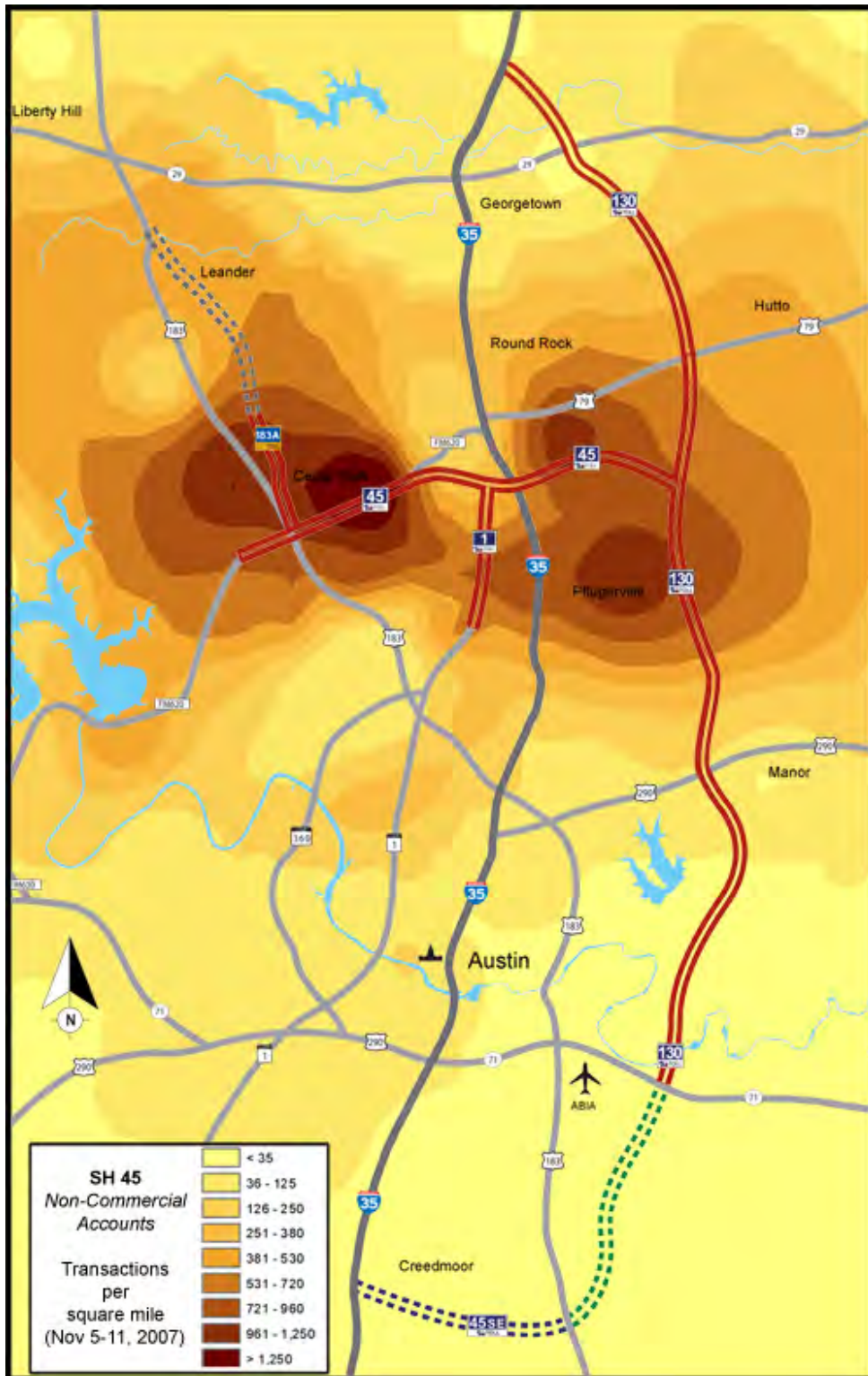


Figure 6.9: Non-Commercial Transactions/Mile² on SH 45

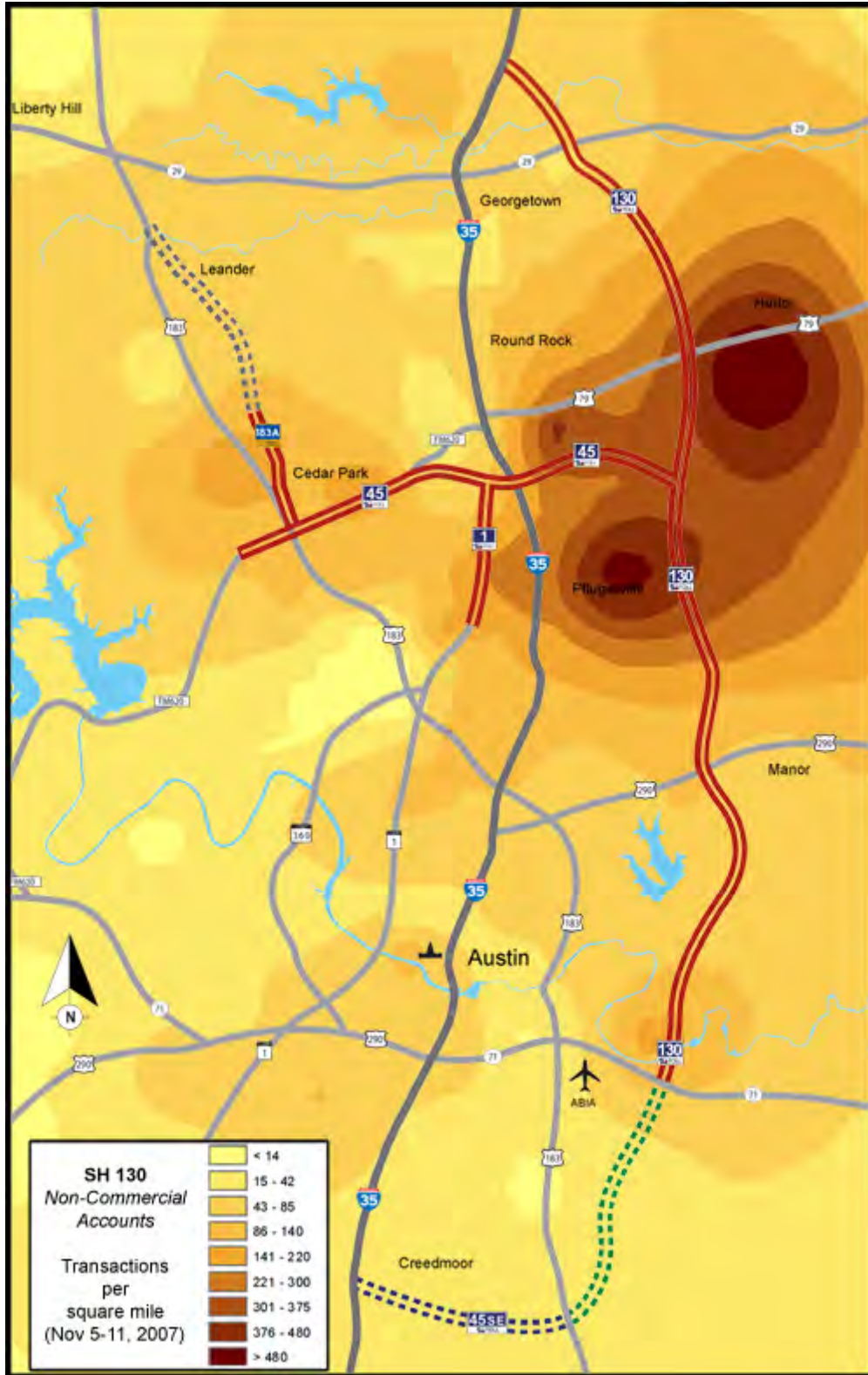


Figure 6.10: Non-Commercial Transactions/Mile² on SH 130

6.5 Concluding Remarks

Overall, this type of spatial analysis is very useful to visualize the billing addresses of the CTTS users. Although the geographical representations were solely based on billing address information (and actual origins were unknown), it can be assumed that in the case of the non-commercial transactions, most of these addresses represent the homes of the TxTAG users and thus the trip origins and destinations during peak hour weekday traffic.

Chapter 7. Concluding Remarks

A comprehensive literature review revealed that a number of previous surveys and research studies have attempted to characterize toll road users and subsets of toll road users. For example, those who use a toll road to commute to work or those who use electronic toll collection to pay the toll compared to cash users. These studies typically explored correlations between toll road usage and income, age, education, household structure, gender, and ethnicity. Survey data collected by Cal Poly in the Fall of 1996, for example, revealed that commuters on SR 91 in California were in their 30s and 40s, male, earning more than \$60,000, worked in professional careers, and came from larger households. Similarly, the NTTA's 2005 study of their TollTag and cash customers found that the Dallas TollTag user is typically older, Caucasian, has a higher level of education, and relatively higher levels of income compared to cash users. In general, the literature pointed to a correlation between toll road usage and higher incomes, as well as education levels and household structure, but the data relating to toll road usage and gender seemed less conclusive.

This research study is different from previous efforts in that it attempted to explore the differences between the auto users and non-users of Central Texas toll roads. In Spring 2008, the authors worked with the Texas Turnpike Authority in administering a survey to Central Texas residents in Bastrop, Caldwell, Hays, Travis, and Williamson counties about their usage and knowledge of the Central Texas toll roads. Survey respondents were characterized as toll road auto users or non-toll road users based on their response to one of the first survey questions that asked whether the respondent has used any of the four toll roads in Central Texas: SH 130, Loop 1 North, SH 45 North, or 183A. Respondents who indicated that they have used a toll road in Central Texas were categorized as toll road users (824 respondents). Respondents that reported that they have not used any toll road in Central Texas were categorized as non-toll road users (683 respondents). The statistical analyses conducted provide significant insight into the characteristics of the auto users and non-users of the CTTS, as well as the influence of certain demographic factors on toll road usage. In addition, the administered survey included numerous questions about respondents' trip types, toll road usage for different trip types, and the reasons for using or not using the Central Texas toll roads.

The statistical tests provided a number of important insights into the association between toll road usage and specific demographic variables. In other words, these tests provided insight into the influence of various demographic variables on toll road usage. Some of the salient findings include the statistical association at the 95% confidence level between:

- household income and toll road auto usage with toll road users having higher household incomes than non-toll road users,
- age and toll road usage with toll road users tending to be younger than non-toll road users,
- household structure and toll road usage with most toll road users being married with children,
- household size and toll road usage with toll road users tending to live in households of three or more members. This analysis supported the findings on toll road usage and household structure,

- the number of vehicles available to households and toll road usage with a higher percentage of toll road users having access to two or more vehicles, and
- employment and toll road usage with a higher percentage of toll road users being employed full time. This analysis supported the findings on toll road usage and household income.

Also, no statistical association was found between ethnicity and toll road usage or education and toll road usage at the 95% confidence level. Finally, the data analysis revealed a statistically significant difference between the gender profile and home ownership profile of toll road and non-toll road users. Specifically, a higher percentage of males use toll roads and a higher percentage of homeowners use toll roads.

Statistical tests were also conducted to differentiate between toll road auto users and non-users based on their trip characteristics, i.e., commuter trips, non-work related trips, and work-related trips. It should, however, be pointed out that although respondents were categorized as toll road users and non-toll road users, this did not equate to those characterized as toll road users using toll roads for all trip purposes or for all trips of a particular trip type. Some of the salient insights into the trip characteristics of auto toll road users and non-users were:

- a statistically significant difference between the commuting profile of toll road and non-toll road auto users with a higher percentage of non-toll road auto users commuting to work. Furthermore it appeared that toll road users commute less frequently than non-toll road users,
- most toll road auto users that commute to work do not use a toll road for every commute trip with the exception of those that commute to work one day per week. Similarly, the majority of toll road users indicated that they use toll roads infrequently for non-work related trips and work-related trips,
- the statistical association at the 95% confidence level between toll road usage and the transportation modes used to commute to work with a higher percentage of toll road users commuting to work “driving alone” than non-toll road users,

A major reason for not using toll roads by both toll road users and non-toll road users for all three trip types were that no toll road alternative was available or a viable alternative to existing routes used. Further analysis, however, revealed that there is a statistically significant difference between the willingness to use a toll road if available for all three trip types between toll road users and non-toll road users. In other words, a higher percentage of toll road users indicated a willingness to use a toll road alternative if one were to be available. Given an available toll road alternative, the most frequently mentioned reason for not using the toll road given by non-toll road users for all three trip types were that it was too expensive. Finally, all non-toll road users were also asked whether they would be willing to use a toll road if it would save travel time. Almost half of the respondents indicated that they would use a toll road if it saved them travel time. Non-toll road users that were willing to pay a toll if it saved travel time were subsequently asked how much time needed to be saved before they would be willing to use a toll road. The responses varied from one minute to two hours, but the majority of respondents (92.2%) needed to save 30 minutes of travel time or less before they would be willing to use a toll road. The average travel time savings needed were 21.9 minutes for a non-toll road user to be

willing to use a toll road. Finally, these respondents were asked to indicate how much they would be willing to pay for the travel time savings they indicated in the previous question. The toll/minute of time saved that these respondents are willing to incur was subsequently calculated. It was found that most respondents (54.4%) are prepared to pay between 1 and 10 cents per minute of travel time saved, with 31.6% of the respondents prepared to pay between 6 and 10 cents per minute of travel time saved and 22.8% prepared to pay between one and five cents per minute of travel time saved. Almost 16.1%, however, indicated that they were not prepared to pay for the travel time saved—thereby contradicting their earlier response. On average, non-toll road users are prepared to pay \$0.48/minute of travel time saved.

Finally, toll roads are unique in that a substantial amount of information can be gathered from each tag that crosses a toll plaza. Acquiring and analyzing this data provides insight into the usage of the toll facility. A sample of 931,360 toll transactions was analyzed for the Central Texas Turnpike System (CTTS)—specifically, Loop 1, SH 130, and SH 45. All transactions occurred during the week of November 5 to November 11, 2007. The transaction data included the day and time of the transaction, the plaza where recorded, account type (i.e., commercial or non-commercial), axle count, and the billing zip code where the toll tag is registered. Given the characteristics of the CTTS at the time the sample was collected, the commercial transactions as a percentage of total transactions (i.e., 11%) appeared reasonable. On the other hand, commercial transactions represent almost 20% of total transactions on SH 130. This percentage is anticipated to increase when the road is completed further to the south, thereby forming a bypass around Austin.

The transaction data was also analyzed in terms of day-of-week of travel by commercial and non-commercial accounts. Approximately 80% of non-commercial transactions occur on a weekday and 90% of commercial transactions occur on a weekday. Interesting, however, is the fact that non-commercial weekend transactions comprise almost 20% of total non-commercial transactions. Also of interest is whether a transaction occurred during a peak hour or off-peak hour. Peak hours were defined as the hours between 6:00 and 10:00 a.m. and 3:00 and 7:00 p.m. on a weekday. Overall for the CTTS, 62.3% of the transactions occurred during peak hours and 37.7% during off-peak hours. Substantial toll road usage during off-peak hours and weekend days suggest that users use toll roads for reasons other than time savings, because it has been pointed out that the parallel non-toll roads are typically less congested during the off-peak hours and weekend days. The latter could be further explored through additional data analysis.

The analyzed transaction data also provided some very interesting findings regarding the billing zip codes of non-commercial account holders. A spatial data analysis revealed that the billing addresses of CTTS users are concentrated in the north portion of the city around SH 45 and in the Pflugerville area between SH 130 and Loop 1 (i.e., Far West area) and Cedar Park—from where the CTTS provide convenient and fast access to downtown. The lowest concentrations are observed on the southwest side of the city and on the southeast side between the airport and downtown. The demographic and land use characteristics of these two areas are quite different—the southwest being mostly middle to upper middle class residential, and the southeast being lower income and less developed residentially. The latter could explain the low concentration of billing addresses on the east, and distance from the CTTS could explain that of the west.

To conclude, demographic factors are considered when conducting toll feasibility studies and when deciding on service levels. Demographic data are typically obtained from the U.S. Census or through neighborhood surveys. This analysis indicated that particular attention should

be paid to the following demographic variables: income, age, household structure/household size, home ownership, number of available vehicles to household, and employment status. No statistical association was found between toll road usage and education and ethnicity. In terms of trip characteristics, the study found that toll road users commute less and less frequently than non-toll road users, toll road users tend to “drive alone” to work, and typically do not use a toll road for every commute trip.

A major reason provided by both toll road users and non-toll road users for not using a toll road for all three trip types were that none was available or a feasible alternative to current routes used. However, a higher percentage of toll road users regardless of the trip type (i.e., commute, work-related or business trip) indicated a willingness to use a toll road if it were available. This suggests that marketing efforts should be targeted to commuters in areas with an existing toll customer base. Finally, almost half of the non-toll road users indicate a willingness to use a toll road if it saved travel time. Marketing efforts should thus clearly demonstrate the potential travel time savings and the average toll per minute of travel time saved to potential toll road users.

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Appendix A: Central Texas Turnpike Survey

HARRIS INTERACTIVE

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J34071

DATE: April 28, 2008

JOB TITLE: TXTAG

Information for Online Surveys

Title for initial survey page (Required for online jobs): CATI

Number of Response Equivalentents (REs):

Wave Number/Version/Languages (if applicable):

Demographics Template (Required for online jobs): CUSTOM

SECTION 400: SAMPLE PRELOAD AND SCREENING QUESTIONS

[PROGRAMMER NOTE: PLEASE COORDINATE WITH THE SAMPLE PROGRAMMER ABOUT THE PROCESSING OF ANY PRELOADED VARIABLES INDICATED IN THIS SECTION.]

BASE: ALL RESPONDENTS

Q158 INITIAL SURVEY MODE

[PROGRAMMER NOTE: CAPTURE INITIAL MODE OF SURVEY]

2 CATI

BASE: ALL RESPONDENTS

Q159 FINAL SURVEY MODE

[PROGRAMMER NOTE: CAPTURE CURRENT/FINAL MODE OF SURVEY]

2 CATI

[STANDARD SAMPLE VARIABLE FOR ALL SURVEYS DO NOT CHANGE CODE LIST]

BASE: ALL RESPONDENTS

Q75 PRELOAD – SAMPLE SUPPLIER (QV7/ICW Field 23)

[ONLY DISPLAY CODES FOR SAMPLE SUPPLIER BEING USED AT THIS QUESTION]
[TO INSERT THE CORRECT CODE LIST FOR THIS QUESTION PLEASE SEE THE MODEL QUESTIONNAIRE ON INTRANET.]

4 SSI (RDD)

BASE: ALL RESPONDENTS

Q130 PHONE

[ALLOW FOR 9 DIGITS]

BASE: ALL RESPONDENTS

Q1250 COUNTY PRELOAD

- 1 BASTROP, TX
- 2 CALDWELL, TX
- 3 HAYS, TX
- 4 TRAVIS, TX
- 5 WILLIAMSON, TX

SECTION 600: SCREENER

BASE: ALL RESPONDENTS

Q405 Hello, I'm _____ from Harris Interactive. We're conducting a survey on transportation issues in Central Texas, and would like to include your opinions. It will only take a few minutes of your time. [IF NEEDED: This is not a sales call.] Are you 16 years of age or older, a driver and live in the household I am calling? NO: May, I speak with a resident of the household age 16 or older who drives? IF NEW R: REPEAT INTRO.

[DO NOT READ]

- 1 Yes, 16+ and driver in HH JUMP TO Q410
- 2 No, no 16+ and driver in HH THANKS & TERMINATE
- 3 16+ and driver not at home THANKS & CALL BACK
- 8 Not sure THANK & TERMINATE
- 9 Decline to answer THANK & TERMINATE

BASE: ALL CONTINUING RESPONDENTS

Q410 Respondent Sex [INTERVIEWER NOTE: FROM OBSERVATION]

- 1 Male
- 2 Female

BASE: ALL CONTINUING RESPONDENTS

Q104 In what year were you born?

[IF DECLINE TO ANSWER OR NOT SURE, PLEASE THANK AND TERMINATE]

[INTERVIEWER NOTE: NOT SURE ENTER "8888" OR DECLINED TO ANSWER ENTER '9999']

[RANGE: 1887-2007, 8888, 9999]

□□□□□

BASE: ALL CONTINUING RESPONDENTS

Q105 [HIDDEN COMPUTE FOR AGE- PLEASE USE Q104.]

[RANGE 0 -120]

[PN: If Q105/NE16+, THANK AND TERMINATE]

BASE: ALL CONTINUING RESPONDENTS

Q600 What county do you live in?

[DO NOT READ]

- 1 Bastrop
- 2 Caldwell
- 3 Hays
- 4 Travis
- 5 Williamson
- 6 Other
- 7 Don't know (V)
- 8 Refuse (V)

[IF RESPONDENT DOES NOT LIVE IN Q600/1-5 THANK AND TERMINATE]

BASE: ALL QUALIFIED RESPONDENTS

Q615 Which of the following toll projects are you familiar with?

[RANDOMIZE]

- 1 SH 130
- 2 SH 45 North
- 3 183A
- 4 Loop 1 North

Q616

- 1 Yes
- 2 No
- 3 Don't know (V)

BASE: ALL QUALIFIED RESPONDENTS

Q665 Several toll roads have opened in Central Texas. Which of these toll roads do you use? (Select all that apply.)

[INFORMATION FOR INTERVIEWER: DO NOT READ. SH 130 to the east of Austin [it starts at SH 71 near the Austin airport and goes to IH 35 north of Georgetown]; Loop 1 North [starts at Parmer Lane at MoPac and ends at SH45 North]; SH 45 North [starts at 183A and ends at SH 130]; 183-A in Williamson County [starts north of 620 and ends north of 1431 near Cedar Park and Leander].

[RANDOMIZE]

- 1 SH 130
- 2 Loop 1 North
- 3 SH 45 North
- 4 183A
- 5 None (V)

BASE: IF USE MORE THAN ONE TOLL ROAD

Q670 Which of these toll roads do you use **most frequently**? (Select one)

[DISPLAY ANSWERS SELELCTED IN Q665 IN SAME ORDER]

- 1 SH 130
- 2 Loop 1 North
- 3 SH 45 North
- 4 183A
- 5 None
- 6 Don't know (V)

SECTIONS 700-800: TOLL ROAD USERS

BASE: TOLL ROAD USERS

Q700 Why do you use toll roads? (Select all that apply)

[DO NOT READ]

- 1 They are faster / get where I need to go more quickly
- 2 They are safer
- 3 They are more reliable
- 4 Fewer trucks on the roads
- 5 I use them for emergencies
- 6 Other (please specify)

BASE: TOLL ROAD USERS

Q705 How do you **usually** pay your tolls? (Select one)

[INTERVIEWER NOTE: PRONOUNCED Textag]

[RANDOMIZE]

- 1 Cash
- 2 TxTag
- 3 Pay by Mail/pay a monthly bill
- 4 Other toll tag [ANCHOR]
- 5 Don't know (V)
- 6 Refused (V)

BASE: TOLL ROAD USERS

Q710 Are you employed full or part time?

[DO NOT READ – SELECT ALL THAT APPLY]

- 1 Yes - Full time
- 2 Yes - Part time
- 3 No

BASE: EMPLOYED TOLL ROAD USERS

Q715 Do you commute to work?

- 1 Yes
- 2 No
- 8 Refused (V)

BASE: TOLL ROAD USERS WHO COMMUTE TO WORK

Q720 Approximately how many miles is your work from your home?

[NUMERIC TEXT BOX]

[VALID RANGE: 1-9999]

BASE: TOLL ROAD USERS WHO COMMUTE TO WORK

Q725 How do you usually get to work? Select all that apply

[RANDOMIZE]

- 1 Drive alone [INTERVIEWER NOTE: THIS INCLUDES MOTORCYCLES]
- 2 Carpool
- 3 Take a bus
- 4 Walk
- 5 Bicycle (bike)
- 6 Other (V)

BASE: DRIVE ALONE OR CARPOOL

Q730 Which major roads and toll roads do you normally drive to get to work? (Select all that apply)

[DO NOT READ]

- 1 Anderson Mill Road
- 2 Ed Bluestein
- 3 Decker Lane
- 4 Pflugerville Loop
- 5 McNeil Road
- 6 Lake Creek Parkway
- 7 Parmer Lane
- 8 I-35 (north to downtown)
- 9 I-35 (south to downtown)
- 10 US 183 North
- 11 SH 45 North
- 12 RM 620
- 13 FM 973
- 14 FM 1460
- 15 FM 1625
- 16 FM 1325
- 17 183A
- 18 US 183 South (east of I-35)
- 19 US 290 East
- 20 US 290W/SH 71W
- 21 Southwest Parkway
- 22 Ben White (SH 71East)
- 23 Loop 360
- 24 Loop 1
- 25 SH 130
- 26 Brodie Lane
- 27 Other, please specify

BASE: TOLL ROAD USERS WHO COMMUTE TO WORK

Q735 Approximately how many minutes does it take you to commute to work?

[NUMERIC TEXT BOX]

[VALID RANGE: 1-1440]

BASE: TOLL ROAD USERS WHO COMMUTE TO WORK

Q740 Approximately how many minutes does it take you to commute home?

[NUMERIC TEXT BOX]

[VALID RANGE: 1-1440]

BASE: TOLL ROAD USERS WHO COMMUTE TO WORK

Q745 How many days/week do you commute to work?

[NUMERIC TEXT BOX]

[VALID RANGE 1-7]

BASE: COMMUTE TO WORK MORE THAN ZERO DAYS/WEEK

Q750 How many of these days do you use a toll road?

[NUMERIC TEXT BOX]

[MUST BE EQUAL TO OR LESS THAN PREVIOUS ANSWER]

BASE: COMMUTES AND USES TOLL ROAD MORE THAN ZERO DAYS/WEEK

Q755 Do you use the toll road...?

- 1 Going to work
- 2 Going home from work, or
- 3 Both going to work and going home from work

BASE: COMMUTES AND USES TOLL ROAD MORE THAN ZERO DAYS/WEEK

Q760 Which toll roads do you use most often to commute to work? (Select all that apply)

[RANDOMIZE]

- 1 183A
- 2 SH 45 North
- 3 Loop 1 North
- 4 SH 130

BASE: COMMUTE TO WORK USING TOLL ROAD 0 DAYS

Q765 Why don't you use a toll road to commute to work? (Select all that apply.)

[DO NOT READ]

- 1 No toll road on my route to work / not available
- 2 Too expensive
- 3 Wouldn't save me any time
- 4 Privacy concerns
- 5 Other (SPECIFY)

BASE: IF TOLL ROAD NOT AVAILABLE

Q770 If there was a toll road that you could take to commute to work, would you use it?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Don't know (V)
- 4 Refused (V)

BASE: TOLL ROAD USERS

Q775 Do you ever use a toll road for non-work related purposes (e.g., to school, to buy groceries or to shop, to visit friends, to go to church)?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Refused (V)

BASE: IF USE TOLL ROAD FOR NON-WORK RELATED PURPOSES

Q780 Which toll road do you use most often for non-work related trips? (Select all that apply)

[RANDOMIZE]

- 1 183A
- 2 SH 45 North
- 3 Loop 1 North
- 4 SH 130

BASE: IF USE TOLL ROAD FOR NON-WORK RELATED PURPOSES

Q785 How often do you use the toll roads for these non-work related trips? Would you say...? (Select one.)

- 1 Multiple times a day
- 2 Once a day
- 3 A few times a week
- 4 Once a week
- 5 A few times per month
- 6 A few times per year

BASE: IF DO NOT USE TOLL ROAD FOR NON-WORK RELATED PURPOSES

Q790 Why don't you use a toll road for these trips? (Select all that apply.)

[DO NOT READ]

- 1 No toll road on my route / not available
- 2 Too expensive
- 3 Wouldn't save me any time
- 4 Privacy concerns
- 5 Other (SPECIFY)

BASE: IF TOLL ROAD NOT AVAILABLE

Q795 If there was a toll road that you could take for non-work related trips, would you use it?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Don't know (V)

BASE: TOLL ROAD USERS WHO WORK

Q800 Do you ever use a toll road for work purposes (e.g., business travel) other than your commute?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Don't know (V)

BASE: IF USE TOLL ROAD FOR WORK PURPOSES OTHER THAN COMMUTE

Q805 Which toll road do you use most often for these business trips? (Select all that apply)

[RANDOMIZE]

- 1 183A
- 2 SH 45 North
- 3 Loop 1 North
- 4 SH 130

BASE: IF USE TOLL ROAD FOR WORK PURPOSES OTHER THAN COMMUTE

Q810 How often do you use the toll roads for business trips? Would you say...?

- 1 Multiple times a day
- 2 Once a day
- 3 A few times a week
- 4 Once a week
- 5 A few times per month
- 6 A few times per year

BASE: IF DO NOT USE TOLL ROAD FOR WORK PURPOSES OTHER THAN COMMUTE

Q815 Why don't you use a toll road for these trips?

[DO NOT READ]

- 1 No toll road on my route / not available
- 2 Too expensive
- 3 Wouldn't save me any time
- 4 Privacy concerns
- 5 Other (SPECIFY)

BASE: IF TOLL ROAD IS NOT AVAILABLE FOR WORK PURPOSES OTHER THAN COMMUTE

Q820 If there was a toll road that you could take for business-related trips, would you use it?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Don't know (V)

SECTIONS 900-1000 NON-TOLL ROAD USERS

BASE: NON-TOLL ROAD USERS

Q900 Are you employed full or part time?

[DO NOT READ]

- 1 Yes - Full time
- 2 Yes - Part time
- 3 No

BASE: EMPLOYED NON-TOLL ROAD USERS

Q905 Do you commute to work?

[DO NOT READ]

- 1 Yes
- 2 No

BASE: NON-TOLL ROAD USERS WHO COMMUTE TO WORK

Q910 Approximately how many miles is your work from your home?

[NUMERIC TEXT BOX]

[VALID RANGE: 0-9999]

BASE: NON-TOLL ROAD USERS WHO COMMUTE TO WORK

Q915 How do you usually get to work? (Select all that supply)

[RANDOMIZE]

- 1 Drive alone [INTERVIEWER NOTE: THIS INCLUDES MOTORCYCLES]
- 2 Carpool
- 3 Take a bus
- 4 Walk
- 5 Bicycle (bike)
- 6 Other (V)

BASE: IF DRIVE ALONE OR CARPOOL

Q920 Which major roads do you normally drive to get to work? (Select all that apply)

[DO NOT READ]

- 1 Anderson Mill Road
- 2 Ed Bluestein
- 3 Decker Lane
- 4 Pflugerville Loop
- 5 McNeil Road
- 6 Lake Creek Parkway
- 7 Parmer Lane
- 8 I-35 (north to downtown)
- 9 I-35 (south to downtown)
- 10 US 183 North
- 11 SH 45 North
- 12 RM 620
- 13 FM 973
- 14 FM 1460
- 15 FM 1625
- 16 FM 1325
- 17 183A
- 18 US 183 South (east of I-35)
- 19 US 290 East
- 20 US 290W/SH 71W
- 21 Southwest Parkway
- 22 Ben White (SH 71East)
- 23 Loop 360
- 24 Loop 1
- 25 SH 130
- 26 Brodie Lane
- 27 Other, please specify

BASE: NON-TOLL ROAD USERS WHO COMMUTE

Q925 Typically, at what time do you leave your home to go to work?

[NUMERIC TEXT BOX]

BASE: NON-TOLL ROAD USERS WHO COMMUTE

Q930 Approximately how many minutes does it take you to commute to work?

[NUMERIC TEXT BOX]

[VALID RANGE: 1-1440]

BASE: NON-TOLL ROAD USERS WHO COMMUTE

Q935 Typically, at what time do you leave your work to go home?

[NUMERIC TEXT BOX]

BASE: NON-TOLL ROAD USERS WHO COMMUTE

Q940 Approximately how many minutes does it take you to commute home?

[NUMERIC TEXT BOX]

[VALID RANGE: 1-1440]

BASE: NON-TOLL ROAD USERS WHO COMMUTE

Q945 How many days/week do you commute to work?

[NUMERIC TEXT BOX]

[VALID RANGE 1-7]

BASE: COMMUTE TO WORK MORE THAN ZERO DAYS/WEEK

Q950 Do you think that any of the following toll roads provide an alternative to the current road you take to get to work? (Select all that apply)

[RANDOMIZE]

- 1 183A
- 2 SH 45 North
- 3 Loop 1 North
- 4 SH 130
- 5 None (V)

BASE: IF ALTERNATIVE TOLL ROADS COULD BE USED

Q955 Why are you not using this/these toll road(s) to get to work?

[DO NOT READ]

- 1 Too expensive
- 2 Wouldn't save me any time
- 3 I'm opposed to toll roads
- 4 Privacy concerns
- 5 Distrust of government
- 6 Other (SPECIFY)

BASE: IF NO ALTERNATIVE TOLL ROADS TO GET TO WORK

Q960 If there was a toll road that you could take to commute to work, would you use it?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Don't know (V)

BASE: NON-TOLL ROAD USERS

Q965 How often do you make trips for non-work purposes (e.g., go to school, shop or run other household errands, conduct personal business or have a medical appointment, visit friends or participate in other social or recreation activities, go to church)? Would you say...?

- 1 Multiple times a day
- 2 Once a day
- 3 A few times a week
- 4 Once a week
- 5 A few times per month
- 6 A few times per year

BASE: NON-TOLL ROAD USERS

Q970 Do you think that any of the following toll roads provide an alternative to the current roads you take for these non-work related trips? (Select all that apply)

[RANDOMIZE]

- 1 183A
- 2 SH 45 North
- 3 Loop 1 North
- 4 SH 130
- 5 None (V)

BASE: NON TOLL USER AND IF ALTERNATIVE TOLL ROADS COULD BE USED

Q975 Why are you not using this/these toll road(s) for non-work related trips?

[DO NOT READ]

- 1 Too expensive
- 2 Wouldn't save me any time
- 3 I'm opposed to toll roads
- 4 Privacy concerns
- 5 Distrust of government
- 6 Other (SPECIFY)

BASE: NON TOLL USER AND IF NO ALTERNATIVE TOLL ROADS FOR NON-WORK RELATED TRIPS

Q980 If there was a toll road that you could take for these non-work related trips, would you use it?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Don't know (V)

BASE: NON-TOLL ROAD USERS WHO WORK

Q985 How often do you make trips for work purposes (e.g., business travel) other than your commute? Would you say...?

- 1 Multiple times a day
- 2 Once a day
- 3 A few times a week
- 4 Once a week
- 5 A few times per month
- 6 A few times per year

BASE: NON-TOLL ROAD USERS WHO WORK

Q990 Do you think that any of the following toll roads provide an alternative to the current roads you take for your business trips? (Select all that apply)

[RANDOMIZE]

- 1 183A
- 2 SH 45 North
- 3 Loop 1 North
- 4 SH 130
- 5 None (V)

BASE: NON TOLL USER AND IF ALTERNATIVE TOLL ROADS COULD BE USED FOR WORK-RELATED PURPOSES

Q995 Why are you not using this toll road for business trips?

[DO NOT READ]

- 1 Too expensive
- 2 Wouldn't save me any time
- 3 I'm opposed to toll roads
- 4 Privacy concerns
- 5 Distrust of government
- 6 Other (SPECIFY)

BASE: NON TOLL USER AND IF NO ALTERNATIVE TOLL ROADS FOR WORK-RELATED PURPOSES

Q1000 If there was a toll road that you could take for these work-related trips, would you use it?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Don't know

BASE: NON-TOLL ROAD USERS

Q1005 Are you willing to pay a toll if it will save you travel time?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Don't know

BASE: NON TOLL USER AND IF WILLING TO PAY A TOLL TO SAVE TIME

Q1010 How much time do you need to save before you would be willing to pay a toll? Please give your response in number of minutes.

[INSERT TEXT BOX]

[VALID RANGE: 1-1440]

BASE: NON TOLL USERS AND IF WILLING TO PAY A TOLL TO SAVE TIME

Q1015 How much would you be willing to pay for that travel time saving?

[INSERT NUMERIC TEXT BOX]

[VALID RANGE: 0-\$10000]

SECTION 1100: ALL RESPONDENTS

BASE: ALL QUALIFIED RESPONDENTS

Q1100 What are the different payment options that you can use to pay for tolls in Austin?

[DO NOT READ]

- 1 TxTag
- 2 Other toll tag
- 3 Cash
- 4 Pay by mail / video billing / pay a monthly bill
- 5 Other -- specify

BASE: ALL QUALIFIED RESPONDENTS

Q1105 Before today, had you heard of **[INTERVIEWER NOTE: THIS IS PRONOUNCED Textag]** TxTag?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Don't know (V)
- 4 Refused (V)

BASE: IF HEARD OF TXTAG

Q1110 Where did you hear of TxTag? [Select all that apply.]

[DO NOT READ]

- 1 TV ad
- 2 Radio ad
- 3 Billboard
- 4 News
- 5 Friend, relative or neighbor
- 6 Other - specify

BASE: IF HEARD OF TXTAG

Q1115 Do you have a TxTag on your vehicle?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Don't know (V)

[IF Q1115/3 SKIP TO Q1145]

BASE: IF HAS TXTAG ON VEHICLE

Q1120 How do you usually add money to your account? (Select one)

[RANDOMIZE]

- 1 Call the customer service center
- 2 Go to the customer service center to pay in person
- 3 Pay online at TxTag website
- 4 With AutoPay, where your credit card is billed automatically when account balance gets too low

BASE: IF NEVER HEARD OF TXTAG (Q1105/2,3,4)

Q1125 Users of toll roads in Central Texas are able to pay their toll with a TxTag. The TxTag sticker is a thin device that goes on the inside of your windshield behind your rearview mirror. Drivers with a TxTag don't have to stop at a toll booth or slow down to pay. TxTags are free at this time; however, you must start the account with at least \$20 in pre-paid tolls.

Knowing this, would you consider getting a TxTag?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Don't know (V)
- 4 Refused (V)

BASE: IF DOES NOT HAVE TXTAG OR WOULD NOT CONSIDER GETTING (Q1115/2 OR Q1125/2,3,4)

Q1130 Would you get a TxTag if you knew it could be used for paying tolls in Houston or Dallas?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Don't know (V)
- 4 Refused (V)

BASE: IF WOULD NOT GET TXTAG IF KNEW IT COULD BE USED FOR PAYING TOLLS IN HOUSTON OR DALLAS

Q1135 What if you knew that it saves you 10% or more on tolls statewide? Would you get a TxTag?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Don't know (V)
- 4 Refused (V)

BASE: IF WOULD NOT GET TXTAG IF KNEW IT SAVES 10% ON TOLLS

Q1140 What if it could be used for paying for other public services, such as parking at the airport or city or private parking garages? Would you get a TxTag?

[DO NOT READ]

- 1 Yes
- 2 No
- 3 Don't know (V)
- 4 Refused (V)

BASE: ALL QUALIFIED RESPONDENTS

Q1145 Of the following options to pay tolls, which do you prefer? (Select one)

[RANDOMIZE]

- 1 Paying tolls in cash at tollbooths
- 2 Paying a monthly bill sent in the mail
- 3 Paying with an electronic toll tag like TxTag

BASE: ALL QUALIFIED RESPONDENTS

Q1155 Which statement most clearly reflects your opinion?

[RANDOMIZE]

- 1 I would use the toll roads if the only options to pay were with a toll tag or paying a monthly bill sent in the mail
- 2 I will use the toll roads only if there's the option to stop at a toll booth and pay with cash.

BASE: IF DOES NOT HAVE A TXTAG

Q1160 TxDOT is considering removing tollbooths from Austin toll roads. Currently only about 16% of tolls are paid with cash. More than 75% of tolls are paid with a TxTag, and the remaining customers are sent a monthly bill. Customers who now pay with cash would save time and money by getting a TxTag because TxTag is 10% cheaper. Getting rid of the cash option would also save TxDOT money because TxTag transactions cost the agency about half of the cost of taking cash in the manned tollbooth lanes. If tollbooths are removed, drivers will pay with a toll tag or pay a monthly bill sent in the mail. Knowing this, how would removing cash tollbooths as a payment option affect your decision about whether or not to drive on the toll roads? Would you say that ...?

- 1 You would still consider using the toll roads.
- 2 You won't use the toll roads if tollbooths are removed.
- 3 Don't know (V)
- 4 Refused (V)

BASE: ALL QUALIFIED RESPONDENTS

Q1165 If the tollbooths are removed, there will be a lot of space and buildings at the toll plazas that could be used for other things without impacting the free flow of traffic on the toll road. Which of the following services would you like to see offered at the toll plazas? (Select all that apply)

[RANDOMIZE]

- 1 Gas stations
- 2 Convenience stores
- 3 Fast food franchises
- 4 Dry cleaning franchises
- 5 Banking locations
- 6 TxTag customer service
- 7 Restrooms
- 8 None (DO NOT READ)
- 9 Other (SPECIFY)

BASE: IF DOES NOT HAVE A TXTAG

Q1170 Next, I'm going to read you some different options for paying tolls. For each option, please tell me whether or not you would consider using it as a way to pay tolls. Is this something you would consider?

- 1 Yes, would consider
- 2 Might (V)
- 3 No, would not consider
- 4 DK (V)
- 5 Ref (V)

[RANDOMIZE]

- 1 Paying with a credit or debit card at an automated machine on the toll road.
- 2 Buying a flat-rate day pass for use on the toll roads.
- 3 Buying a flat-rate multi-day pass for use on the toll roads.
- 4 Getting a discount for pre-registering your license plate with a credit card that would be charged automatically when you use the road.
- 5 Having your tolls billed to your cell phone account by sending a text message with your license plate when you use a toll road.

SECTION 1200: DEMOGRAPHICS

As we are nearing the end of the survey we just have a few questions we would like to ask you for classification purposes

BASE: ALL QUALIFIED RESPONDENTS

Q1210 What is the highest level of education you have attained?

- 1 Grade School
- 2 GED or High School Graduate
- 3 Some college or vocational education
- 4 College Graduate
- 5 Graduate Degree
- 6 Refused (V)

BASE: ALL QUALIFIED RESPONDENTS

Q1215 Do you own your home or rent it?

- 1 Own
- 2 Rent
- 3 Other, please specify

BASE: ALL QUALIFIED RESPONDENTS

Q1220 What is the zip code at your permanent place of residence?

[NUMERIC TEXT BOX]

BASE: ALL QUALIFIED RESPONDENTS

Q1225 How many people, including yourself, live in your home?

- 1 1
- 2 2
- 3 3
- 4 4
- 5 5 or more

BASE: ALL QUALIFIED RESPONDENTS

Q1230 Please describe your household type? Is it...? (Select all that apply)

[INTERVIEWER NOTE: IF SAYS MORE THAN ONE PERSON IN HOUSEHOLD THEN START READING CODES 2 AND SKIP OVER READING CODE 1]

- 1 Single adult
- 2 Unrelated adults
- 3 Married without child(ren)
- 4 Married with child(ren)
- 5 Single parent
- 6 Other, please specify
- 7 Refused (V)

BASE: ALL QUALIFIED RESPONDENTS

Q1235 How many vehicles (cars, trucks, motorcycles) are available for use in your household?

- 1 Zero
- 2 1
- 3 2
- 4 3
- 5 4 or more

BASE: ALL QUALIFIED RESPONDENTS

Q1240 Which income category represents your annual household income in 2007?

- 1 Less than \$25,000
- 2 \$25,000 to \$49,999
- 3 \$50,000 to \$74,999
- 4 \$75,000 to \$99,999
- 5 \$100,000+
- 6 Refused (V)

BASE: ALL QUALIFIED RESPONDENTS

Q1200 Most people classify themselves as being White, or Caucasian, Hispanic or Latino, African-American, or Asian American? What do you consider yourself?

- 1 White or Caucasian
- 2 Hispanic or Latino
- 3 African-American
- 4 Asian-American
- 5 Other
- 6 Refused (V)

BASE: ALL QUALIFIED RESPONDENTS

Q1245 Would you be willing to participate in follow-up research studies on the topic of transportation issues in Central Texas?

- 1 Yes
- 2 No

BASE: ALL QUALIFIED RESPONDENTS

Q165 On behalf of Harris Interactive, thank you very much for your time and for sharing your opinions with me. (INTERVIEWER: END CALL WITH RESPONDENT.)

BASE: ALL ICW RESPONDENTS

Q59 STATUS OF RESPONDENT (LABELS USED IN ICW SAMPLE DISPOSITION REPORTS)

[PN: CAPTURE FIRST QUALIFYING CODE. SINGLE PUNCH]

- 999 COMPLETE (Q99/1)
- 29 OVER QUOTA (99/3)
- 41 Q405 SCREENER REFUSAL #1 (405/8,9)
- 42 Q104 SCREENER REFUSAL #2 – AGE (Q104/8888,9999)
- 43 Q411 SCREENER REFUSAL #3 – EMPLOY (Q411/8,9)
- 61
- 62 NOT QUALIFIED #2 – COMPETE EMPLOY (Q411/1,2,3)
- 63 NOT QUALIFIED #3 – WRONG SERVICE (Q412/NE1 AND Q412/2)
- 64 NOT QUALIFIED #4 - NO FEARNET (440/NE7 AND Q442/NE7)
- 65 NOT QUALIFIED #5 – SCREENER NQ (Q99/6)

BASE: ALL RESPONDENTS

Q60 STATUS OF RESPONDENT (DOES NOT APPEAR ON SCREEN)

- 1 QUALIFIED RESPONDENTS, QUOTA OPEN (Q99/1)
- 2 PARTIALLY QUALIFIED, QUOTA OPEN
- 3 QUALIFIED RESPONDENTS, QUOTA CLOSED (Q99/3,4,5)
- 4 PARTIALLY QUALIFIED RESPONDENTS, QUOTA CLOSED
- 5 OVERALL QUOTA CLOSED
- 6 NOT QUALIFIED (Q99/6)