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16. Abstract

As the use of toll roads increase to finance new road infrastructure or add capacity to existing road infrastructure, the question of who use and do not use toll roads becomes increasingly important to toll road developers, financiers, Traffic and Revenue consultants, and investors, among others. The latter pertains specifically to truck usage of toll facilities. Given the high revenue margin brought in by trucks – i.e., truckers often pay between two and five times the toll rate levied on cars – it is critically important to have robust data and information about truckers' potential usage of toll facilities. This research study thus attempted to characterize truck toll road users and non-users of Texas toll roads. Trucking company respondents (108) to an internet and telephone survey that was conducted in the Summer and Spring of 2009 were categorized as truck users and non-users of Texas toll roads and statistical analysis was conducted to provide insight into the characteristics and differences between truckers that choose to use toll roads and those that choose to avoid 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 information and perceptions expressed in the surveys provide considerable insight into the characteristics of the truck users and non-users of Texas toll roads.

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Characteristics of the Truck Users and Non-Users of Texas Toll Roads

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Chapter 1. Introduction

In the U.S., the largest revenue source for the funding of highway infrastructure is the federal and state fuel taxes. These taxes were conceived in the 1950s as an indirect charge to recover the costs of vehicle travel on the U.S. highway system. However, this tax has not increased with the inflation rate and given increasing maintenance and construction costs, and more fuel efficient vehicles, the "per gallon consumed" tax has become inadequate. Inadequate funding from the traditional fuel tax together with increased demand for transportation and increasing maintenance needs, resulting from an aging highway system, have thus resulted in significant deficits. "Budget shortfalls undermine [the] ability of states to maintain existing facilities properly, leading to deferred maintenance [and] reducing the useful lifespan of roads, bridges, ports, and other infrastructure"(Teigen, 2007). Given these significant maintenance backlogs and the challenges associated with preserving the existing infrastructure, funding for major capital investment projects is becoming increasingly adequate.

A number of options exist to increase available funding—both for capital and maintenance projects—by administering tolls on new or existing road infrastructure. This can be done by constructing new facilities, adding capacity to existing facilities, or by granting a concession to operate an existing facility to the private sector. Concession agreements, when appropriately structured, can provide significant initial time-of-lease capital that can be used to fund maintenance or provide long-term future infrastructure funding. In return, the concessionaire acquires the right to operate and toll the road for a period of time specified in the agreement. As mentioned, the highway system can also be expanded (i.e., Greenfield projects) by charging users a toll for the use of newly constructed facilities. This can take the form of a public agency funding, constructing, operating, and maintaining a toll facility or by using private capital to finance, design, construct, operate, and maintain the facility for a specific period of time (i.e., concession). The private company collects the toll revenue from the facility to cover any initial "lump sum" payments to the public agency, its expenses, as well as to allow for a profit during the specified contract period. At the end of the contract period, the facility is transferred back to the public agency at no cost. A number of U.S. State DOTs, including Texas, are actively pursuing tolling as a means to provide much needed capacity sooner.

Tolling proposals are, however, critically dependent on reliable Traffic and Revenue (T&R) forecasts. A number of studies by the bond rating agencies—including Standard & Poor's (S&P)—have shown that a majority of toll roads failed to meet revenue expectations in their first full year of operation. These studies alluded to the existence of an optimism bias in T&R forecasts, with an over estimation of traffic by 20-30% in the first 5 years of operation. This uncertainty contributes to increased risks about the feasibility of toll roads, requirements for escrow accounts of up to 30% of the amount borrowed, and thus high interest payments (and ultimately higher costs to the users) to compensate investors for higher risks.

Given that trucks are often a significant component of T&R forecasts, it is important to have robust data and information about trucks' potential usage of toll facilities. The literature, however, suggests tremendous uncertainty surrounding assumptions about truck usage in T&R studies. For example, T&R consultants often estimate the number of trucks that will use a toll facility by assuming a certain percentage of the total traffic will be truck traffic. This often results in the overestimation of truck usage of toll facilities.

To improve the robustness of truck toll road usage forecasts, it is very important to acknowledge at the outset that the trucking industry is not homogenous. The trucking sector can be segmented in terms of:

- service area, e.g., local, regional, national, and international (i.e., crossborder U.S.-Canada, U.S.-Mexico, and Canada-Mexico),
- trip type, e.g., intra-city, inter-city, and through trips,
- vehicle ownership, e.g., owner-operator and company truck,
- vehicle operator, e.g., owner-operator[1] and company employee driver,
- fleet size , e.g., small (less than five trucks), medium, and large,
- for-hire or private trucking[2],
- vehicle characteristics, e.g., light, medium, heavy, and specialized trucks,
- type of trailer, e.g., dry freight, refrigerated, flatbed, liquid tank, dry hopper, auto rack, household goods, and
- type of carrier/operation, e.g., truckload[3], less-than-truckload[4], parcel/express[5], and specialized services[6].

Although these segments are not mutually exclusive, it is important to recognize the different segments when trying to understand a trucking company's decision to use or avoid a toll facility. For example, the cost structure and route choices of these segments are different. Local trucker's costs could be significantly increased by congestion. A local toll bridge or tunnel could thus see a high percentage of truck users, for the following reasons: (a) the tolled facility is on the shortest, fastest route to and from the trip's end points, (b) the toll charged is

---

1 Owner-Operators are independent drivers that own their trucks and are hired by shippers or other carriers to transport their goods. They typically operate as truckload carriers

2 Private carriers are trucking fleets owned by a particular manufacturer and used to transport the manufacturer's own products. Examples of these types of carriers are Wal-Mart and HEB.

3 Truckload (TL) carriers generally move full loads of freight, usually from one shipper to one receiver without having to make an intermittent stop to sort the load in a terminal. JB Hunt is an example of this type of carrier. Typical load sizes are 10,000 pounds or more and the distances covered are usually more than 500 miles for long haul carriers and between 200 and 500 miles for medium or regional haulers.

4 Less-than-truck load (LTL) carriers generally deliver smaller shipments from more than one shipper to be delivered to more than one receiver. Shipments are typically picked up by a LTL driver along a regional route/service area and transported to a terminal. The shipments are then sorted and consolidated on a second truck that delivers the shipments to the final destination. Load sizes for LTLs are generally 500 to 2,000 pounds. An example of a LTL carrier is Yellow Freight. The cost structure of LTL carriers is more complex than that of a TL carrier due to the way in which their operation is set up. LTL carriers typically have higher fixed and operating costs, which include increased overhead costs due to the handling of many smaller shipments, additional labor costs for dock personnel at receiving terminals, and the costs of maintaining the terminal areas.

5 Parcel express carriers make door-to-door deliveries of small packages (usually less than 100 pounds). Examples of parcel express carriers are Federal Express (FedEx) and DHL. These carriers conduct their business in a specific delivery timeframe that ensures on-time delivery based on the customer's specifications.

6 Specialized operations include the transportation of chemicals or hazardous materials (Hazmat), as well as the transportation of oversize/overweight loads. Specialized trucking firms have additional fixed and marginal costs associated with their type of operation, such as the need for specialized equipment and the cost of special permits for the commodity being transported.

comparatively low compared to the incremental variable cost to operate on an alternative non-tolled route, and (c) everyone has to use the toll facility as no non-toll alternative exists. In other words, the cost of the toll does not have any competitive consequences. On the other hand, Knorring et al. (2005) found that cost/benefit was a significant factor in the route selection of long haul truckers as these companies typically have more non-toll route choices available.

1.1 The Objectives of this Report

A key objective of TxDOT Research Study 0-6044 was to gain an improved understanding of the behavioral responses of different truck market segments to tolling, as well as the differences between truckers that choose to use toll roads and those that choose to avoid toll roads. A comprehensive literature review and survey data analysis was thus conducted to provide insight into the characteristics of the truck users and non-users of Texas toll roads. This report documents the research team's review of the literature on the characteristics of truck toll road users and the findings from an internet and telephone survey administered to trucking companies whose main offices were predominantly located along the I-35 corridor. 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. Chapter 4 summarizes the survey data analysis in terms of the characteristics of the truck toll road users and non-toll road users, and the results of the statistical tests that were conducted to assess the differences between truck users and non-users of Texas toll roads. Chapter 5 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 6 highlights the salient findings of the analysis conducted in the preceding chapters.

Chapter 2. Background

A comprehensive literature review and analysis of available commercial toll road usage data was conducted to provide preliminary insight into the usage of toll roads by the trucking sector. This Chapter of the report summarizes the salient findings of a number of studies that have been conducted by researchers in an effort to understand truck usage of toll roads, as well as available data on the commercial usage of the John Kilpatrick Turnpike, the Pennsylvania Turnpike, and the Florida Turnpike System. In addition to the studies summarized in this chapter, that aim to illustrate and characterize truck usage of toll roads, a number of other studies have been conducted to provide greater insight into the trucking sector's perception of truck toll lanes. These are briefly summarized in Appendix A.

2.1 Trucking and Road Pricing

Mullet and Poole (2006), in an article on trucking and road pricing, segmented the freight carrier market into: truckload for hire, owner/operator, less-than-truckload for hire, local delivery, parcel/express services, and private fleet (see Table 2.1). From Table 2.1 it is evident that Mullet and Poole believed that tolls are usually paid by the company—the exception being the case of owner/operators when tolls are paid by the driver.

Table 2.1: Freight Carrier Market Segments

Segment	Industry Structure	Hours of Operation	Payment Basis	Who Pays Toll?
Truckload (TL) for hire (Schneider, JB Hunt, etc.)	Large companies dominate; few terminal facilities	24/7	By the mile	Company
Owner operator	Independent contractors or leased to large carriers	24/7	By the mile or percentage of revenue generated	Driver
Less than truckload (LTL) for hire (Yellow, Roadway, Con-Way)	Large companies dominate; large terminal networks	24/7 Monday through Friday, limited weekend operations	Hourly in local operations; by the mile in intercity operations	Company
Local delivery (Shenandoah's, Pride Dairy, Coca-Cola, Sysco Foods)	Varies widely-food, construction supplies, fuel, etc.	Daytime Monday through Friday, with some Saturday operations	Hourly	Company
Parcel/express (UPS, FedEx, DHL)	Dominated by UPS, FedEx, and DHL; large terminal networks	24/7 Monday through Friday, with limited weekend operations	Hourly in local operations; by the mile in intercity operations	Company
Private fleet (Wal-Mart, Kohl's, Tyson Foods)	Company fleet owns moving goods from central warehouses to retail locations	24/7 Monday through Friday, with limited weekend operations	Mix of hourly and by the mile	Company

Source: Mullet and Poole, 2006

The authors reported that truckers' belief that policy makers who advocate road pricing do not see truckers as stakeholders but rather as revenue sources. They argued that policy makers who advocate road pricing:

- favor social engineering as opposed to infrastructure development,
- favor tolling over taxes, because tolls do not need public approval once the tolling authority is established, and
- are interested in local projects— i.e., not the interconnectedness of the national system (Mullet & Poole, 2006).

The article further pointed out that truckers make operational changes to avoid congestion and delays, and that trucking companies are capable of analyzing the costs and benefits when comparing a priced facility and the alternative non-priced facilities en route. The authors also argued that truckers do not always see the benefits of commuter congestion relief measures translating into benefits for trucks. The authors thus concluded that the overall position of the trucking industry regarding tolls centers on: (a) not tolling existing interstate highways and (b) the pricing of additional capacity that truckers can elect to use or avoid. Truckers also prefer for road pricing to result in a direct benefit to the user— whether in the form of increased size, weight, or speeds. In other words, not only in relieved congestion (Mullett & Poole, 2006).

2.2 John Kilpatrick Turnpike

The John Kilpatrick Turnpike—a 25.3 mile four lane highway— serves as a perimeter expressway around the northwest quadrant of Oklahoma City, Oklahoma. It runs from I-40 in the western portion of the city, north, and then east to I-35, where it becomes the Turner Turnpike/ I-44. The toll expressway was constructed as a reliever road for traffic wanting to avoid delays in the central city (see Figure 2.1). The Kilpatrick Turnpike is owned by the Oklahoma Turnpike Authority (OTA), which also operates and maintains the toll road.

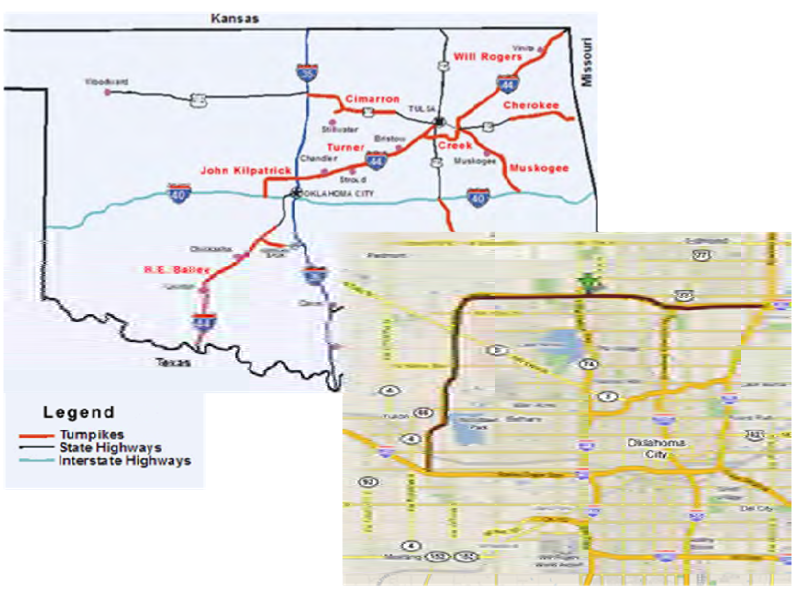
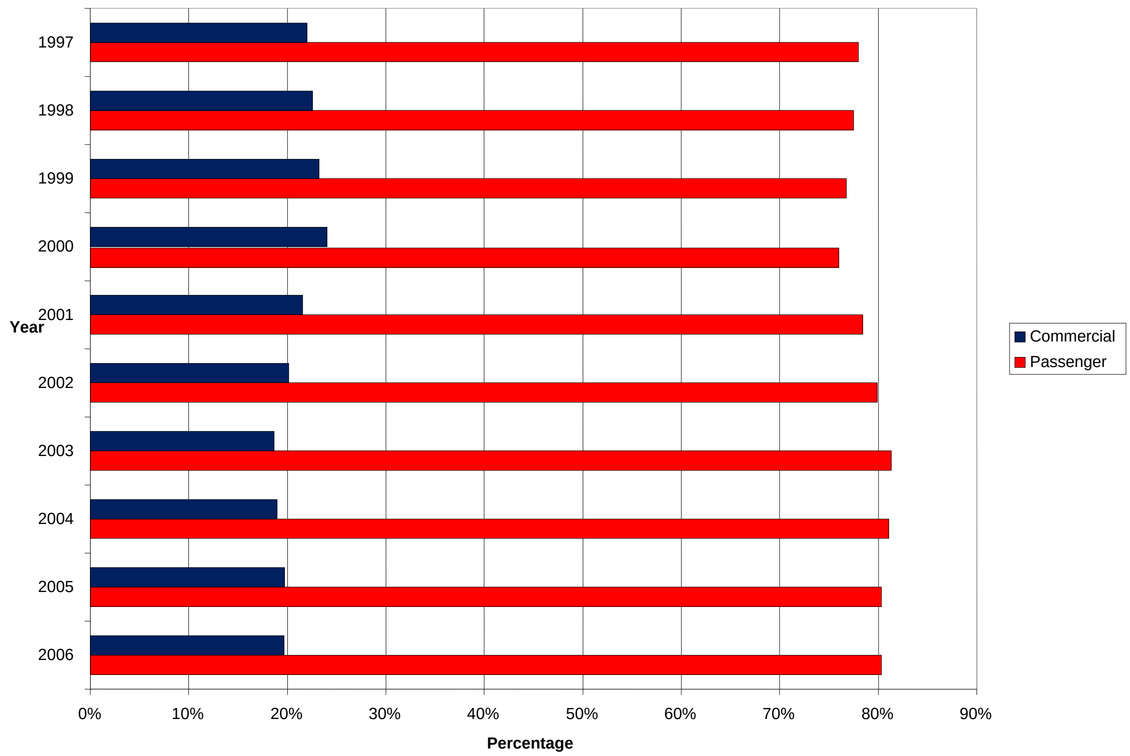


Figure 2.1: John Kilpatrick Turnpike

The OTA has collected detailed annual statistics regarding the facility's usage since its opening in the 1990s. Detailed data is available from 1997 to 2006 regarding the total miles traveled, total transactions, total revenue, average trip length, average tolls collected, and average toll per mile for both commercial and passenger vehicles. An analysis of the data revealed a number of interesting insights. Figure 2.2 illustrates the percentage of total miles traveled on the turnpike between 1997 and 2006 by commercial and passenger vehicles.

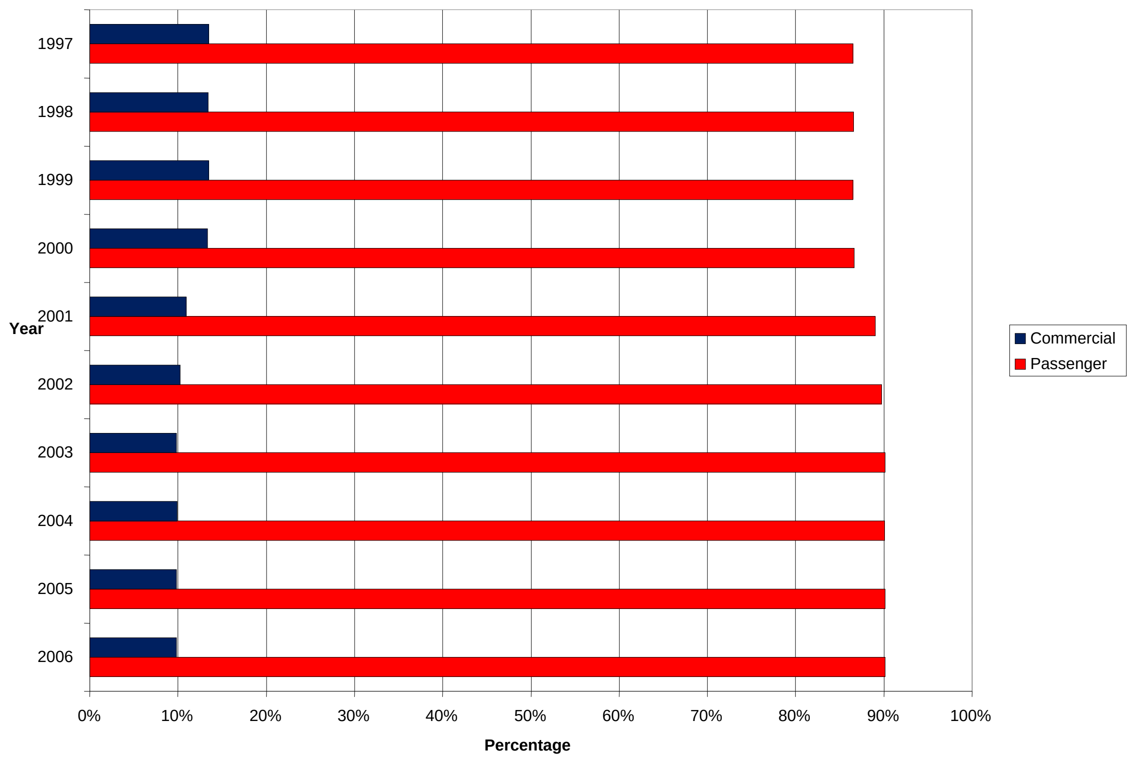


Source: John Kilpatrick, 2006

Figure 2.2: John Kilpatrick Turnpike Percentage of Total Miles Traveled

As is evident from Figure 2.2, passenger traffic dominated the usage of the turnpike in terms of vehicle miles traveled—representing roughly 80% of total miles traveled for the years 1997 to 2006. The highest percentage of commercial vehicle miles traveled was recorded in 2000—almost 25% of total vehicle miles traveled. The OTA, however, increased the average toll collected per commercial transaction by 30% for commercial vehicles in 2001, which lowered the relative percentage of commercial vehicle miles traveled on the John Kilpatrick in subsequent years.

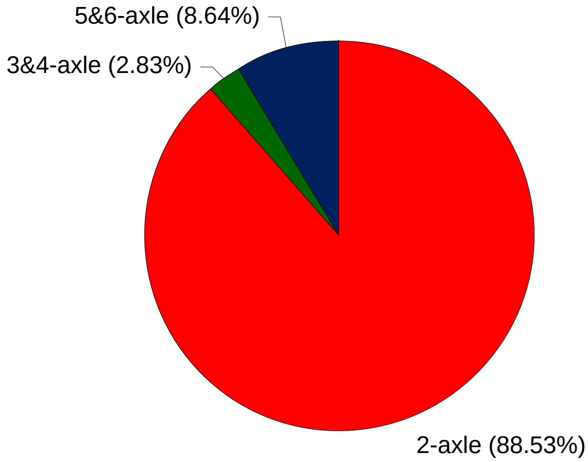
Figure 2.3 illustrates the percentage of total transactions by passenger and commercial vehicles for the period 2002 to 2006.



Source: John Kilpatrick, 2006

Figure 2.3: John Kilpatrick Turnpike Percentage of Total Transactions

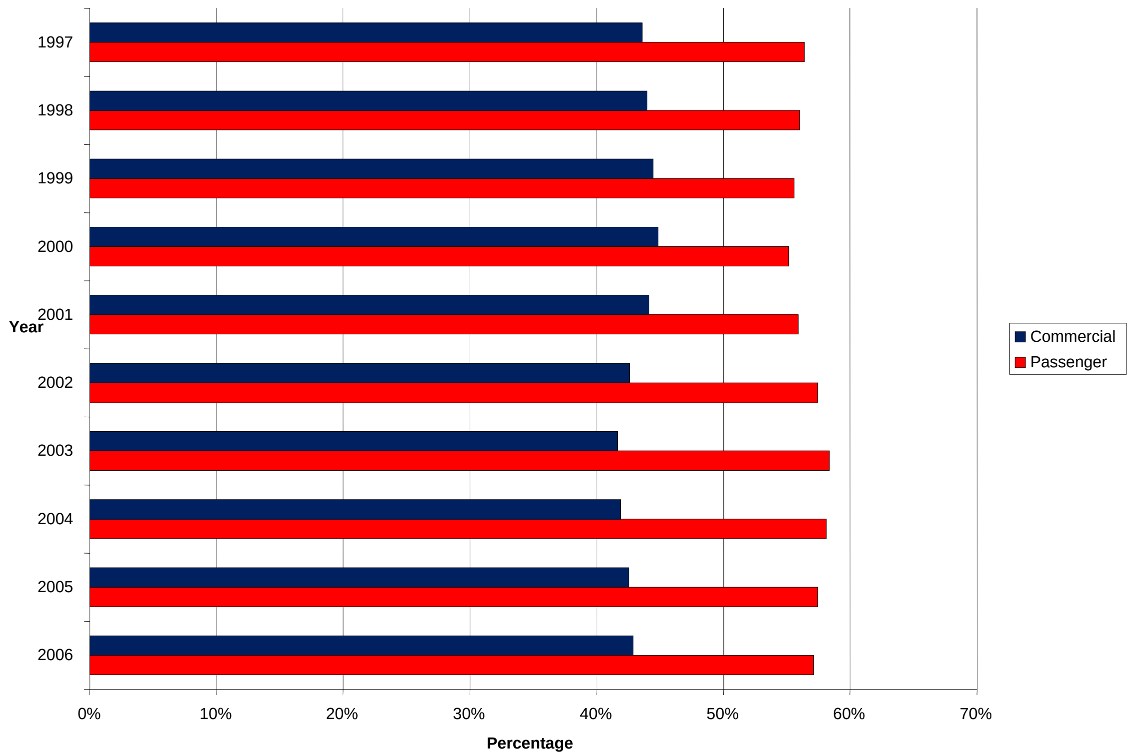
Similar to total miles traveled, passenger traffic represented the largest share of total transactions—representing approximately 90% of total transactions since 2002. Figure 2.4 illustrates the transaction percentages by axle category. From Figure 2.4 it is evident that 88.53% of the transactions represented two-axle vehicles. Vehicles with more than two axles only accounted for 11.47 % of total transactions in 2006 (John Kilpatrick, 2006). Although, it is unknown what percentage of the two-axle vehicles are commercial users, or what percentage of the three- and four-axle users are non-commercial users (i.e., passenger car pulling a trailer), it seems clear truck traffic (i.e., five- and six-axle vehicles) accounted for 8.64% of the total transactions on the John Kilpatrick Turnpike in 2006.



Source: John Kilpatrick, 2006

Figure 2.4: John Kilpatrick Turnpike Percentage of Transactions per Axle (2006)

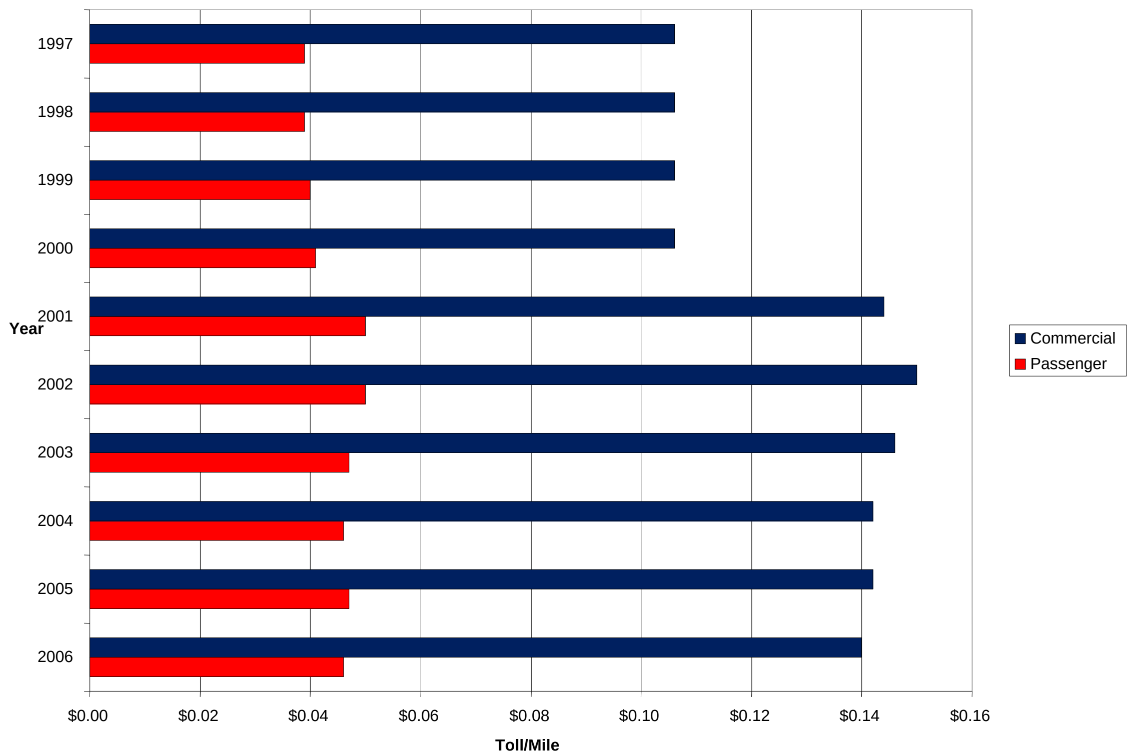
Figure 2.5 illustrates that commercial users accounted for more than 40% of the total revenue collected on the turnpike from 1997 to 2006. Thus approximately 10% of the transactions—i.e., representing the commercial transactions—accounted for more than 40% of the toll road revenue. This is due to the higher toll charged to commercial users (see Figure 2.6) and the longer averaged trip lengths (see Figure 2.6) by this market segment.



Source: John Kilpatrick, 2006

Figure 2.5: John Kilpatrick Turnpike Percentage of Total Revenue

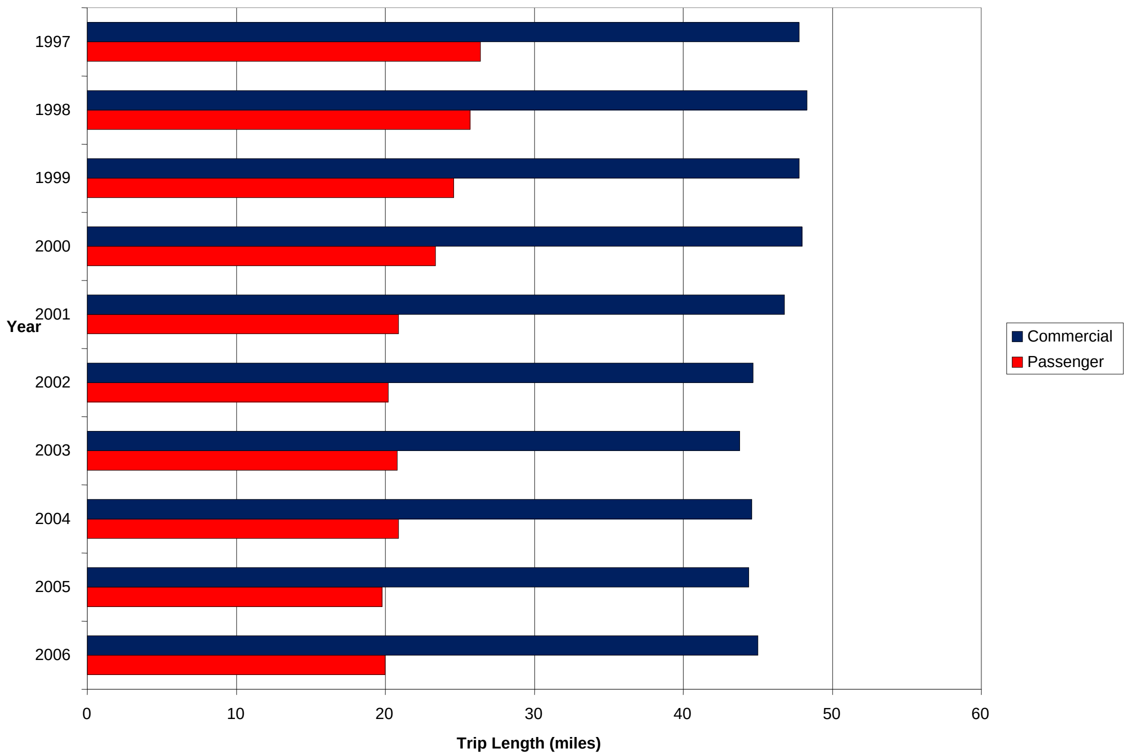
Commercial users are charged a substantially higher toll rate than passenger vehicle users. Figure 2.6 illustrates the average toll charged per mile for commercial and passenger vehicles. From Figure 2.6, it is evident that commercial users pay a substantially higher average toll per mile compared to passenger vehicles. Specifically noteworthy is the sharp increase in the average toll per mile charged to commercial users between 2000 and 2001.



Source: John Kilpatrick, 2006

Figure 2.6: John Kilpatrick Turnpike Average Toll per Mile

Finally, Figure 2.7 illustrates the average trip length per transaction over the analysis period for passenger and commercial vehicles. The figure clearly illustrates that commercial users tend to travel a longer distance on the turnpike per transaction, resulting in an average trip length of about 45 miles in 2006. Passenger users, on the other hand, tend to travel relatively shorter distances on the turnpike, resulting in an average trip length of approximately 20 miles in 2006. Interesting though is the fact that the average trip lengths of both market segments have decreased between 1997 and 2006—although more marginally in the case of commercial users.



Source: John Kilpatrick, 2006

Figure 2.7: John Kilpatrick Turnpike Average Trip Length

2.3 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. The system's 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. The turnpike was originally opened in 1940 as the first long-distance rural highway in the U.S. Since then, several segments were added in the 1950s and since the 1980s. Users are able to pay either cash or using E-ZPass.

Figure 2.8: 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 1,528 responses from passenger (i.e., 639 respondents) and commercial (i.e., 889 respondents) motorists, achieving slightly higher than a 95% confidence level (Patten Pribyl and Goulias, 2003).

In terms of the commercial users, the survey captured information on the gender, race, education, years as a commercial vehicle driver, and annual miles driven of commercial motorists on the facility. It also obtained relevant information on the type of carrier and average trip length (see Table 2.2).

Table 2.2: Pennsylvania Turnpike Commercial User Demographics

Characteristic		Statistic
Median Age		45
Gender	Male Female No Answer	95.3% 3.6% 1.1%
Race	White Black or African American Other No Answer	88.2% 4.7% 4.8% 2.2%
Education	Less than High School High School and Some Post-Secondary College Graduates and Some Graduate School Advanced Degrees No Answer	8.3% 80.4% 7.9% 1.8% 1.6%
Years as a Commercial Vehicle Driver	-10 11-20 21-30 31-40 +41 No Answer	36.3% 24.4% 13.3% 18.0% 2.0% 6.0%
Types of Carrier (multiple answers allowed)	For-Hire Truckload For-Hire Less-Than-Truckload Owner-Operator Private Carrier Passenger Motor Coach (Bus) Specialized Hauling Other	51.1% 20.6% 21.1% 21.9% 1.1% 16.3% 7.9%
Average Trip Length	1-100 miles 101-200 miles 201-499 miles 500+ miles No Answer	2.8% 6.9% 38.5% 50.1% 1.8%
Annual Miles Driving a Commercial Vehicle	-50,000 51,000 to 100,000 101,000 to 150,000 +151,000	10.2% 33.4% 38.9% 8.9% 8.5%

Source: Patten Pribyl and Goulias, 2003

From Table 2.2 it is evident that the median age of commercial users of the Pennsylvania Turnpike is 45 years. As would be expected, the majority of commercial drivers (95.3%) were male. These drivers were also predominantly white (88.2%) and approximately 80.4% of the commercial users had a high school education or some level of post secondary education. In terms of experience, 36.3% of the commercial drivers reported to have 10 or less years of experience as a commercial vehicle driver, 24.4% reported between 11 and 20 years, and 21.3% reported between 21 and 40 years of commercial vehicle driver experience. About half of the commercial drivers (51.1%) classified their type of trucking operation as for-hire truckloads. The average reported trip length supported the reported "type of carrier" information with 50.1% of the respondents reporting an average trip length of over 500 miles. Lastly, over 70% of respondents seem to drive 51,000 to 150,000 miles annually (Patten, Pribyl and Goulias, 2003).

2.4 Florida Turnpike System

The Florida Turnpike System comprises 460 miles of limited-access toll facilities. The majority of the system constitutes the Florida Turnpike Mainline whose development was initiated in the 1950s. The mainline is a 320-mile facility that extends from Florida City in the south through Miami, along the eastern portion of the state north to Orlando and finally culminates in Wildwood, Florida. In addition to the Mainline, the system also comprises:

- the Homestead Extension that begins in Miami-Dade and continues south to US 1 in Florida City,
- the 57-mile Veterans Expressway/Suncoast Parkway that serves West Central Florida,
- the 55-mile Seminole Expressway/Central Florida Greeneway/Southern Connector Extension that serves Osceola, Orange, and Seminole counties,
- the 40-mile Martin Andersen Beachline Expressway that serves Central Florida and the Space Coast,
- the 25-mile Polk Parkway that links major cities in Polk county to each other and I-4,
- the 23-mile Sawgrass Expressway that serves Broward county, and
- the 11-mile Daniel Webster Western Beltway that provides an alternate route between Florida's Turnpike and I-4 (Florida Turnpike Enterprise, ND).

The Florida Turnpike Enterprise lists their top commercial customers on the Florida Turnpike System as part of their annual reporting. Table 2.3 illustrates the principal commercial customers of the Florida Turnpike System in 1997 and 2006. It is interesting to note that the top ten commercial customers comprised approximately 1.22% of the total turnpike system revenues in both 1997 and 2006. Also, United Parcel Service and Southeastern Freight Lines have been major commercial customers of the Florida Turnpike System in both 1997 and 2006. United Parcel Service is an express parcel service and Southeastern Freight Lines is a Less-than-truckload company. In 2006, the top commercial customers of the Florida Turnpike system thus represented the following truck market segments:

- express parcel services- United Parcel Service and Federal Express,
- private trucking services- Wal-mart Stores and Sysco Food Services,
- less-than-truckload carriers- Southeastern Freight Lines and AAA Cooper Transportation,
- truckload carriers- Werner Enterprises, and
- specialized services- Kenan Transportation Company and Waste Management.

Finally, the principal commercial customer of the Florida Turnpike System, Federal Express, spent approximately $2.5 million in tolls in 2007 (Florida Turnpike Enterprise, 2006).

Table 2.3: Florida Turnpike System Principal Commercial Customers (Fiscal Years 1997 and 2006)

Customer	% Total Revenue	
	FY 1997	FY 2006
United Parcel Service	0.19	0.17
Roadway Express	0.17	--
Smalley Transportation	0.15	--
Consolidated Freightways	0.11	--
Penn Tank Lines	0.10	--
Super Transport	0.10	--
Martin Brower	0.10	--
Southeastern Freight Lines	0.08	0.12
Eckerd Drug	0.08	--
Publix Super Market	0.08	--
Federal Express	--	0.21
Werner Enterprises	--	0.16
Wal-Mart Stores	--	0.15
Kenan Transportation Company	--	0.12
AAA Cooper Transportation	--	0.07
Sysco Food Services	--	0.07
Waste Management	--	0.07
School Board of Miami Dade County	--	0.07

Source: Florida Turnpike Enterprise, 2006

2.5 New York and New Jersey

In a 2005 study by Holguin-Veras et al., the researchers aimed to characterize the freight carriers that use E-ZPass in the New York and New Jersey area. Prior to the study in 2002, E-ZPass freight transactions were 9% less than the autos E-ZPass transactions. Previous research reviewed by the study team indicated that business characteristics, such as company size, had a direct impact on a carrier's acceptance of new tolling technologies. Thus the research team distributed surveys to local trucking carriers in an effort to gain additional insight into the characteristics of the E-ZPass users.

Table 2.4 summarizes the carrier respondents to the survey by type of company. As is evident from Table 2.4, the carrier respondents were almost equally divided between common or for-hire carriers (49.47%) and private carriers (49.08%). Furthermore, the private carriers were affiliated with the manufacturing, distribution, construction, and services sectors.

Table 2.4: Company Types

Type of Companies	Percentage
Common carriers:	
Trucking	46.00%
Moving	3.47%
Private Carriers:	
Manufacturing	10.87%
Distributor	15.17%
Construction	4.41%
Service	7.12%
Others	11.51%
Missing data	1.45%
Total	**100.00%**

Source: Holguin-Veras et al., 2005

The most common commodities delivered by the carrier respondents were food, building materials, lumber, metal, cars, and general merchandise. More than three quarters of the companies had the majority of their deliveries originating in New York or New Jersey, and the majority of the destinations were also in New York City, New York State or New Jersey.

The average fleet size of responding companies was eleven trucks. Approximately 46% of the respondents owned between two and five trucks and almost half of the vehicles were smaller trucks (i.e., two axles). This would suggest that these companies make mainly intra-city trips. Almost 25% of the respondents indicated that their truck fleet was comprised of five-axle trucks—the most popular inter-city truck. The characteristics of the respondents' trucking fleets in terms of the number of trucks by axle category are provided in Table 2.5.

Table 2.5: Characteristics of Respondents' Trucking Fleet

Number of trucks	2 axles	3 axles	4 axles	5 axles	6 axles	More than 6 axles	Total
1	11.19%	4.76%	1.23%	10.70%	1.70%	0.39%	29.97%
2~5	27.44%	7.90%	2.28%	6.60%	1.58%	0.24%	46.04%
6~10	6.15%	1.15%	0.71%	2.32%	0.00%	0.10%	10.42%
11~49	3.47%	2.33%	0.75%	3.63%	0.42%	0.45%	11.05%
>=50	1.01%	0.49%	0.10%	0.91%	0.00%	0.00%	2.51%
Total	49.26%	16.63%	5.06%	24.16%	3.71%	1.18%	100.00%

Source: Holguin-Veras et al., 2005

The obtained survey data also pointed to a number of differences between the common and private carrier respondents. For example, the common carrier respondents tended to be larger and used the toll roads more frequently than the private carriers. This was true for both cash and E-ZPass users. Also, the research team found that in the case of both company types (i.e., common and private carriers); E-ZPass users were larger and used the roadways more frequently than the non users (see Table 2.6).

Table 2.6: Common and Private Carrier E-ZPass Users and Non-Users

Key Variables	Nonusers		Users	
	Common Carriers	Private Carriers	Common Carriers	Private Carriers
Frequency (1)	25	20	42	40
Number of trucks	7	6	16	11
Number of Interstate drivers	6	5	17	7

Note: (1) Frequency of using PANYNJ facilities during the last 90 days;
(2) The numbers in the table are the average values

Source: Holguin-Veras et al., 2005

Overall, the study found that the most important factors impacting E-ZPass use were operational and cost considerations. Of the E-ZPass benefits noted by respondents, avoiding traffic congestion and toll plazas were the most frequently mentioned benefit. The most noted reason for not using E-ZPass was that the respondent does not travel through E-ZPass areas often (see Table 2.7).

Table 2.7: Reasons for using / not using E-ZPass

Reasons for not using E-ZPass			
Reasons	**%**	**Reasons**	**%**
1. Does not travel through E-Pass areas often	31%	11. Driver reimbursement more difficult/tracking driver expenses more difficult	4%
2. We haven’t gotten aound to it	17%	12. Respondant not aware of E-ZPass	4%
3. Cost of maintaining pre-paid toll balance for fleet is too high/cost of equiping fleet with E-ZPass too high	14%	13. E-ZPass does not limit waiting at tolls	3%
4. We don’t know how to sign up	8%	14. Privacy concerns	3%
5. Past problems with E-ZPass	6%	15. Customer pays tolls	2%
6. Billing too cumbersome	5%	16. Drivers complain	2%
7. Makes record-keeping difficult	5%	17. Drivers pay tolls	2%
8. No specific reason	4%	18. Discounts not high enough	1%
9. Fear of equipment being stolen	4%	19. Transponder not transferable	1%
10. System is not reliable or accurate	4%	20. Other reasons	6%
Reasons for using E-ZPass			
Benefits	**%**	**Benefits**	**%**
1. Avoid traffic congestion at toll plazas	79%	7. No cash to drivers	16%
2. Basic discount	50%	8. Convenient	7%
3. No need for driver reimbursement	34%	9. Off-peak discount	6%
4. Better accountability for drivers	22%	10. Shows truck time and location	5%
5. No lost receipts	21%	11. Saves money	2%
6. It is faster/saves time	19%	12. Other	4%

Source: Holguin-Veras et al., 2005

The research team also explored the attitudes of respondents towards discounts offered during off-peak hours. It was concluded that time, and not cost, was the most important factor when freight carriers consider taking advantage of off-peak discounts. For example, only sixteen carriers reported shifting their travel to off-peak hours to take advantage of the discounted E-ZPass rates. The reason provided for such a small number of carriers taking advantage of the discounted rates was the inflexibility of receivers.

In a subsequent 2007 report by Holguin-Veras entitled the *"Impacts of Pricing on the Behavior of Freight Traffic: Review and Implications"* the author provided the following characterization of the freight market that use tolled facilities in the New York and New Jersey:

- *Intra-regional (70-80%)* – Trips characterized by numerous stops in a single urban area. Due to the nature and location of these trips, it is typically not possible to bypass the tolled facility.
- *Inter-regional (20-25%)* – Trips characterized by very few stops in an urban area. Freight motorists may have some ability to bypass toll facilities.
- *Thru trips (1-3%)* – Through trips do not have the requirement of making a stop in a particular urban area. This allows carriers to bypass toll facilities as long as they meet delivery constraints.

The report also highlighted the differences between private and for-hire carriers, including scheduling flexibilities. More flexibility is often afforded to private carriers with regards to late and early arrivals compared to for-hire carriers. The private carrier respondents, for example, reported flexibility in late arrivals of on average 79 minutes and early arrival flexibility of 55 minutes. For-hire carriers, on the other hand, indicated an average late arrival flexibility of only 26 minutes and an average early arrival flexibility of only 24 minutes. The author thus concluded that travel time savings are a more important consideration for for-hire carriers as opposed to toll savings. Finally, the author reported that only 9% of the carrier respondents passed the toll cost on to customers (Holguin-Veras, 2007).

Finally, Holguin-Veras et al. (2007) also researched the impact of a time-of-day pricing initiative implemented by the Port Authority of New York and New Jersey (PANYNJ) on their toll facilities in March 2001. The toll charged on the PANYNJ facilities is now a function of the time-of-day when the transaction occurs, the payment method used, and the vehicle type. For example, toll discounts are only available to electronic toll collection (E-ZPass) users. The reasons for implementing this pricing initiative was to help finance the PANYNJ capital budget, reduce congestion, increase the use of mass transit and E-ZPass, and facilitate the management of commercial traffic.

Holguin-Veras et al. administered two surveys as computer aided telephone interviews to capture the behavioral responses of passenger and commercial vehicles to the pricing initiative. The carrier survey targeted companies in New York and New Jersey. The sample was drawn from a commercial database. The commercial survey gathered information about the responding company, behavioral changes after the time-of-day pricing initiative was implemented, current operations and travel flexibility, usage of E-ZPass, and awareness of toll discounts. Of the 200 trucking respondents, 91% were current regular users of the PANYNJ toll facilities and 18% were former regular users of the toll facilities. Also, 48.5% of the trucking respondents were for-hire carriers and 51.5% private carriers. The regular users tended to be Less-Than-Truckload (LTL) or Full Truckload (FTL) operations, operating medium to large trucking fleets, owning larger size trucks, and operating in New York and New Jersey.

When asked about behavioral changes following the time-of-day pricing initiative, 20.2% of the trucking respondents indicated they changed their behavior[7]. Respondents that changed their behavior tended to be FTL operations since these companies have more route alternatives. Local deliverers, on the other hand, usually do not have many alternatives since they would require the approval of receivers to change their time of travel. Respondents that did not change their behavior indicated that they did not have any time-of-arrival flexibility. Also, the research team found that although most of the regular users were using E-ZPass, they were not fully aware of the toll discounts available. Finally, the authors concluded that more research is needed to understand receivers' reactions to the increase in shipment costs (i.e., toll costs) incurred by carriers.

2.6 State Highway 130 Value Pricing Initiative

Geiselbrecht et al. (2008) explored the possibility of using innovative pricing incentives to encourage trucking companies to use the SH 130 toll road in Austin as an alternative route to the congested I-35. SH 130 is 12 miles longer than the parallel non-tolled I-35 segment, making it less attractive to truck users. The authors started the study by reviewing the literature on truck route choice and the financial incentives that could impact route choice. Interviews were subsequently conducted with different types of trucking companies, which largely confirmed the literature findings. The authors concluded that most trucking companies avoid using toll roads under most circumstances and that carriers' react differently to different tolls and incentives to encourage toll road usage. The latter was found to be largely a function of their type of operation.

The researchers administered an online and a mail-out survey to trucking companies to gather information about the type of trucking operation, delivery flexibility, travel behavior, perceptions towards proposed incentives, and various travel scenarios. A total of 2,023 valid responses were obtained. The survey results showed that a small amount of time savings has little benefit to a truckers' delivery schedule since only 6% of the trucking respondents reported a delivery time window of less than 1 hour. The survey results also showed that drivers plan to avoid congestion so the incentives that were found to be the most desirable were those that reduced costs, such as a reduced fuel price along the toll road and off-peak discounts.

Since the trucking sector can be segmented into different types of operations, the authors also explored the different factors that influence different segments' route choices and perceptions about incentives. Current toll rates are equivalent to the per mile cost of fuel, which is the most expensive operating cost component for the trucking industry. In general, the researchers found that owner-operators will avoid using a toll road at all costs, while delivery firms weigh the costs and benefits before making a decision about using a tolled facility. It was also found that trucking companies that traveled during the afternoon peak hour period are more willing to use the toll road. The responses also varied depending on what type of cargo was transported. For example, carriers that transported refrigerated goods were more likely to use the toll road.

After identifying the incentives most favored by carriers, the researchers analyzed the potential costs and benefits to the trucking companies of using SH 130 and the added cost imposed to the toll road operator associated with implementing the incentive. All costs were estimated for the year 2015—the year in which congestion on I-35 is predicted to reach its peak

[7] 19.3% when excluding shipping charges as a behavioral change.

and therefore potentially resulting in more truckers using the SH 130 toll road. From the survey, the authors calculated a truck value of time of $34.49/hour. The time savings associated with using the completed SH 130 were estimated to be:

- 11.6 minutes in off-peak hours,
- between 33.6 and 47.7 minutes in the AM peak hour, and
- between 13.9 and 19 minutes southbound and between 36.9 and 51.7 northbound in the PM peak hour.

The calculated benefit cost ratio was calculated at 1.36, suggesting that although the incentives to shift truck traffic to the toll road would outweigh the costs, the overall costs of implementing the incentives could ultimately result in the costs outweighing the benefits (Geiselbrecht et al., 2008).

2.7 Concluding Remarks

The studies on truck usage of toll roads summarized in this chapter seems to suggest substantial variability in the characteristics of truck toll road users in terms of the characteristics of the tolled facility, the truck market segment, and average trip length. For example, from the information collected from commercial users of the Pennsylvania Turnpike, it was concluded that the majority of truck trips are long-distance trips in excess of 500 miles. On the other hand, Holquin-Veras (2007) reported that intra-regional trips represent 70 to 80% of toll transactions in the New York/New Jersey area. One reason for this difference is obviously attributable to the characteristics of the toll facilities. The Pennsylvania Turnpike traverses the length of the state, while Holquin-Veras's studies pertain to the urban areas of New York/New Jersey. The studies therefore seem to be location specific, which means that caution should be applied in generalizing the results. The next chapter provides information about the survey approach and details the sample characteristics of the surveys that were conducted to characterize the truck users and non-users of Texas toll roads.

Chapter 3. Survey and Study Methodology

As mentioned earlier, the trucking sector can be segmented in terms of service area, trip type, vehicle ownership, company size, vehicle characteristics, and type of carrier/operation. Although these segments are not mutually exclusive, it is important to recognize the different segments when attempting to understand a trucking company's decision to use or avoid a toll facility. Ultimately different types of truck carriers respond differently to tolling—each sector responding to their own needs and financial circumstances. For example, truck load (TL) carriers usually conduct long haul movements, allowing them to plan their trip to avoid traversing congested urban areas during peak hours. For private carriers, such as the Wal-Mart or HEB trucking fleet, toll roads can present an opportunity to increase the fleet's productivity, while it is also probably easier to absorb the toll cost in the cost of the product being hauled. More generally, though it appears that truckers will choose to pay a toll only if it makes business sense, i.e., the rates paid by the shipper allows the trucking company to recover the increased operating costs associated with using the toll facility or the savings in operating costs (time, fuel, etc.) exceed the additional cost imposed by the toll.

In the spring and summer of 2009, the research team administered an internet based survey and telephone survey to Texas trucking companies to gain insight into their usage and non-usage of Texas toll roads. The administered survey included questions about the respondent's company (e.g., type of operation, size of fleet, and type of trucks used), the type of operation (e.g., long, medium or short haul, major commodities transported, delivery windows, time of deliveries, and type of compensation), attitudinal questions concerning respondents' use and non-use of toll roads, and finally a number of questions pertaining to respondents' perceptions of toll roads. In addition, a question was included about shippers' willingness to compensate trucking companies for the additional costs imposed when using a toll road in a mail out survey to Texas freight shippers. This chapter provides information about the research team's survey approach, details the sample characteristics, and describes the statistical tests that were conducted in Chapter 4 to characterize the truck users and non-users of Texas toll roads. In addition, Appendix B summarizes the literature review findings on the cost structures of the different trucking segments.

3.1 Survey Methodology

An initial truck survey questionnaire was developed and piloted during the months of September and October 2008 in Kerrville, Texas during two different workshops organized by the Texas Motor Transportation Association (TMTA). A survey booth was assembled at both workshops. Workshop participants that passed by the survey booth were approached and asked to complete the pilot survey. A higher response rate was obtained during the September Safety workshop than during the Maintenance workshop conducted in October 2008. This is probably attributable to the fact that the research team made a short presentation about the objectives of the study and requested event attendees to stop by the booth and complete the questionnaire at the Safety workshop. This resulted in twenty-five of the event attendees completing the survey questionnaire. In contrast, during the Maintenance workshop, where the research team did not make a short presentation about the study, only nine event attendees completed the questionnaire.

Based on the responses obtained in the pilot survey, the original questionnaire was revised. The wording of some of the questions was made simpler and clearer and a few additional questions were added to provide greater insight into truck carriers' behavioral responses towards toll roads. The revised questionnaire contained forty-three questions in four sections that attempted to collect information about the respondents':

- company, e.g., type of operation, size of fleet, and type of trucks used,
- type of operation, e.g., medium or short haul, major commodities transported, delivery windows, time of deliveries, and driver compensation,
- attitude concerning the use and non-use of toll roads, and
- perception of toll roads.

The survey questionnaire that was used is included as Appendix C.

The survey was implemented as a web-based survey using Zoomerang, an online survey software tool. A web link to the survey and a brief summary about the objectives of the study were published in the TMTA weekly newsletter during the month of March 2009. A number of subsequent attempts were also made to ensure an acceptable response rate, including changing the survey cover letter and publishing the survey in the newsletter in consecutive weeks during March and May 2009. Due to a very low initial response rate to the web-based survey, the research team sent e-mails to 117 carrier contacts that were collected from attending trucking industry seminars and conferences by the research team. Only eight-seven of the 117 e-mail addresses proved valid and these eighty-seven e-mail solicitations resulted in twelve completed surveys, yielding a response rate of 14%. In addition, the TMTA was asked to forward a cover e-mail letter and web link to the internet survey to their members to ask for assistance in completing the survey. Although this attempt yielded a higher response rate than the newsletter—i.e., 19 completed surveys—the sample was still too small to conduct any meaningful analysis. Finally, the research team decided to change the survey approach and administer the questionnaire through a telephone survey. The Texas Department of Transportation Motor Carrier Database was used as a sampling frame for contacting the trucking carriers. The listed telephone number was dialed and it was asked to speak with either the owner or with someone in a managing position that is able to make operational decisions. Of the 2,340 trucking companies that the research team attempted to contact, only thirty valid responses could be included in the analysis.

Also, since discussions with carriers have revealed that in many instances truck usage of toll roads will be determined by the shipper's willingness to pay for the incremental cost of toll charges incurred, the research team asked Texas freight shippers' about their willingness to compensate trucking companies for the additional costs imposed when using a toll road. The research team asked Texas freight shippers if they would be willing to pay toll charges incurred by the trucking service to (a) ensure reliable transit times, (b) faster transit times, (c) accommodate heavier or larger shipments, and (d) other (please specify). Texas freight shippers were asked to check all the reasons that applied to their business. This question was included in a questionnaire that was sent to 569 Texas freight shippers. A total of fifty-five completed surveys were collected, representing freight shippers across the state.

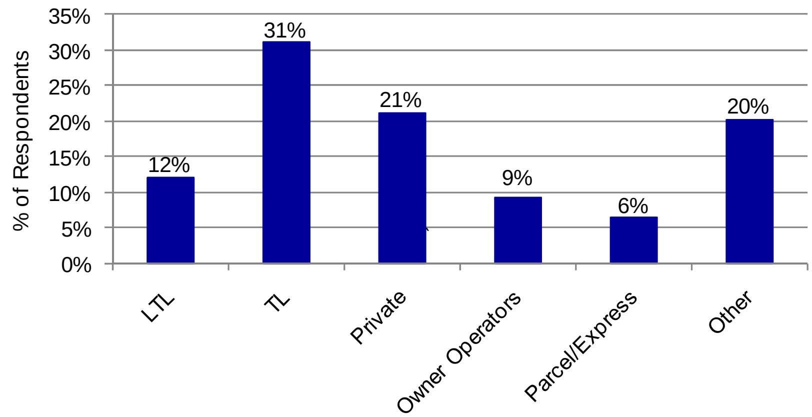
3.2 Sample Characteristics

A total of 112 valid and completed truck survey questionnaires were collected representing the following trucking sectors:

- less-than-truckload (LTL),

- truckload (TL),
- private fleet,
- owner-operators,
- parcel and express services, and
- others, including specialized, intermodal, and heavy hauling services.

As can be seen from Figure 3.1, most of the respondents represented the TL sector, constituting 31% of the total respondents. It should also be noted that the private carriers, which represented 21% of the respondents, were very willing and forthcoming in completing the survey. This sector was found to be more cooperative than the LTL carriers and the owner operators, who ultimately represent 12% and 9% of the respondents, respectively.



Number of respondents: 109

Figure 3.1: Type of Operation

Respondents were asked to record the Texas county where the company's main office is located (see Figure 3.2). The majority of the respondents' (73% of the respondents) main offices were located along the I-35 corridor.

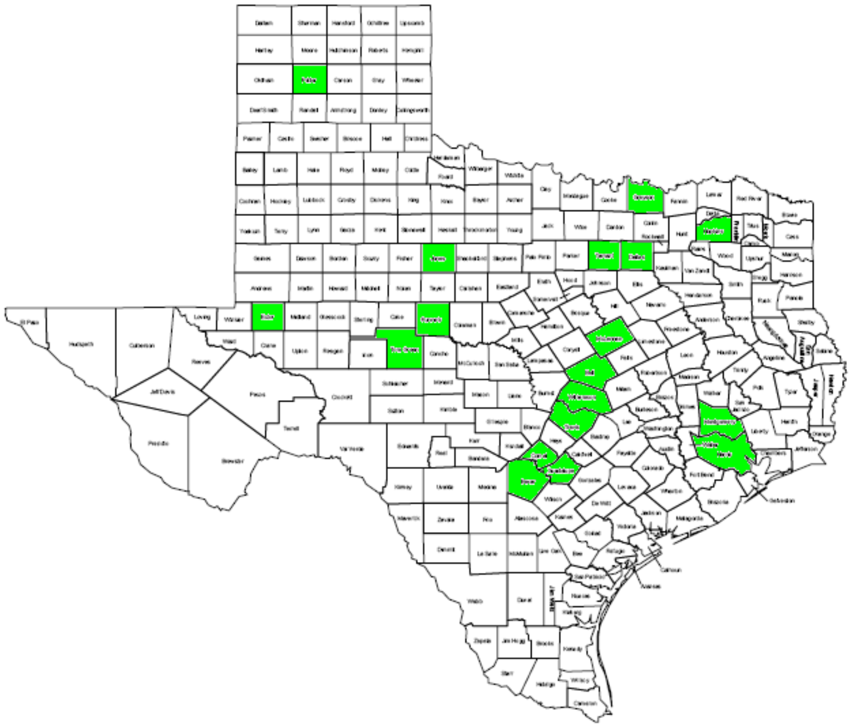
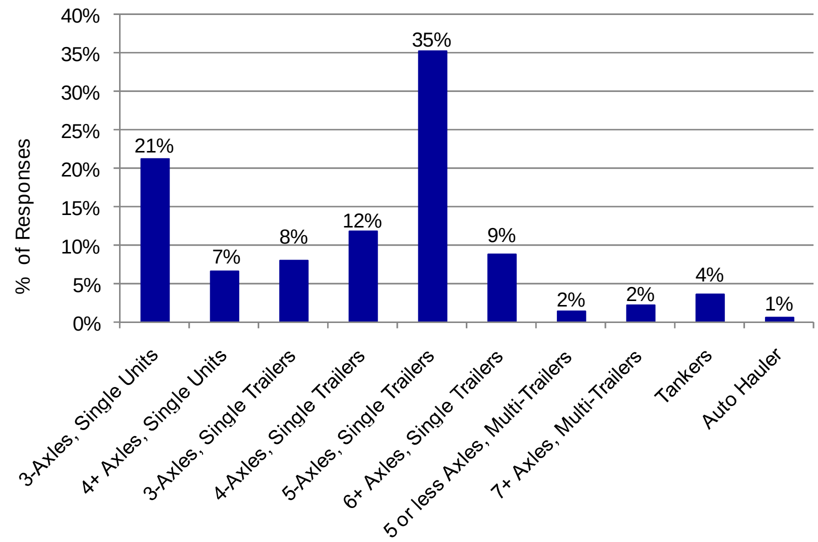


Figure 3.2: County Location of Respondent Companies' Main Office

3.2.1 Company Characteristics

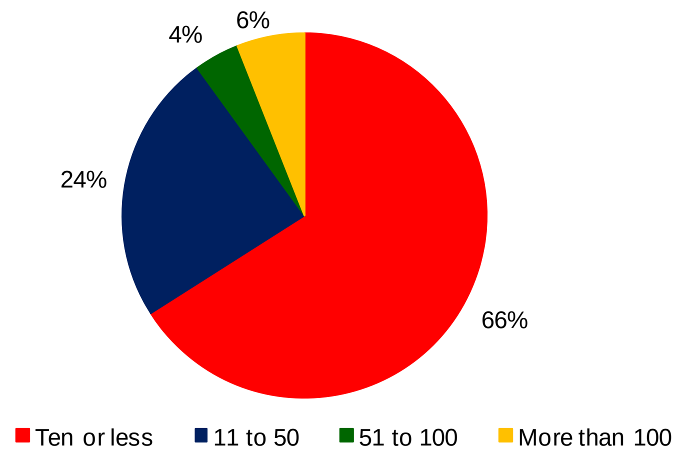
In an effort to characterize the respondents, several questions were included about the size of the company (e.g., number of trucks and drivers), the type of trucks used, the distance traveled, and the type of commodity transported. Figure 3.3 summarizes the various truck types owned or operated by the respondent's companies. As can be seen from Figure 3.3, the 5-axle single trailer is the most popular truck type owned and operated by the respondents' companies, representing 35% of the responses. This particular truck type is the most common type used for inter-regional movements. The second most mentioned truck type was the 3-axle single unit truck (21% of the responses) that are commonly used for local deliveries and intra-regional trips.



Number of responses: 136

Figure 3.3: Truck Type

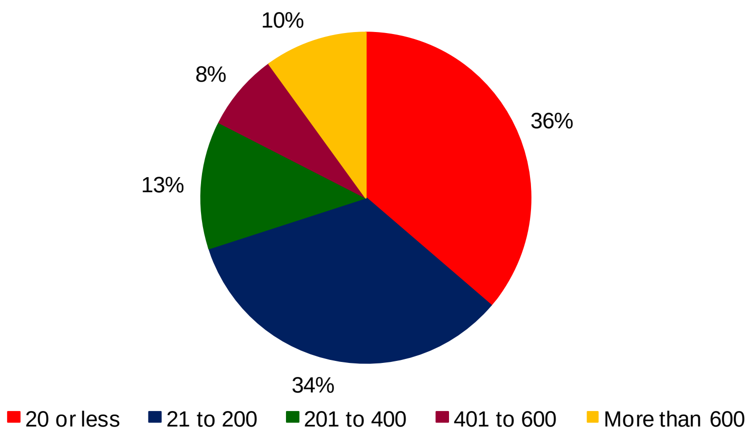
Figure 3.4 to 3.6 illustrates the respondents' answers to the question regarding the size of the company operations in Texas in terms of the number of single units, truck tractors, and trailers operated by the company. From Figure 3.4 it is evident that the majority of respondents (90%) operated less than fifty single unit trucks, which include 66% that operated ten or fewer single unit trucks. Only 6% of the respondents operated more than 100 single unit trucks.



Number of Respondents: 50

Figure 3.4: Number of Single Units

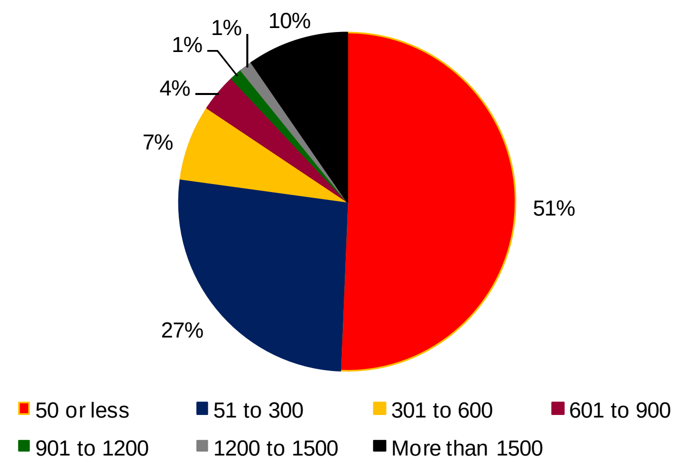
Figure 3.5 illustrates that 70% of the respondents operated 200 or less truck tractors in Texas. More specifically 36% of the respondents operated twenty or fewer truck tractors in Texas. Only 10% of the respondents (eight) reported to operate more than 600 truck tractors in Texas.



Number of Respondents: 80

Figure 3.5: Number of Truck Tractors

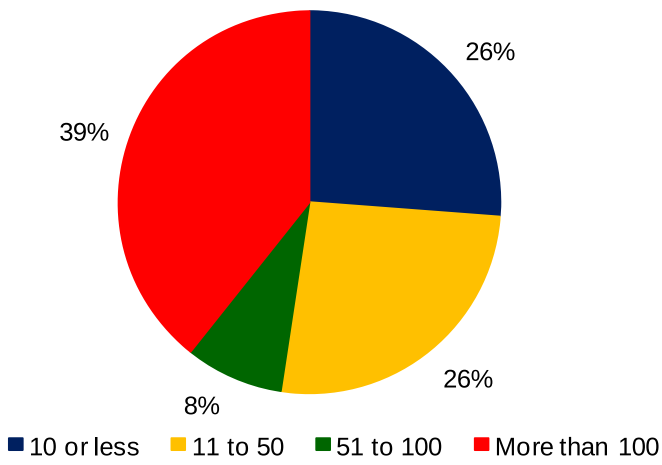
Figure 3.6 illustrates that 78% of the respondents operated 300 or less trailers in Texas. More specifically, 51% of the respondents operated less than fifty trailers in Texas. Only 10% of the respondents reported to operate more than 1,500 trailers in Texas.



Number of Respondents: 83

Figure 3.6: Number of Trailers

Figure 3.7 illustrates that 52% of the respondents employed fifty or fewer drivers in their Texas operations—26% of the respondents employed ten or fewer drivers. On the other hand, 39% of the respondents employed more than 100 drivers in their Texas operations.

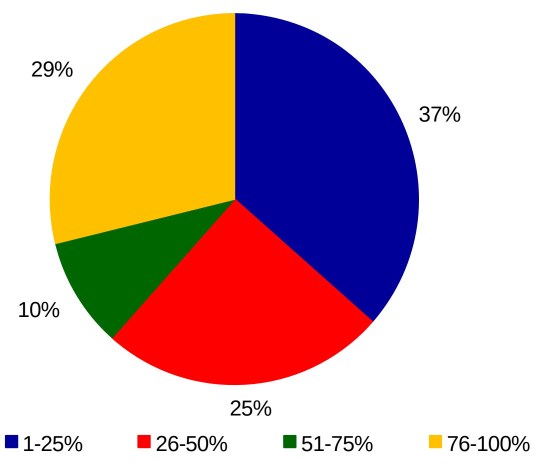


Number of responses: 84

Figure 3.7: Number of Truck Drivers

3.2.1 Operational Characteristics

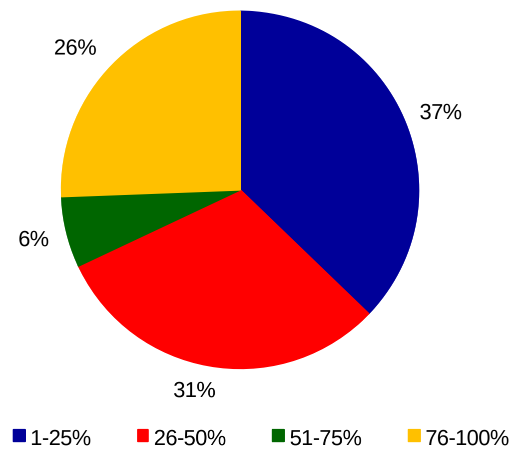
Respondents were asked what percentage of their business was comprised of local haul (less than 50 miles), short haul (50 to 200 miles), medium haul (201 to 500 miles), and long haul (more than 500 miles). Figures 3.8 through 3.11 illustrate the responses received. For example, Figure 3.8 illustrates that for 37% of the respondents 25% or less of their operations involved a local haul of less than 50 miles. On the other hand, for 29% of the respondents 76 to 100% of their operations involved local movements of less than 50 miles. These responses seem to support the information that was collected in terms of the truck types owned and operated by respondents.



Number of respondents: 52

Figure 3.8: Percentage of Operations that Constitutes a Local Haul (less than 50 miles)

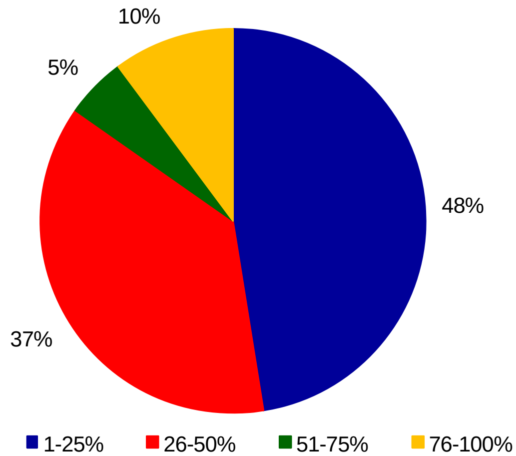
Figure 3.9 illustrates that for 37% of the respondents 25% or less of their operations involved a short haul of between 50 and 200 miles. On the other hand, for 26% of the respondents 76 to 100% of their operations involved short haul movements of 50 to 200 miles.



Number of respondents: 78

Figure 3.9: Percentage of Operations that Constitutes a Short Haul (50 to 200 miles)

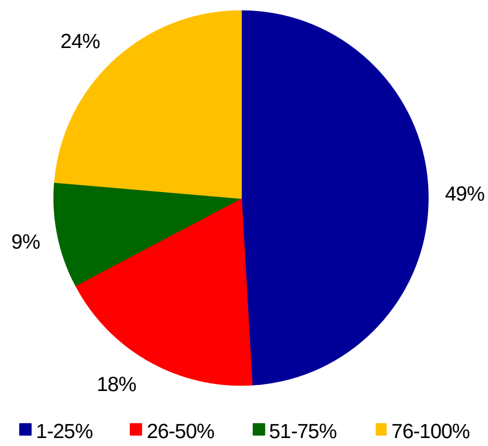
Figure 3.10 illustrates that for 85% of the respondents 50% or less of their operations involved a medium haul of between 201 and 500 miles. For only 10% of the respondents 76 to 100% of their operations involved medium haul movements of 201 to 500 miles.



Number of Respondents: 59

Figure 3.10: Percentage of Operations that Constitutes a Medium Haul (201 to 500 miles)

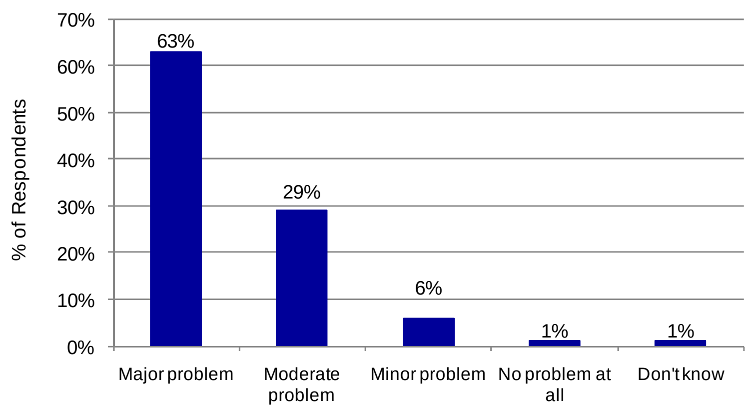
Figure 3.11 illustrates that for 49% of the respondents 25% or less of their operations involved a long haul movement of more than 500 miles. On the other hand, for 24% of the respondents 76 to 100% of their operations involved long haul movements of more than 500 miles. These responses seem to support the information that was collected in terms of the type of trucking operations reported by the respondents in which 31% of the respondents reported their operation to be truckload (see Figure 3.1).



Number of Respondents: 55

Figure 3.11: Percentage of Operations that Constitutes a Long Haul(more than 500 miles)

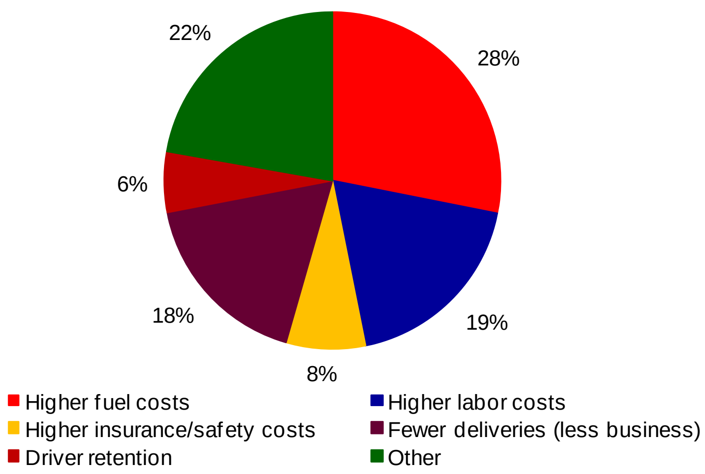
When asked to describe congestion in Central Texas, 63% of the respondents reported congestion to be a major problem and 20% considered congestion a moderate problem (Figure 3.12). Less than one percent of the respondents considered congestion to be no problem at all.



Number of respondents: 110

Figure 3.12: Perception of Congestion

Consequently, when asked if their operations were impacted by congestion, 81% of the respondents indicated affirmatively. The most frequently mentioned impacts of congestion were higher fuel costs (28% of the responses), higher labor costs (19% of the responses), and fewer deliveries/less business (18% of the responses). Some respondents argued that congestion did not limit the number of deliveries made, but that it made them slower and more costly and often times congestion resulted in late deliveries.

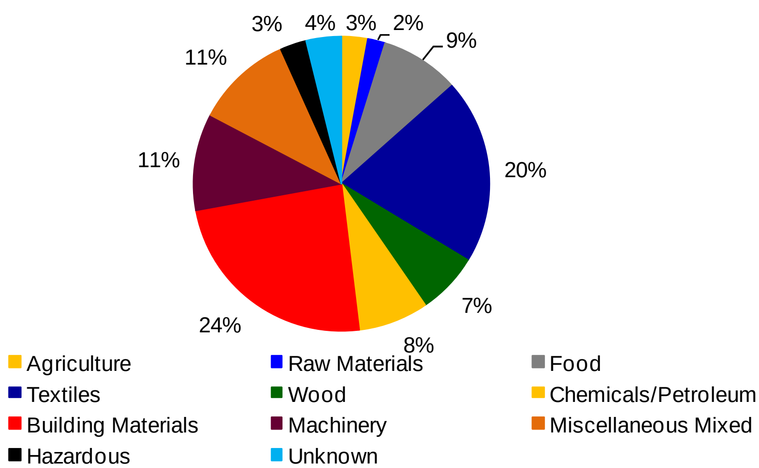


Number of responses: 171

Figure 3.13: Business Impacts Resulting from Congestion

Trucking respondents were also asked a number of questions about their operations, including the major commodity transported by the company, whether the commodity is time sensitive, frequent delivery times, and driver compensation. Figures 3.14 to 3.23 illustrate the responses to these questions.

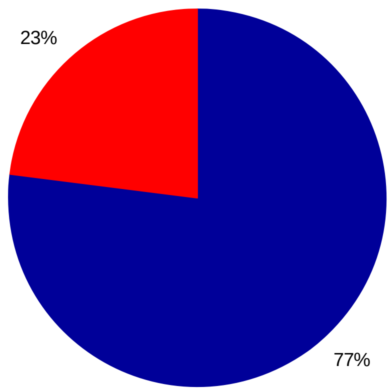
Figure 3.14 illustrates the major commodities transported by the respondents in a representative year. The figure illustrates a wide range of commodities. The major commodities transported, however, were building materials (24% of the respondents) and textiles (20% of the respondents).



Number of respondents: 104

Figure 3.14: Major Commodities Transported

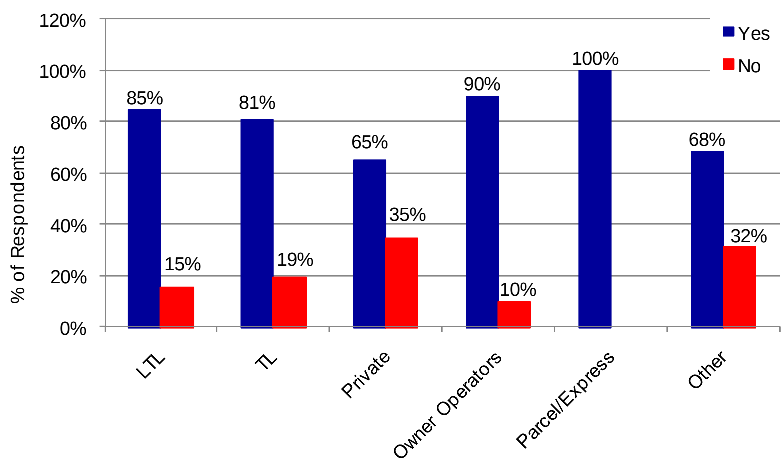
When asked if the commodities transported were time sensitive, 77% of the respondents answered that the commodities were time sensitive (see Figure 3.15).



Number of Respondents: 104

Figure 3.15: Time Sensitivity of Major Commodity Transported

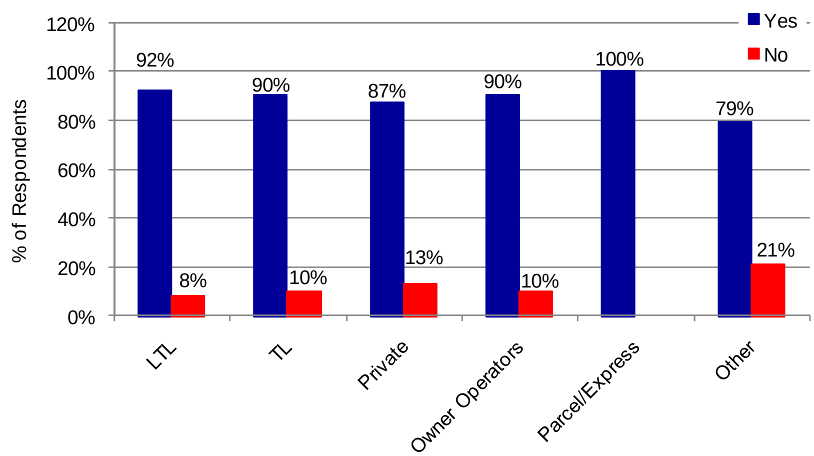
Figure 3.16 illustrates the responses to whether the commodity transported were time sensitive by the operation type of the trucking respondents—i.e., percentage within each operation type. From Figure 3.16 it is evident that all the Parcel/Express respondents indicated that their major commodity delivered is time sensitive. On the other hand, 35% of the private carrier respondents indicated that their major commodity transported was *not* time sensitive. Surprisingly, however, 90% of the owner operator respondents indicated that their major commodity transported was time sensitive.



% within each operation type
Number of respondents: 102

Figure 3.16: Time Sensitivity of Major Commodity Transported by Type of Operation

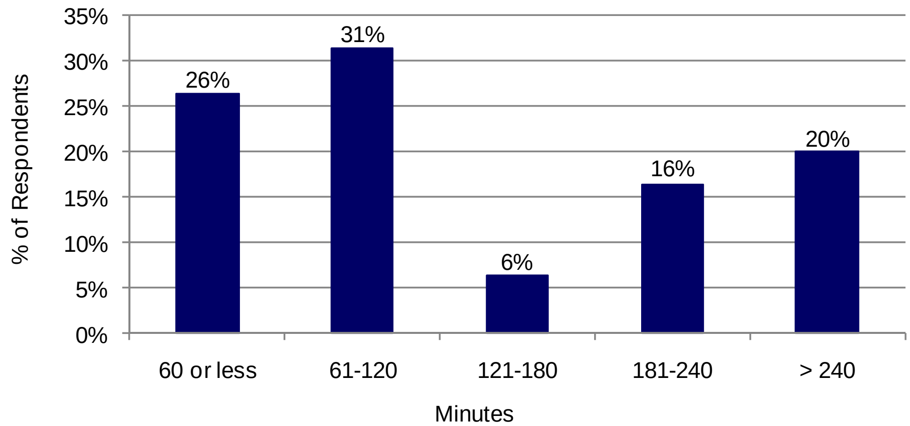
The majority of respondents (88%) indicated to have a delivery window in which to deliver their major commodity transported. Figure 3.17 illustrates the responses to whether the commodity transported was to be delivered within a certain window by the operation type of the trucking respondents—i.e., percentage within each operation type. From Figure 3.17 it is evident that approximately 10% of the respondents in each operation type indicated *not* to have a delivery window for their major commodity transported. The exception is the parcel/express respondents in which case all respondents indicated to have a delivery window. It is also interesting to note that a slightly higher percentage of private carrier respondents (13%) reported not to have a delivery window compared to owner operator (10%), LTL (8%), and TL (10%) respondents.



% within each operation type
Number of respondents: 102

Figure 3.17: Delivery Window by Type of Operation

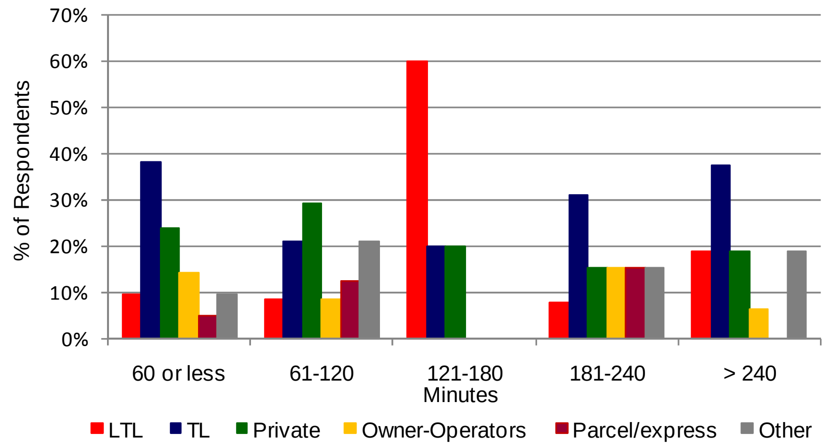
Respondents were subsequently asked about the width of the average delivery window. From Figure 3.18, it is evident that 31% of the respondents reported a delivery window of 1 to 2 hours and 26% of the respondents reported a delivery of 1 hour or less. Of those that reported to have a delivery window of 1 hour or less, 6% of the respondents reported a delivery window of less than 15 minutes.



Number of respondents: 80

Figure 3.18: Width of Average Delivery Window

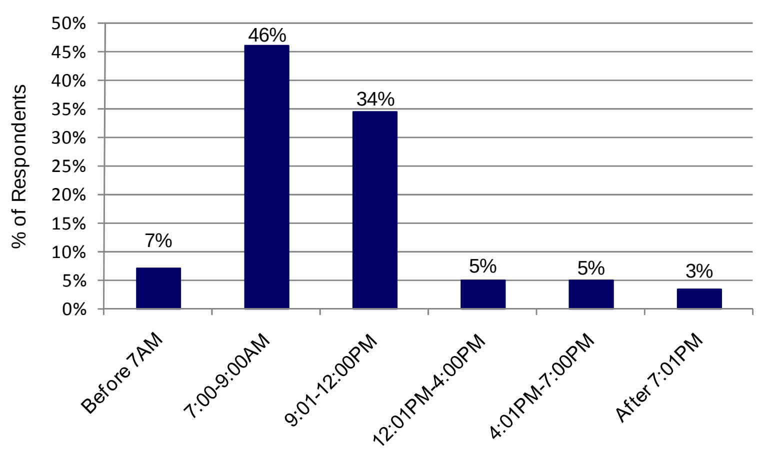
Figure 3.19 illustrates the type of operations of the respondents that reported various delivery window lengths—i.e., percentage within each delivery window. For example, Figure 3.19 shows that 38% of the respondents that reported a delivery window of 1 hour or less were TL carriers. Similarly, 60% of the respondents that reported a delivery window of 121 to 180 minutes were LTL carriers.



% within each delivery window
Number of respondents: 79

Figure 3.19: Type of Operation by Width of Average Delivery Window

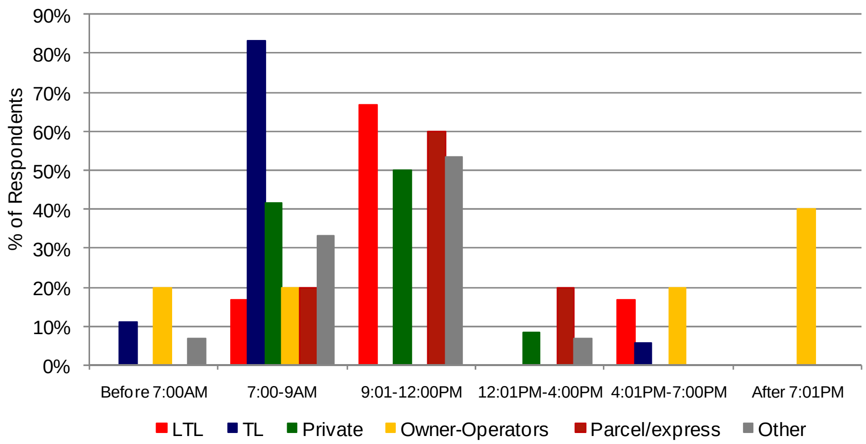
Respondents were also asked about the time they make most of their deliveries. From Figure 3.20 it is evident that most respondents (46%) reported to make most of their deliveries during the morning peak hours (i.e., 7:00am to 9:00am). Another 34% of the responsdents reported to make most of their deliveries during the late morning (i.e., 9:01am to noon). Most respondents (80%) thus indicated to make most of their deliveries between 7:00am and noon.



Number of respondents: 61

Figure 3.20: Time of Delivery

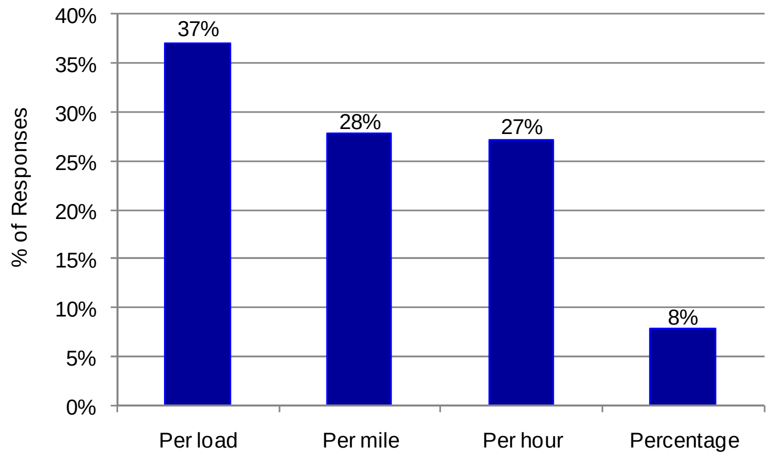
Figure 3.21 illustrates the reported times when most of the deliveries are made by type of trucking operation—i.e., percentage within each operation type. As can be seen in Figure 3.21, 83% of the TL respondents reported to make most of their deliveries during the morning peak hours (i.e., 7:01am to 9:00am). On the other hand, 67% of the LTL respondents reported to make most of their deliveries between 9:00am and noon. Similarly, the parcel/express (60%) and other (53%) respondents reported to make most of their deliveries between 9:00am and noon. On the other hand, 40% of owner operator respondents indicated that they make most of their deliveries after 7:00pm.



% within each operation type
Number of respondents: 61

Figure 3.21: Time of Delivery by Type of Operation

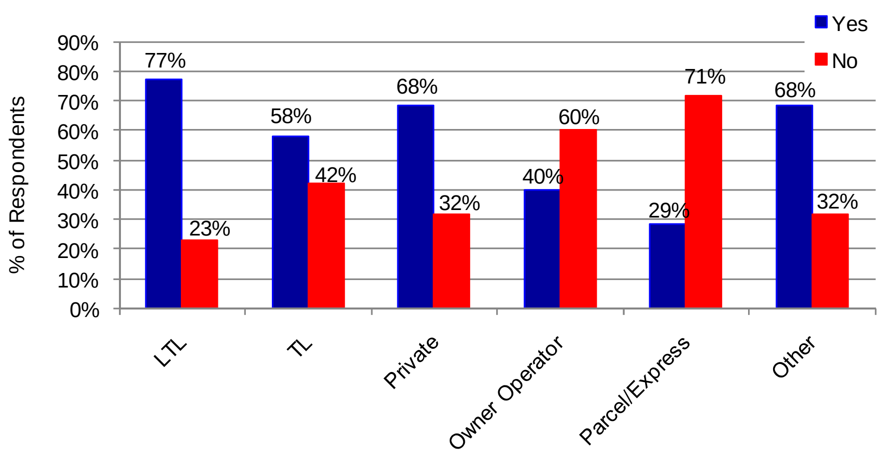
Respondents were also asked how drivers were compensated (e.g., per load, per mile, or per hour). Figure 3.22 illustrates the driver compensation methods recorded. From Figure 3.22, it is evident that most drivers are compensated per load (37% of the responses), per mile (28% of the responses), and per hour (27% of the responses). Since respondents could indicate more than one compensation method, a follow on question was asked to explore how the compensation method was determined. Most respondents indicated that the compensation method depended on the distance traveled: for local trips drivers are paid per hour, but for longer trips drivers are typically paid per mile. Several respondents also indicated that it depended on whether the drivers were employed by the company (in which case they were typically paid per hour) or if the drivers were independent (in which case they were typically paid per load).



Note: The “per load” category include two responses “per stop”
Number of responses: 140

Figure 3.22: Driver Compensation Methods

When respondents were asked if they provided their drivers with predetermined routes, 61% of the respondents indicated that they did. Figure 3.23 illustrates the responses to whether drivers are supplied with predetermined routes by the operation type of the respondent—i.e., percentage within each operation type. From Figure 3.23, it is evident that 77% of the LTL respondents and 68% of the private carrier respondents provided their drivers with predetermined routes. On the other hand, 60% of the owner operator and 71% of the parcel/express respondents indicated that they did not provide their drivers with predetermined routes.



% within each operation type
Number of respondents: 102

Figure 3.23: Predetermined Route by Type of Operation

Finally, respondents were asked about the cost structure of their operations. This question resulted in a very low response rate and a number of invalid responses. However, from the forty-three respondents that answered this question, the cost categories (e.g. driver salaries and benefits, maintenance and tires, capital/depreciation, fuel, taxes, permits and licenses, insurance, and overhead) could be ranked. Thus respondents ranked the various cost categories in decreasing order as: (1) driver salaries and benefits as the major cost, (2) fuel, (3) maintenance and tires, (4) insurance, and (5) taxes, licenses, and permits.

3.3 Statistical Tests

Depending on the response rate for each question, a statistical test was 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 ($\chi 2$) was calculated as follows:

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

Where,
$\chi 2$ = the test statistic that asymptotically approaches a $\chi 2$ distribution,
Oi = the observed frequency,
Ei = the expected (theoretical) frequency, asserted by the null hypothesis, and
n = the number of possible outcomes of each event.

If the calculated value of $\chi 2$ is smaller than the critical value at a 95% confidence level, the null hypothesis cannot be rejected. Therefore the data does not support any claims that there is an association between toll road usage and the demographic variable. However, if the calculated value of $\chi 2$ 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 proportions are the same for toll and non-toll road users or Ho: $p_1=p_2$, 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.

3.4 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. The next chapter characterizes the truck users and non-users of Texas toll roads.

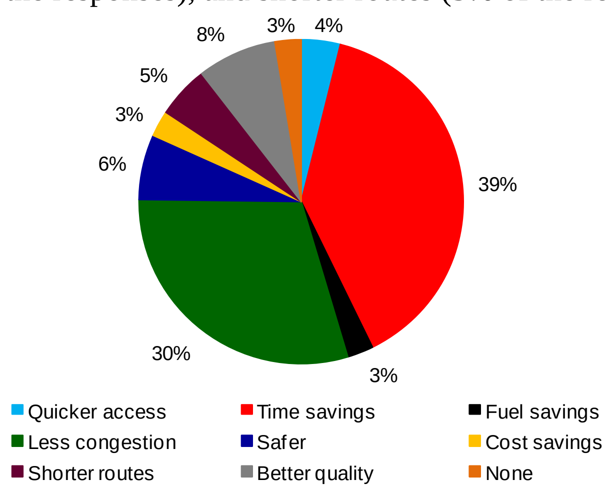
Chapter 4. Characteristics of the Truck Users and Non-Users of Texas Toll Roads

One of the questions asked to trucking respondents was whether their drivers used toll roads in Dallas, Houston, and Central Texas. Respondents that indicated that their drivers have used or are frequently using toll roads were categorized as truck users of Texas toll roads (sixty-three respondents). Respondents that indicated that their drivers have not used any toll roads were categorized as truck non-users of Texas toll roads (forty-five respondents). This chapter summarizes the salient findings of the survey and the analysis that was conducted to characterize the truck users and non-users of Texas toll roads.

4.1 Truck Users of Texas Toll Roads

Truck toll road users were asked about the benefits of toll road usage, frequency of toll road usage, reasons for using toll roads, decision authority for using toll roads, who was paying the toll, and the company's adoption of electronic toll tags.

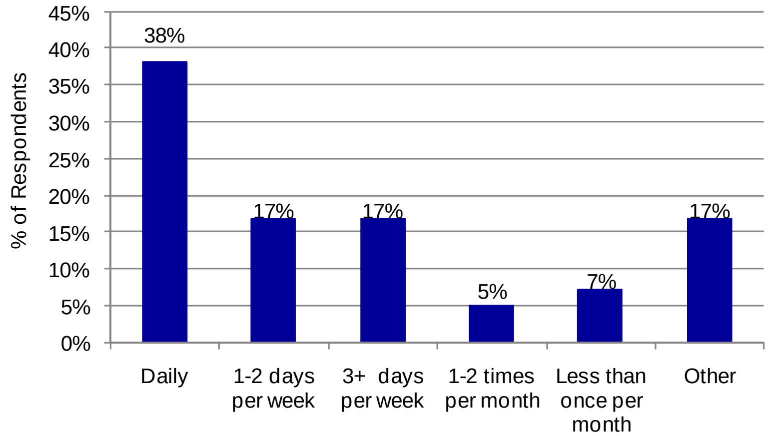
Figure 4.1 illustrates the recorded benefits of using toll roads in Texas. As can be seen, the majority of toll road users (39% of the responses) indicated time savings to be the most significant benefit of using toll roads. The next most frequently mentioned benefit (30% of the responses) was less congestion. Other frequently mentioned benefits were better quality (8% of the responses), safer (6% of the responses), and shorter routes (5% of the responses).



Number of responses: 77

Figure 4.1: Perceived Benefits of Using Toll Roads

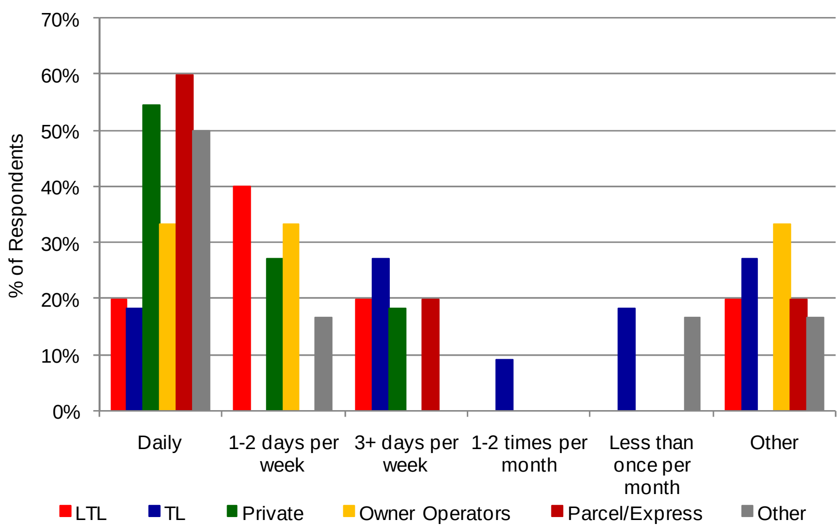
Truck toll road users were asked how frequently their drivers use toll roads. From Figure 4.2 it is evident that almost 40% of the respondents reported that their drivers use toll roads on a daily basis. On the other hand, approximately 11% of the respondents were infrequent users of Texas toll roads, using the toll roads one to two times per month or less.



Number of Respondents: 42

Figure 4.2: Frequency of Toll Road Usage

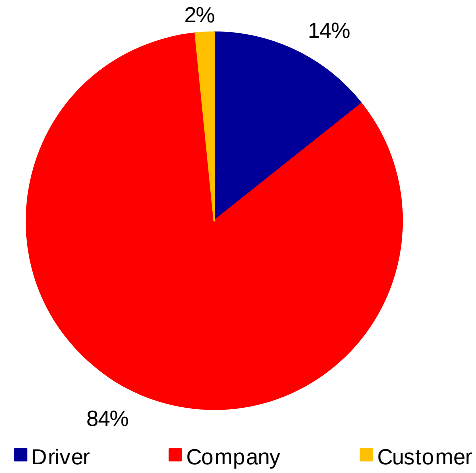
Figure 4.3 illustrates the reported frequency of toll road usage by type of trucking operation—i.e., percentage within each operation type. As can be seen, 60% of the parcel/express and 55% of the private carrier respondents respectively reported to use Texas toll roads daily. Parcel/–express services require predictable travel times and AECOM (2006) reported that since private carriers transport their own products they serve as both the carrier and the shipper, making it easier to absorb the toll cost in the cost of the product and passing it on to the customer. Also, almost 30% of the TL respondents reported to use toll roads three or more days per week and 40% of LTL respondents reported to use toll roads one to two days per week.



% within each operation type
Number of respondents: 41

Figure 4.3: Frequency of Toll Road Usage by Type of Operation

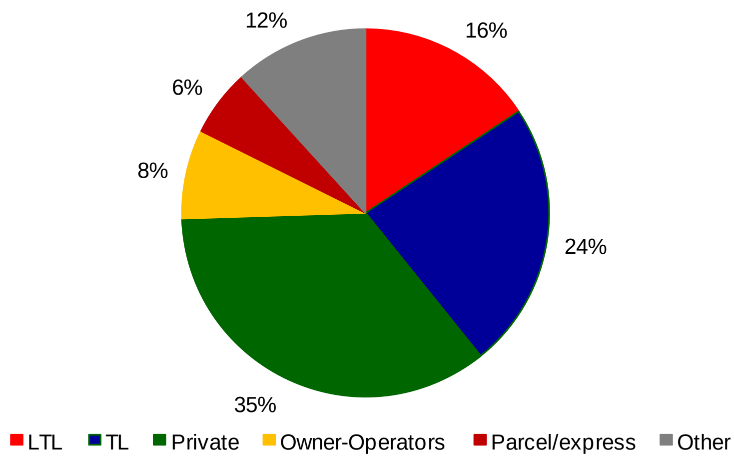
The majority of respondents (84%) reported that the company was paying the cost of the toll (see Figure 4.4). Only two percent of the respondents indicated that the customer was responsible for paying the toll.



Number of respondents: 63

Figure 4.4: Party Responsible for Paying the Tolls

Of the respondents that reported that the company paid for the toll, 35% represented a private carrier, 24% a TL carrier, and 16% represented a LTL carrier. Of those that reported that the driver was responsible for paying for the toll[8], almost half (44%) of the respondents represented a TL carrier.

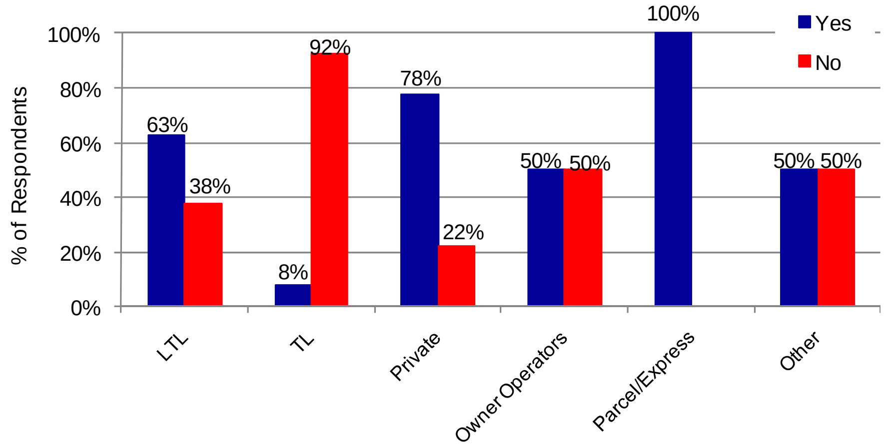


Number of respondents: 51

Figure 4.5: Type of Operation Paying Tolls

8 Nine respondents indicated that the drivers were required to pay the toll. These respondents were subsequently asked whether their company would be willing to pay for the toll given certain benefits (e.g., travel time savings, higher speed limits, higher weight limits, separate lanes for trucks, avoided congestion), how much time needed to be saved before the company would be willing to pay for the toll, and how much the company would be willing to pay for the indicated travel time savings. A very low response rate (three respondents) to these questions, however, prevented any type of analysis.

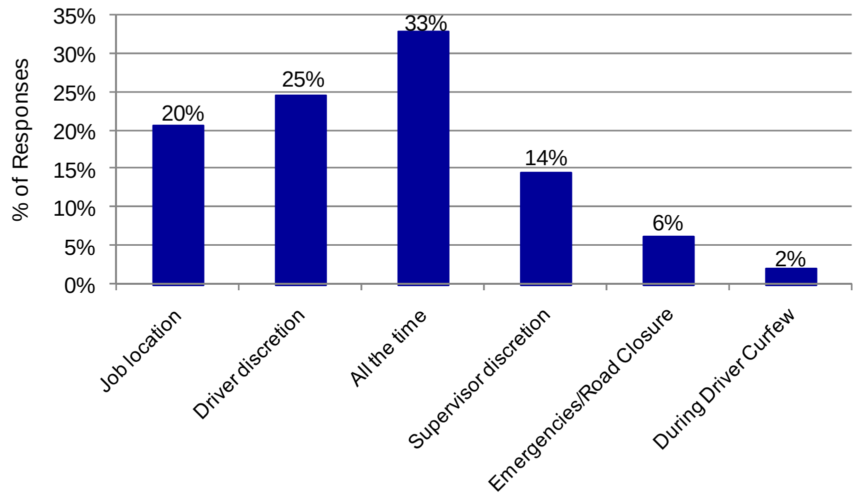
Truck toll road users were also asked whether all the power units in their fleets were equipped with an electronic toll tag that can be used to pay tolls. Slightly more than half (55% of the respondents) reported that all their power units were equipped with an electronic toll tag. Figure 4.6 illustrates implementation of electronic toll tags on all power units by type of trucking operation—i.e., percentage within each operation type. As can be seen, all the parcel/express respondents indicated that all the power units in their fleets were equipped with an electronic toll tag. Also, 78% of the private carrier respondents and 63% of the LTL respondents indicated that all their power units were equipped with electronic toll tags. On the other hand, 92% of the TL respondents indicated that all their power units were not equipped with an electronic toll tag.



% within each operation type
Number of respondents: 52

Figure 4.6: Electronic Toll Tag Implementation by Type of Operation

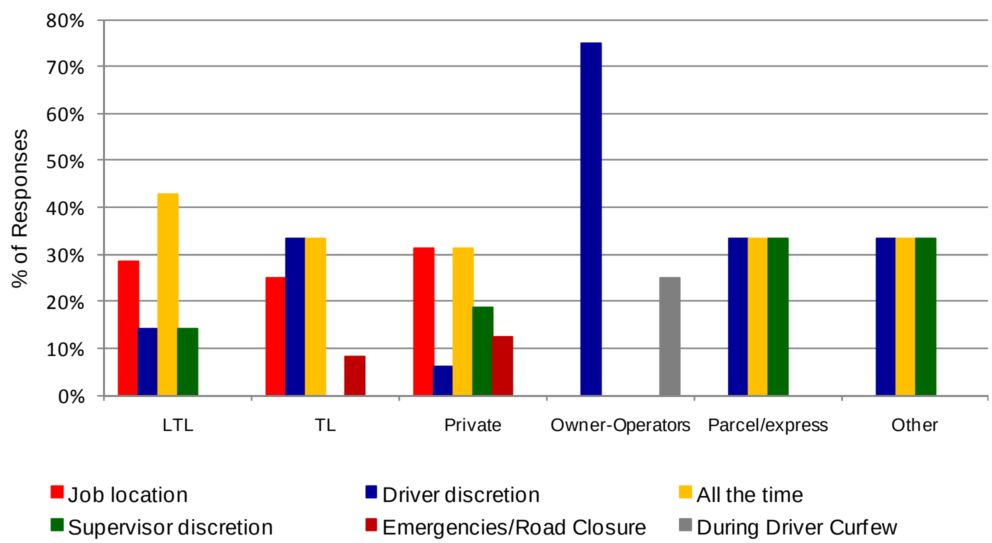
Truck toll road users were also asked to decribe under what circumstances drivers were allowed to use Texas toll roads. About a third of the respondents (33%) indicated that drivers were allowed to use toll roads all the time, 25% indicated that toll road usage was at the drivers' discretion, and 20% indicated that it depended on the delivery destination (i.e., job location). The results are summarized in Figure 4.7.



Number of respondents: 49

Figure 4.7: When Drivers are Allowed to Use Toll Roads

Figure 4.8 illustrates the circumstances under which drivers are allowed to use toll roads by type of trucking operation—i.e., percentage within each operation type. As can be seen, 75% of the owner-operator respondents indicated that toll road usage is at the drivers' discretion. This is to be expected since many of these drivers are also the owners of the truck they drive. Also, 43% of the LTL respondents reported that drivers are allowed to use toll roads all the time. Approximately 66% of TL respondents reported that drivers are allowed to use toll roads either all the time or at the drivers' discretion.



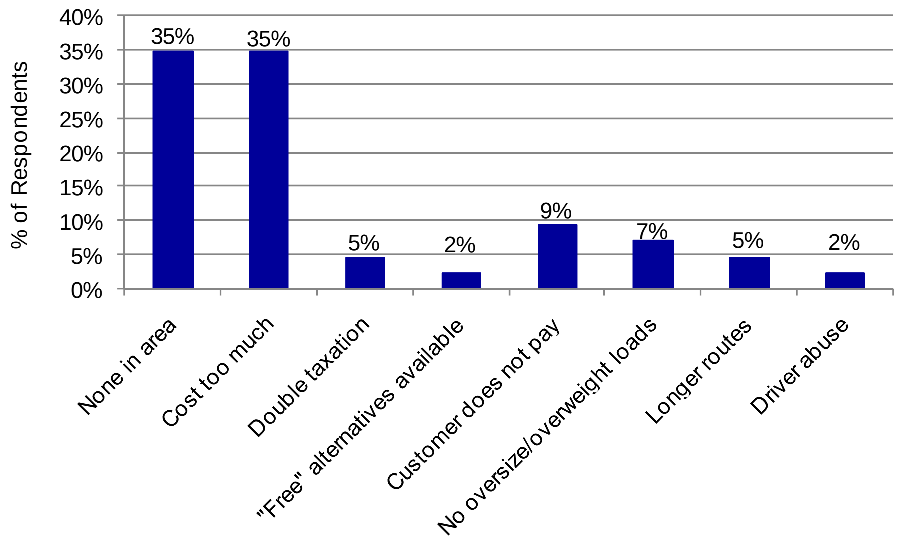
% within each operation type
Number of respondents: 48

Figure 4.8: When Drivers are Allowed to Use Toll Roads by Type of Operation

4.2 Truck Non-Users of Texas Toll Roads

Trucking respondents that stated that their drivers have not or are not frequently using toll roads in Dallas, Houston, and Central Texas were characterized as non-users of Texas toll roads. These respondents were asked the reasons for not using toll roads, under what conditions would drivers be allowed to use toll roads, and how much the respondent would be willing to pay for travel time saved.

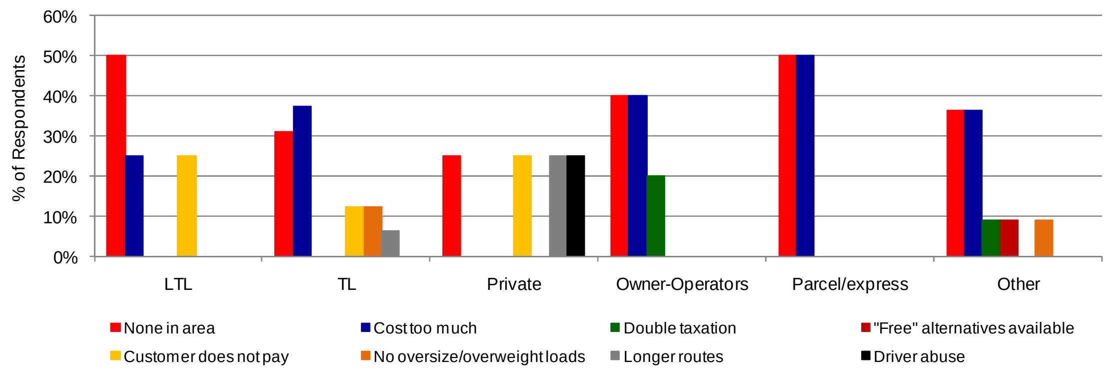
Figure 4.9 illustrates the reasons respondents provided for their drivers not using toll roads. As can be seen, 35% of the respondents indicated that no toll road is available or a feasible alternative, while another 35% indicated that toll roads are not used because of the high costs of the tolls. Other reasons included that the customer is not willing to pay the toll charges (9% of the respondents) and Texas toll roads do not accommodate oversized and overweight loads (7% of the respondents).



Number of Respondents: 43

Figure 4.9: Reasons for Not Using Toll Roads

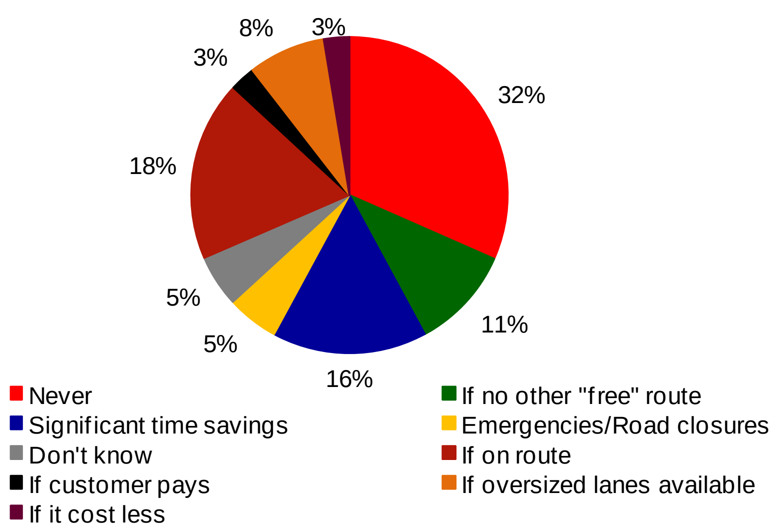
Figure 4.10 illustrates the reasons for respondents' drivers not using Texas toll roads by type of trucking operation— i.e., percentage within each operation type. As can be seen, 50% of the LTL and parcel/express respondents did not use toll roads because none was available or a feasible alternative. The remaining 50% of the parcel/express respondents did not use a toll road because of high costs. Similarly, 40% of the owner operator respondents did not use a toll road because none was in the area, 40% felt it cost too much, and 20% indicated that tolls were a form of "double taxation." It is interesting to note that none of the private carrier respondents indicated that toll roads cost too much as a reason for not using toll roads, although 25% indicated that they did not use toll roads because drivers tend to abuse the situation by using toll roads when unnecessary.



% within each operation type
Number of respondents: 42

Figure 4.10: Reasons for Not Using Toll Roads by Type of Operation

When truck non-users of toll roads were asked to specify under what circumstances would drivers be allowed to use a toll road, almost one third of the respondents (32%) answered that they would never use a toll road and another 11% indicated that they would use a toll road only if no other "free route" existed (see Figure 4.11). This seems to suggest that there is a group of truckers[9] that are inherently opposed to toll roads and are therefore not willing to respond positively to any demonstration of the benefits of toll roads. Only, 18% of the respondents indicated a willingness to use a Texas toll road is it was available or a feasible alternative to their current route.



Number of respondents: 38

Figure 4.11: Non-Users Willingness to Use a Toll Road

However, when truck non-users of toll roads were asked to indicate specifically which perceived benefits (e.g., travel time savings, higher speed limits, higher weight limits, separate

9 Insufficient data, however, prevented an analysis of respondents' willingness to use a toll road by the type of trucking operation that the respondents represented.

lanes for trucks, avoided congestion) would the company be willing to pay a toll for, only fourteen respondents answered the question. Of those fourteen respondents four indicated that the company would be willing to pay a toll if it saved travel time[10] and five respondents indicated that the company would be willing to pay a toll to avoid congestion.

Finally, truck non-users of Texas toll roads were presented with a list of incentives to determine if any of these incentives would persuade non-users to use toll roads. The results are illustrated in Figure 4.12 and can be summarized as follows:

- 36% of the respondents indicated that they *might be* willing to use the Central Texas toll roads if they could subscribe to a toll road use plan where the company would pay a discounted, fixed monthly fee for a specified amount of usage (similar to a cell phone plan),
- 44% of the respondents indicated that they *might be* and 4% indicated that they *would be* willing to use the Central Texas toll roads if the company could receive a frequent user discount, such as free toll road days, free weekends, or discounted toll rates,
- Only 16% of the respondents indicated that they might be willing to use the Central Texas toll roads if the toll tag can be used to pay for other driver purchases, such as fast food, fuel, and parking,
- 38% of the respondents indicated that they *might be* and 3% indicated that they *would be* willing to use the Central Texas toll roads if the company could receive a discounted toll rate during off-peak hours,
- 42% of the respondents indicated that they *might be* and 6% indicated that they *would be* willing to use the Central Texas toll roads if larger, well-maintained truck stops with dining and truck repair facilities, as well as in-cab auxiliary power systems (e.g., IdelAire) are provided alongside the toll road,
- 50% of the respondents indicated that they *might be* and 9% indicated that they *would be* willing to use the Central Texas toll roads if the company could receive a fuel tax refund for the miles driven on the toll road, and
- 32% of the respondents indicated that they *might be* and 6% indicated that they *would be* willing to use the Central Texas toll roads if longer combination vehicles (LCVs) were allowed on the toll roads.

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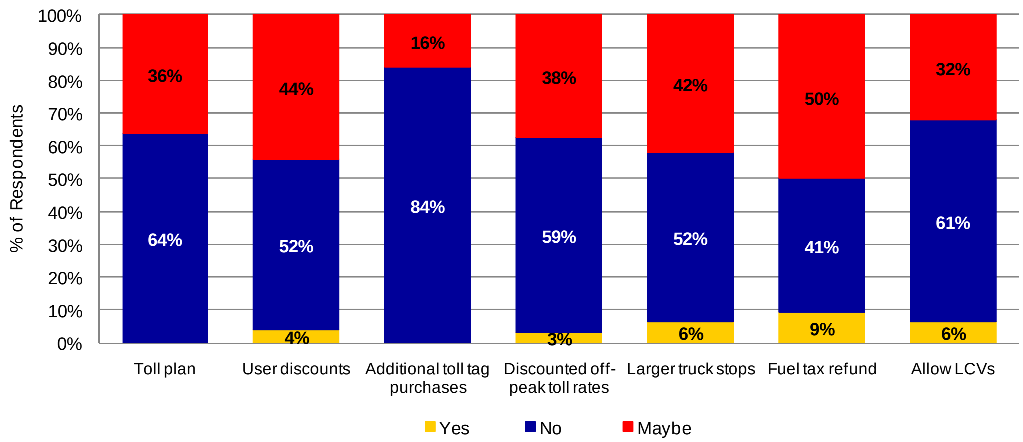
10 Those that answered that the company would be willing to pay a toll road if travel time savings can be realized were asked how much time needed to be saved before the company would be willing to pay a toll and how much the company would be willing to pay for the indicated travel time savings. A very low response rate (four respondents) to these questions, however, prevented any type of analysis.



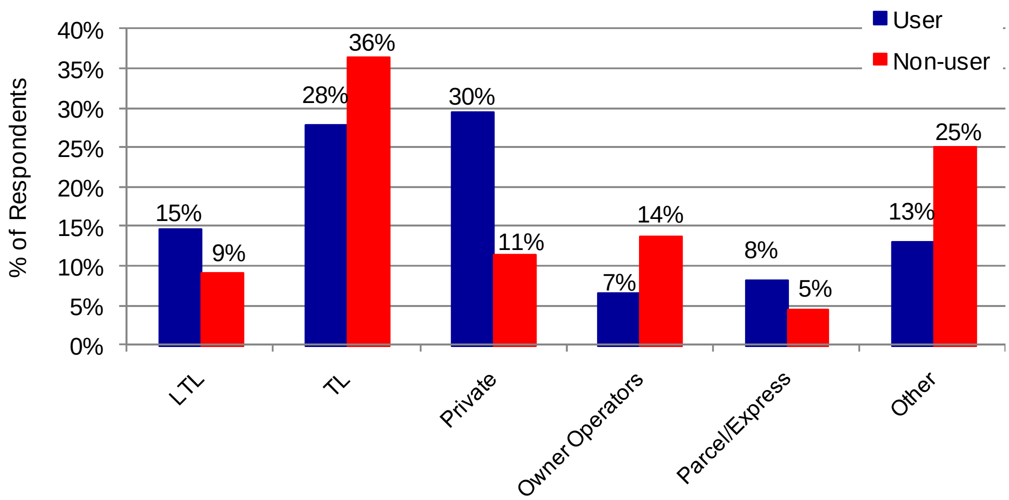
Number of respondents:
Toll plan – 25
User discounts – 25
Additional toll tag purchases – 25
Discounted off-peak toll rate – 32
Larger truck stops – 31
Fuel tax refund – 32
Allow LCVs – 31

Figure 4.12: Toll Road User Incentives

The results illustrated in Figure 4.12 seem to support the earlier observation about an inherent opposition against toll roads that translates into an unwillingness to respond positively towards any incentive to encourage the use of toll roads. Having said that, the incentives that reduce the costs of using the toll road, such as the fuel tax refund, the allowance of LCVs, and the frequent user discounts seem to be more favorably received by the trucking industry. Interesting also is the fact that 42% of the respondents indicated that they *might be* and 6% indicated that they *would be* willing to use the Central Texas toll roads if larger, well-maintained truck stops are provided alongside the toll road

4.3 Differences between Truck Users and Non-Users of Texas Toll Roads

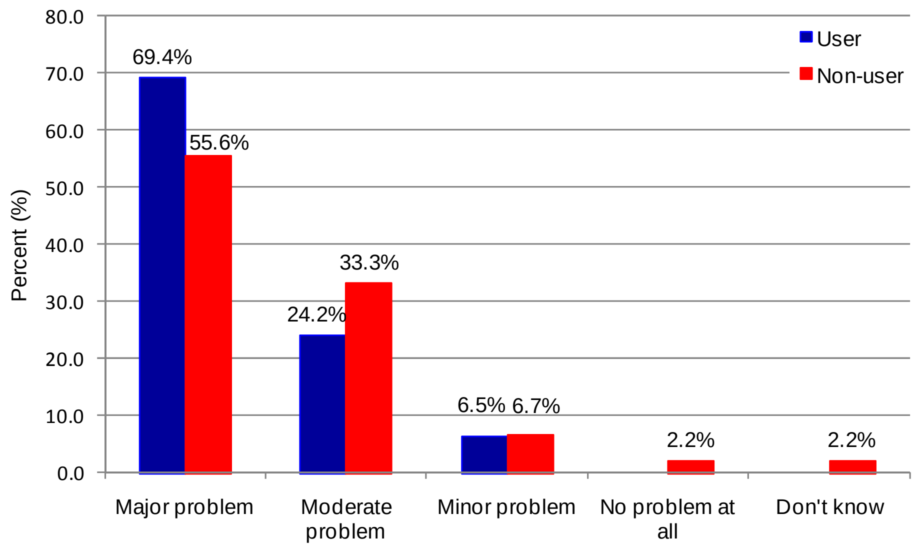
Finally, the survey responses were analyzed in an effort to characterize the differences between truck users and non-users of Texas toll roads. Figure 4.13 illustrates the reported types of operations of the truck users and non-users of Texas toll roads. From Figure 4.13, it appears that the "type of operations" profile of the truck users and non-users of Texas toll roads is different. For example, the majority of the truck toll road users are private carriers (30% of the toll road users), followed by TL carriers (28%), and LTL carriers (15%). On the other hand, the majority of the non-users of Texas toll roads are TL carriers (36% of the toll road non-users), 25% comprising the "other" category, and 14% of the owner operators.



Toll road users: 61
Non-toll road users: 44

Figure 4.13: Type of Operations of Users and Non-Users of Texas Toll Roads

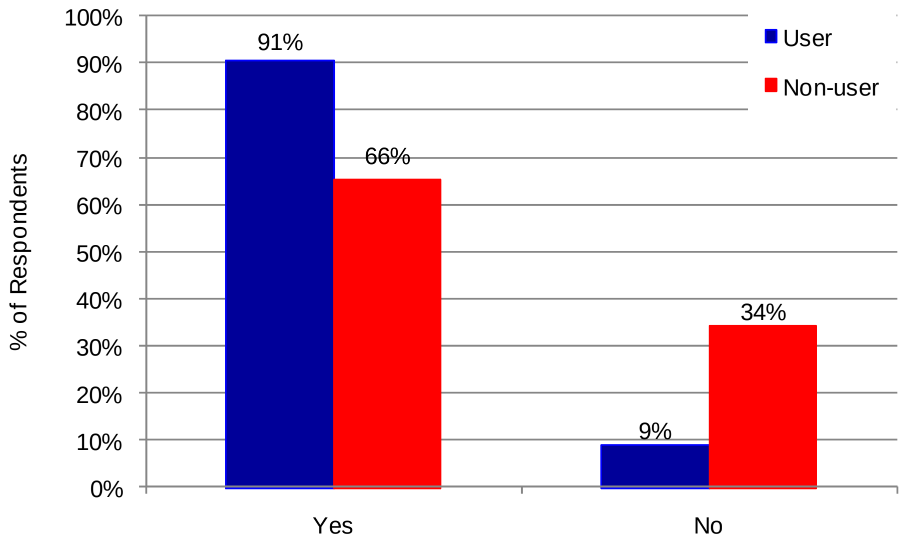
Figure 4.14 illustrates the truck toll road users and non-users' perception of congestion in Central Texas. As can be seen, almost 70% of the truck users of Texas toll roads perceived congestion as a major problem—compared to almost 56% of the non-users of Texas toll roads. On the other hand, only 6.5% of the toll road users viewed congestion as a minor problem while 8.9% of the non-users viewed congestion as a minor problem or not a problem at all.



Toll road users: 62
Non-toll road users: 45

Figure 4.14: Congestion Perception of Users and Non-Users of Texas Toll Roads

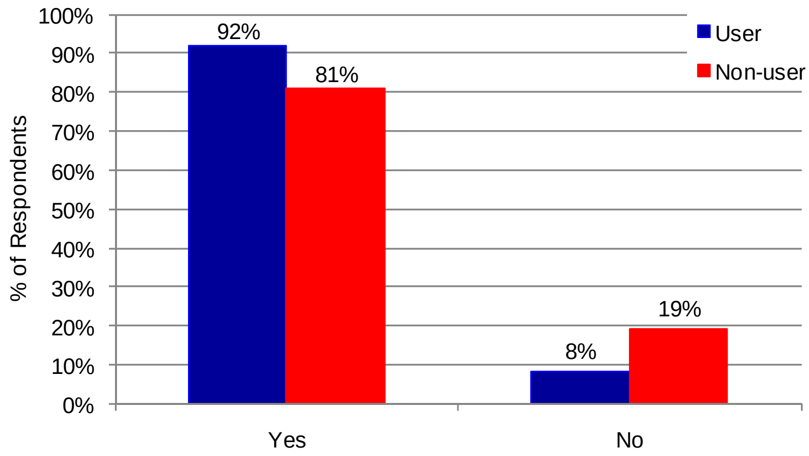
Figure 4.15 illustrates that 91% of the truck toll road users indicated that their operation is impacted by congestion. In contrast, 66% of the non-users of Texas toll roads stated that their operation is impacted by congestion. A sample proportion statistical test was conducted to assess whether the perception that their operation is impacted by congestion of toll road non-toll road users is statistically different. The null hypothesis is that the proportions of toll road users and non-toll road users that indicated that their operations are impacted by congestion are the same at the 95% confidence level (α=0.05). The calculated Z-score is 2.648 and the associated p-value is 0.004. Since the p-value is smaller than 0.05, there is sufficient evidence to reject the null hypothesis. Thus it can be concluded that toll road users and non-toll road users' perception that their operation is impacted by congestion is statistically different.



Toll road users: 43
Non-toll road users: 29

Figure 4.15: Congestion Impact Perception of Users and Non-Users of Texas Toll Roads

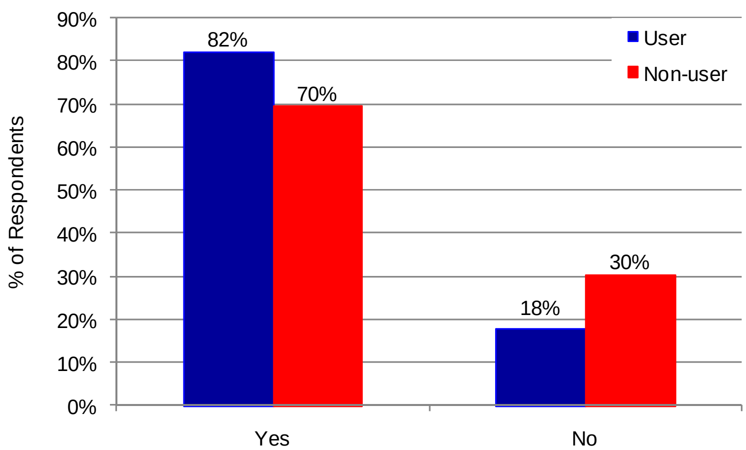
Figure 4.16 illustrates that 92% of the truck toll road users indicated that they have a delivery window in which to deliver the major commodity transported by their company. Also, the majority of non-toll road users (81%) stated that they have a delivery window in which to deliver the major commodity transported by their company. A sample proportion statistical test was conducted to assess whether the proportions of toll road users and non-toll road users that have a delivery window in which to deliver is statistically different. The null hypothesis is that the proportions of toll road users and non-toll road users with a delivery window are the same at the 95% confidence level (α=0.05). The calculated Z-score is 1.662 and the associated p-value is 0.048. Since the p-value is smaller than 0.05, there is sufficient evidence to reject the null hypothesis. Thus it can be concluded that the proportion of toll road users and non-toll road users that have a delivery window in which to deliver the major commodity transported by their company is statistically different.



Toll road users: 62
Non-toll road users: 42

Figure 4.16: Delivery Window for Users and Non-Users of Texas Toll Roads

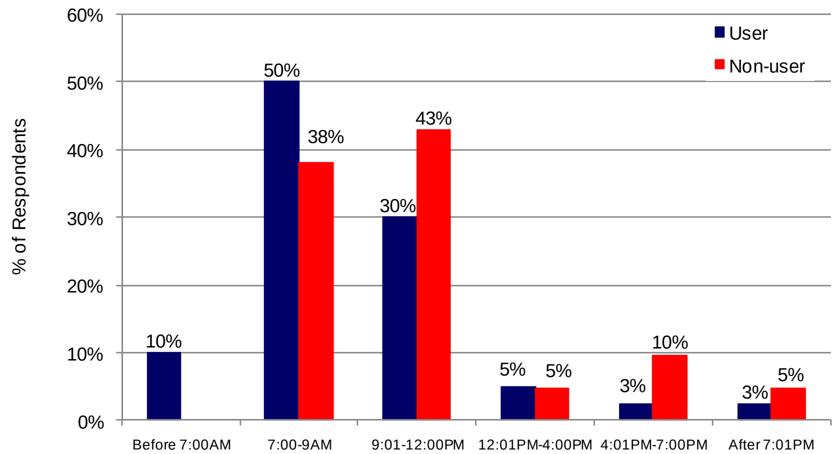
Figure 4.17 illustrates that 82% of the truck toll road users indicated that the major commodity transported by their company in a representative year is time sensitive. Similarly, 70% of the non-users of Texas toll roads stated that the major commodity transported by their company in a representative year is time sensitive. A sample proportion statistical test was conducted to assess whether there is a statistical difference between the proportions of toll road users and non-toll road users that indicated that the major commodity transported by their company is time sensitive. The null hypothesis is that the proportions of toll road users and non-toll road users transporting a time sensitive major commodity are the same at the 95% confidence level (α=0.05). The calculated Z-score is 1.454 and the associated p-value is 0.073. Since the p-value is larger than 0.05, there is not sufficient evidence to reject the null hypothesis. Thus it can be concluded that there is no statistical difference between the proportion of toll road users and non-toll road users that transport time sensitive major commodities in a representative year.



Toll road users: 61
Non-toll road users: 43

Figure 4.17: Time Sensitive Commodity Transported by Users and Non-Users of Texas Toll Roads

Figure 4.18 illustrates that 50% of the truck toll road users reported that the company makes most of their deliveries during the morning peak hours, i.e., between 7:00 and 9:00 am (as opposed to 38% of the non-toll road users). Similarly, 43% of the non-toll road users indicated that the company makes most of their deliveries between 9:01 am and noon (as opposed to 30% of the toll road users).



Toll road users: 40
Non-toll road users: 21

Figure 4.18: Time of Delivery of Users and Non-Users of Texas Toll Roads

Respondents were asked specifically whether they support the construction of additional toll roads in Central Texas (see Figure 4.19). As can be seen, 69% of the toll road users[11] indicated support/conditional support for the construction of additional Central Texas toll roads (as opposed to 37% of the non-toll road users). On the other hand, 49% of the non-toll road users were opposed to the construction of additional toll roads in Central Texas (as opposed to 28% of the toll road users). A chi-square analysis was conducted to assess whether there is an association between support for the construction of additional toll roads in Central Texas and toll road usage. The null hypothesis was that support for the construction of additional Central Texas toll roads is independent of toll road usage at the 95% confidence level (α=0.05). A chi-square analysis revealed that the test statistic is $\chi2$=11.58. The critical value of $\chi2$ is 7.81. 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 support for the construction of additional Central Texas toll roads and toll road usage.

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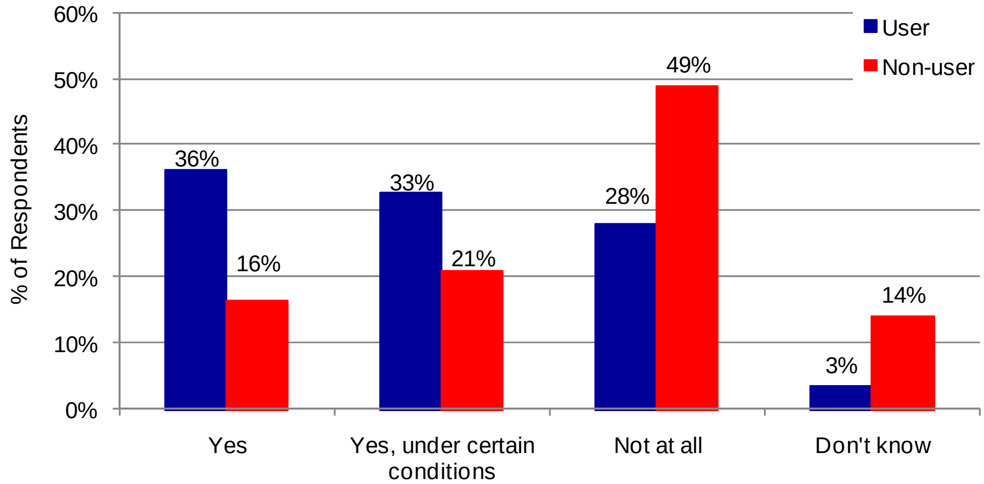
11 Support for the construction of additional toll roads in Central Texas was also found to vary by the type of trucking operation that the respondent represented. For example, 21% of the respondents that provided unconditional support for the construction of additional toll roads in Central Texas were LTL respondents. Also, 38% of the respondents that indicated conditional support were private carrier respondents. Finally, 41% of the respondents that did not at all support the construction of additional toll roads in Central Texas were TL respondents.

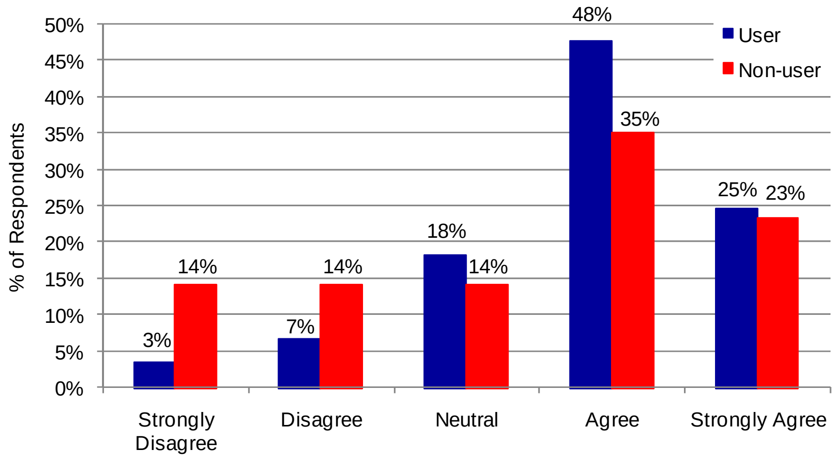


Toll road users: 61
Non-toll road users: 43

Figure 4.19: Toll Road Support – User vs. Non-User

Finally, respondents were provided with a number of statements (e.g., they [toll roads] provide an alternative to congested "freeways," they [toll roads] have superior pavement condition, and they[toll roads] are faster). Respondents were asked to rank each of these statements on a scale of 1 to 5, where 1 meant strongly disagree and 5 meant strongly agree). The responses from the toll road users and non-toll road users are summarized in Figures 4.20 to Figure 4.27.

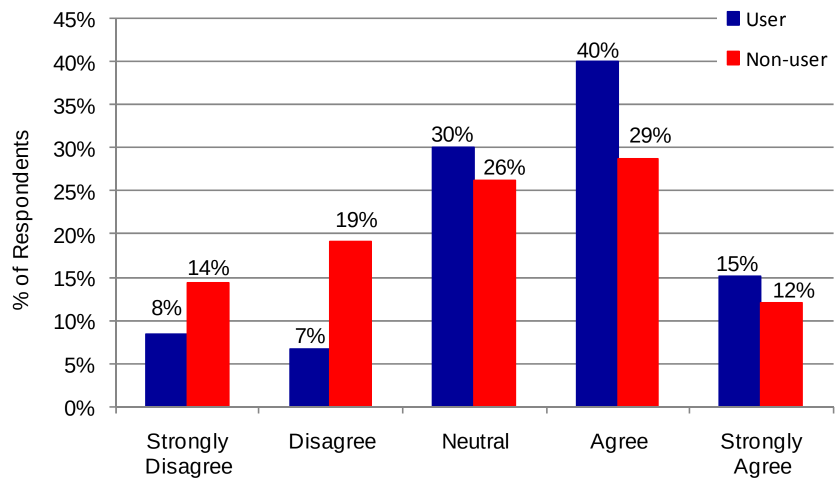
Figure 4.20 illustrates the recorded scores assigned by toll road users and non-toll road users when presented with the following statement: they [toll roads] provide an alternative to congested freeways. As can be seen 73% of the toll road users agreed/strongly agreed with this statement as opposed to 58% of the non-toll road users. On the other hand 28% of the non-users strongly disagreed/disagreed with the statement compared to 10% of the toll road users.



Toll road users: 61
Non-toll road users: 43

Figure 4.20: Toll Roads Provide an Alternative to Congested Freeways

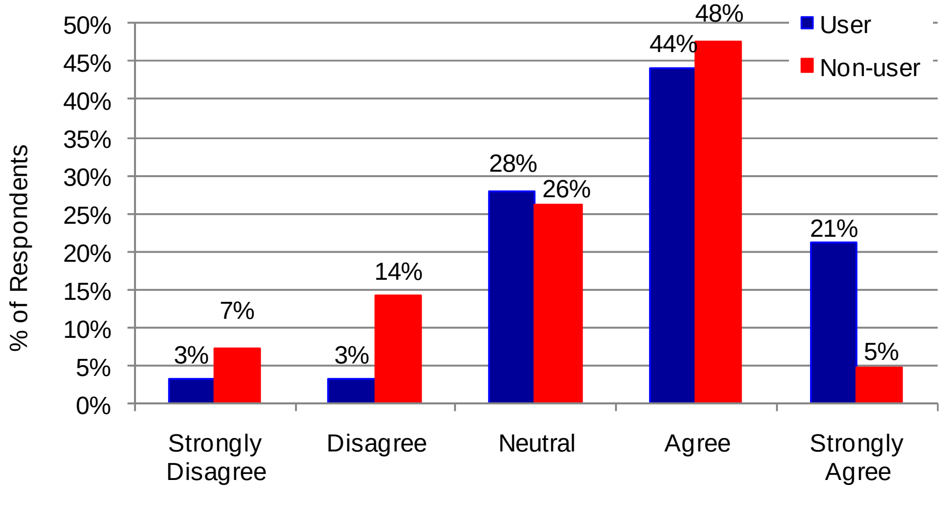
Figure 4.21 illustrates the recorded scores assigned by toll road users and non-toll road users when presented with the statement that toll roads have superior pavement condition. As can be seen 55% of the toll road users agreed/strongly agreed with this statement as opposed to 41% of the non-toll road users. On the other hand 33% of the non-users strongly disagreed/disagreed with the statement compared to 15% of the toll road users.



Toll road users: 60
Non-toll road users: 42

Figure 4.21: Toll Roads Have Superior Pavement Condition

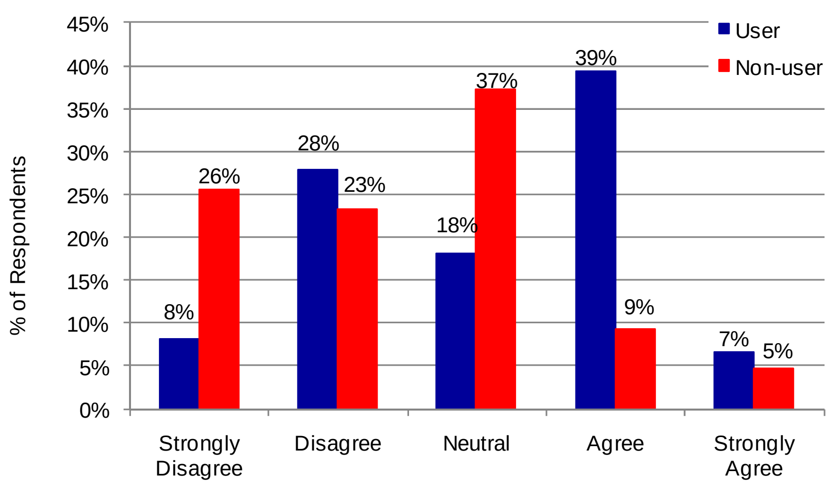
Figure 4.22 illustrates the recorded scores assigned by toll road users and non-toll road users when presented with the statement that toll roads are faster. As can be seen 65% of the toll road users and 53% of the non-toll road users agreed/strongly agreed with this statement. On the other hand 21% of the non-users strongly disagreed/disagreed with the statement compared to 6% of the toll road users.



Toll road users: 61
Non-toll road users: 42

Figure 4.22: Toll Roads are Faster

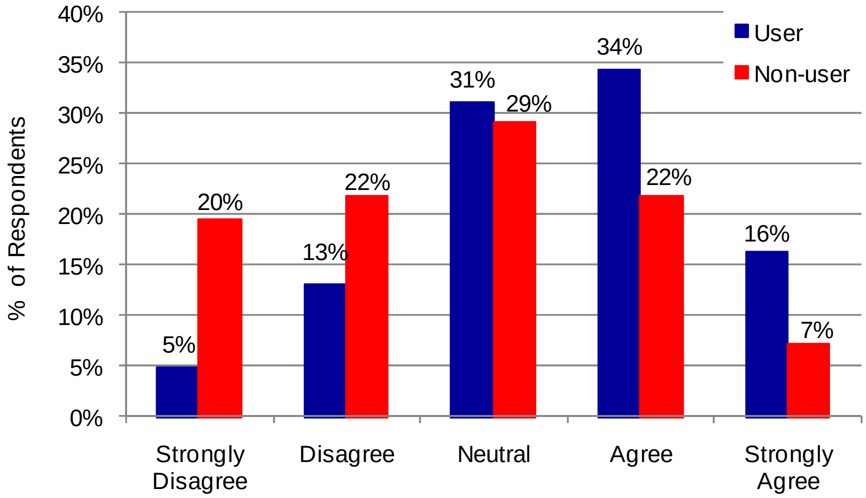
Figure 4.23 illustrates the recorded scores assigned by toll road users and non-toll road users when presented with the statement that toll rates are reasonable considering the benefits. From Figure 4.23 it is evident that 46% of the toll road users agreed with this statement as opposed to 14% of the non-toll road users. On the other hand, 49% of the non-users and 36% of the users strongly disagreed/disagreed with the statement.



Toll road users: 61
Non-toll road users: 43

Figure 4.23: Toll Rates are Reasonable Considering the Benefits

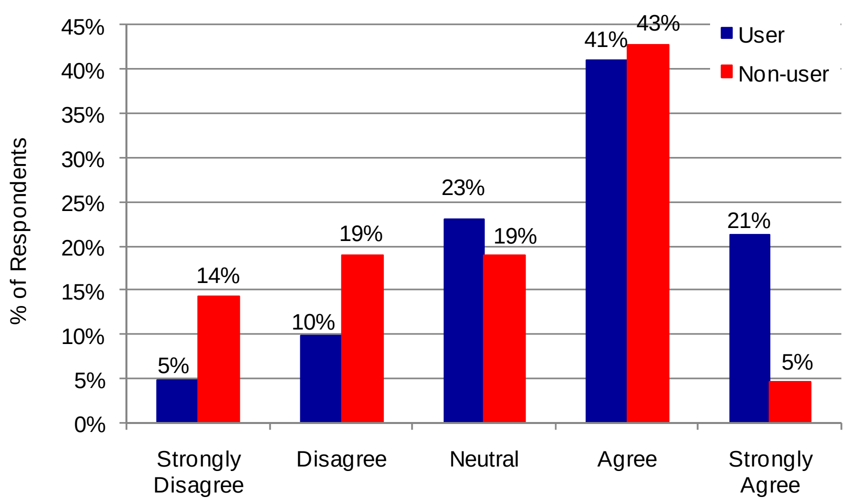
Figure 4.24 illustrates the recorded scores assigned by toll road users and non-toll road users when presented with the statement that toll roads are a safer alternative. As can be seen, half of the toll road users (50%) agreed/strongly agreed with this statement compared to 29% of the non-toll road users. On the other hand, 42% of the non-users strongly disagreed/disagreed with the statement compared to 18% of the toll road users.



Toll road users: 61
Non-toll road users: 41

Figure 4.24: Toll Roads Are a Safer Alternative

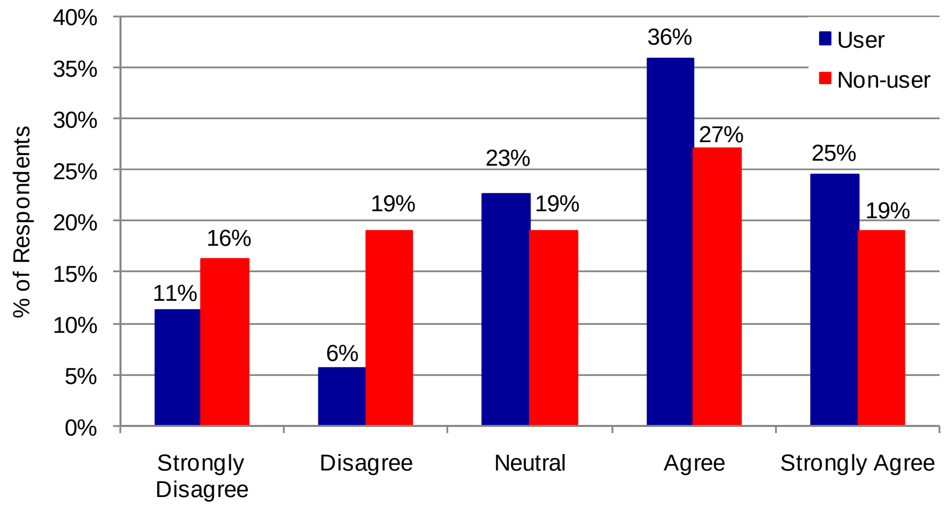
Figure 4.25 illustrates the recorded scores assigned by toll road users and non-toll road users when presented with the statement that toll roads provide more predictable travel time. From Figure 4.25 it is evident that 62% of the toll road users agreed/strongly agreed with this statement as opposed to 48% of the non-toll road users. On the other hand, 33% of the non-users strongly disagreed/disagreed with the statement compared to 15% of the toll road users.



Toll road users: 61
Non-toll road users: 42

Figure 4.25: Toll Roads Provide More Predictable Travel Time

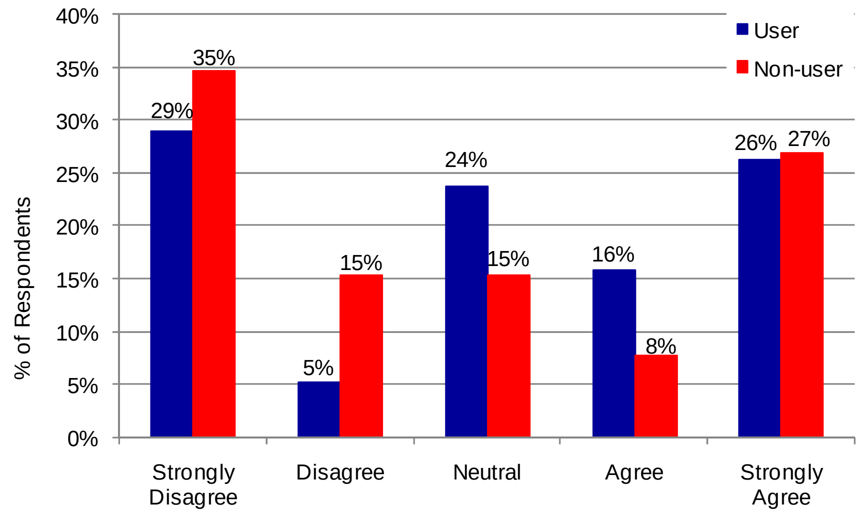
Figure 4.26 illustrates the recorded scores assigned by toll road users and non-toll road users when presented with the statement that toll roads provide an alternative in emergency situations. As can be seen 61% of the toll road users and 46% of the non-toll road users agreed/strongly agreed with this statement. On the other hand 35% of the non-users strongly disagreed/disagreed with the statement compared to 17% of the toll road users.



Toll road users: 53
Non-toll road users: 37

Figure 4.26: Toll Roads Provide an Alternative in Emergency Situations

Figure 4.27 illustrates the recorded scores assigned by toll road users and non-toll road users when presented with the following statement: we will use them [toll roads] when the shipper pays the toll. As can be seen 42% of the toll road users and 35% of the non-toll road users agreed/strongly agreed with this statement. On the other hand 35% of the non-users and 29% of the users strongly disagreed with the statement.



Toll road users: 38
Non-toll road users: 26

Figure 4.27: Will Use Toll Roads if Shipper Pays the Toll

A number of respondents, however, commented that shippers are not willing to pay the costs of the toll incurred by trucking companies. A question was therefore included in a questionnaire that was sent to 569 Texas freight shippers about their willingness to compensate trucking companies for the additional costs imposed when using a toll road. Specifically, the research team asked Texas freight shippers if they would be willing to pay toll charges incurred by the trucking service to (a) ensure reliable transit times, (b) faster transit times, (c) accommodate heavier or larger shipments, and (d) other (please specify). Texas freight shippers were asked to check all the reasons that applied to their business. A total of fifty-five completed surveys were returned from freight shippers across the state. Of the fifty-five completed surveys received, twenty-one Texas freight shippers (38%) indicated that they would be willing to pay the tolls for one or more of the reasons listed. Seven of the twenty-one Texas freight shippers indicated that they would be willing to pay the toll if toll roads could accommodate heavier or larger shipments. Figure 4.28 illustrates the commodities shipped by shippers that were willing to pay the toll. As can be seen, 38% of the shippers that were willing to pay the toll were shipping machinery and molding, 19% were shipping agricultural grains, and 14% were shipping oil and gas products. In other words, these tended to be shippers of bulk commodities.

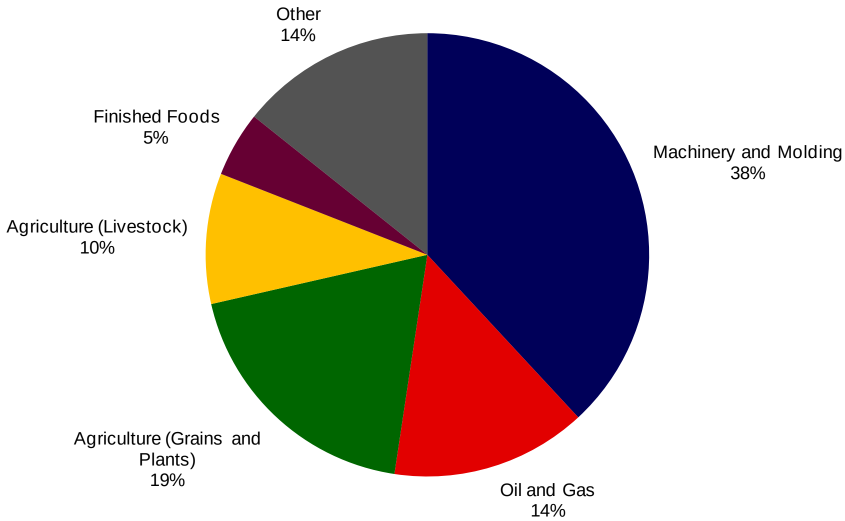


Figure 4.28: Shippers Willing to Pay Tolls by Commodity Shipped

Figure 4.29 illustrates the company size of shippers (in terms of number of employees) that were willing to pay the toll. As can be seen, 43% of the shippers were smaller companies employing twenty-five or fewer people. Another 19% employed twenty-six to fifty people. Thus 62% of the shippers that indicated a willingness to pay the tolls incurred by trucking companies employ fifty or fewer people. Finally 19% employed more than 125 people.

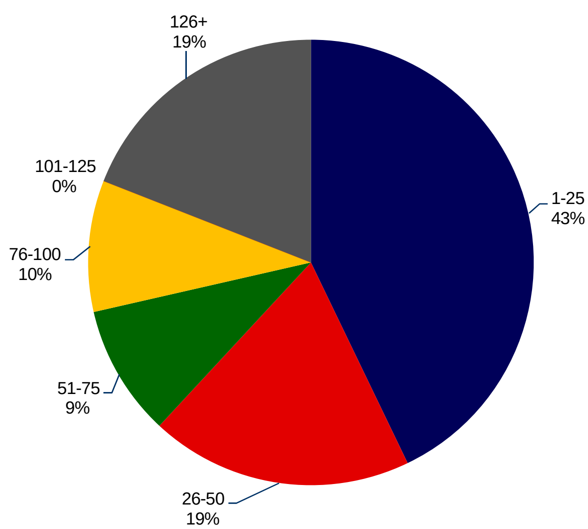


Figure 4.29: Shippers Willing to Pay Tolls by Number of Employees

4.4 Concluding Remarks

This chapter aimed to characterize the truck users and non-users of Central Texas toll roads. It should, however, be noted that although respondents were characterized as toll road users it does not equate to toll roads being used for all trips. As a matter of fact, only 40% of the toll road users reported that their drivers use toll roads on a daily basis. Rather toll road users were respondents that indicated that their drivers have used or are frequently using Texas toll roads. Respondents that indicated that their drivers have not used any toll roads were categorized as non-users of Texas toll roads. Some of the salient insights of the survey were that the “type of operations” profile of truck users and non-users of Texas toll roads differ. Truck toll road users were mostly private carriers (30% of toll road users), followed by TL carriers (28%), and LTL carriers (15%). On the other hand, the majority of the non-users of Texas toll roads were TL carriers (36% of the toll road non-users), 25% comprising the “other” category, and 14% owner operators. Furthermore there is a statistical difference in the perception of toll road users and non-toll road users as to the impact of congestion on their business. In other words, a higher percentage of truck toll road users indicated that their operation is impacted by congestion. On the other hand, there was no statistical difference between the proportion of toll road users and non-toll road users that transport time sensitive commodities. However, 50% of the truck toll road users reported that the company make most of their deliveries during the morning peak hours (i.e., between 7:00 and 9:00am) as opposed to 43% of the non-toll road users who indicated that the company make most of their deliveries between 9:01 am and noon. 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 5. 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, commodity transported or information about the time sensitivity of the commodity is not linked to toll tag records nor are reasons for using the toll roads. This type 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 5th to November 11th, 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 chapter[12].

5.1 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 5.1). Commercial accounts are registered as such when applying for an account[13]. From Table 5.1 it is evident that about 98,460 (or 11%) of the transactions were conducted by commercial account holders.

Table 5.1: CTTS Transactions by Account Type

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

Table 5.2 provides the breakdown of commercial and non-commercial transactions by toll facility.

12 In addition, the CD in included in the back of the report 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.

13 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 5.2: 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 SH130. This percentage is anticipated to increase when the road is completed further to the south, thereby forming a bypass around Austin.

5.2 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 5.3). As can be seen, approximately 91% of commercial transactions occur on a weekday.

Table 5.3: 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 and10:00am and 3:00 and 7:00pm 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 5.4 below illustrates the percentage of total transactions in the peak and off-peak hours by account type.

Table 5.4: 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 5.4, it is evident that a slightly higher percentage of commercial transactions occur during off-peak hours compared to non-commercial transactions. One reason given is that users (particularly commercial users) shift use to off-peak hours to avoid congestion. However, it can also be argued that the parallel non toll roads should be less congested during the off-peak hours. 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.

5.3 Axle Distributions

The transaction data obtained also recorded the number of axles associated with each toll transaction. Table 5.5 summarizes the percentage of total transactions by number of axles for each toll facility and the CTTS.

Table 5.5: 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 5.5, 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 5.2).

Table 5.6 summarizes the percentage of total transactions in each axle category by account type.

Table 5.6: 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 5.7 provides the axle category percentages of total non-commercial and commercial transactions.

Table 5.7: 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%

Interesting to note is that 70.48% of the commercial transactions are two-axle transactions, 15.25% are three-axle transactions, and about 3.9% are four-axle transactions. Five-axle commercial vehicles only comprised 8.34% of the total commercial transactions on the system (see Table 5.7).

5.4 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 5.8 summarizes the top ten zip codes in terms of the number of toll transactions per square mile.

Table 5.8: Zip Codes with Highest CTTS Toll Transactions

Zip code	Transactions/Mile^2
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 5.8 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 5.1). 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 I-35 and SH 130.

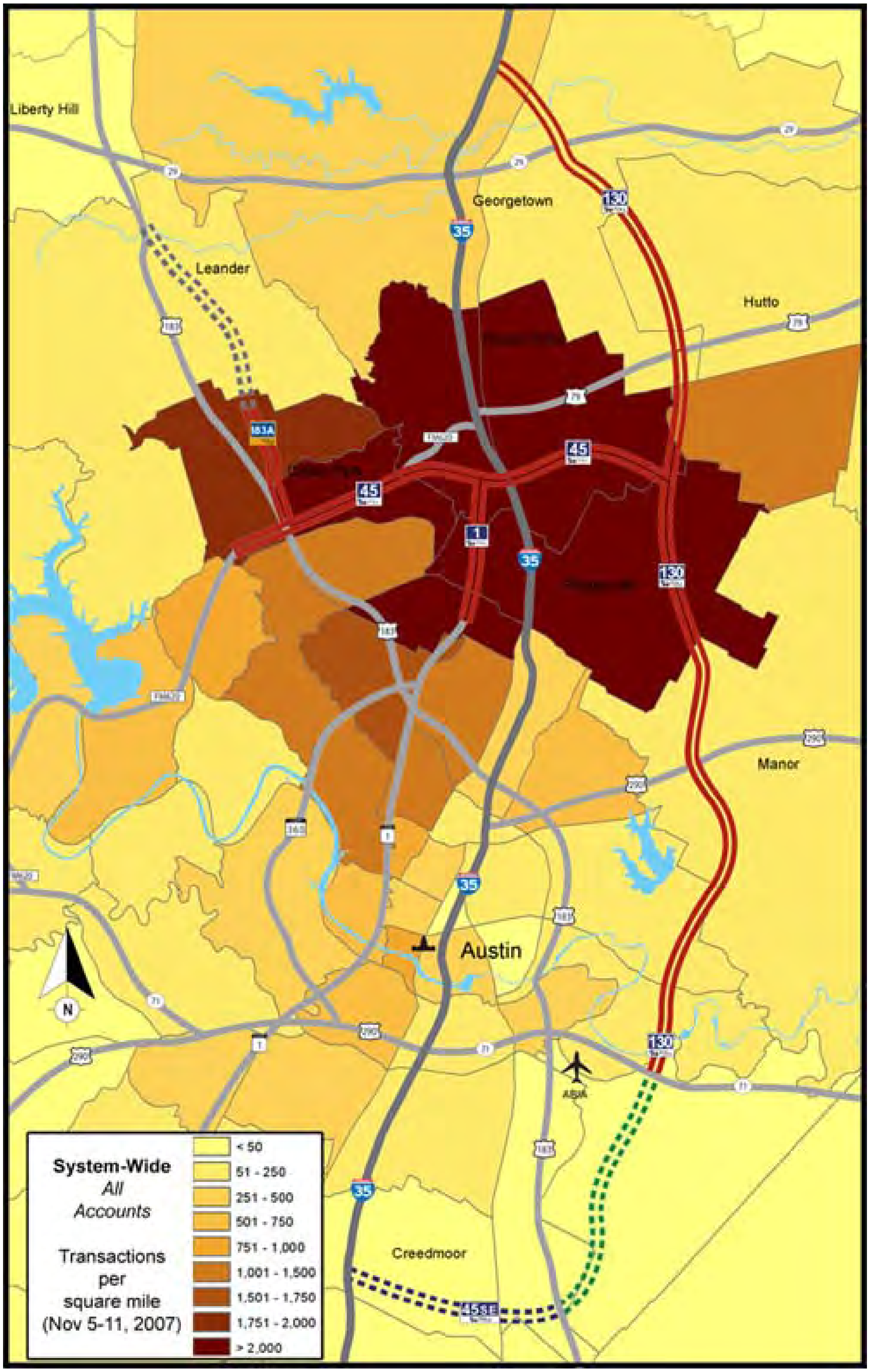


Figure 5.1: CTTS Toll Transactions/Mile[2]

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 zip codes with the highest number of commercial transactions per square mile are summarized in Table 5.9.

Table 5.9: Zip Codes with Highest CTTS Commercial Toll Transactions

Zip code	Transactions/Mile^2
78708	582
78742	476
78664	379
78758	350
78727	335
78728	309
78754	294
78709	243
78704	237

These zip codes are dispersed around the Central Texas area. Zip code 78708 is located in downtown Austin. Since the zip code is linked to the address to which the transactions are billed, it is likely that these commercial transactions are only billed at this location and that this location is not necessarily an origin or destination for the commercial traffic. Zip code 78742 is located just north of the Austin airport, 78664 is in Round Rock, and 78758 is just north of US-183 between I-35 and Loop 1. Dell Computers is registered in zip code 78758, which potentially explains the large number of commercial transactions associated with this zip code.

5.4.2 Spatial Data Analysis

The above analysis provided the number of toll transactions per square mile in the Central Texas zip codes. Figure 5.1 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. Since 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 commercial transactions on the CTTS and by individual toll facility (i.e., Loop 1, SH 45, and SH 130).

5.4.3 Geographic Profile of Toll Transactions

Figure 5.2 illustrates the transaction densities for the billing addresses of the commercial transactions. The billing addresses appears to be concentrated just north of US-183 and west of Pflugerville—between I 35 and Loop 1—as well as just south of the Capitol and around the airport.

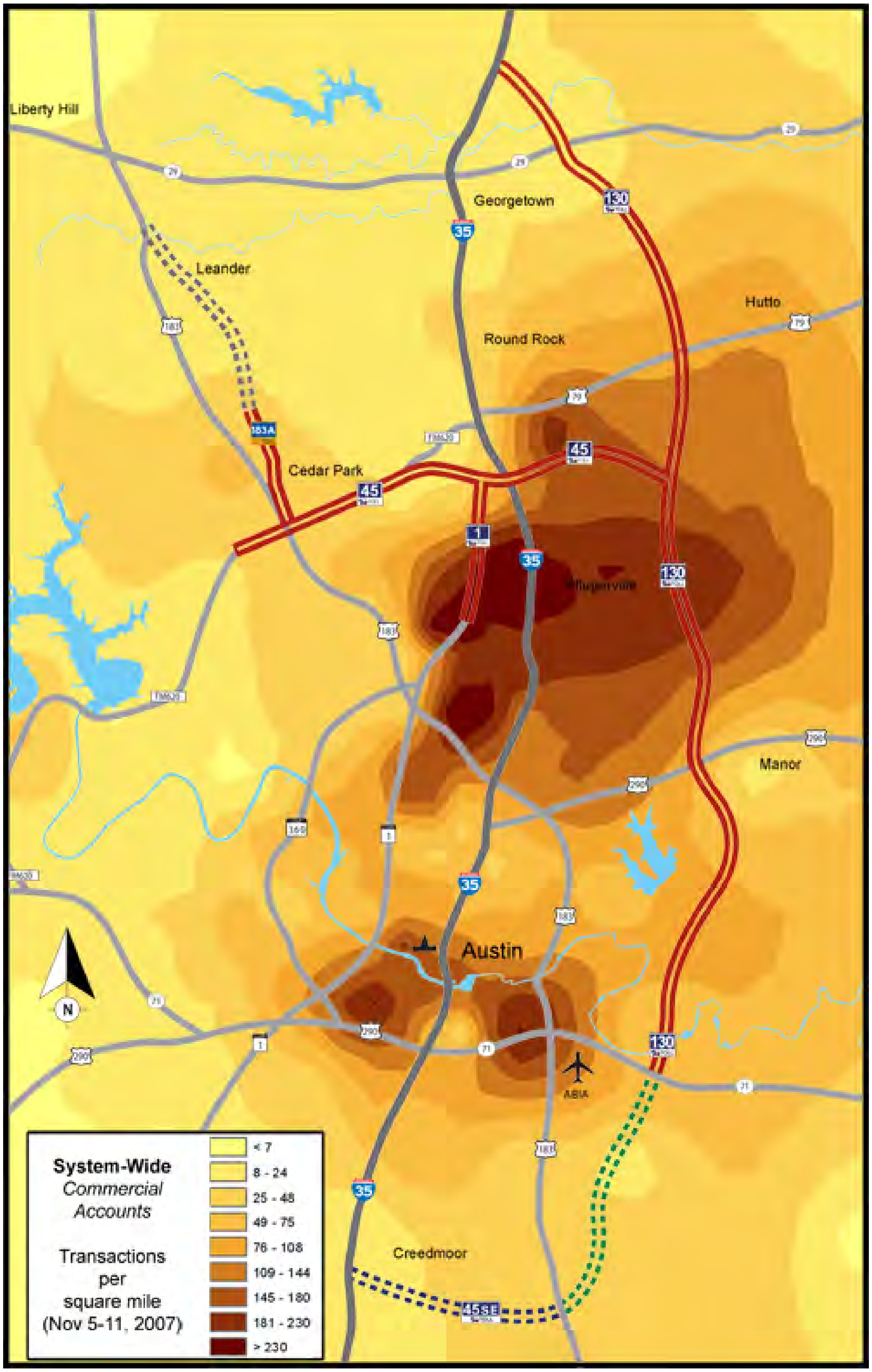


Figure 5.2: CTTS Commercial Transactions/Mile²

Figures 5.3, 5.4, and 5.5 illustrate the billing addresses for the commercial transactions on Loop 1, SH 45, and SH 130, respectively. As can be seen, the billing addresses for the commercial transactions on Loop 1 appear to be concentrated in the corridor between Loop 1 and I-35, and northwest of the airport (see Figure 5.3). Similarly, from Figure 5.4, it is evident that the billing addresses for the commercial transactions on SH 45 also appears to be concentrated in the corridor between Loop 1 and I-35 (north of US-183), and northwest of the airport (south of the river). Finally, from Figure 5.5 it is evident that the billing addresses for the commercial transactions on SH 130 are concentrated in the corridor between I-35 and SH 130 (north of US-290 and south of SH 45). The highest concentration of commercial transactions was billed to zip code 78754 located just north of US-290 between I-35 and SH 130.

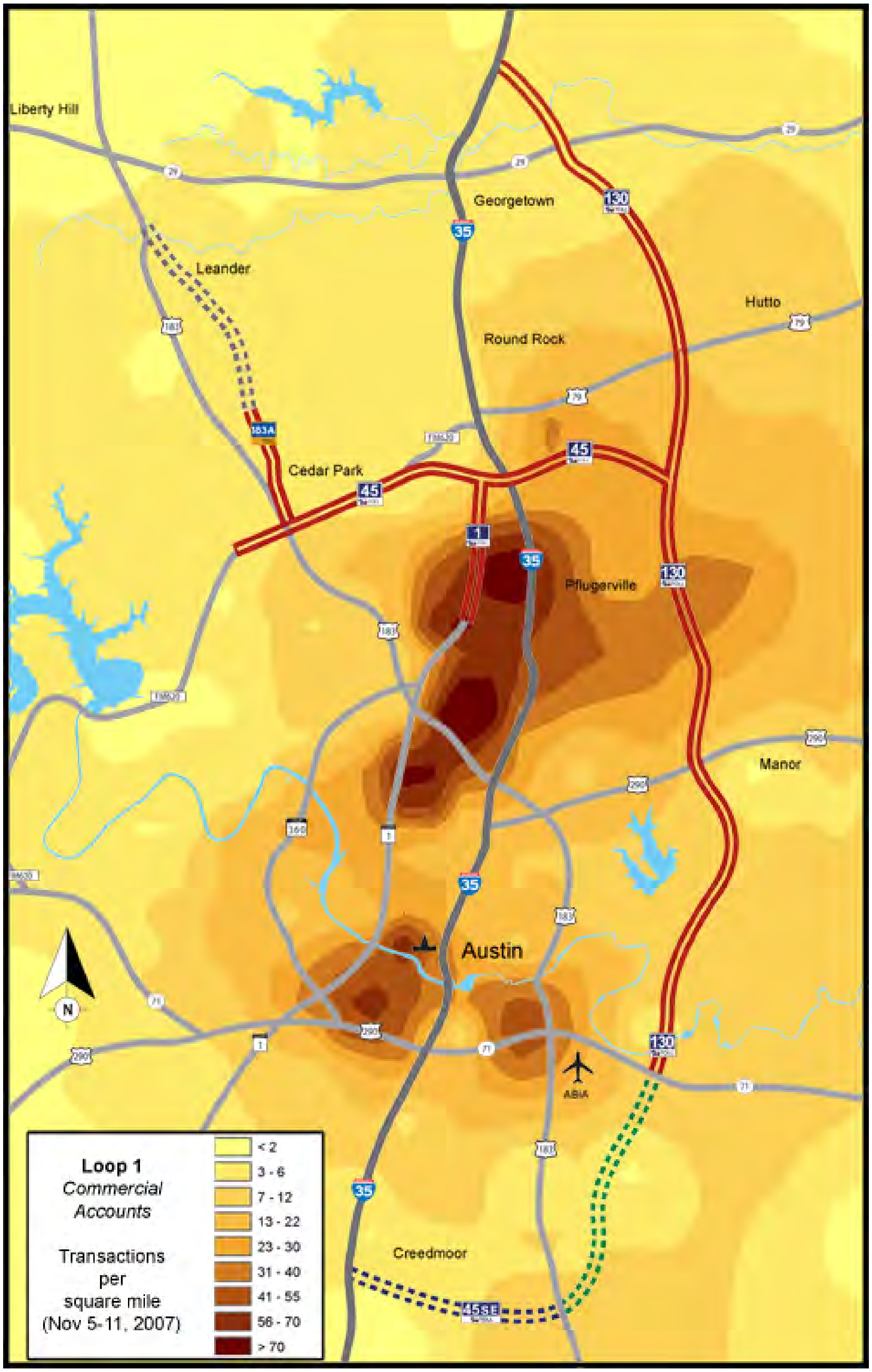


Figure 5.3: Commercial Transactions/Mile^2 on Loop 1

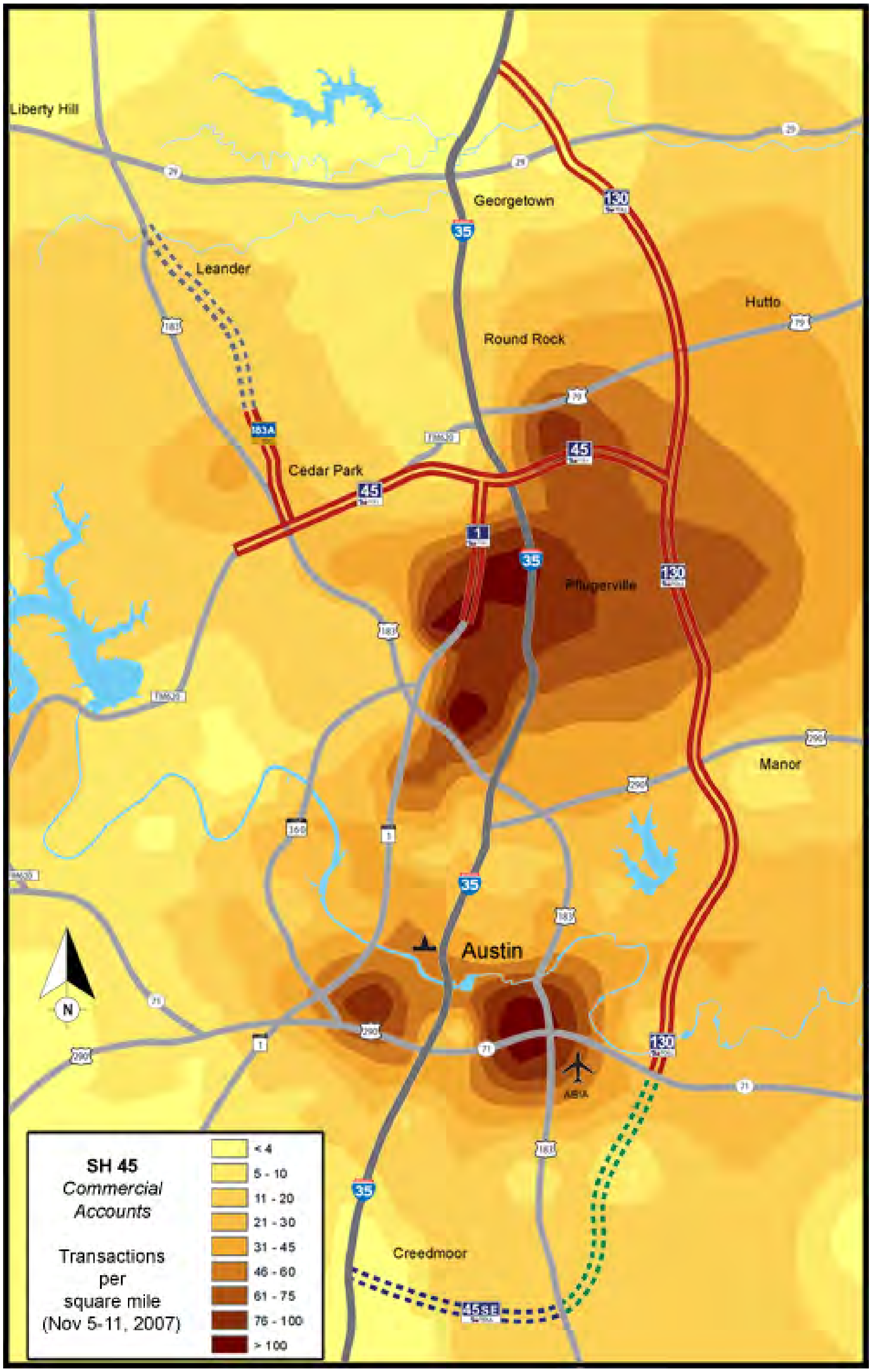


Figure 5.4: Commercial Transactions/Mile^2 on SH 45

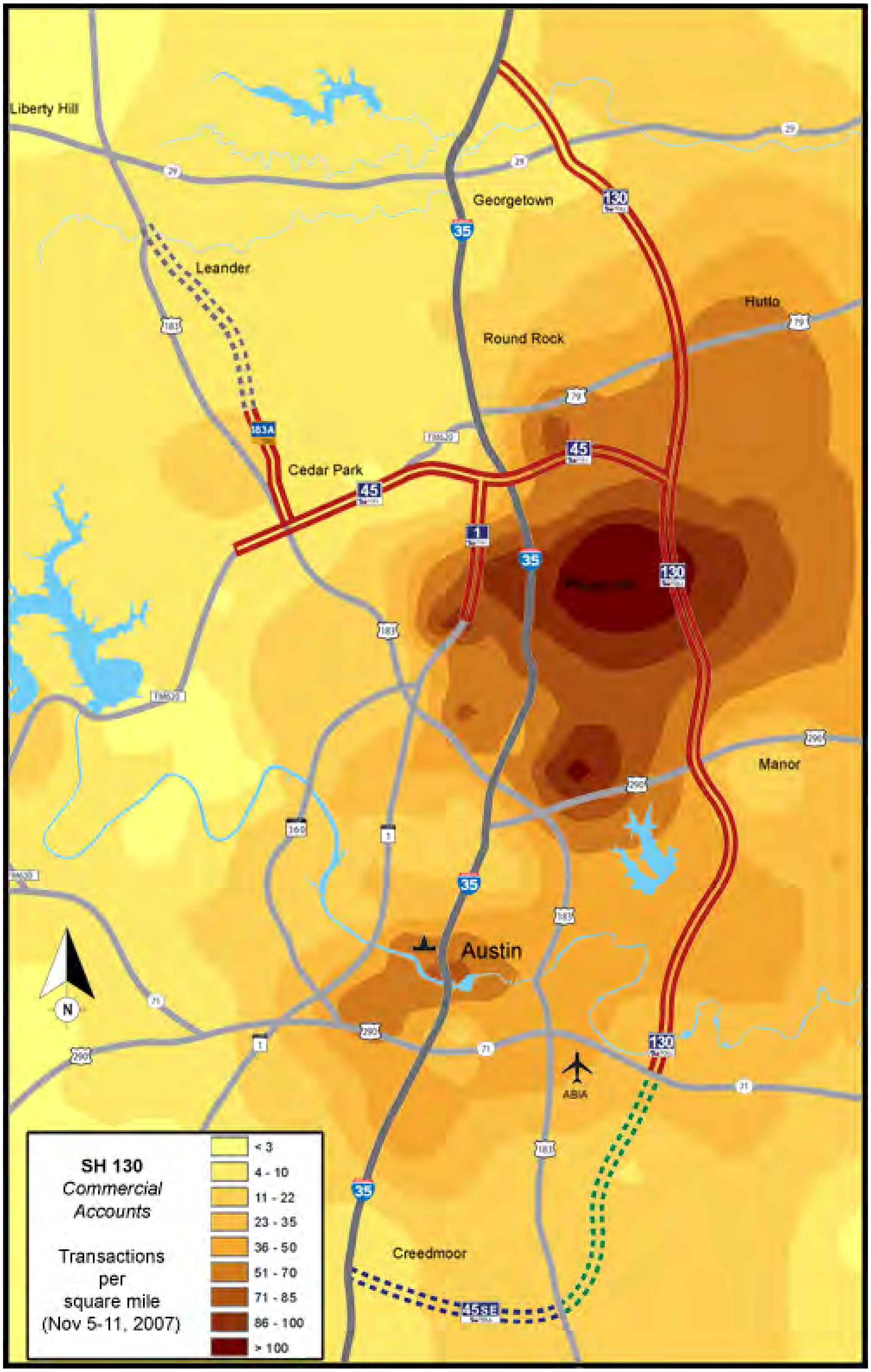


Figure 5.5: Commercial Transactions/Mile^2 on SH 130

5.5 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 during peak hour weekday traffic. On the other hand, for the commercial transactions, these billing addresses may or may not represent the trip origins of the vehicles.

Chapter 6. Concluding Remarks

Trucks are often assumed to contribute significantly to toll road revenues in T&R forecasts. For example, on a typical toll road trucks may contribute 25% of total revenues, although they account for less than 10% of total traffic. It is thus important to have robust data and information about trucks' potential usage of toll facilities. The literature, however, suggests tremendous uncertainty surrounding truck usage of toll road facilities. For example, Standard & Poor's 2005 analysis found that the errors associated with truck forecasts were substantially higher than those observed for private cars (e.g., light vehicles) in T&R studies. The forecasting error measured for trucks were 33% compared to 26% for light vehicles. Given the high revenue margin brought in by trucks—i.e., truckers pay between two and five times the tariff levied on cars—truck forecasting error is a serious issue when trucks are projected to be more than an insignificant fraction of the toll road traffic.

A comprehensive literature review and analysis of available commercial toll road usage data suggested substantial variability in truck toll road usage given the characteristics of the tolled facility, the truck market segment, and average trip length. In terms of the characteristics of the tolled facility, a local toll bridge or tunnel, for example, could attract a high percentage of truck users if the (a) tolled facility is on the shortest, fastest route to and from the trip's end points, (b) toll charged is comparatively low compared to the incremental variable cost to operate on an alternative non-tolled route, and (c) if everyone has to use the toll facility as no non-toll alternative exists. To improve the robustness of truck toll road usage forecasts, it is also important to acknowledge that the trucking industry is not homogenous. The trucking industry can be divided into a number of segments based on, for example, service area, vehicle ownership, fleet size, or type of carrier/operation. Although these segments are not necessarily mutually exclusive, it is important to recognize the different segments when trying to understand a trucking company's decision to use or avoid a toll facility. An inadequate understanding of the potential truck market segments that would use a particular toll facility have resulted in a number of cases where assumptions about the growing need for just-in-time deliveries or a higher willingness to pay for business travel have not resulted in the truck numbers forecasted to use tolled facilities. An owner-operator may, for example, avoid using a toll road at all costs, while a fleet owner may weigh the costs and benefits before making a decision about using a tolled facility. Finally, in terms of trip length it was found that cost/benefit was a significant factor in the route selection of long haul truckers as these companies typically have more non-toll route choices available.

This research study attempted to characterize truck users and non-users of Texas toll roads. In the spring and summer of 2009, the research team administered an internet and telephone survey to Texas trucking companies to gain insight into their usage and non-usage of Texas toll roads. The administered survey included questions about the respondent's company (e.g., type of operation, size of fleet, and type of trucks used), the type of operation (e.g., long, medium or short haul, major commodities transported, delivery windows, time of deliveries, and type of compensation), attitudinal questions concerning respondents' use and non-use of toll roads, and finally a number of questions pertaining to respondents' perceptions of toll roads.

Survey respondents were characterized as truck toll road users or non-toll road users based on their response to one of the first survey questions that asked whether their drivers used toll roads in Dallas, Houston, and Central Texas. Respondents that indicated that their drivers have used or are frequently using toll roads were categorized as truck users of Texas toll roads (sixty-three respondents). Respondents that indicated that their drivers have not used any toll roads were categorized as truck non-users of Texas toll roads (forty-five respondents). It should, however, be noted that although respondents were characterized as toll road users it does not equate to toll roads being used for all trips. As a matter of fact, only 40% of the toll road users reported that their drivers use toll roads on a daily basis.

The statistical analyses conducted provide insight into the characteristics of the truck users and non-users of Texas toll roads, as well as the differences between truck users and non-users of Texas toll roads. Some of the salient findings included:

- The "type of operations" profile of truck users and non-users of Texas toll roads differ. Truck toll road users were mostly private carriers (30% of toll road users), followed by TL carriers (28%), and LTL carriers (15%). On the other hand, the majority of the non-users of Texas toll roads were TL carriers (36% of the toll road non-users), 25% comprising the "other" category, and 14% owner operators.
- There is a statistical difference in the perception of toll road users and non-toll road users as to the impact of congestion on their business. In other words, a higher percentage of truck toll road users indicated that their operation is impacted by congestion than non-toll road users.
- There is a statistical difference between the proportion of toll road users and non-toll road users that have a delivery window in which to deliver the major commodities transported by their company. A higher percentage of truck toll road users indicated that they have a delivery window in which to deliver the major commodities transported by their company than non-toll road users.
- There is no statistical difference between the proportion of toll road users and non-toll road users that transport time sensitive commodities. However, 50% of the truck toll road users reported that their company makes most of their deliveries during the morning peak hours (i.e., between 7:00 and 9:00am) as opposed to 43% of the non-toll road users who indicated that their company makes most of their deliveries between 9:01am and noon.
- There is a statistical association between the level of support for the construction of additional Central Texas toll roads and toll road usage. In other words, a statistically higher percentage of toll road users indicated support or conditional support for the construction of more toll roads in Central Texas than non-toll road users. Furthermore, it was found that toll road users also ranked toll roads more favorably than non-toll road users in terms of (a) providing an alternative to congested freeways, (b) having superior pavement quality, (c) providing a faster alternative, (d) toll rates being reasonable considering the benefits, (e) providing a safer alternative, (f) providing more predictable travel times, and (g) providing an alternative in emergency situations.

Truck non-toll road users indicated that the reasons for not using a toll road were that toll roads cost too much (35%) and that there were no toll roads in their area of operation (35%). When truck non-users of toll roads were subsequently asked to specify under what circumstances their company drivers would be allowed to use a toll road, almost one third of the respondents (32%) answered "never use" and another 11% indicated "only if no other free route existed." This seems to suggest that there is a group of truckers that are inherently opposed to toll roads. This was also evident from the recorded responses to a list of incentives provided to truck non-toll road users to determine if any of these incentives would persuade non-users to use toll roads. The incentives included (a) subscribe to a toll road use plan where the company would pay a discounted, fixed monthly fee for a specified amount of usage (similar to a cell phone plan), (b) the company could receive a frequent user discount, such as free toll road days, free weekends, or discounted toll rates, (c) the toll tag can be used to pay for other driver purchases, such as fast food, fuel, and parking, (d) the company could receive a discounted toll rate during off-peak hours, (e) the provision of larger, well-maintained truck stops with dining and truck repair facilities, as well as in-cab auxiliary power systems (e.g., IdelAire) alongside the toll road, (f) the company could receive a fuel tax refund for the miles driven on the toll road, and (g) longer combination vehicles (LCVs) were allowed on the toll roads. Although none of these incentives resulted in more than 10% of the respondents indicating that they would be willing to use the Central Texas toll roads if the incentive was offered, it did appear that those incentives that reduced the costs of using the toll road, such as a fuel tax refund, the allowance of LCVs, and the frequent user discounts were more favorably received by the truckers that choose to avoid toll facilities. Interesting also is the fact that 42% of the respondents indicated that they *might be* and 6% indicated that they *would be* willing to use the Central Texas toll roads if larger, well-maintained truck stops are provided alongside the toll road.

Also, since discussions with carriers revealed that in many instances truck usage of toll roads will be determined by the shippers' willingness to pay for the incremental cost of toll charges incurred, the research team asked Texas freight shippers' about their willingness to compensate trucking companies for the additional costs imposed when using a toll road. The research team asked Texas freight shippers if they would be willing to pay toll charges incurred by the trucking service to (a) ensure reliable transit times, (b) faster transit times, (c) accommodate heavier or larger shipments, and (d) other (please specify). Texas freight shippers were asked to check all the reasons that applied to their business. This question was included in a questionnaire that was sent to 569 Texas freight shippers. A total of fifty-five completed surveys were collected from freight shippers across the state. Of the fifty-five completed surveys received, twenty-one Texas freight shippers (38%) indicated that they would be willing to pay the tolls for one or more of the reasons listed. Seven of the twenty-one Texas freight shippers indicated that they would be willing to pay the toll if toll roads could accommodate heavier or larger shipments.

Finally, the survey information was supplemented with the analysis of a sample of 931,360 actual toll transactions that occurred on the Central Texas Turnpike System (CTTS)—i.e., Loop 1, SH 130, and SH 45—during the week of November 5th to November 11th, 2007. The transaction data included the day and time of the transaction, the plaza where the transaction was 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 SH130. 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 analyzed to determine day-of-week and time-of-day patterns of travel by commercial and non-commercial accounts. It was found that approximately 90% of commercial transactions occur on a weekday. 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 and10:00am and 3:00 and 7:00pm on a week day. Overall for the CTTS, 58.21% of the commercial transactions occurred during peak hours and 41.79% 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 to avoid congestion, 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 commercial account holders. A spatial data analysis revealed that the billing addresses of CTTS commercial users are concentrated in the north portion of the city—just north of US-183 and west of Pflugerville—between I-35 and Loop 1—as well as just south of the Capitol and around the airport. The billing addresses for the commercial transactions on Loop 1 appeared to be concentrated in the corridor between Loop 1 and I-35, and northwest of the airport. Similarly, the billing addresses for the commercial transactions on SH 45 also appears to be concentrated in the corridor between Loop 1 and I-35 (north of US-183), and northwest of the airport (south of the river). Finally, the billing addresses for the commercial transactions on SH 130 are concentrated in the corridor between I-35 and SH 130 (north of US-290 and south of SH 45). The highest concentration of commercial transactions was billed to zip code 78754 located just north of US-290 between I-35 and SH 130. Overall, this type of spatial analysis is very useful to visualize the billing addresses of the CTTS commercial users. These billing addresses, however, may or may not represent the trip origins of the vehicles.

To conclude, this research study showed that the truck toll road users in Texas (a) are mostly private carriers, TL carriers, and LTL carriers, (b) believe that their operation is impacted by congestion, (c) have a delivery window in which to deliver the major commodities transported by their company, and (d) make most of their deliveries during the morning peak hours (i.e., between 7:00 and 9:00am). Truck toll road users also ranked toll roads more favorably than non-toll road users when presented with statements describing the benefits of toll roads (for example, superior pavement quality, faster, safer, and more predictable travel times). This seems to suggest that marketing efforts should be targeted to these types of operations and the existing toll customer base.

On the other hand, it appears that there is a group of truckers that are inherently opposed to toll roads that translates into an unwillingness to respond positively towards most incentives to encourage the use of toll roads. Having said that, the incentives that reduce the costs of using the toll road, such as a fuel tax refund, the allowance of LCVs, and the frequent user discounts seem to be more favorably viewed by these truckers. Interesting also was the consideration that almost 50% of the non-toll road users would give to using the Central Texas toll roads if larger, well-maintained truck stops are provided alongside the toll road. These are thus incentives that can be further evaluated to encourage the usage of toll roads by the trucking industry.

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Appendix A: Literature Review

Economic and Financial Feasibility of Truck Toll Lanes

Holguin-Veras et al. (2003) analyzed the economic and financial feasibility of Heavy-Truck Toll lanes (HTL). The authors extended the work that was done in the Comprehensive Truck Size and Weight Study (TSWS), which concluded that an increase in truck size and weight could reduce truck vehicle miles and increase economic productivity. The study approach to evaluating the feasibility of HTL, however, differed from the TSWS approach in that the authors proposed to use segregated facilities. The authors argued that investment costs are greatly reduced when using a segregated facility, because only the heavy-truck lane needs to be upgraded and not the entire facility.

The HTL concept presented in this study involved an increase in the size and weight limits of trucks using the HTL. Also the construction and operation of the HTL was anticipated to be financed through private investments (tolls), but trucks using the facility would receive a rebate on gas taxes when traveling on the HTL. The concept required acquiring right-of-way along the existing highway corridors on the federal aid system, relaxing current federal truck size and weight regulations for trucks using the HTL, and a rebate of federal, state, and local gas taxes for miles driven on the HTL.

The authors analyzed a hypothetical study corridor, which consisted of three mixed-traffic lanes (MTL) used by passenger cars, buses, and non-paying trucks that are physically separated from an exclusive HTL using continuous New Jersey barriers. The HTLs would comprise one lane in each direction—with a passing lane every few miles and on hills—and with shoulders on the inner and outer edges. HTLs would also have exclusive entrance and exit ramps and adjacent staging areas to provide for the loading and unloading of conventional truck combinations that will use local freeways and arterials.

The study estimated the productivity gains associated with using the HTL by 3-S2 and 3-S2-T4 truck combinations. The 3-S2 is the most widely used long distance truck combination and the 3-S2-T4 is the largest truck allowed under current regulations. The axle load limits for the HTL were assumed to be 50% higher than the axle loads currently allowed in the U.S.

The productivity analysis was based on costs provided by trucking companies. The cost considerations included travel time, distance, cargo handling, and a fixed cost. The analysis showed that if the amount transported is less than or equal to 15 metric tons, using the HTL are more expensive than the base cases (Case A: tight gross weight limits, Case B: high gross weight limits). If the amount transported is more than 15 metric tons, then using the HTL becomes less expensive for trip distances greater than 40 km.

The authors also argued that when estimating commercial vehicle tolls, the following factors should be considered: (1) objective of the pricing entity, (2) users' willingness to pay, (3) marginal cost of pavement deterioration, (4) traffic congestion, and (5) existing capacity constraints. The study team thus assumed that for an HTL to be attractive to trucking companies, 50% of the cost savings of using a HTL would have to be in the form of direct operational cost savings. The other 50% of the savings is left as an incentive. The analysis results demonstrated that the net savings increases with distance traveled. For example, for the 3-S2 configuration the breakeven distance is more that 23km and for the 3-S2-T4 configuration the breakeven distance is more than 68km.

In addition, the feasibility analysis also considered the point of view of a private investor. The factors considered were: (1) the cost of building and operating the HTL, (2) vehicle operating cost savings, and (3) travel time savings. However, instead of conducting a detailed estimate of the initial investment cost, the study team calculated an approximate pavement cost and undertook a sensitivity analysis. The results indicated a basic investment cost of $425,000/lane-km for the MTL systems, and $600,000/lane-km for the HTLs. Additional sensitivity analyses were conducted to account for the costs of building ramps and terminals and retrofitting the existing structures. The return on investment (ROI) associated with building and operating the HTL was calculated assuming three scenarios of toll rates: $0.05/km, $0.25/km, and $0.50/km. The analysis showed that for the HTL to be feasible—i.e., generate a higher rate of return than the opportunity cost of the capital—the tolls need to be between $0.25 and $0.50/km.

The feasibility of the system will, however, ultimately depend on demand. The feasibility analyses determined that even with low traffic levels, the HTLs will have a positive economic impact that will increase as traffic levels increase. The authors also concluded that HTL presents a good investment opportunity for the private sector.

Exploring Truck Driver Perceptions and Preferences: Congestion and Conflict, Managed Lanes, and Tolls

Adelakun and Cherry (2008) aimed to understand truck drivers' perceptions of urban congestion and safety challenges, and to identify truck drivers' preferences for potential geometric or operational solutions. Five hundred truck drivers were interviewed at a truck stop or plaza that serves two major interstate highways near Knoxville, Tennessee. The target was truck drivers traveling through the Knoxville urban area.

The survey was designed not to overwhelm truck drivers. Simple wording was used to ensure the interviewees understand the questions and provide correct responses. The survey gathered data about operator status, years of driving experience, trip origin and destination, frequency using Knoxville highways, perception of congestion in Knoxville, schedule adjustments, perceptions of lane configurations, factors that reduce efficiency and safety, impacts of passenger vehicles on truck safety, and willingness to pay tolls.

About 47% of the truck drivers interviewed were owner operators and the remaining 53% worked for a trucking company. Owner operators tended to conduct longer trips through the Knoxville area. Both types of truck drivers, however, agreed that they experience severe congestion throughout the Knoxville area, but only half indicated that they change their itineraries or routes to avoid congestion. Regarding safety and efficiency, most truck drivers indicated that aggressive drivers, lane changing behavior, congestion, and merging cars impacts their productivity and safety.

When asked about lane configurations, most respondents preferred the use of the left side lanes as truck lanes (i.e., reversing the current lane configuration). There was also support for the option of a managed truck only lane. Both these configurations, however, pose operational challenges, for example trucks moving and exiting to the right side off-ramps. Also, the truck drivers that supported optional truck only lanes were not willing to pay more to avoid congestion than those that supported other operational changes. The average willingness to pay to save 10 minutes of travel time was $2, which translates into an average value of time of $10 per hour.

The authors were planning to incorporate the survey findings in a micro-simulation model to calculate the effects of different design configurations that would provide the highest levels of capacity improvements and still be acceptable to drivers.

Motor Carriers' Opinions on Potential Optional Truck Only Lanes on Atlanta Interstate Highways

Short (2007) explored the willingness of truck carriers to pay for the use of an optional truck only toll (TOT) lane on Atlanta's interstate highways. The State Road and Tollway Authority (SRTA) determined that the financing of a TOT system would depend on the willingness of trucking companies to pay for the use of the facilities. The researchers interviewed seventy-one Georgia based trucking companies to gain insight into their use of highways, their time of travel, the option of using alternative routes, the criticality of their shipments, and their willingness to increase costs (i.e., pay tolls) in exchange for real/perceived benefits from using the TOT system. Of those trucking companies interviewed 68% were for-hire carriers (i.e., 49% TL and 19% LTL), and 26% were private carriers. The survey results suggested interest in an increase in capacity and congestion mitigation measures, especially the use of TOT lanes if these were non-tolled. The researchers also pointed out that shippers usually set delivery times, which often requires carriers to travel during peak hours. This means that congestion will continue to be a problem and it is shippers' behavior that needs to be influenced.

Toll Truckways: A New Path toward Safer and More Efficient Freight

Poole et al. (2002) argued that the U.S. needs a new approach towards long-distance inter-city trucking, because the current system often leads to conflicts between passenger vehicles and trucks and limits the potential productivity of long-haul trucking. To mitigate these problems, the authors proposed toll truckways, consisting of one or more truck only lanes (each way) that are physically separated from existing lanes by New Jersey concrete barriers. The proposed truckways will have their own entry and exit ramps and will allow for the use of longer and heavier trucks, thereby greatly increasing freight productivity. Also, building specialized lanes for larger and heavier trucks will greatly reduce the investment required to improve the entire system to allow the use of longer combination vehicles (LCVs). The authors also argued that toll truckways will enhance safety because trucks and passenger vehicles will be physically separated.

A number of studies have shown that a combination of factors contribute to pavement deterioration, including axle weight loading, axle configurations, tire width, tire pressure, and suspension characteristics—i.e., not only gross vehicle weight. Of these factors, axle configuration, tire width and pressure, and vehicle suspensions are not regulated by federal or state governments—i.e., only axle weight loading and gross vehicle weight. In terms of bridge load protection, the bridge formula is used to restrict the maximum weight allowed on any group of consecutive axles considering the number of axles in the group and the distance from the first to the last axle. The authors argued that since the bridge formula is used for bridge protection and axle loads limits are used for pavement protection, gross vehicle weight restrictions are unnecessary and redundant. They also argued that gross vehicle weight restriction is ineffective from a safety perspective, because a passenger vehicle will be destroyed in a collision with a large truck regardless of the truck's weight. Safety concerns would, however, be addressed if (1) passenger cars and trucks are separated wherever possible, (2) trucks are manufactured to be more stable and have better handling, (3) more efficient combinations are allowed that will increase productivity, and (4) if freight could be moved using fewer trucks. Also, the authors pointed out that an increase in trucking productivity will yield and increase in revenue that could promote the adoption of improved safety measures and the use of technology to help truck drivers become safer and more productive.

LCVs generally have a good safety record in the environments in which they operate, i.e., turnpikes and multi-lane divided highways. It is, however, difficult to predict how they would operate in more urbanized areas with higher congestion levels. There is also an issue concerning truck and railroad competition. The railroad industry has argued that allowing larger trucks would divert more traffic from the railroad sector resulting in the rail sector incurring economic losses. The authors argued that both the safety and rail concerns can be addressed with a tolled truckway. In terms of safety, the number of trucks on mixed traffic lanes will be reduced. In terms of the rail sector, trucks will be charged a toll sufficient to cover the infrastructure investment similar to how the rail sector finances their own infrastructure. Finally, the authors pointed to the environmental benefits of using LCVs, since LCVs would reduce vehicle miles traveled, fuel consumption, and emissions.

The authors pointed to the Canadian and Australian experiences as examples of how LCVs can be operated productively and safely. In the case of Canada, using the tridem axle has been proven to be superior to tandems and B-trains are preferred over the conventional full trailer with an A-train arrangement and drawbar attachment. Research in Canada concluded that the low U.S. weight limits are a major source of inefficiency in the container trade between Seattle and Vancouver. Canadian provinces generally permit heavier loads, but they impose stricter length regulations. The study concluded that Canadian trucking has benefited from the Canadian federal government acting as a facilitator rather than decision-maker in terms of truck sizes and weight limits. Reform in this area was brought about through research and collaboration among interested parties, and agreements amongst provinces.

In the case of Australia, the B-train is also preferred because the trailer is connected closer to the tractor, which reduces trailer wander. Axle-loading limits are higher than in the U.S. for certified road-friendly suspension systems. These suspension systems are estimated to cause 10 to 20% less damage to pavements. In Australia, the use of LCVs has improved safety without increasing road maintenance costs. The additional cost imposed on bridges is argued to have been offset by the lower costs of moving freight.

The authors also discussed several issues that need to be addressed when implementing a toll truckway system, i.e., the physical configuration of the truckway, the relationship between tolls and existing highway user taxes, and the use of new technologies. The pavement design of truckways has to be stronger and more durable than the typical design of mixed use lanes. If a project is financed by the private sector, it is assumed that investors will build the truckway to a heavier standard to ensure pavements with a longer life and lower maintenance costs. Concerns about "double taxation" can be addressed by providing users with a rebate for the taxes paid on the miles driven on the toll truckways. Another option is for the toll operator to receive the rebates instead of the individual trucking companies. The trucking companies can then set up accounts with the operator, which can be credited with the rebates to offset some of the toll costs. Finally, toll truckways will implement the newest electronic toll collection technology, removing the need for toll plazas. Each truck would thus need a transponder encoded with its size and weight and trucking firms will need to maintain a prepaid account with the truckway operator.

The authors argued that state DOTs will greatly benefit from the construction of toll truckways since it would be providing additional lanes that were probably already needed to be build by the DOT, while diverting 20 to 25% of existing heavy truck traffic off the existing lanes. The latter will reduce pavement consumption, maintenance, and rehabilitation expenditures.

Two concession models for setting toll rates were discussed. The first model sets a ceiling on the rate of return that can be earned during the concession period. This is proposed in a situation where traffic management is needed since the model does not set toll prices directly. The second model involves negotiating a future rate schedule based on an inflation index and traffic levels.

Two scenarios were also described in which toll truckways can be implemented. The first is to extent the territory in which LCVs can operate, in which case the truckway will serve as a "bridge" across those states which currently do not allow for LCV operations. The second scenario involves using toll truckways to assist the U.S. in meeting its trucking obligations under the NAFTA agreement, which seeks to harmonize operating standards in the U.S., Canada, and Mexico. The authors concluded that toll truckways will not be possible without some policy changes at the federal level, including the provision of right-of-way for toll truckways along existing Interstate and National Network corridors, changes to current federal size and weight restrictions, and the implementation of federal and state gas tax rebates for the use of the tolled truckway.

Appendix B: Operating and Financial Characteristics of the Trucking Sector

Different trucking segments have different operating and financial characteristics, which impacts the way in which they conduct business and the decisions which they make when presented with route decisions (e.g., toll roads versus non-toll roads). When making route decisions, trucking companies evaluate their total operating cost of travel, including both fixed and variable costs. Fixed costs are typically defined as those costs that do not vary with the amount of travel. Fixed costs for the trucking industry include overhead, rent, and interest payments on loans. These costs per unit are reduced as the output—e.g., vehicle miles traveled or ton-miles traveled—increases. Variable costs per unit, on the other hand, are fixed and total variable costs are a function of the output produced. The change in cost that results from a one unit change in output is called the marginal cost. This section of the report summarizes the findings of a number of studies that have gathered and analyzed trucking costs.

Typically cost data have been obtained through surveys of the industry. The cost components considered were generally driver wages and benefits, fuel and fuel taxes, truck maintenance, tires, depreciation, insurance, and administrative costs. The Table presents a summary of the operating costs obtained from the literature review. The average cost per mile (converted to 2008 dollars) was $1.48. When considering that the average truck pays $0.31 per mile to drive on a Central Texas toll road, the toll cost as a percentage of the total truck operating cost per mile will thus equate to 17.3%—if all mileage were to be driven on Central Texas toll roads.

Truck Operating Costs ($2008/mile)

	ATA		**Barnes & Langworthy**	**SKM**	**ATRI**	**OOIDA**
	2001*	**2003***	**2003***	**2008***	**2008***	**2003***
Driver wages	0.47	0.64			0.44	0.06
Fuel and Fuel Taxes	0.21	0.23	0.75		0.69	0.32
Outside Maintenance	0.07	0.08	0.12	0.10	0.09	0.09
Tax and License	0.04	0.04			0.02	0.02
Tires	0.02	0.02	0.02-0.05		0.03	0.02
Other Wages and Benefits	0.57	0.94		0.15	0.16	0.06
Depreciation	0.12	0.13		0.19		0.00
Insurance	0.07	0.11		0.11	0.06	0.02
Interest				0.13		0.02
Administrative costs				0.03		0.01
Total Operating Cost	**1.58**	**2.19**			**1.50**	**0.64**

* Year study was published

The American Trucking Research Institute (ATRI) reported in a study entitled "*An Analysis of the Operational Costs of Trucking*" (2008) that driver costs have always been the highest marginal expense of the trucking industry. However, due to increased fuel prices in 2008, diesel fuel cost per mile has exceeded the driver wage per mile in 2008. With diesel prices reaching $4.79 per gallon in 2008, ATRI calculated that fuel and fuel taxes amount to $0.69 per mile (ARTI, 2008)[14]. However, fuel prices have decreased considerably in the last months of 2008 and beginning of 2009, so that a more accurate cost of fuel can probably be calculated at $0.33 per mile given an average diesel price of $2.31 per gallon in 2008. For owner-operators, the cost of fuel and fuel taxes was calculated to be $0.27 per mile ($0.32 per mile when expressed in $2008) based on data collected by the 2003 Owner-Operators Independent Drivers Association (OOIDA) survey.

How drivers are compensated depends on the carrier's type of operation. A TL carrier usually pays a driver per mile driven, while LTL drivers are usually paid by the hour. According to ATRI (2008), drivers that are paid by the mile are paid on average 44.1 cents per mile. For those paid by the hour, the average pay was $16.59 (ATRI, 2008). According to the results of the *2003 Cost of Operations Survey* conducted by the OOIDA, the cost of driver salaries for owner-operators is $0.05 ($0.06 per mile when expressed in $2008). At first glance, there appears to be a significant difference in these numbers, but it should be kept in mind that owner-operators usually do not pay themselves a wage, but rather share in the profit of the company. Drivers are also often provided performance bonuses as an incentive. In addition, benefits that can also be part of a driver's payment are Federal Insurance Contributions Act (FICA) taxes, which constitutes 7.5% of the total wage and unemployment taxes. According to the 2008 ATRI survey, bonuses and benefit payments amounted to $0.16 per mile. This value was similar to the $0.15 per mile value presented by SKM in *Truck Operation Costs Outlook – Major Cause for Concern* (2008). On the other hand, these costs for owner-operators only amounted to $0.05 per mile in 2003, which would be equivalent to $0.06 per mile in $2008. Again this difference can probably be explained by the fact that owner-operators typically share in the profits of the business as opposed to paying themselves a bonus.

Repair and maintenance costs will vary by region and the type of trucks operated—i.e., the type of carrier operation. Specialized trucks have higher maintenance and repair costs. The average repair and maintenance cost per mile reported by the ATRI (2008) study for all sectors was $0.09 per mile. Barnes and Langworthy (2004) reported that maintenance and repair costs were $0.11 per mile, which equates to $0.12 per mile in $2008. For owner-operators, the cost reported by the OOIDA survey (2003) was $0.08 per mile, which is equivalent to $0.09 per mile in $2008.

The cost of tires varies also varies greatly by region and with the cost of oil. Tire costs thus amounted to $0.03 per mile in 2008, because of the escalated price of oil (ATRI, 2008). The latter estimate is within the range of $0.02 to $0.04 per mile that was calculated by Barnes and Langworthy in 2004—thus $0.02-$0.05 in 2008 dollars. Tire costs also vary depending on the type of carrier. LTL carriers usually incur higher tire costs per mile than TL carriers. According to the ATRI survey (2008), tire costs per mile for a LTL carrier is more than double the cost for a TL carrier. For owner-operators, the cost reported by the OOIDA survey (2003) was $0.02 per mile–$0.023 per mile when converted to $2008 dollars.

The average cost incurred for licensing and permits, according to the 2008 ATRI survey, was $0.02 per mile. This cost is similar to the costs obtained during the OOIDA 2003 survey, which also translates into $0.02 per mile when converted to $2008. It, however, has to be mentioned that specialized carriers could have significantly higher costs for licensing and permits, depending if they transport Hazmat or oversize/overweight loads.

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14 This results concur with those computed following a Barnes and Langworthy (2004) estimate that trucks get around 7 miles to the gallon, which would yield a cost of $0.68 per mile for fuel and fuel taxes.

While insurance costs can be considered fixed costs, since it has to be paid even if the truck is not in use, ATRI considered it a marginal cost item, because insurance coverage is largely a function of the type and use of the vehicle. ATRI (2008) reported an average insurance cost of $0.06 per mile. TL carriers reportedly have the lowest insurance costs while the insurance costs of specialized carriers can be up to 130% higher (ARTI, 2008). The insurance costs reported in the OOIDA survey (2003) were $0.02 per mile, which is equivalent to $0.023 per mile in 2008 dollars.

Appendix C: Trucking Survey Questionnaire

Truck Toll Survey

Truck Companies' View of Toll Roads

CENTER FOR TRANSPORTATION RESEARCH
THE UNIVERSITY OF TEXAS AT AUSTIN

Page 1 - Heading

Your Company

Page 1 - Question 1 - Choice - One Answer (Bullets)

How would you describe your trucking operation? (Select only your primary type of operation)

- ❍ Less-than-truckload (LTL)
- ❍ Truckload
- ❍ Private fleet
- ❍ Owner operator
- ❍ Parcel/express
- ❍ Specialized (e.g. HazMat)
- ❍ Intermodal
- ❍ Other, please specify

____

Page 1 - Heading

Please answer all of the following questions in terms of the primary type of operation selected in Question 1.

Page 1 - Question 2 - Choice - Multiple Answers (Bullets)

Please mark the truck types that your company owns or operates. (Check all that apply)

- ❑ Class 5: 3-Axle, Single Units
- ❑ Class 6: 4 or more Axles, Single Units
- ❑ Class7: 3-Axle, Single Trailers
- ❑ Class 8: 4-Axles, Single Trailers
- ❑ Class 9: 5-Axles, Single Trailers
- ❑ Class 10: 6 or more Axles, Single Trailers
- ❑ Class 11: 5 or less Axles, Multi-Trailers
- ❑ Class 12: 6-Axles, Multi-Trailers
- ❑ Class 13: 7 or more Axles, Multi-Trailers

Page 1 - Question 3 - Open Ended - One or More Lines with Prompt

What is the size of your operation in Texas?

- Number of Single Units ____________
- Number of Truck Tractors ____________
- Number of Trailers ____________
- Number of Truck Drivers ____________

Page 1 - Question 4 - Open Ended - One Line

In which Texas county is your main office located?

____

Page 2 - Heading

Your Operation

Page 2 - Heading

Please answer all of the following questions in terms of the primary type of operation selected in Question 1.

Page 2 - Question 5 - Open Ended - One or More Lines with Prompt

What percentage (%) of your operation is:

- Local haul (less than 50 miles) ____________
- Short haul (50 to 200 miles) ____________
- Medium haul (201 to 500 miles) ____________
- Long haul (more than 500 miles) ____________

Page 2 - Question 6 - Choice - One Answer (Bullets)

Would you describe congestion in Central Texas as a

- ❍ Major problem
- ❍ Moderate problem
- ❍ Minor problem
- ❍ No problem at all
- ❍ Don't know

Page 2 - Question 7 - Yes or No

Is your operation impacted by congestion?

- ❍ Yes
- ❍ No

Page 2 - Question 8 - Choice - Multiple Answers (Bullets)

If Yes, how is it impacted? (check all that apply)

- ❑ Higher fuel costs
- ❑ Higher labor costs
- ❑ Higher insurance/safety costs
- ❑ Fewer deliveries (less business)
- ❑ Driver retention
- ❑ Other, please specify

Page 3 - Heading

Your Operation

Page 3 - Heading

Please answer all of the following questions in terms of the primary type of operation selected in Question 1.

Page 3 - Question 9 - Open Ended - One Line

In a representative year, what is the major commodity (for example, perishable products) transported by your company?

Page 3 - Question 10 - Yes or No

Would you consider this commodity to be time sensitive?

- ❍ Yes
- ❍ No

Page 3 - Question 11 - Yes or No

Do you have a delivery window in which to deliver this commodity?

- ❍ Yes
- ❍ No

Page 3 - Question 12 - Open Ended - One Line

If Yes, how wide is the average window for on-time delivery (hours)?

Page 3 - Question 13 - Choice - One Answer (Bullets)

At what time do you make most of your deliveries?

- ❍ Before 7:00 AM
- ❍ 7:00 AM to 9:00 AM
- ❍ 9:01 AM to 12:00 PM

- 12:01 PM to 4:00 PM
- 4:01 PM to 7:00 PM
- After 7:01 PM

Page 3 - Question 14 - Choice - Multiple Answers (Bullets)

How are drivers compensated? (check all that apply)

- Per load
- Per mile
- Per hour
- Other, please specify

Page 3 - Question 15 - Open Ended - Comments Box

If more than one compensation method is used, how is the method determined?

Page 3 - Question 16 - Yes or No

Do you supply your drivers with predetermined routes?

- Yes
- No

Page 3 - Question 17 - Open Ended - One or More Lines with Prompt

What percentage (%) of your costs comprise:

- Driver salaries and benefits
- Maintenance and tires
- Capital / Depreciation
- Fuel
- Taxes, permits and licenses
- Insurance
- Overhead
- Other, please specify

Page 4 - Heading

Your Use of Toll Roads

Page 4 - Heading

Please answer all of the following questions in terms of the primary type of operation selected in Question 1.

Page 4 - Question 18 - Yes or No [Mandatory]

There are several toll roads in Dallas, Houston, and Central Texas. Have your drivers used or are they frequently using any of these toll roads?

- ❍ Yes [Skip to 5]
- ❍ No [Skip to 8]

Page 5 - Heading

Your Use of Toll Roads

Page 5 - Heading

Please answer all of the following questions in terms of the primary type of operation selected in Question 1.

Page 5 - Question 19 - Open Ended - Comments Box

What are the benefits of using toll roads?

Page 5 - Question 20 - Choice - One Answer (Bullets)

How frequently do your drivers use toll roads?

- ❍ Daily
- ❍ 1-2 days per week
- ❍ 3 or more days per week
- ❍ 1-2 times per month
- ❍ Less than once per month
- ❍ Other, please specify

Page 5 - Question 21 - Choice - One Answer (Bullets) [Mandatory]

Who is responsible for paying the tolls?

- ❍ Driver [Skip to 7]
- ❍ Company [Skip to 6]

Page 6 - Heading

Your Use of Toll Roads

Page 6 - Heading

Please answer all of the following questions in terms of the primary type of operation selected in Question 1.

Page 6 - Question 22 - Yes or No

Do all power units have an electronic toll tag that can be used to pay tolls?

- ❍ Yes
- ❍ No

Page 6 - Question 23 - Open Ended - Comments Box

When are drivers allowed to use the toll roads?

[Skip Unconditionally to 9]

Page 7 - Heading

Your Use of Toll Roads

Page 7 - Heading

Please answer all of the following questions in terms of the primary type of operation selected in Question 1.

Page 7 - Question 24 - Choice - Multiple Answers (Bullets)

Would your company be willing to pay a toll if it: (Check all that apply)

- ❑ Saved travel time
- ❑ Allowed higher speed limits
- ❑ Allowed higher weight limits
- ❑ Offered separate lanes for trucks
- ❑ Avoided congestion
- ❑ Other, please specify

Page 7 - Question 25 - Choice - One Answer (Bullets)

If you checked 'saved travel time", how much time needs to be saved before your company would be willing to pay a toll?

- ❍ 10 minutes
- ❍ 15 minutes
- ❍ 30 minutes
- ❍ 60 minutes

- ○ Other, please specify

____

Page 7 - Question 26 - Open Ended - One or More Lines with Prompt

If you checked, "saved travel time", how much would your company be willing to pay for that travel time saving?

- $ for a 10 minute time saving ______________________________
- $ for a 15 minute time saving ______________________________
- $ for a 30 minute time saving ______________________________
- $ for a 60 minute time saving ______________________________
- Other, please specify ______________________________

[Skip Unconditionally to 9]

Page 8 - Heading

Your Use of Toll Roads

Page 8 - Heading

Please answer all of the following questions in terms of the primary type of operation selected in Question 1.

Page 8 - Question 27 - Open Ended - Comments Box

Why are your drivers not using toll roads?

Page 8 - Question 28 - Open Ended - Comments Box

Under what circumstances would your drivers use a toll road?

Page 8 - Question 29 - Choice - Multiple Answers (Bullets)

Would your company be willing to pay a toll if it: (Check all that apply)

- ☐ Saved travel time
- ☐ Allowed higher speed limits
- ☐ Allowed higher weight limits

- ❑ Offered separate lanes for trucks
- ❑ Avoided congestion
- ❑ Other, please specify

____

Page 8 - Question 30 - Choice - One Answer (Bullets)

If you checked 'saved travel time", how much time needs to be saved before your company would be willing to pay a toll?

- ❍ 10 minutes
- ❍ 15 minutes
- ❍ 30 minutes
- ❍ 60 minutes
- ❍ Other, please specify

____

Page 8 - Question 31 - Open Ended - One or More Lines with Prompt

If you checked, "saved travel time", how much would your company be willing to pay for that travel time saving?

- $ for a 10 minute time saving _______________________
- $ for a 15 minute time saving _______________________
- $ for a 30 minute time saving _______________________
- $ for a 60 minute time saving _______________________
- Other, please specify _______________________

Page 8 - Heading

Please indicate if your company would use the Central Texas toll roads if you could:

Page 8 - Question 32 - Choice - One Answer (Bullets)

Subscribe to a toll road use plan, where you pay a discounted, fixed monthly fee for a specified amount of usage, similar to a cell phone plan

- ❍ Yes
- ❍ No
- ❍ Maybe

Page 8 - Question 33 - Choice - One Answer (Bullets)

Receive frequent user discounts, for example, free toll road days, free weekends, discounted toll rates, etc.

- ❍ Yes
- ❍ No
- ❍ Maybe

Page 8 - Question 34 - Choice - One Answer (Bullets)

Use the toll tag to pay for other driver purchases, for example, fast food, parking, fuel, etc.

- Yes
- No
- Maybe

Page 8 - Question 35 - Choice - One Answer (Bullets)

Receive a discounted toll rate during off-peak hours

- Yes
- No
- Maybe

Page 8 - Question 36 - Choice - One Answer (Bullets)

Use larger, well maintained truck stops with dining and truck repair facilities as well as, in-cab auxiliary power systems (such as IdleAire) alongside the toll road

- Yes
- No
- Maybe

Page 8 - Question 37 - Choice - One Answer (Bullets)

Get a fuel tax refund for the miles driven on the toll road

- Yes
- No
- Maybe

Page 8 - Question 38 - Choice - One Answer (Bullets)

Use Longer Combination Vehicles (LCV) on the toll road

- Yes
- No
- Maybe

Page 9 - Heading

Your Perception of Toll Roads

Page 9 - Heading

Please answer all of the following questions in terms of the primary type of operation selected in Question 1.

Page 9 - Question 39 - Choice - One Answer (Bullets)

Do you support the construction of additional toll roads in Central Texas?

- ❍ Yes
- ❍ Yes, under certain conditions
- ❍ Not at all
- ❍ Don't know

Page 9 - Question 40 - Yes or No

Do you think there are better alternatives for relieving traffic congestion than toll roads?

- ❍ Yes
- ❍ No

Page 9 - Question 41 - Open Ended - Comments Box

If Yes, what are they?

Page 9 - Question 42 - Rating Scale - Matrix

Please check the number that best describes how you feel about toll roads (1 means strongly disagree, 5 means strongly agree)

	1	2	3	4	5	N / A
They provide an alternative to congested "freeways'						
They have superior pavement condition						
They are faster						
Toll rates are reasonable considering the benefits						
They are a safer alternative						
They provide more predictable travel time						
They provide an alternative in emergency situations						
We will use them when the shipper pays the toll						

Page 9 - Question 43 - Open Ended - Comments Box

Any other comments?

Thank You Page

Thank you so much for your participation!