Public Perceptions of Toll Roads: A Survey of the Texas Perspective

By

Kaethe V. Podgorski
Graduate Student Researcher
The University of Texas at Austin
6.9 E. Cockrell Jr. Hall
Austin, TX 78712-1076
kvp@mail.utexas.edu

and

Kara M. Kockelman
(Corresponding Author)
Clare Boothe Luce Associate Professor of Civil Engineering
The University of Texas at Austin
6.9 E. Cockrell Jr. Hall
Austin, TX 78712-1076
kkockelm@mail.utexas.edu
Phone: 512-471-0210
FAX: 512-475-8744

Submitted for publication in *Transportation Research Part A*, 2 November 2004
And presented at the 84th Annual Meeting of the Transportation Research Board, Washington D.C., January 2005

ABSTRACT

Like many U.S. states, Texas is experiencing shortfalls in transportation funding, along with growing needs for system improvements. Accordingly, the Texas Department of Transportation (TxDOT) is turning to tolling to bridge the funding gap. To assist planning efforts and effectively direct public information, a telephone survey of 2,111 Texans was undertaken statewide to gauge public opinion on tolling issues.

Some issues yielded a definite consensus among survey respondents. Over 70% agreed on attending to existing roads first, keeping existing roads toll-free, reducing tolls after construction, using revenues within the same region, charging higher tolls for trucks, not imposing SOV tolls, and maintaining the same toll rates during rush-hours. Some opinions varied by region. Austinites were more likely to support additional transportation spending, while residents of the Lower Rio Grande Valley were less supportive of raising the gas tax and public/private partnerships. Opinions also varied with survey design. In eight places in the survey optional text was provided or question order was modified to intentionally influence response. For two questions, support for tolling was decreased when information on personal transportation costs

and higher gas tax rates in other states was offered. Ordered probit and binomial and multinomial logit models were estimated to assess the impact of demographic and travel characteristics on respondent opinions, and results for key issues are presented. Opinions across demographic groups were also examined. The survey was successful at measuring opinions on several key tolling issues and will be a useful tool for transportation planners and policymakers.

INTRODUCTION

While traffic congestion and infrastructure deterioration strain the Texas transportation system, transportation spending is limited by budget shortfalls. Costs to maintain the existing transportation network in Texas are rising as the system ages. Texas transportation officials are also trying to accommodate rising demand on the highway system due to a growing population, an increase in driving, and evolving travel patterns by residents. While trying to address these issues, Texas is dealing with problems of financial shortages. Traditionally, most transportation funding has come from state and federal gas taxes. However, because these taxes have not been tied to inflation and improved vehicle fuel efficiencies have helped limit demand, Texas's annual maintenance costs now exceed the annual state gas tax revenues. TxDOT estimates it will have adequate funding for only 36% of needed projects over the next ten years (Comptroller 2001).

To overcome the gap between available funding and needed improvements and generate additional revenue for transportation improvements, TxDOT is planning the system expansion of toll roads. The existing toll road system in the state is limited, with just over 160 centerline miles of tolled roads and revenues that account for only 3 percent of state highway funding. Expansion of the toll road system will impact many more Texans than are currently using toll roads. Therefore, TxDOT will use the results of this study to plan an information campaign to increase awareness of and support for tolling. Results will also be used to better inform and shape transportation policy.

Polls in Texas and elsewhere in the U.S. have revealed that traffic and transportation are some of the most important regional issues for residents, even more so than education, crime, and the economy. (Scheibal 2002, Knickerbocker 2000 & Fimrite 2002) This is not surprising since Shrank and Lomax (2002) have found that on average (over the 75 areas included in their Urban Mobility Study) each traveler looses $1,160 annually due to wasted fuel and time spent in traffic. Because of the importance of transportation to residents and the region, Texas policy makers have taken action.

The passage of Texas House Bill 3588 in May of 2003 has authorized the use of several new tools for transportation planning. The bill (Krusee 2003) provides for the:

- establishment of the **Trans-Texas Corridor** (TTC), a state-wide network of corridors containing limited access toll roads, high-speed rail, and utilities.
- creation of **Regional Mobility Authorities** (RMAs) to plan, finance, build, maintain, and manage transportation improvements within a region, invoke eminent domain, and issue revenue bonds.
- issuing of up to $3 billion in **bonds** by the Texas Transportation Commission to finance highway improvement projects.
- **transfer** of existing non-tolled state highways to county toll authorities for management.

- inception of the **Texas Mobility Fund** (separate from the General Revenue Fund), to retain existing transportation revenues and to act as a security for bonds.
- encouragement of **Comprehensive Development Agreements** (CDAs) with private parties to contract design/build and other services for toll road projects.

Given this new policy, TxDOT, MPOs, and RMAs will be employing new tools in transportation planning. With such changes, however, public communication is important.

All state DOTs are subject to the Transportation Equity Act of the 21st Century (TEA-21), which formally requires public involvement in transportation planning. TEA-21 requires DOTs to not only disseminate information to the public, but also to solicit and consider public opinion in forming transportation policy. Some methods for this communication include public hearings, citizen advisory committees, and resident workshops; however, sparse attendance and overrepresentation of vocal interest groups can obscure true public opinion in these settings. Surveys are one way planners and policy makers can account for more representative sentiment in their transportation recommendations..

This paper details the methods, data, analysis, and results of a phone survey designed and administered on the subject of toll roads.

LITERATURE REVIEW

According to FHWA values for roadway lengths, approximately 5,000 miles, 9% of U.S. highway mileage, is tolled. Tolling will likely play a prominent role in future development of the Texas transportation system. (TxDOT 2002, TxDOT 2003) Texas is not unique in this regard; a number of U.S. states are planning toll projects, including Washington State's pilot project to convert SR 167 HOV lanes to HOT lanes (WSDOT 2004), Maryland's plan to create a statewide system of express toll lanes (MDOT 2004), Colorado's study of conversion to HOT lanes on I-25 (CDOT 2004), Virginia's consideration of tolling I-81 (Sluss 2004), Minnesota's project to convert HOV lanes to HOT lanes on I-394 (MNDOT 2004), and North Carolina's establishment of a toll authority to plan, build, and manage up to three toll roads (NCDOT 2004). With so many toll projects in the works, research assessing public perceptions of and attitudes toward tolling and associated policies is important for planning and policymaking efforts nationwide.

This is not the first project of its sort. In 1994 Oswald et. al (1995) conducted a mail out-mail back survey of Texans on tolling finance and application. They concluded that use of toll revenues to improve non-tolled facilities was acceptable (45% support), and tolling existing (non-tolled) facilities may be appropriate (36% support). Recently, Kockelman and Kalmanje (2003) administered an opinion survey on the subject of "Credit-Based Congestion Pricing" in Austin, and found that 25% of Austinites were supportive of such a policy. Pacific Rim Resources' (2001) telephone survey emphasizing managed and HOT lane concepts found that 40% of Washington State's Puget Sound area respondents were willing to pay a toll for travel time savings, and 50% supported variable toll rates to manage congestion. Wilbur Smith (FHWA 2002) conducted a telephone survey of I-15 users in the San Diego area on the subject of value pricing in 2001, and found considerable support for managed lanes. 91 percent of respondents

supported having an alternate option for saving time on I-15, and 66% of I-15 users who did not use the HOT lanes still supported the program. (FHWA 2002)

For this study, a number of references on survey design and methods were reviewed. Sudman and Bradburn (1988) discuss response effects as a result of question type. Dillman (1978) offers an extensive discussion of mail and telephone survey considerations and the "total design method"; and Dillman (2000) discusses "tailored" implementation of mail and internet surveys in the context of recent technological advancement and greater sociological understanding. Groves et. al (2004) present survey methodology considerations from survey planning and sample design stages to data analysis. Fowler (2000) offers an overview of survey research. Much of this general survey literature provides researchers with strategies for improving response rates and obtaining more accurate data through attention to survey mode choice, questionnaire design, and implementation. Within the domain of transportation, Richardson et. al (1995) provide a comprehensive and largely qualitative discussion of travel surveys. Ampt (2003) offers a thorough discussion of respondent burden, Morris and Adler (2003) present considerations for mixed-mode surveys, and Zmud (2003) discusses instrument design and non-response.

Following sections discuss the methodology, data, analysis, and results of this survey.

METHODOLOGY

The toll road questionnaire for this study was designed by UT researchers and administered state-wide by the Office of Survey Research (OSR) at the University of Texas at Austin. Completed surveys totaled 2,111 statewide, with approximately 300 each from the Houston, Dallas-Fort Worth, San Antonio, Austin, Lubbock, and Lower Rio Grande Valley areas, plus 300 from all *other* areas of Texas. 177 interview (approximately 8%) were conducted in Spanish. TxDOT selected the six urban areas for focused sampling to assess regional attitudes toward potential toll road projects. All seven regions have varied demographic compositions and transportation systems. Toll road and toll bridge/tunnel facilities within the State of Texas are currently limited to the Houston and Dallas regions, although there are several bridge crossings to Mexico in border regions.

Random digit dialing (RDD), based on block lists purchased from Survey Sampling Inc., was used to draw a random sample of households in each of the seven study areas (defined by counties to coincide with Census Metropolitan Statistical Areas). Household RDD phone lists are a sample of randomly generated working residential exchanges and regional blocks. The member-with-the-most-recent-birthday method was used to ensure random selection within each contacted household. To reduce bias and non-response, OSR employed repeat dialing (at least 5 calls to establish contact), callback appointments (for respondent convenience), expert bilingual interviewers, and Computer Assisted Telephone Interviewing (CATI). CATI allowed interviewers to cross-check responses with previous answers and to run logic checks as answers were entered, thus improving data quality. Informal pre-testing (by distribution to colleagues) then formal pilot testing was done during the survey design process to refine and improve the questionnaire. Designed for phone administration and to limit respondent burden, the questionnaire was relatively uncomplicated, and had an initial target length of ten minutes. The

average final survey length, however, was just over 13 minutes, but response rates remained strong.

Phone survey questions topics covered transportation in general, use of toll revenues, funding preferences, pricing, equity, toll road features, travel and demographic characteristics, and recruitment for a follow-up survey (to obtain more detailed feedback and information on a wider array of topics). There were a total of 32 questions in the phone survey instrument. One element of this study was survey design variation. Since many individuals are unfamiliar with State funding issues and other aspects of transport policy, additional or alternate educational information was included in half of the surveys. Varied introductions were provided in six instances, each intended to influence responses to one or more questions. Additionally, in one portion of the survey, question order was varied. Thus, two versions of the survey were used, in order to ascertain which arguments impacted approval rates for toll road implementation policies and whether question ordering played a role.

SURVEY DATA

In order to obtain 2,111 completed interviews, 53,625 calls were made to 18,750 phone numbers. All call dispositions were examined to identify issues of phone survey methodology and sample representativeness. For calls where gender was distinguishable, 65% of those who answered the phone were women; thus, 64% of refusals were made by women. (60% of completed interviews were given by women.) 51% of refusals were estimated to be by persons between the ages of 20 and 40, while those ages correspond to only 43% of the target population (i.e., Texans over 18 years of age). 198 individuals gave partial interviews, only 26 of which were eventually completed. Refusal conversions, however, accounted for 10% of completed interviews.

Response and cooperation rates for this survey were typical for phone surveys. American Association for Public Opinion Research (AAPOR) (2004) definitions were used to determine these values. **Response rates** (completed interviews over the total eligible sample) ranged from 16% to 19% across the seven regions. **Cooperation rates** (completed interviews over the total eligible contacted) ranged from 86% to 91%, except for the Lubbock region (80%). Two other surveys (10 and 12 minutes long with similar administration) recently completed by OSR for the Texas region were on the subjects of marriage and the internet/computers. These surveys had response rates of 16% and 19% respectively and cooperation rates of 88% and 86%. We had anticipated that the relevance of the transportation to respondents (as discussed above) would result in slightly higher cooperation and response rates; however, they were fairly typical.

Though RDD is often cited as providing a close-to-truly random sample (particularly with randomization of possible respondents within the contacted household, as done here), non-response by certain populations resulted in certain sample biases. The final sample over-represented older persons, women, and the highly educated (with a bachelor's degree or higher). While 21% of the entire Texas *population* is highly educated, a startling 43% of those in the *sample* were highly educated. Unemployed older individuals also were (slightly) over-represented. Thus, the results described here use weights to correct for age, gender, employment status, and education level, based on the 2000 Census's Public Use Microdata Sample (PUMS) for the various Texas regions.

For certain questions, item non-response was also an issue. Almost 20% of survey respondents refused to provide household income information (based on $25,000-range categories). Estimates of continuous income were imputed for those missing values using a variation of a tobit model (with censored data provided in known categories), while range midpoint values were used for respondents who provided their income category. These multi-category tobit models were specified for each region's income responses, as a function of individual and household characteristics, including age, gender, household size, employment status, and education level. Interviewers attempted to collect each respondent's actual age; but, for those respondents that preferred to provide their age in a grouped category (in ranges of five or ten years), the midpoint value of the chosen range was used to approximate a continuous value. Variable descriptions are shown in **Table 1**.

ANALYSIS AND RESULTS

The data obtained for all of the opinion and preference questions in the survey were analyzed, and (weighted) response percentages are shown in **Table 2**. Margins of error on all statewide response percentages are approximately ±1%. Overwhelming consensus (over 70%) was noted in several instances: Texas should expand and improve its existing roads before building new ones, drivers should not have to pay tolls for existing roads, tolls should be reduced after road construction is paid for, revenues should stay in the region they are collected, commercial trucks should be charged higher tolls than passenger vehicles, higher tolls for SOVs should not be imposed, and standard congestion pricing should not be used. Opinions and preferences on other topics were more evenly divided. Ordered probit (OP), binomial logit (BL) and multinomial logit (MNL) model estimations were estimated to assess choice tendencies as a function of demographics and travel characteristics. Some responses varied by region, and some varied according to introduction and order variations in the administered survey. Model results on key toll road issues and opinions of certain demographic groups are presented. All analyses and results are discussed in this section.

Response Variation by Region

Table 3 shows response percentages for questions that varied most substantially by region. Margins of error on all regional response percentages are approximately ±3%. Residents of large urban areas (Houston, Dallas-Ft. Worth, San Antonio, and Austin) were more aware of toll projects. Growth and congestion are considerable in these regions and toll roads projects are already in use and/or have been proposed in those areas. Austinites, more than residents of other surveyed regions, felt that more transportation spending was warranted. Austin is rated one of the most congested cities for its size by the Texas Transportation Institute's Urban Mobility Report. (Schrank & Lomax 2002)

Residents of smaller urban and rural areas (the Valley region, Lubbock, and General Texas) were more supportive of exclusive use of toll tags and tolling existing roads. Perhaps they feel that these policies are more likely to be implemented in large urban areas and therefore will not negatively impact them. They also were more concerned about toll tag privacy and toll road equity. Perhaps these residents are more supportive of a toll-tag privacy fee because they are not

as used to widespread use of such technology as residents of the other areas. They also may depend more on driving (because of land use patterns and/or lack of alternative modes) and are therefore more concerned about equity in transportation access. Valley residents were particularly opposed to raising the gas tax, preferring rush-hour tolls (57%) over raising gas taxes (19%) (24% had no preference) by the greatest margin. The Valley region is located in an area that experiences significant volumes of international trade, which may explain the greater preference for a user fee over a tax increase. Residents of these regions favored public management of road projects over public/private partnerships (or no preference) more than residents of the larger urban areas (except San Antonio). Additionally, these three regions had higher percentages of respondents preferring the mail version of the follow-up survey to the internet version. Regional indicator variables in MNL and BL models, however, were insignificant in predicting preferences for management or follow-up survey version; regional variations on these issues are better captured by other observed characteristics.

Response Variation by Question Introduction and Ordering

Responses also varied according to the administered survey version. **Table 4** shows survey version response percentages for all questions with varied introductions or order. Margins of error on all survey version response percentages are approximately ±2%. Overall percentage shifts, ranging from 2-8%, did not always reflect the subtlety or obviousness of the introductory information, though all were in the expected direction.

Introductory information was used to influence response to two questions measuring support for **tolls**. While survey version one mentioned the costs for construction and maintenance that TxDOT incurs yearly, version two instead gave average yearly costs for an American to own and operate a vehicle. A 5% shift in agreement that drivers should *not* have to pay tolls on **existing roads** was seen between survey versions one and two, with survey version two respondents more likely to agree, as expected. Examining the marginal effect of the survey version variable via an OP model, the average Texan given survey version two was about 5% more likely to agree. The shift in agreement between survey versions was within the margin of error for the statement that drivers should *not* have to pay tolls on **new roads**. However, using an OP model to examine the marginal effect of the survey version variable, the average Texan given survey version two was about 4.5% more likely to agree.

The percentage shift in support for **public/private partnerships** (over the public or no preference) was 4% (within the margin of error) when introductory information that partnerships usually result in quicker project completion was given. However, examining the marginal effect of the survey version variable with a MNL model, the increase in support for public/private partnerships for the average Texan was approximately 6%. There was a 6% shift in support for **gas taxes** (over conversion to toll roads or no preference) between the two survey versions. Using a MNL model, the marginal effect of information that half of U.S. States have higher gas taxes than Texas, with the highest rate being 49 cents per gallon (indicated with a survey version variable), made the average Texan about 4.5% more likely to support an increase in gas taxes.

A larger shift in support for **truck tolls** was anticipated. The statement that trucks impact pavement, congestion, safety, and the environment more than passenger vehicles did not increase

support for higher truck tolls (in any statistically significant way). Perhaps given this blatant information some respondents were reluctant to choose the obvious answer. A shift in favor of **privacy fees** also was expected to be more pronounced; the information that toll tags electronically record the date, time, location, and amount for each toll did not impact support for privacy fees (in any statistically significant way). In contrast, a larger than expected shift in support of **SOV tolls** (8% overall) was realized when introductory information (reducing SOV travel could help limit congestion) was given. Perhaps the prospect of reducing congestion is more compelling than anticipated (though congestion pricing was not shown much support). Examining the marginal effect of the variable in a BL model, it was found that this information increased support for higher SOV tolls by about 2% for the average Texan.

A 6% shift in response percentages resulted from alternating the order of questions 17 and 18. When the question on toll road fairness was posed first, respondents were less likely to agree that tolling would improve roadway **efficiency**. The shift for the average Texan was about 7% (examining the marginal effect via an OP model). It was expected that awareness of a potential drawback of tolling would negatively impact perceptions of potential advantages.

Findings on Key Issues

Model results for some of the most relevant issues for transportation planners in Texas and elsewhere are presented here. These key issues include additional transportation spending, tolling on new and existing roadways, use of public/private partnerships for project management, HOT lanes, and exclusive use of toll tags for collection. This information is useful in assessing current levels of support as well as in helping to plan strategies to increase support for these most likely policies. In order to asses how reasonable model results are, intuitive interpretations are offered for model coefficients. This reasoning can be further evaluated in focus groups or future surveys.

An OP model was estimated to predict level of agreement with the statement that TxDOT should not increase its spending because Texas has more important spending needs. Overall, 41% agreed, 19% were neutral, and 40% disagreed. The unemployed, males, more educated persons, and those with higher household incomes were more likely to support an increase in **transportation spending**, while non-SOV commuters were less likely. Unemployed persons (not including retirees or students) were more likely to support additional spending, perhaps because they relate to money differently than those who are employed. Males, those with higher household incomes, and those with at least a bachelor's degree were more likely to support additional transportation spending. According to the 1995 Nationwide Personal Transportation Survey (NPTS), men, on average, drive almost 10 miles more per day than women (Hu & Young 1999). Tripmaking also generally increases with household income. (Hu & Young 1999) Perhaps because they travel more, males and persons with higher income prefer better transportation services and/or are more used to paying for services than those of lower income. Those with higher levels of education may prefer to increase transportation spending because they value improved access to potential employment or area cultural attractions. Intuitively, non-SOV commuters are more likely to oppose spending increases, since they tend to depend less on driving.

The issue of paying **tolls on new and existing roadways** is important for Texas transportation policy. Agreement with statements that drivers should not have to pay tolls for new/existing roads was predicted using OP models. Overall, 51% agreed, 12% were neutral, 37% disagreed for new roads, while 71% agreed, 7% were neutral, and 22% disagreed for existing roads. Older individuals and those who were relatively new to their area were more likely to support tolls for both new and existing roads. Retired individuals, however, were less likely. Older individuals may be more likely to support tolling since they have witnessed the deterioration of roadways and increasing congestion. Retired individuals, however, may be more concerned about tolls since they are more likely to be on a fixed income. Newer residents may be more willing to accept change and innovative policies than those who have lived in the area a long time. As one might expect, those using toll roads regularly (at least once a month) were more likely to support tolls for both new and existing roadways. Residents of Austin and San Antonio were less likely to support tolls on existing roads. These regions currently do not have any toll roads and the Austin area MPO just approved a controversial plan to add several to the region. Males were also less likely to support tolls for both new and existing roads. Additionally, as mentioned above, those respondents given information on how much an average American pays yearly to own and operate a car were less likely to support tolls for new or existing roads. All model results are shown in **Table 5**.

Given the choice for project management between **public/private partnerships** and the public alone (or no preference), respondents were almost equally divided (46% to 45% [with 9% indicating no preference]). Project funding preferences were predicted using an MNL model. More educated persons and those aware of toll projects in their areas were more likely to support public/private partnerships, while retirees and males were less likely. Those aware of local toll projects were more likely to favor partnerships, perhaps because they have witnessed the slow process of roadway development and construction under public management. More educated persons may be more open to new policies and transportation solutions and therefore are more likely to support partnerships. Retirees were less likely to favor partnerships, perhaps because they are more accustomed to traditional methods of roadway development. Males were also less likely to support partnerships. As expected, those who were given the information that partnerships generally result in quicker project completion were less likely to favor the public alone (the overall shift in support between survey versions was 3%). All model results are shown in **Table 6**.

Support for **HOT lanes** was split, with 52% in favor. A BL model was used to predict support for HOT lanes. Older persons, males, those who travel to work on toll roads, and those who live very far (more than 50 miles) from their workplace had a greater tendency to support HOT lanes, while those who use toll roads often (but not necessarily for commuting) tended to oppose them more. Older persons are more likely to support HOT lanes perhaps because they are a reasonable idea for making use of existing infrastructure. Those who commute long distances (over 50 miles) and who commute on toll roads would probably appreciate another option when traveling to and from work and therefore reasonably support HOT lanes. Males are also more likely to support HOT lanes, perhaps because they travel more (as mentioned above) and would benefit from access to another travel option. Those who use toll roads often (but not for commuting) are probably more likely to be traveling with more passengers (vehicle occupancy rates are higher for non-work trip purposes (Hu & Young 1999)) and therefore already would be

eligible to use HOV lanes. It would make sense then that these individuals would prefer more exclusive access. All model results are shown in Table 6.

Toll tags are another important issue for transportation planners since traditional toll collection can be costly and contribute to congestion. There is considerable support (66%) for exclusive use of toll tags for collection (rather than allowing any manual payment). Support for exclusive use of toll tags was predicted using a BL model. Those who live 11 to 50 miles away from work were more likely to support exclusive use of toll tags, perhaps because they would benefit from toll-booth-free commutes. Those who infrequently use toll roads were less likely to support exclusive use of toll tags, understandably since they would be required to invest in and maintain tags for only occasional use. Interestingly, Houston residents were also less likely to support this feature, perhaps because of respondents' prior (and possibly poor) experiences with and/or knowledge of toll tags.

Market Segmentation

Cumulative results of OP and logit models revealed logical consistencies across some demographic groups. **Frequent toll road users** indicated support for a wide range of policy ideas such as more transportation spending, tolling, conversion to toll roads (versus raising gas taxes), new highway construction, and use of revenues elsewhere. **Older persons** also were more supportive of many transportation policies such as building new highways, tolling new and existing roads, and HOT lanes, but oppose rush-hour tolls and privacy fees. **Highly educated persons** were more likely to support some new policies (partnerships, tolls for new roads) but also favored traditional concepts (like no tolls on existing roads, toll reductions after construction). **Long-distance commuters** tended to support toll tags and HOT lanes. **Women** were more likely to support tolling more than men. **Retirees** were more likely to oppose new policies such as tolling, more spending, partnerships (versus the public); they were also more concerned about privacy and fairness.

CONCLUSIONS

There is consensus on a number of toll road issues among Texans, such as attending to existing infrastructure first, keeping existing roads toll-free, reducing tolls after roadway construction is paid, keeping revenues within a region, charging higher tolls for trucks, not applying higher tolls for SOVs, and not implementing congestion pricing.

Responses varied by region for some issues, such as equity, privacy, and support for conversion to toll roads (versus increasing the gas tax). Austin residents showed greater support for increasing State transportation spending, while Valley residents were more opposed to raising gas taxes and public/private partnerships. Responses also differed in several cases where question introduction or ordering was varied. Information on personal transportation costs, on quicker project completion via public-private partnerships, on higher gas tax rates in other states, and on easing congestion by limiting drive-alone travel all influenced opinions. Question ordering also influenced responses, when a toll-road fairness question was posed prior to (rather than after) an efficiency question, indicating that exposure to one idea can influence level agreement with another.

Logit and OP model results revealed the impact of demographic and travel characteristics on respondents' opinions of key tolling issues. Holding all other variables constant, older individuals and those who are relatively new to their area were more likely to support tolls for both new and existing roads; also, those who travel to work on toll roads and those who commute longer distances had a greater tendency to support HOT lanes. Frequent toll road users tended to be more supportive of a wide range of transportation policies, while retirees were more likely to oppose various policies.

The recent transportation funding crisis and increasing travel demands on the nation's highway system have encouraged an interest in road tolls. The survey designed and administered for this project measured more representative public sentiment across the State of Texas than a traditional public hearing process. The results will be useful not only for informing transportation planning and policy making efforts at regional, state and national levels, but also for enhancing the design of future survey instruments.

ACKNOWLEDGEMENTS

This research was sponsored by TxDOT under research project number 0-4817. During survey design, UT planning graduate student Andrew Parker lent his remarkable planning and writing skills to help create and revise survey questions. Wendy Hopper and Randall Dillard at TxDOT's Public Information Office were extremely helpful in developing the survey, providing feedback, and fostering discussion. O'Neil Provost and Veronica Inchauste at UT's OSR were invaluable resources for all administration issues and questions. Transportation engineering graduate students Jianming Ma and Natalia Ruiz-Juri shared their time and talents to help with translations to html and Spanish. UT staffer Annette Perrone provided great support and attention to detail.

REFERENCES

Ampt, E.S. (2003) Respondent Burden. *Transport Survey Quality and Innovation* P. Stopher and P. Jones eds, pp. 507-521. Pergamon, San Diego.

CDOT 2004 "North I-25 HOT Lanes Study" *North I-25 HOT Lanes Information Website*. http://www.valuelanes.com/ *(Accessed June 21, 2004)*

Comptroller (2001) "Paving the Way: A Review of the Texas Department of Transportation" *Texas Comptroller of Public Accounts Website.* http://www.window.state.tx.us/txdot/txdot200.html *(Accessed July 8, 2004)*

Dillman, D.A. (1978) *Mail and Telephone Surveys: The Total Design Method*. John Wiley & Sons, New York.

Dillman, D.A. (2000) *Mail and Internet Surveys: The Tailored Design Method*. John Wiley & Sons, New York.

FHWA (2002) “Value Pricing Notes” *Value Pricing Homepage.* http://www.hhh.umn.edu/centers/slp/projects/conpric/news/spring02.pdf *(Accessed June 21, 2004)*

Fimrite, P. (2002), “Traffic Tops List of Bay Area Banes, Weak Economy is Number 2 Bane, Survey Shows.” *San Francisco Chronicle.* (5, December 2002). Accessed from http://sfgate.com/cgi-bin/article.cgi?file=/c/a/2002/12/05/MN51835.DTL#sections.

Fowler, F.J. (2002) *Survey Research Methods*. Sage Publications, London.

Groves, R.M., Fowler Jr., F.J., Couper, M.P., Lepkowski, J.M., Singer, E., and Tourangeau, R., (2004) *Survey Methodology*. Wiley-Interscience, Hoboken.

Hu, P.S. and Young, J.R. (1999) “Summary of Travel Trends 1995 Nationwide Personal Transportation Survey” for the U.S. Department of Transportation and the Federal Highway Administration.

Knickerbocker, Brad. (2000). “Forget Crime - But Please Fix the Traffic.” *Christian Science Monitor*. (February 16)

Kockelman, K., and Kalmanje, S. (2003)**.** “Credit-Based Congestion Pricing: A Policy Proposal and the Public’s Response.” Presented at the *10th International Conference on Travel Behaviour Research* (Lucerne, Switzerland, 10-14 August 2003) and at the 83rd Annual Meeting of the Transportation Research Board, Washington, DC (January 2004). Under final consideration for publication in special congestion pricing issues of *Transportation Research Part A.*

Krusee, M. (2003) “Summary of HB 3588” *Texas Department of Transportation Website.* ftp://ftp.dot.state.tx.us/pub/txdot-info/lao/HB3588_summary.pdf *(Accessed June 21, 2004)*

MDOT 2004 “Maryland’s Express Toll Lanes Initiative” *Maryland Department of Transportation Website*. http://www.mdot.state.md.us/Express%20Toll%20Lanes/Express%20Toll%20Lanes%20Index *(Accessed June 21, 2004)*

Morris, J. and Adler, T. (2003) Mixed Mode Surveys. *Transport Survey Quality and Innovation* P. Stopher and P Jones eds, pp. 239-252. Pergamon, San Diego.

MNDOT 2004 “Interstate 394 HOT Lane Project” *Minnesota Department of Transportation Website*. http://www.dot.state.mn.us/information/mnpass/ *(Accessed June 21, 2004)*

NCDOT 2004 “Frequently Asked Questions” *North Carolina Turnpike Authority Website.* http://www.ncdot.org/NCTA/faq/ *(Accessed June 21, 2004)*

Oswald, C.J. et al. (1995) *Texas Public Opinion Regarding Toll Roads.* Center for Transportation Research, The University of Texas, Austin, TX.

Pacific Rim Resources (2001) “Managed Lanes Public Opinion Research” *Washington State Department of Transportation Website.* http://www.wsdot.wa.gov/mobility/managed/Survey.ppt *(Accessed June 21, 2004)*

Richardson, A.J., Ampt, E.S. and Meyburg, A.H. (1995) *Survey Methods for Transport Planning.* Eucalyptus Press, Parkville.

Scheibal, S. (2002). “New Planning Group Kicks-off Effort with Survey on What Area Residents Want.” *Austin American Statesman*. (August 26).

Schrank, D. and Lomax T. (2002). *The Urban Mobility Report*. Texas Transportation Institute, College Station, TX.

Sluss 2004 “Panel Keeps I-81 Car Toll Alive” *Roanoke Times Website.* http://www.roanoke.com/roatimes/news/story162216.html February 6, 2004 *(Accessed June 21, 2004)*

Sudman, S. and Bradburn, N.M. (1988) *Asking Questions: A Practical Guide to Questionnaire Design.* Jossey-Bass Publishers, San Francisco.

TxDOT (2002) “Creating Tomorrow's Transportation System: Strategic Plan 2003 = 2007” *Texas Department of Transportation Website*. ftp://ftp.dot.state.tx.us/pub/txdot-info/lao/strategic_plan.pdf *(Accessed July 8, 2004)*

TxDOT (2003) “Texas Metropolitan Mobility Plan: Breaking the Gridlock” *Texas Department of Transportation Website*. http://www.dot.state.tx.us/btg/tmmp.pdf *(Accessed July 8, 2004)*

WSDOT 2004 “SR 167 HOV to HOT Lane Pilot Project” *Washington State Department of Transportation Website.* http://www.wsdot.wa.gov/hov/sr167hotlanes/ *(Accessed June 21, 2004)*

Zmud, J. (2003) Designing Instruments to Improve Response. *Transport Survey Quality and Innovation.* P. Stopher and P Jones eds, pp. 89-108. Pergamon, San Diego.

List of Tables:

Table 1: Description of Variables

Type	Variable	Description	Min.	Max.	Mean	SD
Dependent Variables	Aware of local toll projects?	0- no, 1- yes	0	1	0.28	0.45
	Should expand/improve existing roads first	0 - strongly agree, 1- agree, 2- neutral, 3- disagree, 4- strongly disagree (abbreviated below)	0	4	1.05	0.81
	More important spending needs than transport	0 - str. ag., 1- ag., 2- neu., 3- disag., 4- str. disag.	0	4	1.98	1.08
	Should not pay tolls for NEW roads	0 - str. ag., 1- ag., 2- neu., 3- disag., 4- str. disag.	0	4	1.75	1.16
	Should not pay tolls for EXISTING roads	0 - str. ag., 1- ag., 2- neu., 3- disag., 4- str. disag.	0	4	1.32	1.09
	Gas taxes vs. conversion to toll roads	0 - str. ag., 1- ag., 2- neu., 3- disag., 4- str. disag.	1	3	N/A	N/A
	Gas taxes vs. rush-hour tolls (congestion pricing)	1- gas taxes, 2- rush-hour tolls, 3- no preference	1	3	N/A	N/A
	Public-private partnerships vs. public	1- partnerships, 2- public alone, 3- no preference	1	3	N/A	N/A
	Truck tolls	0- no, 1- yes	0	1	0.79	0.41
	SOV tolls	0- no, 1- yes	0	1	0.21	0.41
	Reduce tolls after construction costs paid	0 - str. ag., 1- ag., 2- neu., 3- disag., 4- str. disag.	0	4	1.24	1.05
	Revenues should stay in region	0 - str. ag., 1- ag., 2- neu., 3- disag., 4- str. disag.	0	4	1.25	1.01
	Tolls allow efficient use	0 - str. ag., 1- ag., 2- neu., 3- disag., 4- str. disag.	0	4	1.73	1.07
	Toll roads not as fair	0 - str. ag., 1- ag., 2- neu., 3- disag., 4- str. disag.	0	4	1.76	1.10
	Increase toll rates during rush-hours (congestion pricing)	0- not a good feature, 1- good feature	0	1	0.26	0.44
	SOVs in HOV lane for toll	0- not a good feature, 1- good feature	0	1	0.52	0.50
	Tolls only by toll tags	0- not a good feature, 1- good feature	0	1	0.66	0.47
	Privacy fee included in tag cost	0- not a good feature, 1- good feature	0	1	0.64	0.48
	Willing to follow up	0- no, 1- yes	0	1	0.61	0.49
	Mail or internet follow-up survey choice	0- mail, 1- internet	0	1	0.26	0.44
Demographic Variables	Age	Age (in years)	18	87	43.51	16.38
	Male Gender (female as base)	Indicator for male gender	0	1	0.48	0.50
	Household characteristics					
	Household Size	Household size (number of persons)	1	12	3.09	1.60
	Household Income	Annual household income (dollars)	10,339*	129,958*	51,948	30,369
	Employment status (unemployed as base)					
	Employed full-time	Indicator for full-time employment	0	1	0.53	0.50
	Employed part-time	Indicator for part-time employment	0	1	0.08	0.28
	Student	Indicator for student	0	1	0.05	0.23
	Retired	Indicator for retired	0	1	0.17	0.37
	Education level (low education as base)					
	Medium education	Indicator for completed bachelor's degree	0	1	0.40	0.49
	High education	Indicator for completed master's degree or higher	0	1	0.07	0.25
	Aware of toll projects (not aware as base)	Indicator for awareness of regional toll projects	0	1	0.28	0.45
	Time lived in region (native as base)					
	Less than 3 years	Indicator for less than 3 years	0	1	0.13	0.33
	3-10 years	Indicator for 3-10 years	0	1	0.21	0.41
	More than 10 years	Indicator for more than 10 years	0	1	0.46	0.50
	Region (General Texas as base)					
	Austin	Indicator for Austin region	0	1	0.06	0.24
	Houston	Indicator for Houston region	0	1	0.20	0.40
	Dallas-Ft. Worth	Indicator for Dallas-Ft. Worth region	0	1	0.24	0.43
	San Antonio	Indicator for San Antonio region	0	1	0.08	0.27
	Valley	Indicator for Valley region	0	1	0.04	0.20
	Lubbock	Indicator for Lubbock region	0	1	0.01	0.12
Travel Variables	Travel on toll roads (never as base)					
	More than 4 times a week	Indicator for more than 4 days a week	0	1	0.07	0.26
	At least once a week	Indicator for at least once a week	0	1	0.08	0.27
	At least once a month	Indicator for at least once a month	0	1	0.13	0.34
	At least once a year	Indicator for at least once a year	0	1	0.23	0.42
	Less than once a year	Indicator for less than once a year	0	1	0.26	0.44
	Distance from home to work (< 5 miles as base)					
	5-10 miles	Indicator for 5-10 miles	0	1	0.15	0.36
	11-25 miles	Indicator for 11-25 miles	0	1	0.20	0.40
	25-50 miles	Indicator for 25-50 miles	0	1	0.10	0.30
	More than 50 miles	Indicator for more than 50 miles	0	1	0.03	0.16
	Road type for commuting (local roads as base)					
	Highway	Indicator for non-tolled highways	0	1	0.31	0.46
	Toll Road	Indicator for toll roads	0	1	0.03	0.16
	Rural	Indicator for rural roads	0	1	0.05	0.21
	Non-SOV travel mode for commuting (drive alone as base)	Indicator for other travel mode for commuting	0	1	0.09	0.28
	Survey additional text version 1	Indicator for survey version 1	0	1	0.54	0.50

*Imputed income values

Note: Sample data have been weighted to reflect population proportions.

Table 2: Response percentages for all opinion and preference questions

	Agree	Neutral	Disagree
Should expand/improve existing roads first	82%	10%	8%
More important spending needs than transport	41%	19%	40%
Should not pay tolls for NEW roads	51%	12%	37%
Should not pay tolls for EXISTING roads	71%	7%	22%
Reduce tolls after construction paid	75%	7%	18%
Revenues should stay in region	78%	5%	17%
Tolls allow efficient use	59%	10%	32%
Toll roads not as fair	55%	12%	33%
	Option 1	**Option 2**	**No Pref.**
Gas taxes vs. conversion to toll roads	23%	61%	16%
Gas taxes vs. rush-hour tolls (congestion pricing)	36%	47%	17%
Public-private partnerships vs. public	46%	45%	10%
	Good feature		**Not good feature**
Increase toll rates during rush-hours (congestion pricing)	26%		74%
SOVs in HOV lane for toll	52%		48%
Tolls only by toll tags	66%		34%
Privacy fee included in tag cost	64%		36%
	Yes		**No**
Truck tolls	79%		21%
SOV tolls	21%		79%
Aware of toll projects	28%		72%
Willing to follow up	61%		39%
	Mail		**Internet**
Mail or internet follow up survey choice	70%		30%

Notes:

Sample data have been weighted to reflect population proportions.

Error on all statewide response percentages is ±1%.

Table 3: Response variation by region

		Agree	Neutral	Disagree
More important spending needs than transport	All	41%	19%	40%
	Austin	**31%**	**22%**	**47%**
	Houston	45%	11%	43%
	General Texas	43%	23%	34%
	DFW	33%	18%	49%
	San Antonio	45%	20%	35%
	Valley	**51%**	**12%**	**36%**
	Lubbock	42%	24%	34%
Toll roads not as fair	All	55%	12%	33%
	Austin	53%	9%	38%
	Houston	**51%**	**11%**	**38%**
	General Texas	58%	14%	28%
	DFW	51%	12%	37%
	San Antonio	57%	15%	29%
	Valley	**68%**	**8%**	**25%**
	Lubbock	60%	15%	25%
		Option 1	**Option 2**	**No Pref.**
Gas taxes vs. rush-hour tolls (congestion pricing)	All	36%	47%	17%
	Austin	**40%**	**44%**	**16%**
	Houston	37%	47%	16%
	General Texas	34%	49%	17%
	DFW	40%	45%	16%
	San Antonio	39%	38%	23%
	Valley	**19%**	**57%**	**24%**
	Lubbock	36%	48%	16%
Public-private partnerships vs. public	All	46%	45%	10%
	Austin	**52%**	**36%**	**12%**
	Houston	46%	46%	8%
	General Texas	43%	48%	9%
	DFW	50%	41%	9%
	San Antonio	43%	44%	13%
	Valley	**34%**	**54%**	**12%**
	Lubbock	43%	46%	10%
		Good feature		**Not good feature**
Privacy fee included in tag cost	All	64%		36%
	Austin	**53%**		**47%**
	Houston	60%		40%
	General Texas	71%		29%
	DFW	57%		43%
	San Antonio	61%		39%
	Valley	**73%**		**27%**
	Lubbock	72%		28%
		Yes		**No**
Aware of local toll projects	All	28%		72%
	Austin	**50%**		**50%**
	Houston	42%		58%
	General Texas	12%		88%
	DFW	44%		56%
	San Antonio	26%		74%
	Valley	8%		92%
	Lubbock	**8%**		**92%**
		Mail		**Internet**
Mail or internet follow-up survey choice	All	70%		30%
	Austin	**63%**		**37%**
	Houston	68%		32%
	General Texas	77%		23%
	DFW	66%		34%
	San Antonio	66%		34%
	Valley	**80%**		**20%**
	Lubbock	71%		29%

Notes:
Sample data have been weighted to reflect population proportions.

Error on all statewide response percentages is **±**1%.

Error on all regional response percentages is ±3%.

Table 4: Response variation by survey version

	Version 1			Version 2		
	Agree	**Neutral**	**Disagree**	**Agree**	**Neutral**	**Disagree**
Tolls for NEW roads	51%	11%	38%	53%	12%	35%
Tolls for EXISTING roads	69%	6%	25%	74%	6%	20%
	Option 1	**Option 2**	**No Pref.**	**Option 1**	**Option 2**	**No Pref.**
Gas taxes vs. conversion	26%	59%	15%	20%	63%	17%
Partnerships vs. public	48%	42%	10%	44%	47%	9%
	Yes	**No**		**Yes**	**No**	
Truck tolls	80%	20%		76%	24%	
SOV tolls	25%	75%		17%	83%	
	Good feature	**Not good feature**		**Good feature**	**Not good feature**	
Only use toll tags	67%	33%		67%	33%	
Privacy fee	65%	35%		62%	38%	
	Agree	**Neutral**	**Disagree**	**Agree**	**Neutral**	**Disagree**
Efficient use	62%	10%	28%	56%	9%	35%
Fair	54%	11%	35%	56%	15%	29%

Notes:

Sample data have been weighted to reflect population proportions.

Error on all survey version response percentages is ±2%.

Table 5: Ordered probit model specifications for opinions on tolls

Drivers should ***not*** have to pay tolls for NEW roads	Coef.	T-stat	Drivers should ***not*** have to pay tolls for EXISTING roads	Coef.	T-stat
Constant			**Constant**		
Constant	0.828	19.948	Constant	0.747	15.897
Age			**Age**		
Age	7.75E-03	9.785	Age	5.11E-03	6.200
Gender (female as base)			**Gender (female as base)**		
Male	-0.103	-5.060	Male	-9.64E-02	-4.840
Employment status (unemployed as base)			**Employment status (unemployed as base)**		
Employed full-time	-4.62E-02	-2.176	Employed part-time	0.215	6.444
Student	0.177	5.474	Student	0.139	4.226
Retired	-0.247	-8.090	Retired	-0.144	-4.584
Education Level (low education as base)			**Education Level (low education as base)**		
High education	0.191	2.493	Medium education	-0.107	-5.127
Travel on toll roads (never as base)			**Awareness of toll projects (not aware as base)**		
More than 4 times a week	0.151	3.828	Yes, aware	6.48E-02	2.497
At least once a week	0.170	4.123	**Travel on toll roads (never as base)**		
At least once a month	0.355	12.180	More than 4 times a week	0.146	2.651
At least once a year	8.89E-02	4.338	At least once a week	0.246	5.046
Time lived in region (native as base)			At least once a month	0.233	7.728
3-10 years	0.213	7.651	At least once a year	-6.69E-02	-2.434
more than 10 years	-9.52E-02	-4.273	Less than once a year	-6.43E-02	-2.446
Survey additional text version (1 as base)			**Time lived in region (native as base)**		
Version 2	-0.117	-6.397	Less than 3 years	8.13E-02	2.061
Regional Interactions			3-10 years	0.111	3.838
Lived in DFW less than 3 years	0.206	3.889	**Primary type of road for travel to work (local roads as base)**		
Lived in DFW 3-10 years	-0.404	-10.549	Toll road	-0.263	-2.619
Lived in DFW more than 10 years	0.127	3.448	**Distance from home to work**		
			11-25 miles	-0.189	-7.193
			Survey additional text version (1 as base)		
			Version 2	-0.149	-7.906
			Region		
			Austin	-0.341	-2.656
			Dallas-Ft. Worth	-0.223	-7.135
			San Antonio	-0.202	-2.114
			Regional Interactions		
			Lived in Houston 3-10 years	0.241	3.807
			Lived in DFW less than 3 years	0.442	5.809
			Lived in DFW more than 10 years	0.199	4.679
μ_1	1.123	33.749	μ_1	1.361	39.119
μ_2	1.443	40.650	μ_2	1.588	42.835
μ_3	2.959	45.143	μ_3	2.934	39.108
L(Constants)	-2724.354		L(Constants)	-2510.149	
L(Convergence)	-2686.841		L(Convergence)	-2458.293	
LRI	0.014		LRI	0.021	

Note: Responses based on 5 point scale: 0 = strongly agree, 1 = agree, 3 = neutral, 4 = disagree, 4 = strongly disagree.

Table 6: Logit model specifications for funding preferences and support of HOT lanes

Prefer partnerships, public, or no preference? (Multinomial logit)	Coef.	T-stat	HOT lanes good feature? (Binomial logit)	Coef.	T-stat
Constants (no preference as base)			**Constants (no as base)**		
Partnerships	1.053	8.705	Yes	-0.348	-2.354
Public	1.537	11.349	**Age**		
Gender (female as base)			Age	1.29E-02	4.227
Male (partnerships)	0.519	3.009	**Gender (female as base)**		
Male (public)	0.597	3.465	Male	0.247	2.648
Employment status (unemployed as base)			**Travel on toll roads (never as base)**		
Retired (partnerships)	-0.532	-4.053	More than 4 times a week	-0.663	-2.919
Education level (low education as base)			At least once a year	-0.335	-2.976
Medium education (public)	-0.616	-6.253	**Time lived in region (native as base)**		
High education (partnerships)	0.950	4.854	More than 10 years	-0.445	-4.523
Awareness of toll projects (not aware as base)			**Primary type of road for travel to work**		
Yes, aware (public)	-0.396	-3.640	**(local roads as base)**		
Travel on toll roads (never as base)			Toll road	0.876	2.411
At least once a week (partnerships)	1.247	2.829	Rural	0.575	2.443
At least once a week (public)	1.228	2.756	**Distance from home to work**		
At least once a month (partnerships)	1.241	3.611	More than 50 miles	0.927	2.979
At least once a month (public)	1.193	3.450			
At least once a year (partnerships)	0.775	3.458			
At least once a year (public)	0.685	3.035			
Primary type of road for travel to work (local roads as base)					
Rural (partnerships)	0.693	3.054			
Survey additional text version (2 as base)					
Version 1 (gas taxes)	-0.294	-3.119			
L(Constants)	-1828.186		L(Constants)	-1344.567	
L(Convergence)	-1746.016		L(Convergence)	-1309.880	
ρbar_c^2	0.037		ρbar_c^2	0.020	