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16. Abstract

This research examines a new methodology for prospectively estimating the willingness of travelers to use a toll road by combining travel time saved with the income of the prospective customer base. The purpose of the research is to facilitate network level planning by allowing some reasonable predictions of acceptable toll rates using readily available data and estimation techniques. Methods of estimating user benefit resulted in simulated distributions of value of user time. Values of time are linked to census tract income data for the user population to produce value of time as a percent of income as an indicator, which is hypothesized to be a more useful indicator of the travel market than conventional indicators. Techniques for estimating the travelshed of a toll road are examined.

Results show that considering value of time as a percentage of census tract median income provides an improved portrayal of the toll road market, as usage of the toll road increases with increasing income. Using census tract median income as the income parameter has shortcomings, in that it produces anomalous results at very low population levels. Of the two methods of estimating the travelshed, the visual estimation approach was not satisfactory, leaving the analyst to use select link analyses instead.

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ESTIMATION OF TOLL ROAD USERS VALUE OF TIME

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ABSTRACT

This research examines a new methodology for prospectively estimating the willingness of travelers to use a toll road by combining travel time saved with the income of the prospective customer base. The purpose of the research is to facilitate network level planning by allowing some reasonable predictions of acceptable toll rates using readily available data and estimation techniques. Methods of estimating user benefit resulted in simulated distributions of value of user time. Values of time are linked to census tract income data for the user population to produce value of time as a percent of income as an indicator, which is hypothesized to be a more useful indicator of the travel market than conventional indicators. Techniques for estimating the travelshed of a toll road are examined.

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EXECUTIVE SUMMARY

Estimating toll road usage and revenue are important for the financial viability of a toll project. At the early stage of toll feasibility analysis, it is desirable to have a network planning tool that provides planners and decision makers with simplified techniques to make reasonable estimates of usage and revenue. The key questions for developing the tool are how to estimate the value of a toll option to potential patrons and how income distribution may affect the attractiveness of the toll facility to the potential patrons. In order to address the questions the following two hypotheses are examined.

Hypothesis 1: Frequency of toll road use is inversely related to user Value of Time (VoT) as measured by a percentage of median income. If that hypothesis is accepted, then understanding the relationship between patronage and income distribution should improve the quality of preliminary revenue estimates for prospective toll roads.

Hypothesis 2: If Hypothesis 1 is accepted, using VoT as a percent of income enhances the predictive capabilities for the potential viability of prospective toll roads.

As methodology to test the hypotheses a segment of the President George Bush Turnpike in northwest Dallas, Texas, known as the "SuperConnector" was selected. That segment was chosen because it represents a very logical alternative to a pre-existing non-toll route (I-35/I-635) and, as a result, clearly shows the travel time saved (TTS) by the toll road. Toll transaction records, including times, locations, and users, are collected by Electronic Toll Collection (ETC) facilities. ETC transactions typically represent about 80 percent of the patrons of the SuperConnector. For non-tolled route, separate travel time measurements were made using an instrumented research vehicle. The tolled and non-tolled route data are divided into the two directions, northbound and southbound, and three periods, AM peak, Midday, and PM peak, for the study period.

Value of time of the SuperConnector patrons is estimated by the following equation:

$VoT = \Delta C/\Delta T$ = toll/travel time savings (TTS).

In the equation the numerator, toll, is fixed value and the value of the denominator, TTS, is simulated with the assumption of triangular distributions to make maximum effective use of the limited data. As a result, VoT becomes not a single value but probabilistic distributions of value of time for six direction-period combinations.

The hypothesis of this research is that there is an observable, and hopefully replicable, relationship between the value of time saved and the toll road user's income. As the income characteristics of individual users are neither available nor practical to obtain for high-level planning analysis, income data from the U.S. Census Bureau (2000) has been selected for the research to rely on surrogate measures of income. There are several advantages to the use of Census data. First, it is very easy to obtain from the Census Bureau's web site. Second, the data are readily available for all areas of the country. Third, the size of census tracts is typically small enough to provide adequate granularity for the analysis. Finally, toll tag user information can be geocoded to relate the home location of toll tag users to specific census tracts, without disclosing private information about the customer.

By combining the toll tag users' census tracts and census tract income data from the Census Bureau, the SuperConnector patrons' surrogated median income distributions were established. Then, the range of VoT saved was related to percent of income by income grouping.

As summary of findings from the research, the two principal hypotheses were accepted, with some caveats. Hypothesis 1 proposed an inverse relationship between value of time saved and user income, at a level of detail heretofore unexplored in the literature and practice. Only a portion of the proposed relationship was strongly supported, though none of the data appeared to contradict the hypothesis. For peak period travel and for trips with potentially high-value trip purposes (e.g., toward the airport), there was strong evidence that toll route use increased with higher income users (greater than $60,000 median income). The areas of weak support for the hypothesis were plausible, if not predictable—lower income travelers did not use the toll route in sufficient numbers to demonstrate any usage pattern related to income and users at all income levels eschewed the toll route when the travel time savings were small or negligible. Analysis of travel patterns showed that toll road usage increased with the inverse of the value of the user's time estimated as a percent of income.

Hypothesis 2 proposed that estimations of toll road usage based on data weighted by user income characteristics would improve the quality of preliminary estimates of revenue. Based on the characteristics of the study data, it was apparent that the customer base is predominately from a fairly narrow band of income brackets, with lower income and very high-income users contributing only a small fraction of the total usage. When comparing potential toll rates for the subject segment, the analysis demonstrated that a toll that is 25 percent higher than conventional estimation techniques, and 75 percent higher than the current toll, would be plausible for this facility.

This research sought to address a weakness in current preliminary planning for toll roads. Current methods of estimating toll revenue rely on per-mile industry practice or on a flat percentage of overall “average wage” for the area. This research showed that estimates of benefit to the prospective user (e.g., time saved), in combination with a prospective user incomes, would give the analyst a better estimate of the likely toll value of a facility. Incorporating this type of toll rate estimator into available spreadsheet analysis tools should provide public agencies, toll authorities, and the investment community with a more reliable, verifiable method for making macroscopic preliminary planning decisions about the viability of a prospective toll road.

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CHAPTER I

INTRODUCTION

The declining efficiency of the fuel tax will severely limit funding available for congestion relief in virtually all states in the United States. Inflation-adjusted revenues are down substantially from the late 1990s, yet demands for new construction continue to increase. There is a general political distaste for any consideration of raising fuel taxes to meet construction demand.

Electronic toll collection (ETC) has emerged in the tolling industry and radically changed the attractiveness of toll roads. The congestion-producing inefficiencies of toll plazas gave way to highway speed tolling, increasing the capacity and attractiveness of toll roads. Further, toll roads retain the benefit of a usage-based fee, while being essentially a local option, both in terms of project development and user choice.

There is an important distinction between the role of toll roads in the past and their role as it is emerging in the 21st century. Historically, at least in Texas, the toll road was a convenience for some and its primary operational goal was to generate sufficient revenue to pay for itself, even at the expense of sub-optimal network mobility. Those two goals of revenue generation and network mobility are more nearly equal today, as the toll road gains significance in the overall mobility role.

All metropolitan areas in Texas and many smaller communities are considering toll roads to address critical mobility needs that cannot be addressed with current funding approaches. In nearly all cases, a central question is: will the revenue generated by the toll project be sufficient to make the project financially feasible?

Statement of the Problem

There are spreadsheet-based tools available in the public domain to aid in the evaluation of toll road feasibility (Smith et al. 2004). At the network planning level, assessment of the viability of a prospective toll road depends in part on (Stockton et al. 2005):

- the development of a reasonable estimate of the potential toll revenue, which depends on
- the number of patrons and the tolls they are willing to pay, which depends on
- the toll charged compared to the value received by the patron.

Few if any of the tools available in the public sector provide mechanisms to estimate willingness to pay (Stockton et al. 2005).

The development of a public sector tool or technique for estimating willingness to pay will require two important capabilities. The first capability is how to estimate the value of a toll option to potential patrons. As will be shown subsequently, "value" has several dimensions when comparing a toll route with a "free" route. To simplify that task, this research will test whether travel time savings can be used as a surrogate for value.

The second important capability is the understanding of how income distribution may affect the attractiveness of the toll facility to the potential patrons. With that understanding, it may be possible to develop a tool that can be applicable in a wide range of economic settings by making the appropriate income adjustments.

Argument

Estimating toll road usage and revenue are important, both for the mobility implications and for the financial viability of a toll project. One of the central factors in that estimation will be the potential user's willingness to pay a designated toll. It is desirable to have a network planning tool that provides planners with simplified techniques to make reasonable estimates of usage and revenue.

As will be shown in the next chapter, income has an impact on the traveler's decision to use a toll route. Virtually all research has treated the user population as homogeneous with respect to income, using "percent of average wage" as a typical estimate of the value of user time. The principal argument to be addressed in this research is whether grouping potential toll road users according to census income groups improves the ability to estimate willingness to pay. Using projected <u>travel time savings</u> and an estimate of the patron's <u>value of time</u>, we can estimate the approximate <u>value of the travel time savings</u> of using the toll route. However, estimating the value of time is problematic because it varies by locale, individual, and even by trip purpose. As a first step toward improving the capability of estimating willingness to pay, this paper argues that examining patronage by income groups will prove fruitful.

Hypothesis

Two hypotheses are examined.

The first and principal hypothesis of this research is that user value of time (VoT) varies with income level. More specifically stated,

Hypothesis 1: Frequency of toll road use is inversely related to user value of time as measured by a percentage of median income.

If that hypothesis is accepted, then understanding the relationship between patronage and income distribution should improve the quality of preliminary revenue estimates for prospective toll roads.

Hypothesis 2: If Hypothesis 1 is accepted, using VoT as a percent of income enhances the predictive capabilities for the potential viability of prospective toll roads.

Scope and Limitations

This research focuses on contributing to the materials available in the public domain that are used by decision-makers and planners to conduct high-level network planning. Specifically, this research will test whether readily available data and simple simulation techniques can accomplish the goal of allowing these decision-makers to estimate the value of a toll road trip to the user base and estimate appropriate tolls based on that estimated value.

The ultimate goal for the use of this research is to facilitate the very preliminary feasibility analysis for prospective toll roads. It is envisioned that the analytical techniques developed will permit future applications to better capture the "toll tolerance" and patronage for toll roads, but the requirements for estimating the potential demand for any highway, especially a toll facility, are complex and beyond the scope of this research.

Because this research is based on a single study site, there are significant limitations on how effectively the results can be generalized to other locations. However, the approach is designed for universal application (at least within the United States). Future refinements may consider techniques to calibrate to other circumstances.

Simplifying Assumptions

The author makes a few simplifying assumptions, either to reduce unnecessary caveats on the analysis or to assure that the end results are readily applicable to practitioners. Those assumptions are:

- Travelers are rational. They will use the route the represents the lowest cost, considering the value of their time.
- Census tract median income is an acceptable indicator of income distribution for the purposes of the analyses related to value of time.
- Results of the analyses should be compatible with the toll viability screening tool (TVST) by Smith et al. (2004), as these results will likely be combined with that tool at some future date.
- Value of travel time savings is a surrogate for "value" of the toll segment to the traveler. This concept will be explained in detail in Chapter III.

CHAPTER II

LITERATURE REVIEW

Traveler Choice Options

The toll road represents a choice—usually a choice between a faster route with an out-of-pocket expense (toll) and a slower non-toll route that is "free." Users weigh numerous factors in making the decision whether to choose the toll road, including the user's value of time.

Gunn (2000) describes a simple behavioral model that illustrates the attractiveness of one alternative over another (Equation 1).

$$\Delta A = -\alpha\,\Delta C - \beta\,\Delta T + \gamma\,\Delta E \qquad \text{(Eq. 1)}$$

- ΔA is the relative attractiveness of the two alternatives—in the current case, of the toll road over the next best alternative for each user.
- ΔT is the difference in travel time,
- ΔC is the difference in cost (primarily out-of-pocket cost), and
- ΔE is the difference in all other factors, or "everything else," according to Gunn.
- α and β are negative coefficients, because an increase in either reduces the relative attractiveness of the alternative.

If ΔT is increased by one time unit, then ΔA is decreased by the amount β; likewise for changes in cost. Therefore, α/β represents the "value of time" (Gunn 2000).

Lam and Small (2001) have demonstrated that many factors are conceptually embedded in the utility function, principally in "everything else" (ΔE). In their research on SR-91 in California, Lam and Small attempted to estimate both VoT and value of travel time reliability (VoR).

The simple methodology sought by this current project will attempt to use only travel time savings as a predictor in measuring user response to travel time savings.

Willingness to Pay

Valuing a Toll Option

Gunn (2000) provides a graphic depiction of the user's choice in Fig. 1, where travel options can be compared on the two measures of ΔC and ΔT. User choice in the upper right and lower left quadrants is straightforward. However, most user decisions between a toll road and a tax road will fall into the upper left quadrant, where the toll road is faster but more expensive to the user than the tax road.

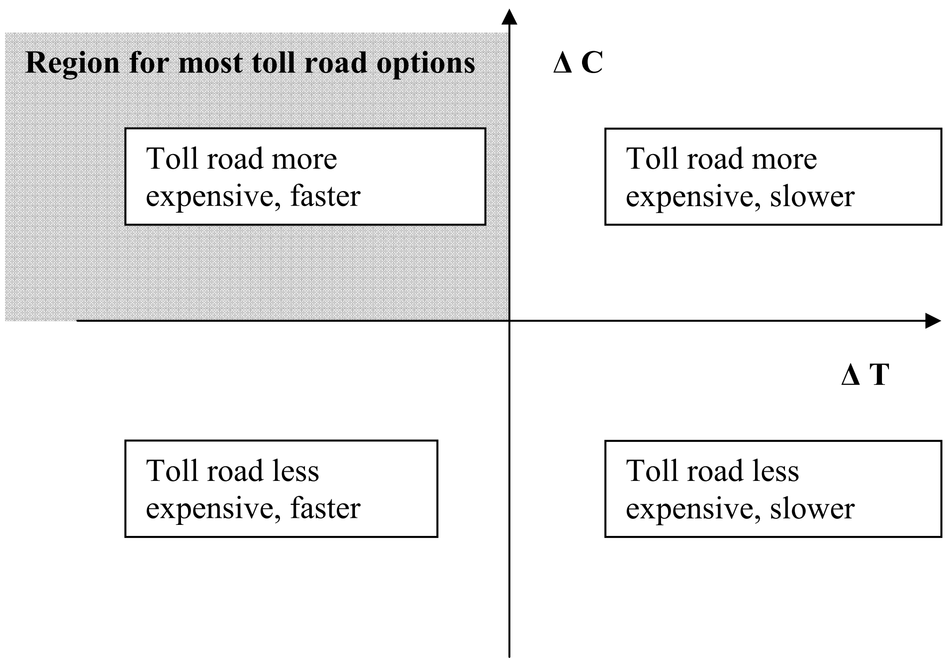


Fig. 1. Options in user choice in experiments (adapted from Gunn 2000)

Valuing Travel Time Saved

Estimating VoT, however, is more problematic. Not only does VoT vary with place and time (Lam and Small 2001), but it varies with users. Hensher (2000) and Gunn (2000) both note that trip purpose can play in important role in the user's VoT, as does user income. The urgency of the trip purpose can play a critical role in the user's decision-making process between a route with increased out-of-pocket cost ("toll") but shorter travel time and one with reduced cash cost ("free") but longer travel time. Lam and Small (2001) report an overall VoT of 72 percent of wage rate.

An upcoming book by Small and Verhoef (2007) recaps more than a decade of well-documented studies on values of time. Waters (1996) reports findings of average ratio of VoT to wage rate of 48 percent, noting that the range is 35 to 50 percent. Transport Canada (1994) and U.S. Department of Transportation (1997) both recommend VoT for personal automobile travel at 50 percent of wage rate. Other reviewers—Wardman (1998), Mackie et al. (2003), and Gunn (2001)—all report VoT estimates of 50 to 52 percent wage rate, though Gunn reported some differentiation by household income. French Commissariat General du Plan (2001) found VoT to be 77 percent for commuting and 42 percent for other urban travel, for an average of 59 percent.

Effect of Income on Choice

Hensher and Goodwin (2004) argue that the most practical way to segment the user population is by income, trip length, and time of day. They acknowledge that studies have found numerous sensible systematic bases for variation, including trip purpose and employment status, in addition to the practical variables they recommend. They also note that value of travel time saved (VTTS) is not a point estimate, but a distribution.

Travelers at all income levels will have trip purposes where the implied VoT is greater than the toll, or crosses that threshold. Discretionary trips, such as for recreation or non-specific shopping, may have a lower VoT than trips to the airport, where the penalty for late arrival can be high. Studies of the behavioral response to tolls on SR-91 (Sullivan 2000) have shown that travelers of all income brackets will make use of the toll facility when their trip purpose VoT threshold is met, but that frequency of use was higher among higher income travelers. Intuitively, each income group will have a different threshold toll level for a given trip purpose, suggesting that the proportion of the trips made by higher income travelers that exceed the toll threshold (e.g., time savings greater than the toll) will be greater than for lower income travelers assuming that all income ranges have the same trip purpose spectrum.

An early British study (MVA Consultancy 1987) found that "higher income groups had incomes more than three times those of the lowest group, but values of time were only 30 to 40 percent higher" (quoted in Small and Verhoef 2007).

Mackie et al. (2003) found that VoT for the highest income group was 1.5 to 2.4 times that of the lowest income group.

Both stated preference (SP) and revealed preference (RP) have been used to assess both VoT and effect of income. Brownstone and Small (2005) report significant discrepancies between SP and RP data, with the RP data reflecting a much higher value of time. They attribute the difference in part to travelers' poor estimation of their actual time savings, and they recommend using RP data if possible.

Small and Verhoef conclude that the value of time for personal travel is almost always between 20 and 90 percent, with business travel generally taken at 100 percent. They also conclude that although VoT does not vary exactly proportionally with income, it is close enough for a good approximation.

Sullivan (2000) reported that on the SR-91, where the traveler has a side-by-side choice between faster toll lanes and slower "free" lanes, use of toll facilities ranged from 21 percent for lowest income group (less than $40,000 annually) to 51 percent for highest group (greater than $100,000).

Sullivan (2000) also reported increasing frequency of use with increasing income.

Mackie et al. (2003) acknowledged the preference for full weighting scheme in appraising transport sector projects, but deferred to the pragmatism of average values because the income profiles would be difficult to establish. (Addressing that difficulty is, in part, the goal of this research.)

Simplified Estimation of Toll Revenues

Smith et al. (2004) developed a toll viability screening tool (TVST) that uses a simple simulation model to estimate ranges of revenue based on user-supplied assumptions. The model estimates net present value of the revenue for the life of a toll project and conducts a sensitivity analysis to alert the analyst to which of the key assumptions has significant influence on the final revenue estimate.

While Smith et al. (2004) did not directly use VTTS in their model as an estimator of logical toll rates, they provided a simple off-line process that allows the analyst to check the reasonableness of toll rates used as candidates in the TVST model. They speculated that unit estimates of value of time and toll rate per mile were not as meaningful in gauging attractiveness to the user as is total trip cost (principally out-of-pocket costs, i.e., toll charges).

Position of this Research Relative to the Literature

Three principal elements of the research literature are particularly applicable to the current research—user value, value of time, and the impact of income. The literature expresses a wide range of factors that affect a traveler's decision to take a particular mode or route over another. For the current research, the traveler's decision is between two routes, one tolled and faster and the other not tolled but slower.

Value of time is thoroughly covered in the literature. The literature lends considerable support to the common practice of using 50 percent of the average wage rate as the basis for value of time. In practice, that VoT estimate may then applied to estimate the potential patronage on a toll facility, though this practice is not as common because it requires the estimation of an "average wage rate."

Finally, there is some attention in the literature to the effect of income on VoT. Expressing VoT as a percent of income (or "wage rate") is the predominant nomenclature, but only a few studies have examined the effect that income differences have on patronage and tolls. This current research proposes to at least assess that relationship, without attempting to explain it mathematically.

CHAPTER III

METHODOLOGY

Introduction

At a network planning level, we are interested in whether travelers in the aggregate will find the benefits of a toll road sufficiently attractive to pay the toll and use the route, thereby exhibiting a willingness to pay (WTP). If we again simplify the benefits of using the toll road to value of travel time saved, then we may be able to draw some general conclusions about the potential financial viability of the toll facility.

Viewed deterministically (Equation 2, adapted from Gunn 2000), VTTS can be described as the product of travel time saved (TTS, in time units) and the user's value of time (VoT saved, in dollars per unit time).

$$VTTS = TTS * VoT \qquad \text{(Eq. 2)}$$

Travel time saved is estimable by comparing travel time on the existing route with calculations of expected travel time on the proposed toll route. Notice that calculations of a single value estimate of travel time have inherent weaknesses which can be mitigated with additional measurements or application of statistical techniques.

"Value" to the potential toll road user has several dimensions, including time saved, reliability, safety, convenience, fuel savings, trip purpose, and familiarity. At the preliminary planning stage for a toll road, expected time saved is the only dimension that is estimable with reasonable efforts. Observation of user choice in the aggregate can measure only the time saved dimension, recognizing that user choice is actually based on all value motivations combined, not just time saved. If travel time saved can be used as a surrogate of value, then the task of prospectively estimating value and thus willingness to pay at the planning stage is greatly simplified. It is further noteworthy that an empirical analysis such as this does not actually estimate the traveler's revealed value of time, it merely reflects the number of users for which the imputed unit price of time saved is less than their maximum acceptable value. ("Imputed" refers to having a cash value though no money is received or credited [Imputed 2006].)

Fig. 2 illustrates basic "break-even" tolls (from the traveler's perspective) for ranges of travel time savings and values of time. Below a specific toll curve, the VTTS is less than the toll, so a rational user would not choose the toll route. For example, a 6-minute TTS (1/10 hour) at a user VoT of $5.00 per hour would produce a VTTS of $0.50. This benefit is less than the $1.00 toll and a rational user would not choose the toll route.

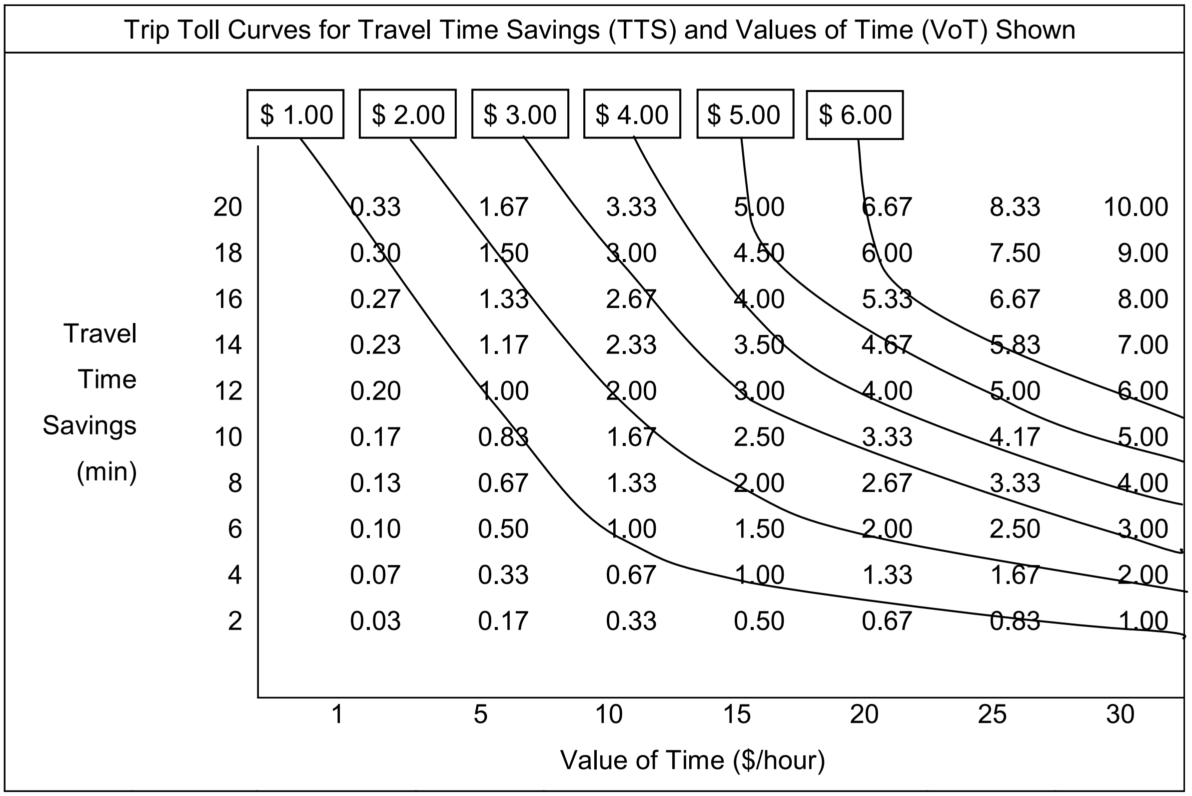


Fig. 2. Break-even tolls for travel time savings by value of time

Sullivan's research on SR-91 (Sullivan 2000) showed that travelers of all income brackets would use a toll route when their trip purpose VoT threshold is met, but that frequency of use was higher among higher income travelers. Intuitively, each income group will have a different threshold toll level for a given trip purpose, suggesting that the proportion of the trips made by higher income travelers that exceed the toll threshold will be greater than for lower income travelers, assuming that all income ranges have the same trip purpose spectrum.

Using that observation it seems reasonable that grouping potential travelers by income could produce a defensible approach to estimating usage at different toll rates. Fig. 3 illustrates how such a grouping might look.

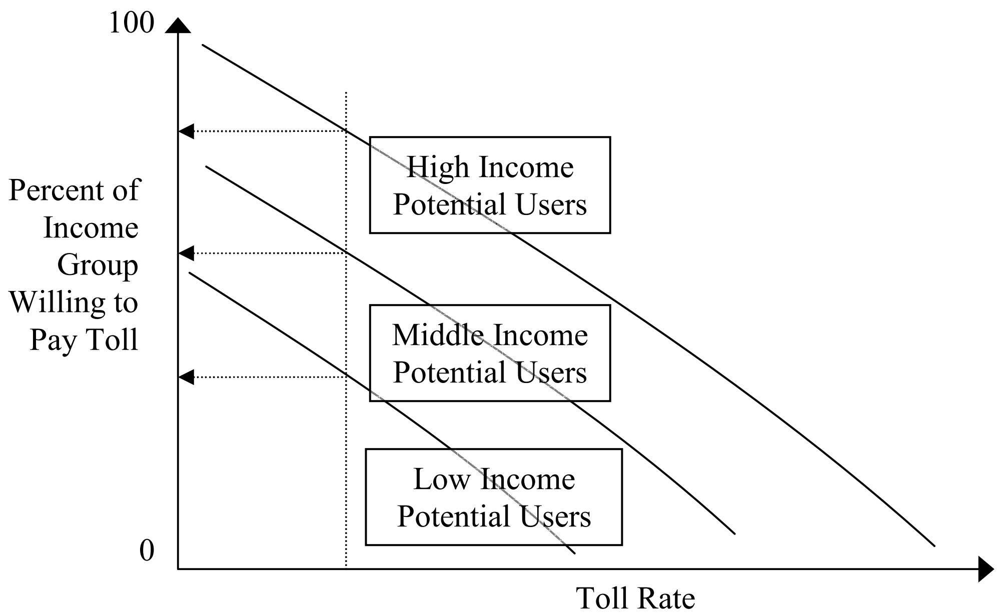


Fig. 3. Hypothetical bands representing income groups to depict willingness to pay

This hypothetical graph illustrates a declining willingness to pay a toll as the toll rate increases. Segregating the travelers into income groups, even artificially, could allow us to approximate a distribution across income levels, presumably improving the quality of the estimate. Thus for a given toll rate, one could estimate the willingness to pay for each of the three income groups.

However, this hypothetical relationship does not include a value of time component, so "willingness to pay" may not be meaningful. Fig. 4 adjusts the x-axis by incorporating toll and travel time savings into a ratio. In fact, the x-axis is a form of VoT, so the hypothetical curves describing traveler behavior have (presumably) a decidedly different shape.

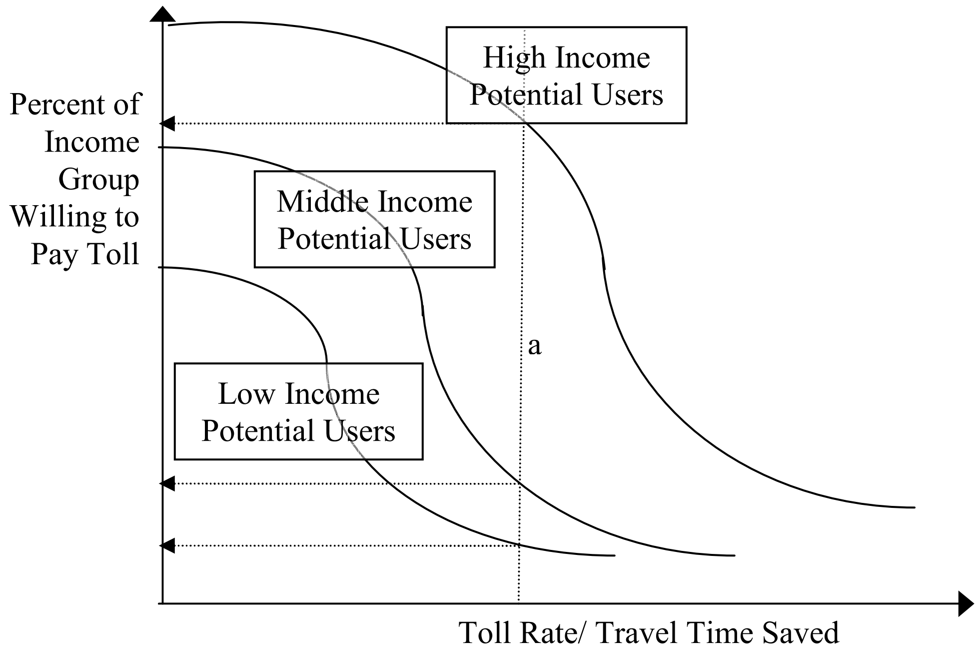


Fig. 4. Diagram of hypothetical relationship between willingness to pay and value of time saved by income group

Vertical line ‘a’ in the graph illustrates a distribution of users willing to pay the toll for the ratio of toll to time saved represented at the intersection with the x-axis. If one had a single-point estimate for the value of time, then theoretically that estimate could be dissembled into a synthetic estimate for the three income groups.

Defining the proposed income groups could be problematic, as “high” income in one region could be very different from high income in another. To address that potential inconsistency, this study uses United States Census Bureau income categories to examine both toll road users and the larger populations of potential users.

Hypothesis

The hypothesis of this research is that the value a user places on time saved (VoT saved) varies with income level. If that hypothesis is accepted, then understanding the relationship between patronage and income distribution should improve the quality of preliminary revenue estimates for prospective toll roads.

Study Methodology

The study includes five principal tasks to address the hypotheses:

1. estimating the value of time saved for a sample of toll road users,
2. estimating geographic distribution of users,
3. estimating the income of the sample of toll road users,
4. relating VoT to income by estimating VoT saved as a percent of income, and
5. comparing user sample income distribution to those of larger populations.

Study Site

The principal study site was a segment of the President George Bush Turnpike in northwest Dallas, Texas, known as the "SuperConnector" (Fig. 5). That segment was chosen because it represents a very logical alternative to a pre-existing non-toll route (I-35/I-635). This toll facility is geographically located between relatively high-income residential areas in Collin County on the north end and high-income employment areas on the south end. Further, the Dallas/Ft. Worth International Airport (DFW) is near the south end of the SuperConnector. The following sections describe the study approach.

Table 1 shows the categorization of collected data on the SuperConnector during the study period. The duration defined for the AM and PM peaks and the midday period are used to approximate hourly estimates of usage, but those rates should not be presumed to represent peak flow rates or total traffic. The number of transactions and users are divided into the six direction-periods for the total 9-day study period. These data are for electronic toll collection customers only, which according to the North Texas Tollway Authority (NTTA), typically represent about 80 percent of the patrons of the SuperConnector.

Fig. 5. Study site – President George Bush Turnpike, Dallas/Ft. Worth, TX

Table 1. Combinations of Direction-Time Period

Travel Direction	Period	Time Interval	Duration (hours)
	AM	6:30 AM – 9:00 AM	2.5
Southbound (SB)	Midday (MD)	9:30 AM – 3:00 PM	5.5
	PM	4:00 PM – 6:30 PM	2.5
	AM	6:30 AM – 9:00 AM	2.5
Northbound (NB)	Midday (MD)	9:30 AM – 3:00 PM	5.5
	PM	4:00 PM – 6:30 PM	2.5

Methodology for Estimating VoT saved for a Sample of Toll Road Users

In this section we attempt to define an estimate of what toll road users would be willing to pay for time savings (including all other forms of 'value') by using the toll paid and the travel time saved.

Rearranging Equation 2, we get:

VoT = VTTS/TTS (Eq. 3)

If we assume that the value to the user of the time saved is at least the price of the toll paid (a rational traveler), then that value is at least the current fixed toll of $0.60. Substituting that toll for the value of travel time saved from Equation 3, we get this estimate of value of time:

$$VoT = \Delta C/\Delta T = \text{toll/travel time savings (TTS)} \quad \text{(Eq. 4)}$$

Travel time (TT) measurements were made of for the tolled route (TT_{TR}) and the non-tolled route (TT_{NTR}), as shown schematically in Fig. 6. These measurements were made for both directions of travel (northbound and southbound) and for three times of day (AM peak, midday, and PM peak). Using an instrumented research vehicle, peak period and midday travel time runs were conducted along both routes on incident-free days, producing a minimum of three travel time estimates for each combination of direction and time of day. Appendix A displays the specifics of data collection for the travel time runs.

Table 2 shows the summary of the travel time data from Appendix A. These data were collected on Tuesdays, Wednesdays, and Thursdays in August 2006, as our experience has shown those weekdays to produce more reliable estimators of travel times than Mondays or Fridays. Consequently, we limited our analysis of toll tag data to the same days of the week, to facilitate comparisons.

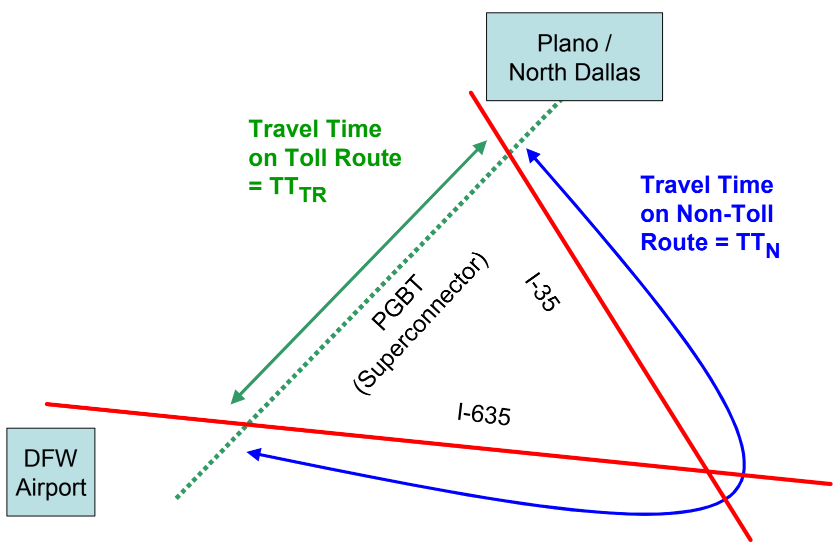


Fig. 6. Schematic of travel time data collection

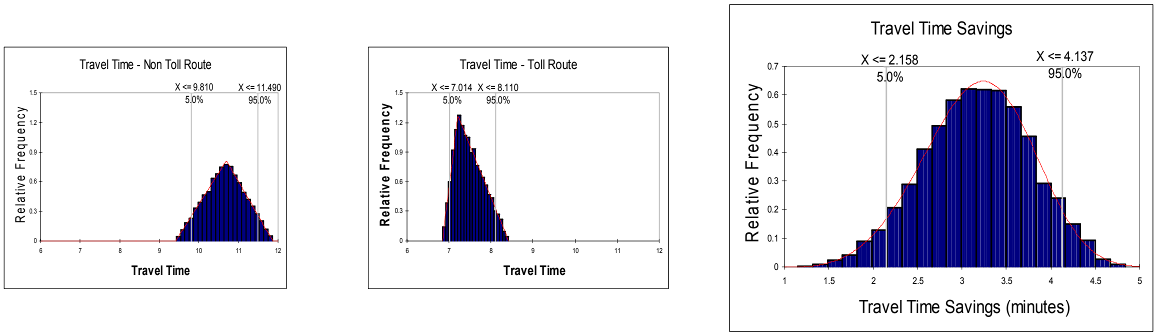
Table 2. Results from Travel Time Runs on Toll Road (TR) and Non-Toll Road (NTR)

Route		AM Peak			Midday			PM Peak		
		Min	Most Likely	Max	Min	Most Likely	Max	Min	Most Likely	Max
SB	NTR	9.68	13.54	16.24	9.52	9.81	10.32	9.01	9.30	9.63
	TR	6.14	6.24	6.34	6.07	6.21	6.35	6.14	6.40	6.57
NB	NTR	9.43	10.03	11.13	9.07	9.24	9.35	9.41	10.71	11.86
	TR	6.54	6.68	6.84	6.52	6.74	7.09	6.85	7.22	8.42

The data in Table 2 show that travel times on the non-toll route are somewhat more varied than travel times on the toll route, in addition to being longer travel times. The largest variance is shown in the southbound NTR data for the AM peak, which is the peak commute direction. For purpose of this analysis, we treated these data as 12 sets, one for each combination of direction, route, and time of day. For example, the southbound (SB) NTR AM peak travel times were: minimum = 9.68 minutes, most likely = 13.54 minutes, and maximum = 16.24 minutes.

To make maximum effective use of the limited data, we treated each of these travel time samples as a triangular distribution, which is commonly used for description of populations for which there are limited data (Weisstein 2006).

Fig. 7 shows the result of using Monte Carlo simulation to generate the estimated travel time savings produced by subtracting the toll route travel time distribution from the non-toll route travel time distribution for the southbound AM peak period. The triangle on the left in Fig. 7 was generated by the @Risk software package (Palisade Corporation), using the built-in triangular distribution function, setting the three values (min, most likely, max) for the SB NTR AM peak at 9.68, 13.54, and 16.24 minutes, respectively (from Table 2). The middle triangle uses the SB TR AM peak data from Table 2. By simulating the computation of the differences between these two distributions, we generate the distribution on the right, which produces a 95th percentile estimate of time savings of 4.62 minutes for the SB AM peak, a mean of 6.90 minutes, and a 5th percentile estimate of 9.06 minutes. Table 3 shows the results of the travel time savings simulation runs for all 12 data sets.



Northbound PM Peak Travel Times (in

Fig. 7. Simulation distribution of travel time differences

Table 3. Summary of Estimated Travel Time Savings

Direction / Time of Day		Travel Time Savings (minutes)		
		95^{th} Percentile	Mean	5^{th} Percentile
SB	AM	4.62	6.90	9.06
	Midday	3.39	3.67	3.97
	PM	2.69	2.95	3.20
NB	AM	2.95	3.51	4.12
	Midday	2.21	2.44	2.65
	PM	2.16	3.17	4.14

The absolute travel time savings may appear to be small but may represent a very large percentage of the trip time from beginning to end. In terms of perceived benefit, reducing travel time by half, at least for one segment, may be very enticing to a traveler.

According to Equation 4, it is possible to estimate the distribution for the value of time by dividing the cost by the travel time savings. Because the toll for this study site is fixed at $0.60 per trip, the out-of-pocket expense is always the same, regardless of the travel time savings. Therefore the results obtained by dividing the fixed ΔC (toll) by the distribution of ΔT (travel time savings) produce yet another distribution, as shown in Fig. 8. (As noted previously, it may be more appropriate to describe this result as “unit price of time saved,” rather than value of time, because we can only reliably conclude that the unit price is less than the maximum value of time for the user.)

This same operation was performed for all six combinations of direction and time of day to allow a comparison of value of time estimates with toll road usage for each, as shown in the next chapter.

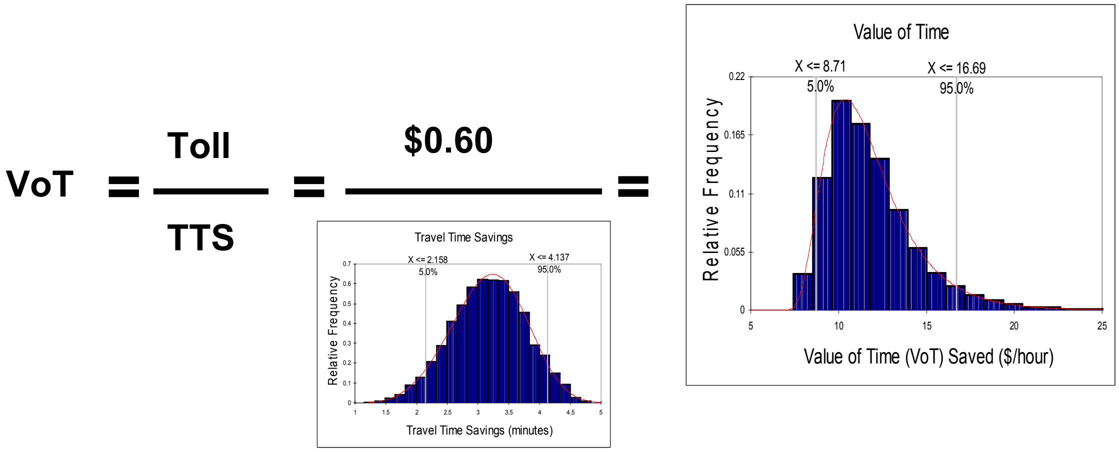


Fig. 8. Simulated distribution of value of time based on travel time savings (distributions in this figure show northbound PM peak period)

Methodology for Estimating Geographic Distribution of SuperConnector Users

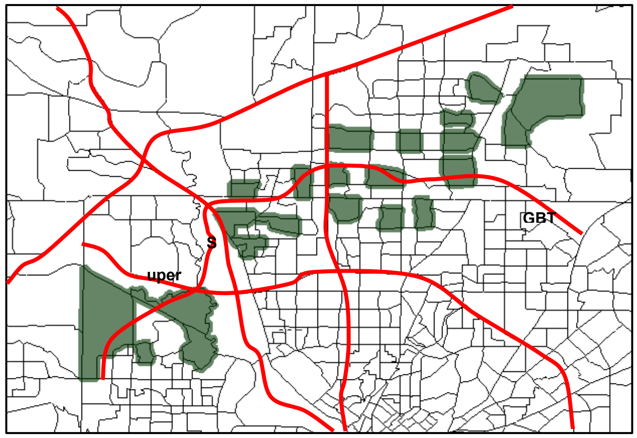
The term "travelshed" is used in the transportation planning community and is defined as "the region or area generally served by a major transportation facility, system, or corridor" (The Rules 2006; Vermont Corridor Management Handbook 2006). In the case of the SuperConnector in this study, one definition of travelshed could be the census tracts representing the home location of the toll tags recorded as having used the facility. There are some limitations in using toll tag home location as a basis for defining the travelshed, at least from the network planning perspective. The first is the obvious concern that not all census tracts will be represented, while the second is a potential income bias represented by the sampling of only users of electronic toll collection.

Two approaches to identifying geographic distribution were considered—1) visual inspection and estimation of the travelshed, and 2) using a select-link analysis. A select link analysis in planning is an analysis of origins and destinations of trips assigned to a specific link or links in a network (US DOT). For the very high-level analysis envisioned in this network planning tool, an estimation of the travelshed by visual inspection would be attractive. This approach would involve a three-step process: identifying the "actual" travelshed, then the "apparent" travelshed, and finally the "prospective" travelshed, all shown hypothetically with fictitious data in Fig. 9.

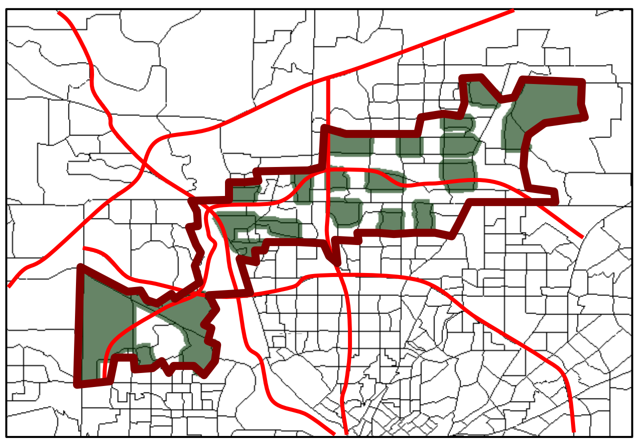
The "actual" travelshed (Fig. 9[1]) would be the home census tracts of users of the toll facility, as determined from NTTA data. The "apparent" travelshed (Fig. 9[2]) would be a construction that identifies travelshed boundaries by connecting the census tracts of recorded users (from the "actual" travelshed). Both of these hypothetical travelsheds emanate from data regarding actual users.

In the planning process such data of actual users are not available, so the planners may need to speculate about the travelshed for the prospective toll road. The "prospective" travelshed (Fig. 9[3]) is that which might be visually estimated in the early stages of toll facility consideration. The purpose of being able to estimate the travelshed prospectively is to allow an examination of the census tract income properties for estimating potential willingness to pay a toll. If this approach is workable, it will allow analysts and decision-makers to use macroscopic estimates as a first cut for identifying census tracts and ultimately income profiles for the travelshed.

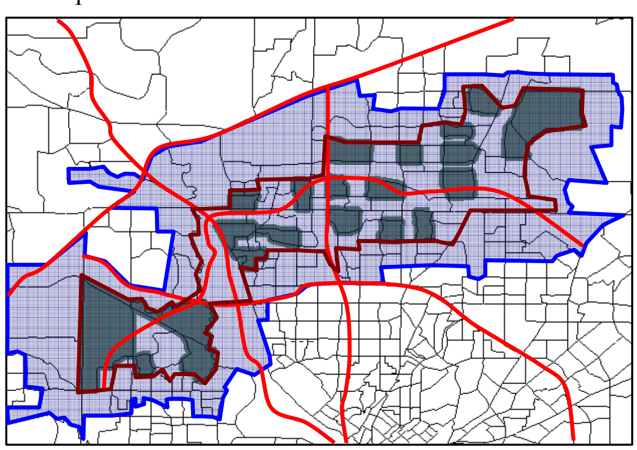
The alternative approach, the select-link analysis, is more scientific and would likely produce more reliable results (Personal Interview, Ken Cervenka, North Central Texas Council of Governments, July 14, 2006). However, such an approach is more labor and time-intensive and is subject to the availability of regional travel demand models and modeling staff (Cervenka Interview 2006). The select link analysis is a synthetic process that can provide substantial information about the origins and destinations of likely users of a specific roadway segment. Those synthetic origins and destinations can be used to identify the relevant census tracts more directly than the visual inspection approach but can take days or weeks longer (Cervenka Interview 2006). Therefore, one of the first tasks upon receiving user data was to determine whether the visual inspection approach was viable.



(1) Hypothetical Map of Census Tracts for "Actual" SuperConnector Travelshed



(2) Hypothetical Map of Census Tracts for "Apparent" SuperConnector Travelshed



(3) Hypothetical Map of Census Tracts for "Prospective" SuperConnector Travelshed

Fig. 9. Hypothetical example of visual estimation approach to travelshed

Methodology for Estimating User Income Distribution

The hypothesis of this research is that there is an observable, and hopefully replicable, relationship between the value of time saved and the toll road user's income. As the income characteristics of individual users are neither available nor practical to obtain for high-level planning analysis, a useful planning tool will need to rely on surrogate measures of income.

Income data from the U.S. Census Bureau (2000) has been selected for use at this stage of the research. There are several advantages to the use of Census data. First, it is very easy to obtain from the Census Bureau's web site and it can be downloaded directly into spreadsheets for ease of manipulation. Second, the data are readily available for all areas of the country, so that tools built around this approach can be readily applied in virtually any setting. Third, the size of census tracts is typically small enough to provide adequate granularity for the analysis. Finally, toll tag user information can be geocoded to relate the home location of toll tag users to specific census tracts, without disclosing private information about the customer.

Because privacy is always important in this kind of test, we developed an encryption technique that allows us to assign a unique, anonymous, untraceable identifier to each user, so that each use of the SuperConnector is recorded, including where they enter and exit. As income information is vital to this analysis, a masking routine is employed to allow the North Texas Tollway Authority (NTTA) to provide the home location of the user in the form of two decimal place latitude and longitude (lat-long) reference. This degree of lat-long resolution is sufficient to allow determination of the relevant census tract, but will not allow the identification of individual residences.

Due to the difficulty of segregating income levels with significant break points, the income categories used for all census data were retained in their original form. An example of that form is shown in Fig. 10, which is the combined median income data by census tract for Collin County, Texas.

Finally, the question of which income parameter was most relevant was considered. Because the tool yielded by this research is intended for very preliminary estimations and because of concerns raised by Hensher and Goodwin (2004) that use of mean income would tend to overestimate revenue potential, we chose to use median income for each census tract as the income parameter.

The geographic distribution of users (and potential users) is as important in an analysis of this type as is the income distribution because the analyst will need to know what census tracts to consider for the analysis of potential usage. The data provided by the NTTA allowed us to identify the home census tracts for the SuperConnector users.

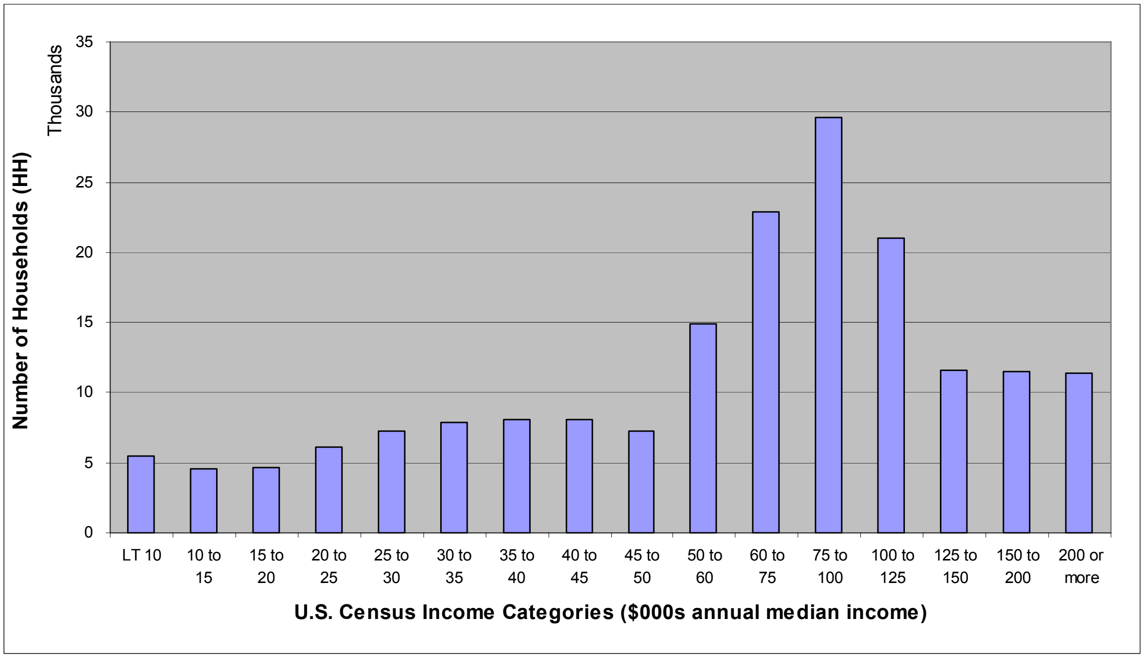


Fig. 10. Example of median income distribution (Collin County, TX)

Methodology for Estimating VoT saved as a Percent of Median Income

Techniques in current use for estimating value of time or potential user acceptance of tolls report or use percentage of wage rate as a rough estimator of toll "acceptance." Lam and Small (2001) found the VoT for a sample of users on SR-91 in southern California to be in the range of 60 percent of reported wage, while a more recent comprehensive literature review by Small and Verhoef (2007) concluded that most estimates centered around 50 percent of the "average wage." It seems reasonable to apply an approach that is similar to that of Lam and Small (2001) and Small and Verhoef (2007) and adjust those estimates of VoT saved to user income. Unlike these references, the approach here is to address the VoT saved relative to each income category, not as a single percentage applied to "average wage." Using the census tract median income data, we were able to relate the range of VoT saved to percent of income by income grouping.

Because the VoT is typically reported in dollars per hour, we converted annual median income into hourly rate by the following equation.

Median Hourly Income (\$/hour) = Median Annual Income / 2088 (Eq. 5)

Methodology for Estimating Income Distributions for Larger Populations

While the results from actual usage of an existing toll road are more than interesting, it must be recognized that those user data will not be available in the network planning stage for a prospective toll road. At that stage there may be some well-formed ideas about potential locations, but the primary question is not whether to build a road, but whether the road can be financed as a toll road based on prospective usage. Information about potential user income must come from a much larger population, with the desire to infer from that income data and the anticipated travel time savings approximately what level of toll would reflect the values of the time savings of the users in that travelshed.

The question of defining the appropriate larger population was addressed on two levels. The first approach was to look at the population of potential users as represented by the counties through which the SuperConnector passes—Collin, Dallas, Tarrant, and Denton counties. While Dallas County has the largest population, Collin and Denton counties have higher income profiles. This distinction could be important because the SuperConnector serves to connect both of those counties to higher income employment centers and the DFW Airport.

Because the SuperConnector does not serve the entirety of any of these counties, a narrower estimation of the travelshed, but consistent with the visual inspection approach, is more logical. Because the SuperConnector is a controlled-access road (freeway design), we considered what other similar travel alternatives would be available and estimated the prospective travelshed shown in Fig. 11.

The boundaries of this "prospective" travelshed are based on the assumption that a rational traveler will choose routes that benefit him most, which may be assumed to be those routes closest to the traveler's origin. This assumption is probably an overstatement of the boundaries of the travelshed because the toll requirement presents an additional deterrent that could influence travelers to drive farther to use a 'free' road instead of the toll route. However, at the network planning level, such an assumption is easy to describe and apply, without unnecessary concern for precision. In practice, it would be prudent to confirm a "prospective" travelshed via a select-link analysis, even if the visual estimation approach appears viable.

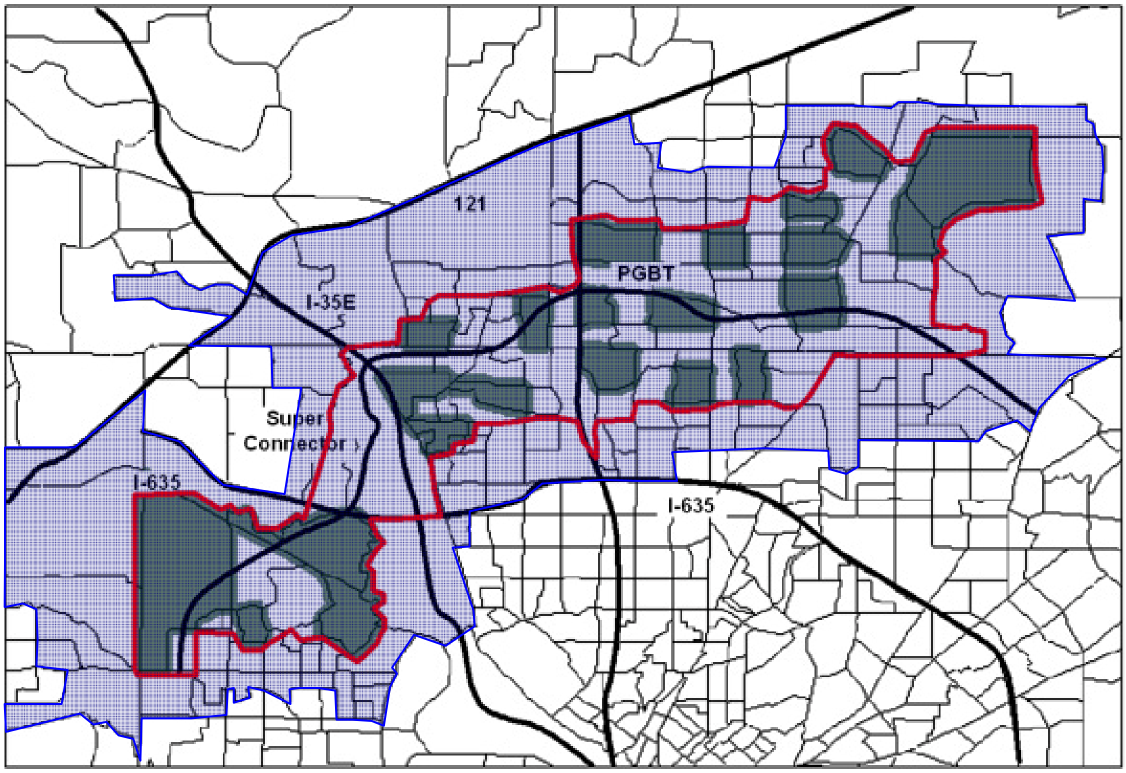


Fig. 11. Hypothetical map of census tracts for "prospective" SuperConnector travelshed

CHAPTER IV

FINDINGS

One of the principal purposes of this research is to contribute to the development of relatively simple techniques of estimating complex traveler responses to a toll road option so that decision-makers can gain a macroscopic understanding of the potential viability of a toll project at the network level. This research is intended to contribute in this way: to allow the planner to gain insight into the potential toll rate based on projected travel time savings and census tract median income of the travelshed surrounding the prospective toll road. The previous chapter's methodology led to several findings related to the two hypotheses.

Findings Related to Hypothesis 1

<u>Hypothesis 1</u>. Frequency of toll road use is inversely related to user value of time saved as measured by a percentage of median income.

To address that hypothesis, the methodology from the previous chapter is applied to produce these findings:

- estimates of SuperConnector user sample VoT saved,
- estimates of income distribution and usage rates for the SuperConnector user sample, and
- comparison of the SuperConnector user sample VoT saved as measured by a percentage of median income and sample usage rates.

Estimates of SuperConnector User Sample VoT Saved

Equation 4 defined the unit price of time saved as the fixed toll divided by the distribution of travel time saved:

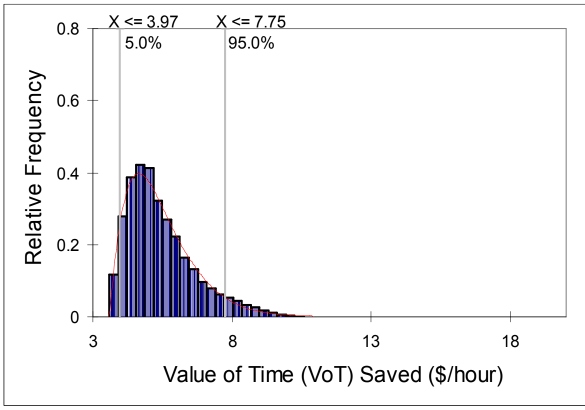
$$VoT = \Delta C/\Delta T = \text{toll/travel time savings (TTS)} \quad \text{(Eq. 4)}$$

Fig. 8 in the preceding chapter illustrated how dividing the fixed toll of $0.60 by the distribution of travel time savings produces a distribution of VoT saved. Based on the six data sets that describe the distribution of travel time saved, Table 4 shows selected statistics in tabular form for the six simulations of VoT saved and Fig. 12 shows the distribution of VoT saved for those six combinations of travel direction and time of day. The values in Table 4 are shown in traditional dollars per hour format, as well as in dollars per minute saved, which may be better suited to the scale of the savings and the analysis.

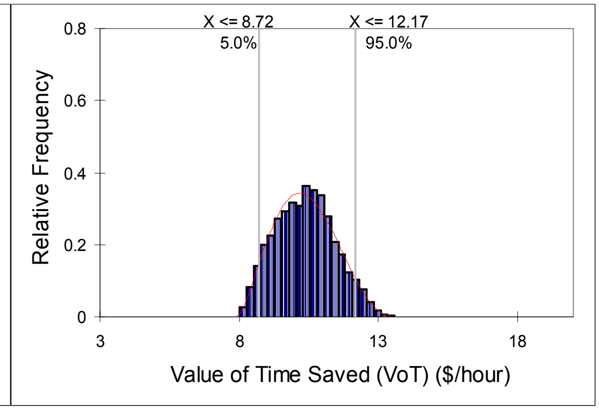
In this approach, we are not technically measuring the user's VoT, but rather the unit price of time saved. When a user takes advantage of the toll facility at the fixed price of $0.60, we can infer that the user's value of time is equal to or greater than the price of time saved. Consider the mean price of time saved for the southbound AM peak, $0.09 per minute. Users during that time period are revealing that their personal value of time (including other dimensions of 'value') is greater than $0.09 per minute. That personal value may be $0.10 per minute or $10.00 per minute, but we can only infer that it is greater than $0.09. As the unit price of saving time increases—because there are smaller time savings for the same fixed cost—users who have a lower personal value of time will reject the toll route in favor of the "free" or non-toll route.

Table 4. Distributions of Resulting Unit Price of Time Saved for Six Combinations of Travel Direction and Time of Day

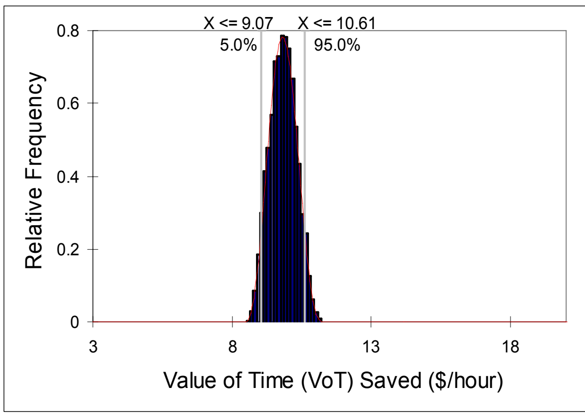
Direction and Time of Day		Resulting Unit Price of Time Saved in $ per hour ($/minute)		
		95th percentile	Mean	5th percentile
	AM	0.07	0.09	0.13
Southbound	Midday	0.15	0.16	0.18
	PM	0.19	0.20	0.22
	AM	0.16	0.17	0.20
Northbound	Midday	0.23	0.25	0.27
	PM	0.15	0.20	0.28



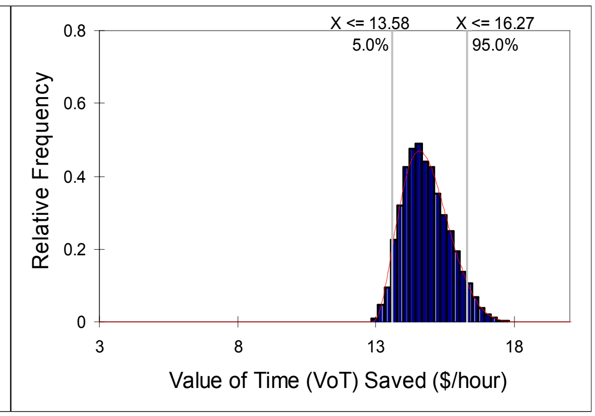
(1) SB AM Peak



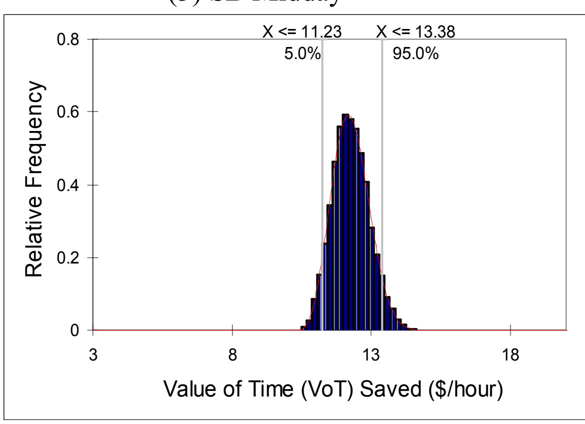
(2) NB AM Peak



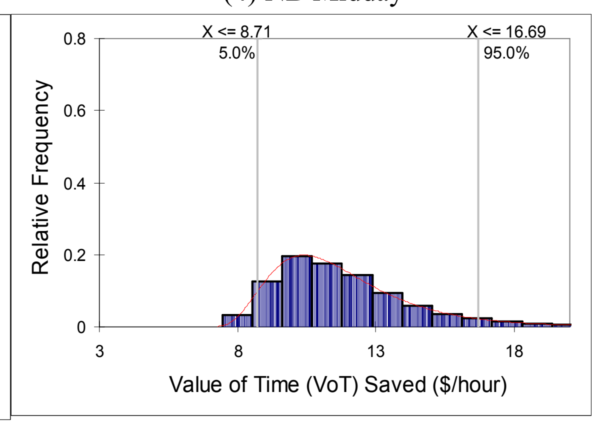
(3) SB Midday



(4) NB Midday



(5) SB PM Peak



(6) NB PM Peak

Fig. 12. Distributions of the VoT saved for the six combinations of travel direction and time of day

Fig. 12 illustrates these same findings in a form that better reflects the actual distribution of resulting unit price of time saved than do the summary statistics in Table 4. Note that the x-axis is unit price of time saved in dollars per hour. The y-axis reflects the frequency of occurrence for each of the elemental estimates of VoT saved in the simulation. Wide distributions in VoT saved reflect more variation in travel time savings. Those are most pronounced during the SB AM peak and NB PM peak, the two times that the non-toll route is most vulnerable to congestion and slower travel times. The narrow distributions seen for SB midday, SB PM peak, and NB midday reflect fairly stable travel times on both routes, leading to relatively small savings in travel time and therefore a narrow range of VoT saved.

The SB AM peak distribution is skewed the farthest to the left because the absolute travel time savings is highest. Recall that because the VoT saved is the fixed toll divided by the travel time savings, when the denominator increases (i.e., greater travel time savings) then the unit price of travel time saved decreases. Thus, the lower the VoT saved, the greater the travel "bargain." The NB midday graph shows a very high VoT saved ($0.25 per minute), which appears to be less of a bargain (higher price per minute saved). However, the 5489 northbound midday transactions during the 9-day study period demonstrate that the option is clearly valued by the patrons, likely for reasons of reliability and convenience.

Some of these results are intuitive. As shown in Table 3, the largest travel time savings (ΔT) between the two routes was in the southbound AM peak. As a result, the imputed value of time saved in Fig. 12(1) is the smallest, as the toll (ΔC) remains fixed. Considering the toll is fixed, then the more minutes saved, the better the "bargain," such that the unit price of time saved for the southbound AM peak ranges from $0.07 to $0.13 per minute (Table 4).

These six distributions, in combination with the three usage periods shown in Table 1, illustrate how conditions change throughout the day, but also suggest that some of the other choice factors previously noted—reliability, convenience, familiarity, etc.—are likely influencing decisions to use the toll road, when the benefits of travel time savings are somewhat nominal. Considering again the comparison between southbound AM peak and northbound PM peak, there is almost no overlap between the distributions, meaning that the unit price for time savings in the northbound PM is much greater than the unit price for southbound AM. This is at least in part because the time savings southbound is much greater in the morning than the northbound time savings in the afternoon. Viewed another way, the traveler receives considerably more time savings for their $0.60 in the morning than the afternoon. Therefore, travelers who are willing to pay the toll northbound in the afternoon are exhibiting a willingness to pay for a higher value of time saved than for the morning conditions. In actuality, this significant difference may be evidence of the influence of some of the other factors that affect traveler decision-making, such as reliability, convenience, regular users, etc. Further, because the imputed unit prices are only known to be less than the user's maximum acceptable value, the differences in usage may more affected by factors other than time savings.

For this research, we have data available that allow analysis of unit price of time saved for the six relevant time/direction combinations. This may not always be true, so we examined one general distribution of unit price of time saved, which may be preferable for circumstances when the more detailed data are not available.

Combining all six data sets into a composite set, southbound and northbound travel time savings and estimated unit price of time saved created some very unusual distributions, as seen in Fig. 13. Each distribution was multimodal, which is not unexpected, given the large differences observed in Fig. 14. Because the individual time/direction distributions (Fig. 14) were much more useful than the composite (Fig. 13), most subsequent analyses treat each of the six time/direction combinations independently. The composite data set is used subsequently to show patterns of user behavior for the entire sample.

Estimates of Income Distribution and Usage Rates for SuperConnector User Sample

Fig. 15 shows the census tracts for which one or more transactions of the SuperConnector were recorded during the study period. For purposes of simple identification, we will refer to this collection of census tracts as the "actual" travelshed. The data sets from which all user and transaction data were extracted are shown in Appendix B.

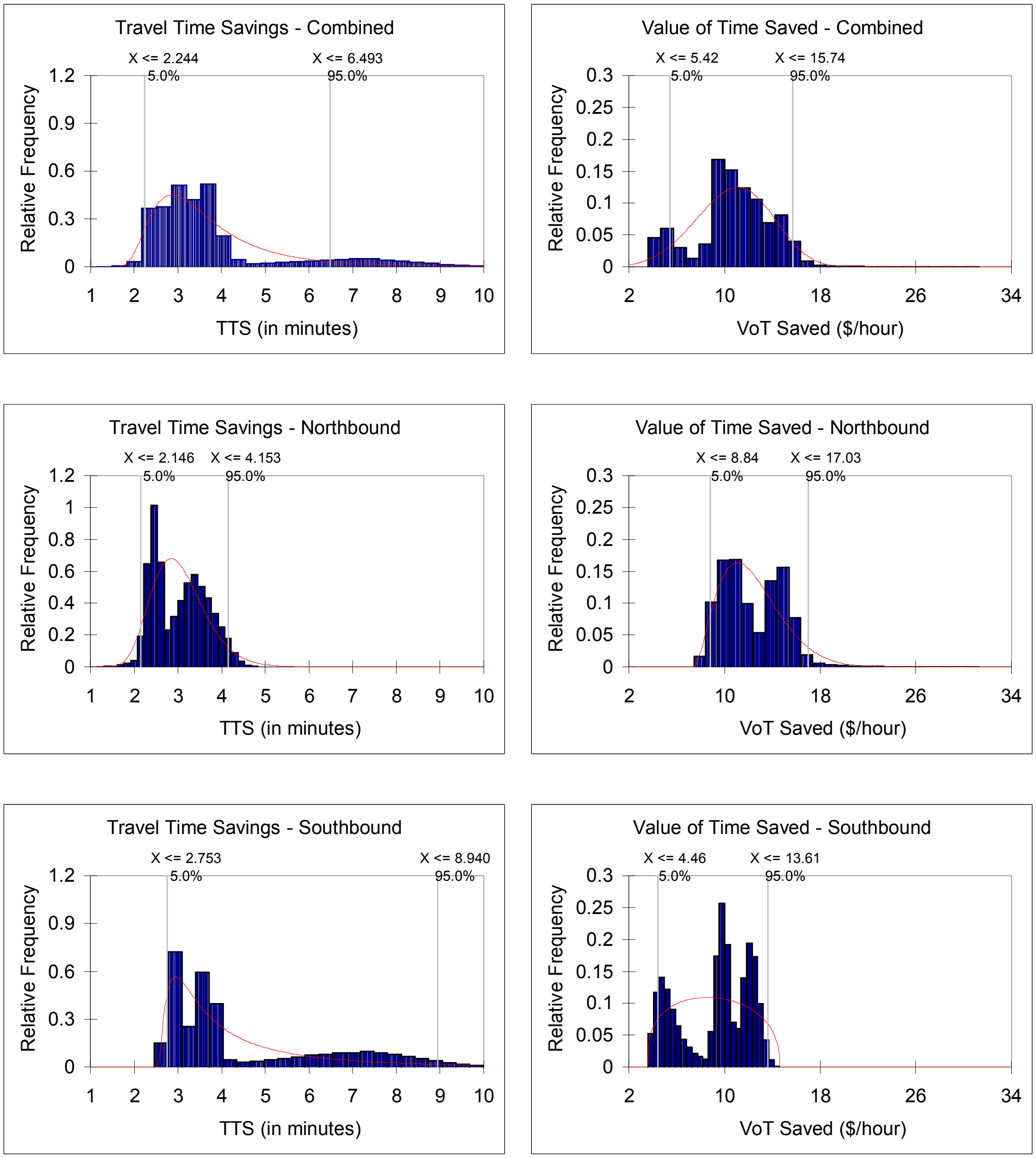


Fig. 13. Composite TTS and VoT saved distributions based on all travel time savings combined

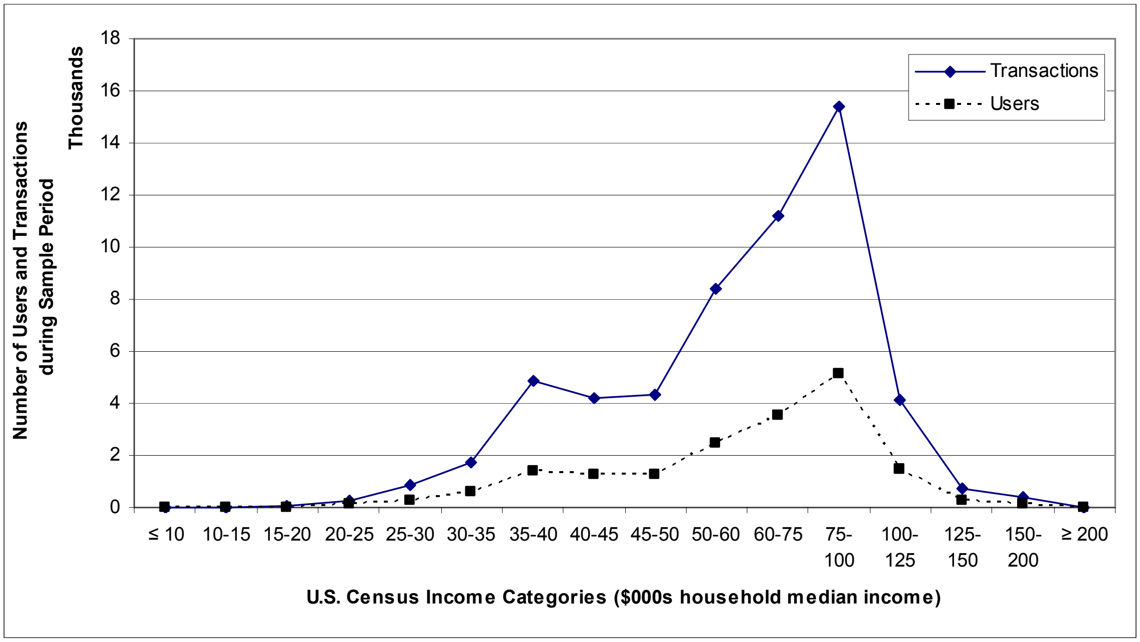


Fig. 14. Distribution of users and transactions by census tract median income

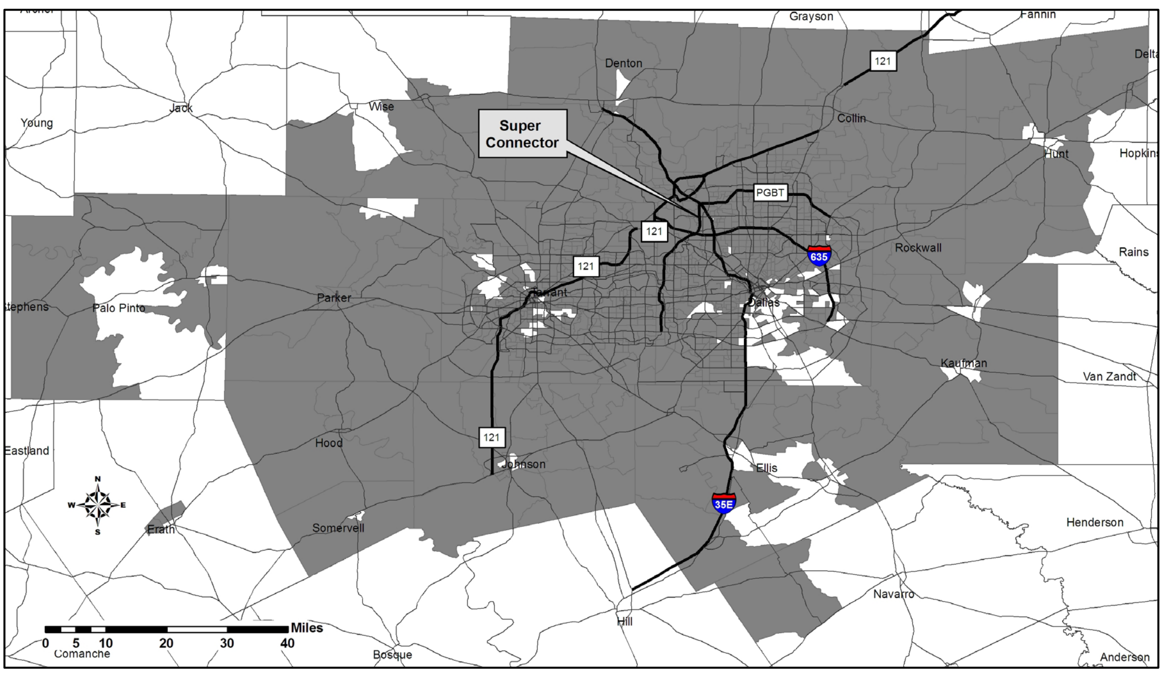


Fig. 15. Census tracts with one of more recorded uses of SuperConnector

Comparing the travelshed in Fig. 15 with the hypothesized travelshed in Fig. 9 illustrates our very significant underestimation of the size of the travelshed. Our initial estimate was there would be about 100 census tracts in the travelshed, but in actuality there are 886. This gross difference in travelshed estimation casts serious doubt on the notion that one can apply the visual estimation approach to identifying the travelshed. To minimize the effect of infrequent users on the number of census tracts and therefore the overall population base for the travelshed, we considered the census tracts that accounted for 90 percent of total transactions. This approach significantly reduced the number of census tracts to 324 but generated a new set of anomalous conditions. Appendix C shows the relevant detailed census data. For subsequent analyses in this research, we discarded any use or consideration of the visually estimated travelsheds. However, for future research, an analysis of the "prospective" travelshed to determine what percentage of the actual transactions it represented might provide insight on better methods of visual estimation.

Usage was estimated based on users and transactions. Each toll tag was identified as a separate user, as NTTA intends that each tag remain with the assigned vehicle. Fig. 14 shows how the number of users and number of transactions were distributed by census tract median income (CTMI).

In Fig. 14 the income distribution of users above about $40,000 median income is similar to the income distribution for the populations of the surrounding counties. All four counties had their highest percentages of households in the $60,000–$100,000 range. The most unexpected aspect of the data illustrated in Fig. 14 is the low number of users in the three highest income categories, especially since the location of the SuperConnector would certainly appear to serve typical travel demand. The initial suspicion was that there were simply a very low number of relevant census tracts and that the usage rates would be more realistic when compared on a population base in the next figure.

Although the number of users of the toll road is useful for the current analysis, a statistic that may be more readily transferable to other locations would be the number of users as a function of population for each income category. That statistic is reflected in Fig. 16. This change from absolute numbers to a rate produced some anomalous results. At very low population levels, a small number of transactions can produce an artificially high rate. For example in Fig. 16, the rate for number of users per 1000 population for annual median incomes of less than $10,000 was more than 10 users per thousand population—the highest rate on the chart. As it turns out, this income bracket (less than $10,000 median) represented only 2 census tracts out of the 886 in the sample. Further, the combined population of those tracts was 1252 persons, who had 15 transactions during the study period. That population is negligible compared to the 4.5 million represented by the 886 census tracts, as are the 15 transactions compared to the more than 56,000 in the sample.

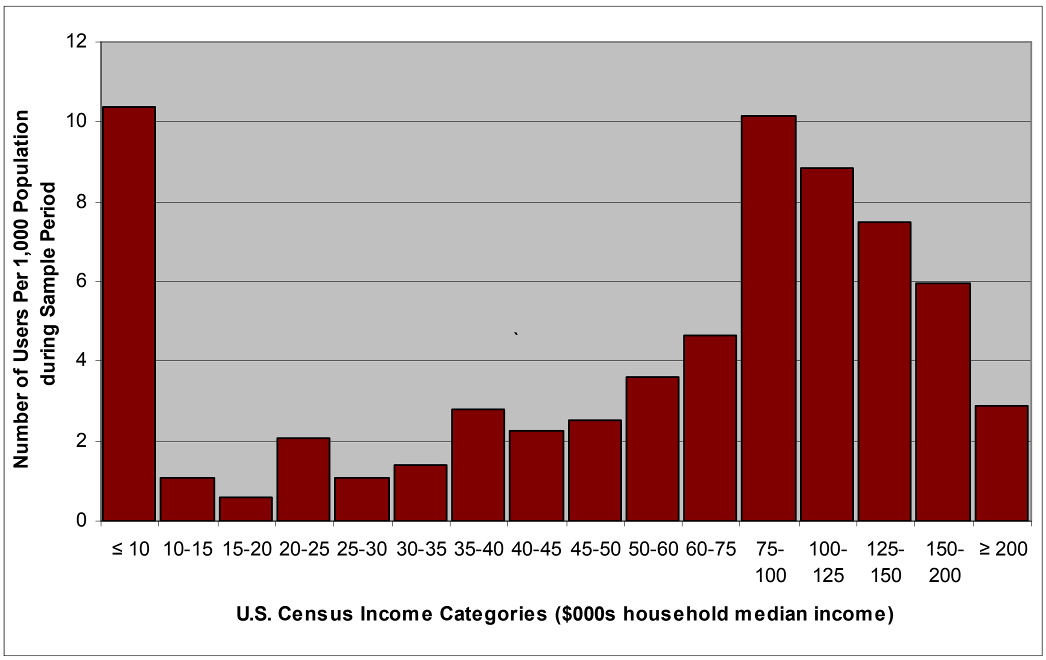


Fig. 16. Number of SuperConnector users per 1,000 population

Note from the previous use of this graphic that it reflects only the number of users, not the number of transactions. Fig. 16 illustrates a limitation of using a rate comparison, because very low populations, particularly at the lowest and highest income levels, can produce a misleading usage rates. In a practical application, those usage rates stemming from very low population should be carefully examined and accounted for in any overall estimates of usage or revenue.

The general hypothesis of this research is that income affects use; that would suggest that not only would the number of users increase with income, but the frequency of use would increase as well. Fig. 17 shows the frequency of use of the SuperConnector per 1000 population for the census tract income categories. This histogram trend is expected by the hypothesis, recognizing that the very low-end and high-end usage is somewhat overrepresented, as was the case for the user rate shown in Fig. 16. These high-end and low-end data points represent an anomaly created by the very low population in those income brackets. As the denominator in the rate calculations (transactions/population), very low populations can produce a visual misinterpretation. For trend analysis in subsequent sections of this report, these data from these anomalous ranges are not included, as they would tend to bias the observations.

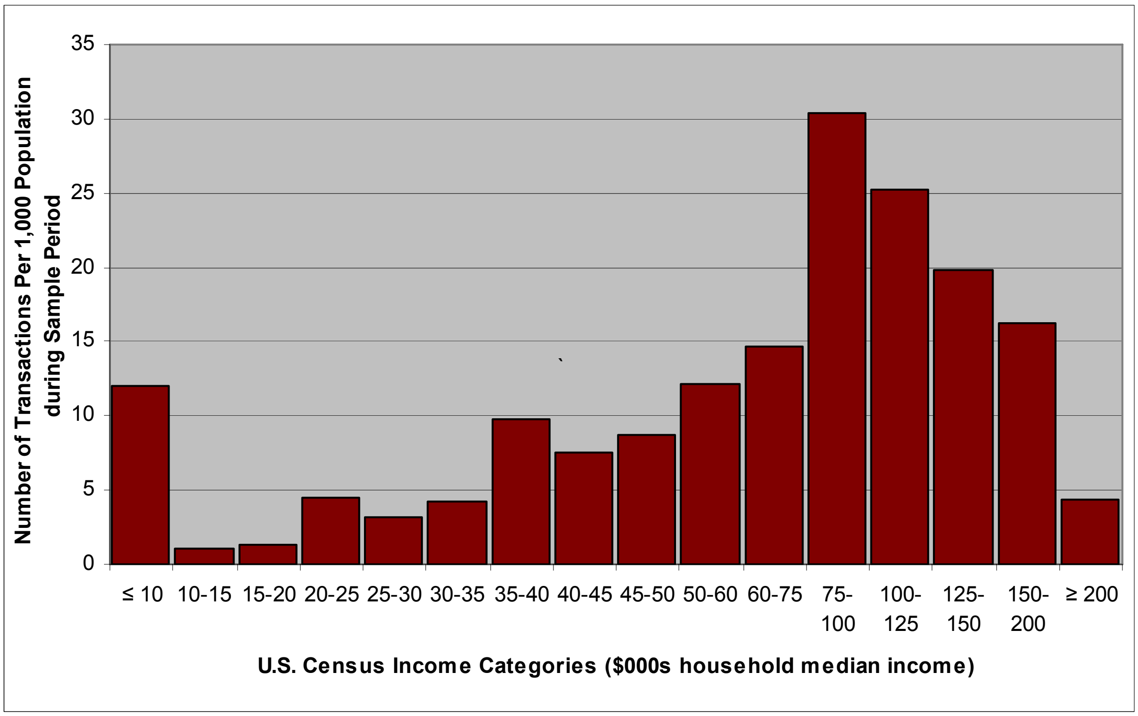


Fig. 17. Number of transactions per 1000 population

Estimates of SuperConnector User Sample VoT Saved as a Percent of Income

The previous section demonstrates the predicted relationship between income and both users and usage. In this research, we hypothesize that if we merge VoT saved and some derivative of income, the product will allow us to more easily relate usage to income, and desirably to estimate the toll rates that will likely be acceptable to the user population. The range of VoT saved as a percent of hourly median income for the composite data set of the entire sample is superimposed on the number of users per 1000 population (from Fig. 16) to show the expected inverse relationship (Fig. 18).

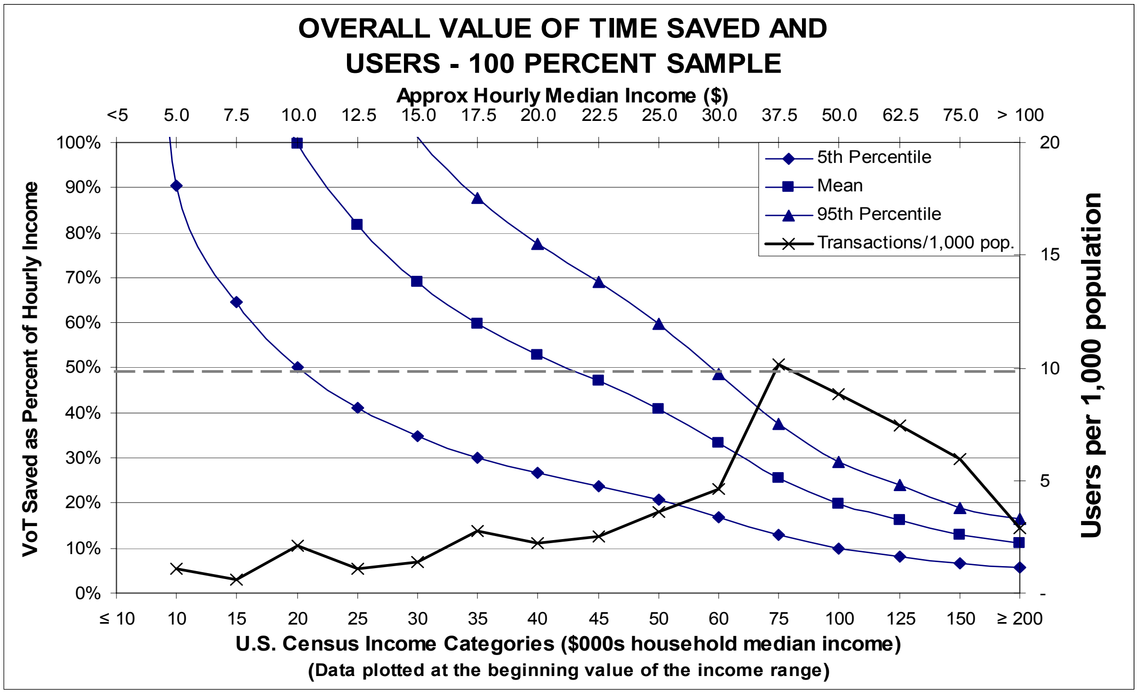


Fig. 18. VoT saved as percent of income superimposed on number of users per population by census tract median income

Fig. 18 has four data series plotted. The x-axis is the same census tract income groups that we have used throughout this report. In addition, we have included a secondary x-axis above the plot that shows that income in dollars per hour. The left-hand y-axis is VoT saved as a percent to of hourly income. The three data plots that run from the top toward the lower right corner relate to the VoT saved as a percent of income (shown on the left y-axis). Using the combined data as an example, the 5th percentile of VoT saved was $5.42 per hour, the mean was $10.75 per hour saved, and the 95th percentile was $15.75 per hour of time saved.

For each income group, the VoT saved is plotted as a percent of the corresponding hourly median income. The first data point (upper left portion of the plot) is for median income in the $10,000–$15,000 range, which translates to an hourly rate in the midpoint of that range of $5.99 per hour. The $5.42 VoT saved is approximately 91 percent of the hourly wage of $5.99. The estimates for the mean and 95th percentile VoT saved as percent of income are above 100 percent (for the less than $10,000 group) and are not plotted on this graphic.

The first income group for which all three data points are on the plot is $35,000-$40,000 median annual income ($17.50–$20.00 median hourly income). For that income group, the 5th

percentile VoT saved ($5.42 per hour) is approximately 30 percent of hourly income, the mean VoT saved ($10.75) is approximately 60 percent of hourly income, and the 95th percentile VoT saved ($15.75) is approximately 88 percent of hourly income.

The dashed line at the 50th percentile of VoT saved as a percent of income on Fig. 18 is a reminder of the consensus of the literature and prevailing practice. Comparing that flat rate approach across all income levels with the general trend of the users per 1000 population in Fig. 18, it could be inferred that higher income patrons have a higher willingness to pay at a given toll rate, so the flat rate assumption may not be the most accurate portrayal of the potential user base.

The solid line graph across the lower half of Fig. 18 shows the number of users per 1000 population by income group. The scale for this line is on the right-side y-axis. For the data set represented in Fig. 18, usage increases at higher incomes (greater than $50,000). That trend of usage increasing with higher income appears to support the hypothesis of this research, whereas the conventional approach of basing value on a flat line at 50 percent VoT saved suggests that all income groups respond similar to each other.

One of the purposes of this research is to find a meaningful way to represent the effect of income on VoT saved and therefore on potential toll rates. The analytical approach described above for Fig. 18 was applied in two ways. In the first approach, the right-side y-axis was fixed so that all user and transaction data were compared on the same scale for each of the six direction/time of day combinations. Subsequently, the scale for the right-side y-axis was allowed to vary to best fit the data for that specific combination of direction and time of day.

Plots of VoT saved as a percent of hourly income were prepared using both fixed and variable scales for all combinations of direction and time of day (Appendix D). A close inspection of all the plots in Appendix D suggests that trip urgency could be affecting the user's decision to take the toll route, regardless of the VoT saved. Three of the six time periods show a significant positive trend for usage rates, whether on a variable or fixed scale: southbound AM peak, southbound midday, and northbound PM peak. The southbound AM peak could be attributed to a combination of work arrival time and flight departure time from DFW Airport, both of which have some penalty associated with being late, and therefore worthy of a reliable trip time. Southbound midday usage could also be reflective of DFW Airport departures or arrivals, while northbound PM peak could be other time-sensitive post-work activities, though that is impossible to tell without surveying the users.

There is one comparison for each of the six time/direction combinations (Fig. 19). For each time/direction combination, the user data and VoT saved are for that combination only. The dashed line on the 50th percentile of VoT saved on Fig. 19 is inserted to facilitate visual comparison of the approach proposed herein with the conventional wisdom of 50 percent of average wage. Note that this "percent of average wage" approach may understate the potential value to a significant group of users, especially in the southbound direction (toward D/FW Airport). The width of the band between the 5th and 95th percentiles reflects the variation in the travel time savings for each time of day and direction, and therefore the variation in imputed VoT saved. The farther the band is to the right of the graph, the higher the imputed value of time saved as a percent of income.

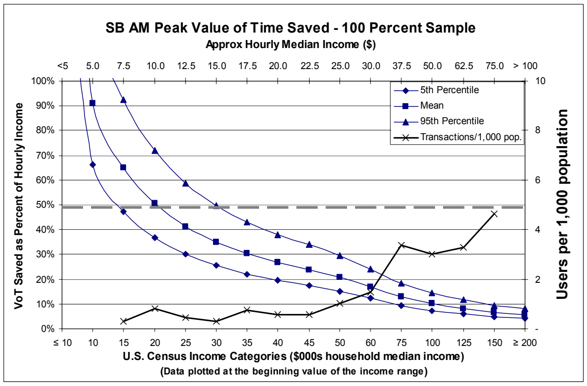
Fig. 18 and Fig. 19 show results of superimposing the number of users on VoT saved as a percent of income. For comparison purposes, Fig. 20 shows the result of superimposing the number of transactions per 1000 populat ion by CTMI (from Fig. 17) on the VoT saved as a percent of hourly income for the composite data set.

Summary Finding for Hypothesis 1

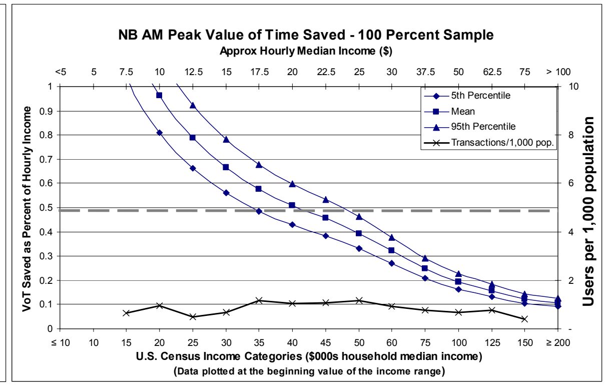
Hypothesis 1. Frequency of toll road use is inversely related to user value of time (VoT) saved as measured by a percentage of median income.

Six combinations of time of day and direction of travel were examined using VoT saved as a percent of income compared with either users per 1000 population or transactions per 1000 population. Two techniques for assessing the trends in users and transactions were employed. In all of the analyses, the hypothesized relationship was either strongly evident or weakly evident. In no case was the hypothesized relationship contraindicated.

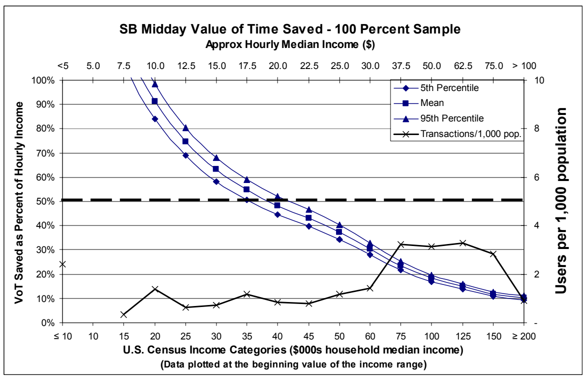
There is strong evidence supporting the hypothesis for users in census tracts with median income above $60,000. For these higher income groups, increased usage was most evident for the southbound AM peak, southbound midday, and northbound PM peak, all of which have a plausible explanation of possible trip urgency, which could contribute to increased willingness to pay a toll, regardless of VoT saved.



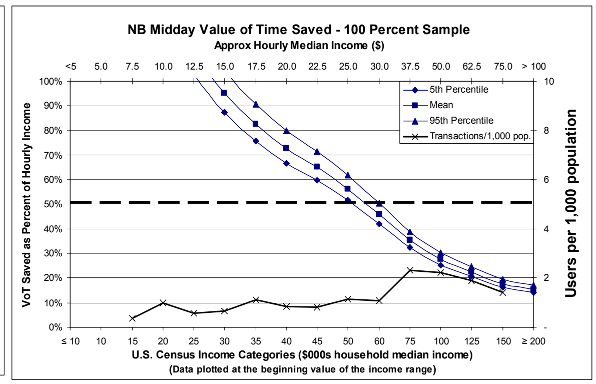
(1) SB AM Peak



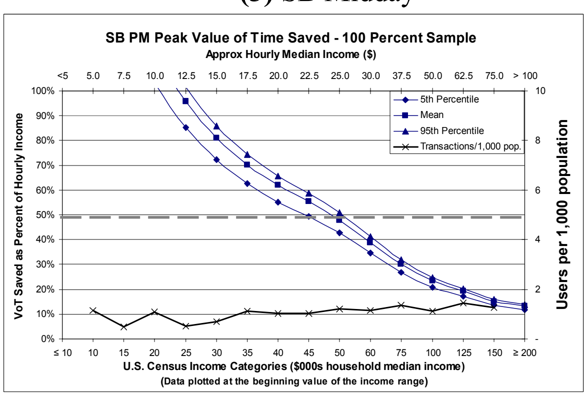
(2) NB AM Peak



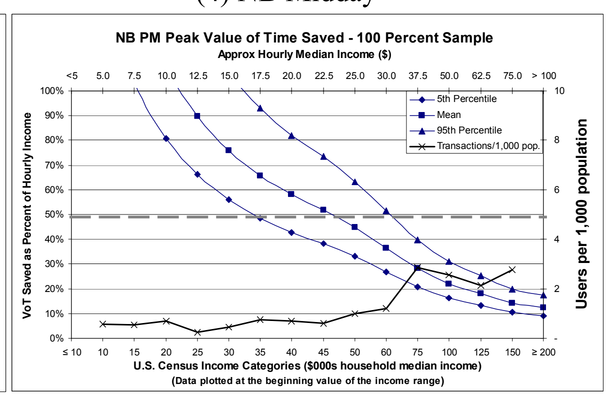
(3) SB Midday



(4) NB Midday



(**5**) SB PM Peak



(6) NB PM Peak

Fig. 19. VoT saved as percent of income superimposed on users per 1000 population (using a fixed user scale) for each combination of time of day and direction of travel

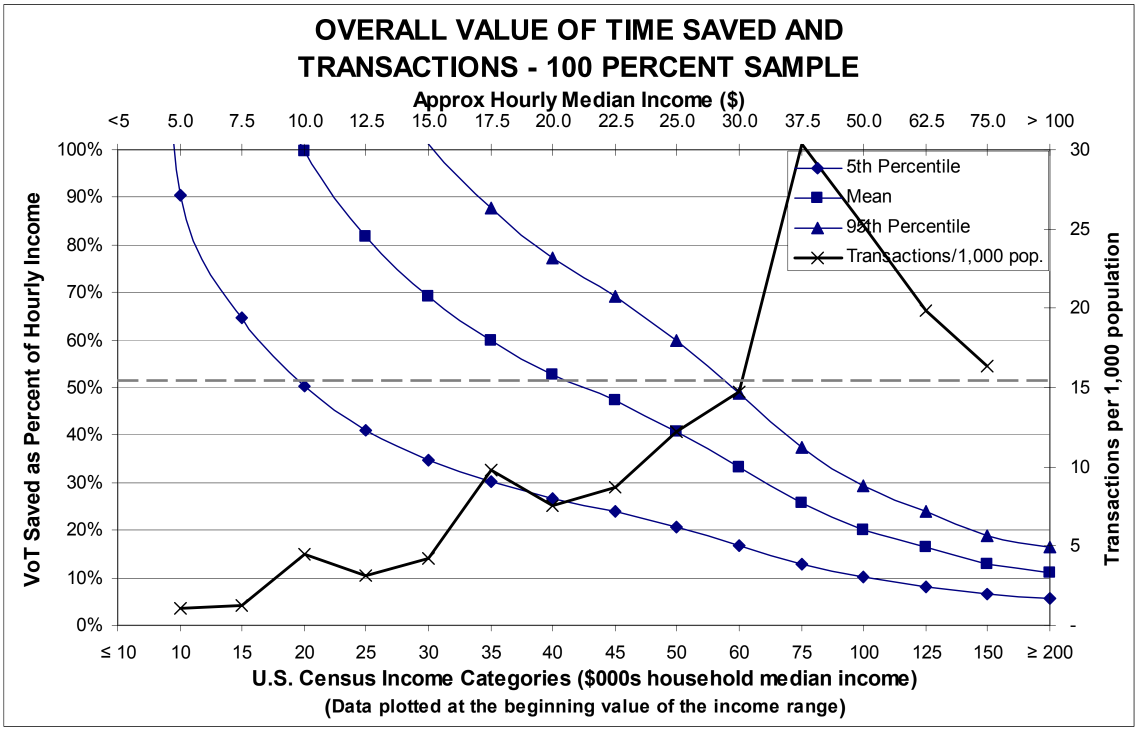


Fig. 20. VoT saved as a percent of income superimposed on transactions per 1000 population

Recalling that this research is intended to support high-level preliminary planning with only rough approximations of potential revenues, and based on those observations, hypothesis 1 is accepted, as there appears to be a preponderance of evidence that the hypothesized relationship is a better descriptor of traveler behavior than the flat rate assumption in the literature and common practice.

Findings Related to Hypothesis 2

Hypothesis 2. If Hypothesis 1 is accepted, then using VoT saved as a percent of income enhances the predictive capabilities for the potential viability of prospective toll roads.

To address that hypothesis the methodology from the previous chapter and some of the findings with regard to Hypothesis 1 are applied to produce the following:

- estimates of SuperConnector usage by median income, and
- comparison of methods for estimating toll potential.

Estimates of SuperConnector Usage by Median Income

Fig. 21 shows transactions as a cumulative distribution based on percent of transactions in each of the income categories. Given the previous observations about the scarcity of high-income and low-income users, it is not surprising that the vast majority of transactions have home census tracts of middle and upper middle median incomes.

A dashed vertical line in Fig. 21 is located at the 10th percentile of transactions, meaning that 90 percent of the transactions during the study period came from home census tracts with income equal to or greater than $35,000 annually. Similarly, the upper 10 percent of transactions resulted from users in census tracts above $100,000. Therefore, 80 percent of the transactions (and presumably revenues) are generated by patrons from home census tracts with median incomes between $35,000 and $100,000, as shown between the two vertical dashed lines.

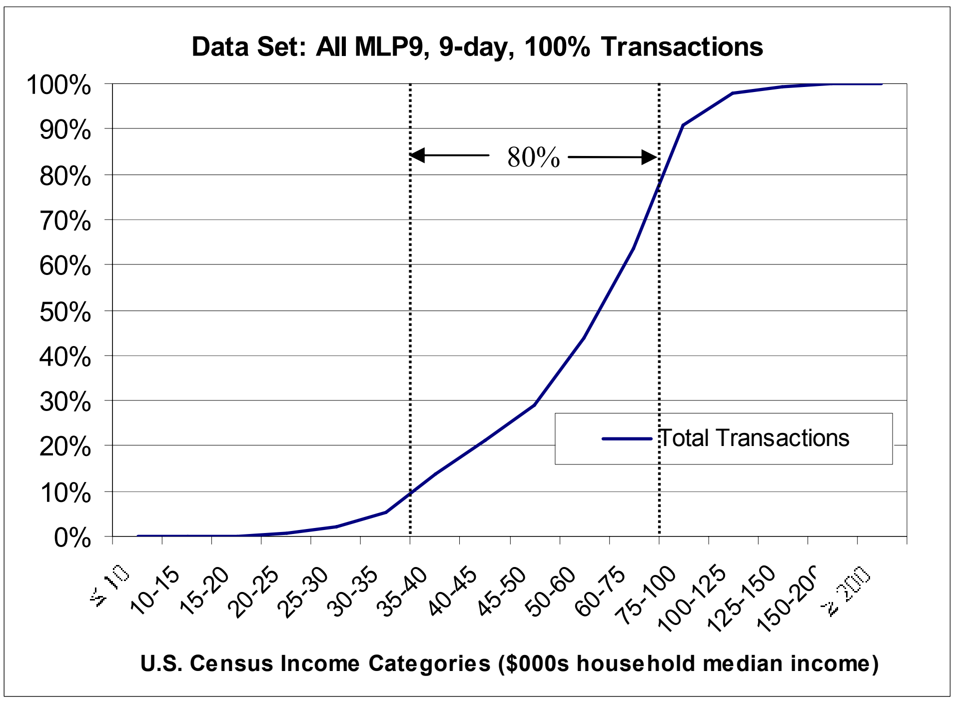


Fig. 21. Cumulative distribution of transactions by census tract median income

Comparison of Methods for Estimating Toll Potential

One of the key goals of this research was to determine whether a refined income-based approach to estimating traveler value in a toll facility would be an improvement over current methods. In general, the current methods are:

- using a region-wide or universal per-mile toll rate as the basis for a segment toll, and
- using a percentage of average wage to estimate user value in a toll segment.

These two methods are compared with the results obtained using the results of this research, by illustrating the toll potential described by each method.

Estimating a segment toll based on a region-wide per-mile toll rate. It is common practice in Texas, and with the NTTA, to use values in the range of $0.11 to $0.15 per mile as a reasonable toll rate, without regard for the actual "value" of a particular segment to the traveler (interviews). This approach, while not generally aligned with market principles, is not without merit. In many ways toll rates are a public policy decision, requiring rate-setting bodies to consider factors other than the value of a particular segment (interviews).

As the segment in question is about 7 miles long (based on author measurements), using a per-mile rate of $0.11-0.12 per mile would produce a segment toll of $0.77-$0.84, compared to the actual toll of $0.60. It should be noted that the exact mechanism used by NTTA to measure relevant distances is not necessarily reflected in this per-mile calculation (interviews), so the discrepancy suggested may not be meaningful.

Estimating a segment toll based on value of time as a percent of average wage. A simplifying assumption of this research was that travelers are rational in making their route choices. This assumption contends that if the value of the combined benefits of the toll route (time savings, reliability, etc.) exceeds the toll, then the traveler will choose the toll route. While the literature suggests a range for value of time as a percent of income, there is support for valuing the time of the user at 50 percent of "average wage" (Small and Verhoef 2007), which is the common industry practice.

If "average wage" is estimated as the average of the median wage for the census tracts serving the SuperConnector, then we computed an average wage of $25.10 per hour. For the day-long average travel time savings of 3.9 minutes over the alternative route, this estimated value of time would result in a toll valued at $0.81, compared again to the current $0.60.

Thus, two common methods of estimating a toll—per mile and based on average wage—produce results that are consistent for this segment: approximately $0.80.

Estimating a segment toll based on value of time as a percent of income. The technique examined in detail in this research varies from the previous approach, which uses a fixed percentage of the average wage. In the present research, the approach is to consider the implications of the variation in the percent of income for the income range of the customer base. The presumption is that higher income travelers will use the toll road more frequently because the toll is insignificant compared to their hourly income.

To reflect the weighted value of time for actual usage, the number of transactions for each income category was multiplied by that median income. Using that technique the weighted average hourly median income is $32.62 per hour. That value is considerably higher than the "average wage" computed in the previous approach, because the present approach reflects lower usage rates among lower income census tracts. Applying this average value of time in the same manner as the previous section—that is at 50 percent of the hourly rate—produces a value of travel time saved by using the tolled segment of $1.05, again compared to the actual toll of $0.60.

Comparing three methods of valuing the toll segment, two in common practice and one proposed by this research, it would appear that the value of the toll segment is likely higher than the current toll in place. If this were a proposed toll road in the preliminary planning stages, it would not be unreasonable to place the value of the toll of this segment at a rate considerably higher than the current toll, thus generating potentially greater revenue than the current toll. However, there is typically some elasticity of demand, which would theoretically manifest by lower usage at the higher toll rate. That elasticity should be tested at the more advanced stages of project development, when the investment grade studies of traffic and revenue are conducted. At this preliminary planning stage, revenue estimates based on the proposed methodology would be defensible.

Based on the observations from previous sections that show reasonably high toll acceptance and in this section estimating toll acceptance based on specific weighted averages related to value of time as a percent of income, it is reasonable to conclude that this weighting approach gives a much different picture of the relationship of the toll and the value of the segment to the patron base. If toll rate setting were simply a matter of economics, there would be justification for setting the toll for the SuperConnector at a rate that appears to more closely reflect the value of the savings for the current customer base.

Implications for Hypothesis 2. The above analyses support the hypothesis that considering the impact of income on user value of time facilitates a more accurate estimate of the toll potential, even if it may aggravate non-economic considerations in toll-setting.

Summary Finding for Hypothesis 2

Hypothesis 2. If Hypothesis 1 is accepted, then using VoT saved as a percent of income enhances the predictive capabilities for the potential viability of prospective toll roads.

Three methods of estimating the value to the patron were used and compared to the existing toll for the segment. The proposed method, based on the research linking VoT saved to census tract income, produced a very different and defensible estimate of toll potential, which if tested through investment grade revenue analysis, would likely produce substantially higher revenue estimates. This finding lends strong support to Hypothesis 2.

CHAPTER V

CONCLUSIONS AND FUTURE WORK

Summary of Findings

The two principal hypotheses in this research were accepted, with some caveats. Hypothesis 1 proposed an inverse relationship between value of time saved and user income, at a level of detail heretofore unexplored in the literature and practice. Only a portion of the proposed relationship was strongly supported, though none of the data appeared to contradict the hypothesis. For peak period travel and for trips with potentially high-value trip purposes (e.g., toward the airport), there was strong evidence that toll route use increased with higher income users (greater than $60,000 median income). The areas of weak support for the hypothesis were plausible, if not predictable—lower income travelers did not use the toll route in sufficient numbers to demonstrate any usage pattern related to income and users at all income levels eschewed the toll route when the travel time savings were small or negligible. Analysis of travel patterns showed that toll road usage increased with the inverse of the value of the user's time estimated as a percent of income.

Hypothesis 2 proposed that estimations of toll road usage based on data weighted by user income characteristics would improve the quality of preliminary estimates of revenue. Based on the characteristics of the study data, it was apparent that the customer base is predominately from a fairly narrow band of income brackets, with lower income and very high-income users contributing only a small fraction of the total usage. When comparing potential toll rates for the subject segment, the analysis demonstrated that a toll that is 25 percent higher than conventional estimation techniques, and 75 percent higher than the current toll, would be plausible for this facility.

This research sought to address a weakness in current preliminary planning for toll roads. Current methods of estimating toll revenue rely on per-mile industry practice or on a flat percentage of overall "average wage" for the area. This research showed that estimates of benefit to the prospective user (e.g., time saved), in combination with a prospective user incomes, would give the analyst a better estimate of the likely toll value of a facility.

Incorporating this type of toll rate estimator into available spreadsheet analysis tools should provide public agencies, toll authorities, and the investment community with a more reliable, verifiable method for making macroscopic preliminary planning decisions about the viability of a prospective toll road.

Not unexpectedly, answering questions about the relationship between income and toll road use raised more questions and exposed other weaknesses in assumptions and processes. The specific issues addressed in this research and suggestions for future research follow.

Regarding Value of Time Estimation

Estimates of the value of time exhibited from the study data showed a wide range of values, depending on time of day and direction of travel. The lowest estimated mean value of time saved was $5.44 per hour, with the highest mean being $14.81 per hour.

Value of time saved estimated as a percent of income was not consistent with the rules of thumb and general literature that places value of time at about 50 percent of "average wage." That conventional method may overestimate the willingness to pay for lower income travelers and may underestimate willingness to pay for higher income drivers. The possible response of higher income users to higher toll rates was not clear.

Results based on use of census tract median income as the representative statistic for income appear acceptable. Income categories represented by a small number of census tracts and low populations produced some analytical challenges, especially when trying to establish likely users and transactions per 1000 population. As population was the denominator in those calculations, the results showed higher usage rates than are likely warranted.

Regarding Estimation of Travelsheds

In order to estimate the income characteristics for a prospective toll road, it will be necessary to identify the geographic area from which potential patrons will be drawn, or the "travelshed." Two methods were considered for estimating the area that would represent the travelshed for the study site—visual estimation and select-link analysis. The visual estimation approach was pursued because its "quick and dirty" availability would be well suited to the very preliminary nature of the analysis intended. However, comparing the actual travelshed with the authors' visual estimation of the travelshed cast doubt on the use of that technique, at least as the sole method for estimating the travelshed. It would be worthwhile to examine the two techniques in combination to determine if there may be a variation of the visual estimation approach that is suitable.

Regarding Estimation of Revenues

The overarching purpose behind this research is to develop a simple, straightforward method of estimating travelers' willingness to pay tolls. Understanding that willingness to pay will allow network planners to develop macroscopic estimates of revenues using tools such as the Toll Viability Screening Tool (Smith et al. 2004) and other spreadsheet-based tools. This research made a valuable contribution toward that end. Additional work to incorporate these techniques into such a model remains to be done.

Observations

During the course of the research, some observations about practical implications of the results of this analysis came to light. These are not conclusions of the research, but rather considerations that the research suggests that may be significant, at least from a public policy standpoint.

Regarding Toll Acceptance and Toll Equity

An apparent increase in willingness to pay at higher income levels is evident in the data presented herein. As transportation network planning begins to place increasing expectations on toll revenue generation, at least two policy issues arise. The first is the notion of equity, particularly for the lower income travelers, who are underrepresented in the toll road data. While issues of fairness, entitlement, etc., may arise, the larger question is what is the most prudent way to gain maximum mobility from a network that includes both toll and non-toll roads. It may become clear at some point that some credit or discounting or public subsidy program that facilitates lower income users may be prudent public policy.

Future Work

Like many research projects, this one began with a fairly simple goal of improving the ability to estimate willingness to pay a toll. As assumptions about techniques and approaches were explored, many questions arose that deserve additional attention in future research. Toll road customers represent a marketplace of sorts and there is much yet to be learned about that market.

Other Factors as well as Travel Time Savings as a Surrogate for "Value"

For many good reasons, it would be very desirable for travel time savings to be an adequate surrogate for overall value of a toll segment to travelers. The wide range of values imputed based solely on travel time saved suggests that some of the other decision-making influences described in Chapter III are at work. Of particular interest is the notion of value of reliability, which shows up as significant in work done by Lam and Small (2001), as well as ongoing efforts to describe mobility needs by Schrank and Lomax (2005). Research to establish a relationship or some mechanism for estimating the role these other variables play, while still retaining the computational simplicity of value of time, would be extremely beneficial.

Estimating Prospective Revenues

One of the principal purposes of this research is to enable decision-makers to plan networks with reasonable estimates of revenue from prospective toll roads. Many factors influence revenues; customer VoT is but one of them. Numerous other factors, such as future travel demand, origin-destination (O-D) patterns, and competing alternative roads, all play a role potentially equal to or greater than the value of time for the prospective customers.

The importance of making reasonable projections of revenue remains high, and many of the insights gained in the current research will advance the prospects of such efforts. Using a technique called "select link analysis," network modelers can identify approximate demands and origin-destination patterns for an existing or proposed link on a network. The O-D data would allow the identification of census tracts, which would in turn allow estimation of income characteristics.

As a follow-on to this specific site analysis, the following research is recommended.

1. Work with the local metropolitan planning organization (MPO), the North Central Texas Council of Governments (NCTCOG), to identify travel model support that could achieve the select link analysis or other appropriate tool to identify expected demand and O-D patterns.
2. Using the O-D data, identify the census tracts that would be served and the approximate demand from those tracts.
3. Compare the income profile resulting from the O-D analysis with the income profile developed for the actual travelshed.
4. Using the income profiles, demand estimates, and the VoT analyses herein, employ the Toll Viability Screening Tool to estimate project revenues.

Updating Demographic Data

One of the intended strengths of this research is that it is based on readily available demographic data, rather than dependent on surveys of the potential customer base. That strength can also be a weakness, depending on the age of the data. Additional research is needed to develop an updating methodology that is both reliable and simple.

Decennial census income data are typically a year older than the date of the census, i.e., income data for the 2000 census is actually 1999 income data. During the latter half of the decade, such data may be seriously out of date. That concern may be particularly significant for the subject application, as toll roads are more frequently under consideration in developing areas than in fully developed areas. So the demographics are likely to be changing rapidly.

Updates from the United States Bureau of Census typically have two shortcomings. The first is that updates are often limited to population changes, and then usually limited to state or county level, rather than census tract. Occasionally, there will be income updates, but again, most often at the state level.

Fortunately, transportation demand models that are commonly maintained in the MPOs undergo period data updates in order to maintain the validity of their models. However, even those data will require some manipulation to satisfactorily incorporate them into the revenue estimation process.

Manual updates of population or income below the county level are very labor-intensive, especially without personal knowledge of local development patterns. Even with information about building permits and/or water connections, the translation to population or income updates is complicated and tedious. Future research to simplify and accelerate this process would be highly beneficial.

Estimating Sensitivity of Higher Incomes to Toll Rates

While some research has included income-related analyses, as yet there seems to be none that explores the elasticity of willingness to pay specifically by income category, as envisioned herein. As a part of understanding the marketplace better, some empirical analyses of elasticity in higher income (>$60,000) ranges is needed.

Comparing the Relative Results of Using Mean Income Instead of Median Income

Because of some of the anomalies observed with the use of median incomes, research to compare the same data set using mean incomes would be worthwhile. Notwithstanding the observation by Hensher and Goodwin (2004) that use of mean incomes can tend to overestimate revenue potential, that shortcoming should be considered in comparison to the accuracy of estimating usage based on this research.

Comparing Income Distributions of Toll and Non-toll Alternatives

Again, as a part of understanding the marketplace, there are undoubtedly users of the non-toll alternative to the SuperConnector that are not considered at all in this analysis. The magnitude of their numbers is unknown at this time. The unspoken presumption is those users have a different income distribution, but additional research is needed to ascertain whether that presumption is true.

REFERENCES

Brownstone, D., and Small, K.A. (2005). "Valuing time and reliability: Assessing the evidence from road pricing demonstrations." *Transportation Research Part A*, 39, 279-293.

Commissariat Général du Plan. (2001). *Transports: Choix des investissements et coût des nuisances* (*Transportation: Choice of investments and the cost of nuisances*). Government of France, Paris.

Gunn, H.F. (2000). "An introduction to the valuation of travel time savings and losses." In D.A. Hensher and K.J. Button (Eds.), *Handbook of Transport Modeling* (pp. 433-448). Edward Elgar Publishing Limited, Northampton, Mass.

Gunn, H.F. (2001). "Spatial and temporal transferability of relationships between travel demand, trip cost and travel time." *Transportation Research Part E*, 37, 163-189.

Hensher D.A. (2000). "Measurement of the valuation of travel time savings." *Journal of Transport Economics and Policy*, 35(1), 71-98.

Hensher, D.A., and Goodwin, P. (2004). "Using values of travel time savings for toll roads: Avoiding some common errors." *Transport Policy,* 11, 171-181.

"Imputed." (2006). Dictionary.com unabridged (v 1.0.1). Based on the Random House Unabridged Dictionary©, Random House, Inc. (Dictionary.com, http://dictionary.reference.com/browse/imputed) (October 13, 2006).

Lam, T.C., and Small, K.A. (2001). "The value of time and reliability: Measurement from a value pricing experiment." *Transportation Research E*, 37, 231-251.

Mackie, P.J., Wardman, M., Fowkes, A.S., Whelan, G., Nellthorp, J., and Bates, J. (2003). "Values of travel time savings in the UK: Summary report." (http://www.dft.gov.uk/stellent/groups/dft_econappr/documents/page/dft_econappr_022708-01.hcsp) (December 30, 2004).

MVA Consultancy. (1987). "The value of travel time savings." Institute for Transport Studies of the University of Leeds, and Transport Studies Unit of the University of Oxford.

"Rules, The." (2006). Colorado Department of Transportation. (http://www.dot.state.co.us/StateWidePlanning/PlansStudies/Docs/604-2-Planning%20Rules%202006%20Revisions051906.pdf) (May 19, 2006).

Schrank, D., and Lomax, T. (2005). "The 2005 urban mobility report." Texas Transportation Institute, College Station, TX.

Small, K.A., and Verhoef, E.T. (2007). "Urban transportation economics, Chapter 2." Routledge (a division of Taylor and Francis), forthcoming.

Smith, D.R., Chang-Albitres, C., Stockton, W.R., and Smith, C.R. (2004). "Development of a toll viability screening tool." *Research Rep. 4726-1*, Texas Transportation Institute, College Station, TX.

Stockton, W., Chang, C., Smith, D., and Smith, C. (2005). "Development of a toll viability screening tool." Paper presented at the 84th Annual Meeting of the Transportation Research Board, Washington, DC.

Sullivan, E. (2000). "Continuation study to evaluate the impacts of the SR-91 value-priced express lanes, final report." Traffic Operations Program, Cal Poly State University, San Luis Obispo, CA.

Texas Department of Transportation. (2004). "Preliminary feasibility tool." Software developed by the Texas Department of Transportation for internal use and for use by consultants.

Transport Canada. (1994). "Guide to benefit-cost analysis in Transport Canada, Ottawa." (http://www.tc.gc.ca/finance/BCA/en/TOC_e.htm) (July 21, 2006).

U.S. Census Bureau. (2000). "Selected historical decennial census population and housing counts." (http://www.census.gov/).

U.S. Department of Transportation. (1997). "The value of travel time: Departmental guidance for conducting economic evaluations." Author, Washington, DC.

Vermont Corridor Management Handbook. (2006). Appendix G – Glossary. (www.aot.state.vt.us/planning/Documents/Step1.pdf).

Wardman, M. (1998). "The value of travel time: A review of British evidence." *Journal of Transport Economics and Policy*, 32, 285-316.

Waters, W.G., II. (1996). "Values of travel time savings in road transport project evaluation." In D.A. Hensher, J. King, and T. Hoon Oum (Eds.), *Proceedings of 7th World Conference on Transport Research* (213-223). Pergamon, New York.

Weisstein, E.W. (2006). "Triangular distribution." From *MathWorld*—A Wolfram Web Resource. (http://mathworld.wolfram.com/TriangularDistribution.html)

APPENDIX A

COMPARISONS OF TRAVEL TIME DATA SUMMARIES ON TOLL ROAD AND ALTERNATIVE (FREE) ROUTE

FACILITY NAME: IH35E TO IH635
ROAD TYPE: MAIN LANES
DIRECTION: SOUTH BOUND
TIME PERIOD: PM PEAK

Filename:				*3SMS16H2.16D*			*3SMS16H2.16J*			*3SMS16H2.17F*			*3SMS16H2.18A*			*3SMS16H2.18H*					
Start Time:				*16:15:34*			*16:49:33*			*17:25:44*			*18:04:28*			*18:37:02*			***Time Period Averages***		
Date:				*8/22/2006*			*8/22/2006*			*8/22/2006*			*8/22/2006*			*8/22/2006*					
TRAVELED FACILITY	**SEGMENT CHECKPOINT**	**INT DIST (miles)**	**CUMM DIST (miles)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**
IH35E	FR SH121 ENTR	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**	**-----**
IH35E	SH121 (TOLLWAY) EN	0.230	0.23	0.26	0.26	54.05	0.25	0.25	55.83	0.35	0.35	38.96	0.24	0.24	57.78	0.25	0.25	55.83	**0.27**	**0.27**	**51.39**
IH35E	FRANKFORD EX	0.420	0.65	0.49	0.75	50.98	0.54	0.78	47.06	0.70	1.05	35.98	0.42	0.66	59.98	0.41	0.66	61.19	**0.51**	**0.78**	**49.18**
IH35E	FRANKFORD BRIDGE	0.130	0.78	0.15	0.90	52.58	0.14	0.92	55.71	0.15	1.20	52.58	0.12	0.77	67.63	0.12	0.78	63.07	**0.14**	**0.92**	**57.72**
IH35E	EB SH190 (PGBT) EX	0.440	1.22	0.43	1.33	61.61	0.42	1.34	62.83	0.43	1.63	61.63	0.42	1.19	62.83	0.44	1.23	59.35	**0.43**	**1.34**	**61.62**
IH35E	SB SH190 (PGBT) EX	0.320	1.54	0.31	1.64	61.34	0.31	1.65	62.95	0.30	1.94	62.99	0.30	1.50	62.99	0.30	1.53	62.99	**0.31**	**1.65**	**62.64**
IH35E	FRANKFORD ENTR	0.280	1.82	0.28	1.92	59.96	0.27	1.92	61.80	0.27	2.21	61.76	0.27	1.77	61.76	0.27	1.80	61.76	**0.27**	**1.92**	**61.40**
IH35E	SH190 (PGBT) BRIDGE	0.030	1.85	0.03	1.95	54.82	0.03	1.95	54.55	0.02	2.23	72.97	0.03	1.80	54.82	0.03	1.84	54.82	**0.03**	**1.96**	**57.63**
IH35E	SH190 (PGBT) ENTR	0.370	2.22	0.36	2.32	61.24	0.37	2.32	59.89	0.38	2.61	58.58	0.37	2.17	59.87	0.36	2.20	61.24	**0.37**	**2.32**	**60.15**
IH35E	SANDY LAKE EX	0.540	2.76	0.52	2.83	62.41	0.52	2.84	62.43	0.55	3.16	58.70	0.51	2.69	63.43	0.52	2.72	62.41	**0.52**	**2.85**	**61.83**
IH35E	SANDY LAKE BRIDGE	0.250	3.01	0.24	3.07	62.81	0.25	3.09	60.69	0.25	3.41	60.69	0.23	2.92	65.03	0.24	2.96	62.81	**0.24**	**3.09**	**62.36**
IH35E	NORTHSIDE BRIDGE	0.310	3.32	0.30	3.38	61.02	0.30	3.39	62.70	0.30	3.72	61.02	0.29	3.20	64.51	0.30	3.25	62.70	**0.30**	**3.39**	**62.36**
IH35E	BELTLINE BRIDGE	0.840	4.16	0.81	4.19	62.41	0.80	4.19	63.07	0.82	4.54	61.18	0.81	4.01	62.43	0.81	4.06	62.43	**0.81**	**4.20**	**62.30**
IH35E	CROSBY BRIDGE	0.530	4.69	0.54	4.72	59.38	0.52	4.70	61.27	0.52	5.06	61.27	0.53	4.54	60.30	0.52	4.58	61.27	**0.52**	**4.72**	**60.69**
IH35E	VALWOOD BRIDGE	0.620	5.31	0.65	5.37	57.16	0.60	5.31	61.85	0.61	5.67	61.02	0.63	5.17	58.64	0.63	5.21	59.41	**0.62**	**5.35**	**59.57**
IH35E	VALLEY VIEW BRIDG	1.100	6.41	1.20	6.57	54.87	1.12	6.43	58.90	1.12	6.79	58.90	1.13	6.30	58.47	1.06	6.27	62.10	**1.13**	**6.47**	**58.56**
IH35E	EB IH635 EX	0.190	6.60	0.21	6.79	53.19	0.19	6.62	60.16	0.21	7.00	53.19	0.19	6.49	60.16	0.17	6.44	65.90	**0.20**	**6.67**	**58.12**
IH35E	WB IH635 EX	0.620	7.22	0.62	7.41	60.21	0.63	7.24	59.42	0.68	7.68	55.07	0.62	7.11	60.21	0.58	7.03	63.59	**0.62**	**7.29**	**59.57**
IH635	SB IH35E EN	0.330	7.55	0.38	7.79	52.24	0.35	7.60	55.88	0.38	8.06	52.24	0.38	7.49	52.24	0.35	7.38	55.88	**0.37**	**7.66**	**53.64**
IH635	LUNA ROAD BRIDGE	1.140	8.69	1.20	8.99	56.87	1.10	8.70	61.96	1.15	9.21	59.30	1.04	8.53	65.89	1.03	8.41	66.42	**1.11**	**8.77**	**61.86**
IH635	VALLEY VIEW EX	0.650	9.34	0.67	9.66	58.44	0.61	9.31	63.97	0.62	9.83	63.12	0.60	9.13	64.86	0.58	9.00	66.67	**0.62**	**9.38**	**63.29**
IH635	PGBT (SH190) EX	0.210	9.55	0.21	9.86	61.17	0.20	9.51	63.69	0.20	10.03	63.74	0.21	9.33	61.17	0.20	9.19	63.74	**0.20**	**9.59**	**62.68**
IH635	PGBT (SH190) BRIDGE	0.450	10.00	0.44	10.31	60.70	0.43	9.94	63.04	0.43	10.46	63.01	0.44	9.77	61.83	0.44	9.63	61.83	**0.44**	**10.02**	**62.07**
IH635	PGBT (SH190) ENTR	0.270	10.27	0.26	10.57	61.44	0.26	10.20	61.44	0.26	10.72	61.44	0.26	10.03	63.45	0.26	9.89	61.44	**0.26**	**10.28**	**61.83**
IH635	MACARTHUR BRIDGE	0.680	10.95	0.70	11.27	58.26	0.68	10.88	59.66	0.68	11.40	59.66	0.66	10.69	61.90	0.64	10.54	63.49	**0.67**	**10.96**	**60.54**
IH635	OLYMPUS EX	0.310	11.26	0.32	11.59	57.88	0.35	11.23	53.76	0.32	11.72	57.88	0.33	11.02	56.45	0.31	10.85	59.42	**0.33**	**11.28**	**57.01**
Run Averages				-----	11.59	58.28	-----	11.23	60.16	-----	11.72	57.63	-----	11.02	61.33	-----	10.85	62.26	**-----**	**11.28**	**59.88**

Measured Travel Time (SB SH190 (PGBT) EX to PGBT (SH190) ENTR)

FACILITY NAME: IH635 TO IH35E
ROAD TYPE: MAIN LANES
DIRECTION: NORTH BOUND
TIME PERIOD: AM PEAK

Filename:				*6EME16H2.06G*			*6EME16H2.07B*			*6EME16H2.07I*			*6EME16H2.08E*					
Start Time:				*06:35:00*			*07:08:22*			*07:43:59*			*08:23:52*			***Time Period Averages***		
Date:				*8/24/2006*			*8/24/2006*			*8/24/2006*			*8/24/2006*					
TRAVELED FACILITY	**SEGMENT CHECKPOINT**	**INT DIST (miles)**	**CUMM DIST (miles)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**
IH635	OLYMPUS EN	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**	**-----**
IH635	MACAURTHUR BRID(	0.350	0.35	0.36	0.36	57.93	0.36	0.36	57.93	0.35	0.35	59.27	0.35	0.35	59.29	**0.36**	**0.36**	**58.60**
IH635	SB PGBT (SH190) EX	0.100	0.45	0.10	0.46	60.71	0.10	0.46	60.71	0.10	0.45	60.71	0.10	0.45	60.61	**0.10**	**0.46**	**60.68**
IH635	NB PGBT (SH190) EX	0.030	0.48	0.03	0.49	54.55	0.03	0.49	54.55	0.02	0.48	72.48	0.02	0.48	72.97	**0.03**	**0.49**	**62.34**
IH635	PGBT (SH190) BRIDGI	0.020	0.50	0.02	0.51	72.73	0.02	0.51	72.73	0.02	0.50	48.65	0.02	0.50	48.65	**0.02**	**0.51**	**58.30**
IH635	PGBT (SH190) ENTR	0.410	0.91	0.40	0.91	60.94	0.40	0.91	60.94	0.39	0.89	63.54	0.40	0.90	62.20	**0.40**	**0.90**	**61.89**
IH635	LUNA ROAD BRIDGE	0.970	1.88	0.91	1.82	64.21	0.95	1.86	61.42	0.91	1.80	63.64	0.90	1.80	64.81	**0.92**	**1.82**	**63.50**
IH635	NB IH35E EXIT	0.830	2.71	0.81	2.63	61.68	0.80	2.66	62.31	0.82	2.62	61.05	0.89	2.69	55.97	**0.83**	**2.65**	**60.14**
IH35E	IH635 EN	1.300	4.01	1.43	4.05	54.72	1.49	4.15	52.31	1.87	4.49	41.71	3.16	5.84	24.72	**1.99**	**4.63**	**39.28**
IH35E	VALLEY VIEW BRIDG	0.250	4.26	0.34	4.39	44.40	0.32	4.47	46.68	0.30	4.80	49.21	0.29	6.13	52.02	**0.31**	**4.95**	**47.91**
IH35E	VALWOOD BRIDGE	1.100	5.36	1.32	5.71	50.07	1.20	5.68	54.87	1.33	6.13	49.44	1.19	7.32	55.63	**1.26**	**6.21**	**52.36**
IH35E	CROSBY BRIDGE	0.640	6.00	0.61	6.32	62.99	0.64	6.32	59.75	0.67	6.80	57.54	0.65	7.97	58.99	**0.64**	**6.85**	**59.75**
IH35E	BELTLINE BRIDGE	0.510	6.51	0.51	6.83	59.90	0.52	6.84	58.96	0.54	7.33	57.14	0.52	8.49	58.96	**0.52**	**7.37**	**58.72**
IH35E	NORTHSIDE BRIDGE	0.840	7.35	0.86	7.69	58.82	0.89	7.73	56.64	0.89	8.22	56.65	0.86	9.34	58.82	**0.87**	**8.24**	**57.71**
IH35E	SANDY LAKE BRIDGI	0.320	7.67	0.33	8.02	58.27	0.32	8.05	59.75	0.32	8.54	59.75	0.30	9.65	62.99	**0.32**	**8.56**	**60.14**
IH35E	SANDY LAKE ENTR	0.160	7.83	0.17	8.19	55.44	0.16	8.21	61.34	0.17	8.72	55.49	0.15	9.80	64.72	**0.16**	**8.73**	**58.99**
IH35E	SH190 (PGBT) EX	0.570	8.40	0.62	8.81	55.35	0.58	8.78	59.29	0.63	9.35	53.90	0.60	10.40	56.87	**0.61**	**9.33**	**56.28**
IH35E	FRANKFORD EX	0.390	8.79	0.40	9.21	57.97	0.39	9.17	60.44	0.43	9.78	54.63	0.44	10.83	53.59	**0.41**	**9.75**	**56.53**
IH35E	SH190 (PGBT) BRIDGI	0.050	8.84	0.05	9.26	60.61	0.05	9.22	60.61	0.06	9.84	52.02	0.05	10.88	60.61	**0.05**	**9.80**	**58.21**
IH35E	WB SH190 (PGBT) EN	0.180	9.02	0.18	9.44	59.61	0.17	9.39	62.43	0.19	10.03	56.99	0.19	11.07	56.99	**0.18**	**9.98**	**58.92**
IH35E	NB SH190 (PGBT) ENT	0.400	9.42	0.39	9.83	61.96	0.40	9.80	59.45	0.41	10.44	58.25	0.41	11.48	58.28	**0.40**	**10.39**	**59.45**
IH35E	FRANKFORD BRIDGE	0.490	9.91	0.49	10.31	60.49	0.50	10.30	58.51	0.53	10.97	55.75	0.58	12.07	50.26	**0.53**	**10.91**	**55.98**
IH35E	FRANKFORD ENTR	0.100	10.01	0.09	10.41	66.18	0.10	10.40	60.71	0.12	11.08	52.02	0.11	12.18	55.99	**0.10**	**11.02**	**58.25**
IH35E	SH121 (TOLLWAY) EX	0.400	10.41	0.38	10.78	63.32	0.40	10.79	60.68	0.48	11.56	50.23	0.50	12.68	47.76	**0.44**	**11.45**	**54.71**
IH35E	FR SH121 EX	0.230	10.64	0.23	11.02	59.83	0.25	11.04	55.83	0.39	11.95	35.64	0.28	12.96	49.26	**0.29**	**11.74**	**48.20**
Run Averages				-----	11.02	57.96	-----	11.04	57.83	-----	11.95	53.44	-----	12.96	49.26	**-----**	**11.74**	**54.38**

Measured Travel Time

FACILITY NAME: IH635 TO IH35E
ROAD TYPE: MAIN LANES
DIRECTION: NORTH BOUND
TIME PERIOD: MIDDAY

Filename:				*6EME16H2.09G*			*6EME16H2.09L*			*6EME16H2.14A*			*6EME16H2.14F*			*6EME16H2.14L*					
Start Time:				*09:31:19*			*09:59:45*			*14:00:02*			*14:27:47*			*14:56:44*			***Time Period Averages***		
Date:				*8/24/2006*			*8/24/2006*			*8/24/2006*			*8/24/2006*			*8/24/2006*					
TRAVELED FACILITY	**SEGMENT CHECKPOINT**	**INT DIST (miles)**	**CUMM DIST (miles)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**
IH635	OLYMPUS EN	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**	**-----**
IH635	MACAURTHUR BRID(	0.350	0.35	0.37	0.37	56.63	0.36	0.36	57.93	0.40	0.40	53.10	0.41	0.41	50.99	0.35	0.35	60.66	**0.38**	**0.38**	**55.65**
IH635	SB PGBT (SH190) EX	0.100	0.45	0.10	0.47	60.71	0.10	0.46	60.71	0.10	0.49	60.71	0.12	0.53	52.02	0.10	0.45	60.71	**0.10**	**0.48**	**58.75**
IH635	NB PGBT (SH190) EX	0.030	0.48	0.03	0.50	54.55	0.03	0.49	54.55	0.03	0.53	54.55	0.03	0.56	54.55	0.02	0.47	72.97	**0.03**	**0.51**	**57.45**
IH635	PGBT (SH190) BRIDGI	0.020	0.50	0.02	0.52	72.73	0.02	0.51	72.73	0.02	0.54	72.73	0.02	0.58	48.65	0.02	0.49	48.65	**0.02**	**0.53**	**60.71**
IH635	PGBT (SH190) ENTR	0.410	0.91	0.39	0.91	63.54	0.40	0.91	62.20	0.40	0.94	62.20	0.42	1.01	58.55	0.39	0.88	63.51	**0.40**	**0.93**	**61.94**
IH635	LUNA ROAD BRIDGE	0.970	1.88	0.94	1.85	61.97	0.92	1.83	63.08	0.94	1.88	61.97	0.96	1.97	60.37	0.95	1.83	61.42	**0.94**	**1.87**	**61.75**
IH635	NB IH35E EXIT	0.830	2.71	0.78	2.63	63.62	0.81	2.64	61.67	0.86	2.74	58.12	0.84	2.81	59.26	0.80	2.63	62.31	**0.82**	**2.69**	**60.93**
IH35E	IH635 EN	1.300	4.01	1.34	3.97	58.09	1.37	4.00	57.03	1.44	4.18	54.10	1.47	4.28	53.19	1.42	4.05	55.05	**1.41**	**4.09**	**55.43**
IH35E	VALLEY VIEW BRIDC	0.250	4.26	0.28	4.25	53.54	0.30	4.30	50.59	0.27	4.45	55.18	0.29	4.56	52.02	0.30	4.34	50.56	**0.29**	**4.38**	**52.32**
IH35E	VALWOOD BRIDGE	1.100	5.36	1.19	5.44	55.63	1.18	5.48	56.02	1.19	5.64	55.25	1.14	5.70	58.05	1.29	5.63	51.36	**1.20**	**5.58**	**55.17**
IH35E	CROSBY BRIDGE	0.640	6.00	0.64	6.08	59.75	0.62	6.10	62.14	0.65	6.29	59.00	0.62	6.32	62.14	0.63	6.26	60.52	**0.63**	**6.21**	**60.68**
IH35E	BELTLINE BRIDGE	0.510	6.51	0.49	6.57	61.90	0.50	6.60	60.90	0.49	6.79	61.90	0.53	6.85	58.05	0.51	6.77	59.92	**0.51**	**6.72**	**60.50**
IH35E	NORTHSIDE BRIDGE	0.840	7.35	0.85	7.42	59.39	0.87	7.46	58.27	0.84	7.63	59.98	0.87	7.71	58.25	0.86	7.63	58.82	**0.86**	**7.57**	**58.93**
IH35E	SANDY LAKE BRIDGI	0.320	7.67	0.30	7.73	62.99	0.31	7.78	61.31	0.31	7.94	61.31	0.31	8.02	61.34	0.32	7.95	59.75	**0.31**	**7.88**	**61.32**
IH35E	SANDY LAKE ENTR	0.160	7.83	0.16	7.88	61.34	0.16	7.93	61.34	0.15	8.09	64.79	0.16	8.18	61.34	0.16	8.11	61.28	**0.15**	**8.04**	**61.99**
IH35E	SH190 (PGBT) EX	0.570	8.40	0.56	8.44	61.05	0.62	8.55	55.34	0.56	8.65	61.04	0.55	8.73	61.94	0.56	8.67	61.05	**0.57**	**8.61**	**59.98**
IH35E	FRANKFORD EX	0.390	8.79	0.38	8.82	61.74	0.40	8.95	59.19	0.37	9.02	63.13	0.40	9.13	59.19	0.40	9.06	59.17	**0.39**	**9.00**	**60.44**
IH35E	SH190 (PGBT) BRIDGI	0.050	8.84	0.04	8.86	72.87	0.05	9.00	60.61	0.05	9.07	60.61	0.05	9.18	60.61	0.05	9.11	60.81	**0.05**	**9.04**	**62.76**
IH35E	WB SH190 (PGBT) ENT	0.180	9.02	0.17	9.04	62.43	0.17	9.17	62.43	0.17	9.24	62.43	0.18	9.36	59.61	0.18	9.29	59.56	**0.18**	**9.22**	**61.26**
IH35E	NB SH190 (PGBT) ENT	0.400	9.42	0.40	9.44	59.43	0.41	9.58	58.25	0.39	9.63	61.99	0.40	9.75	60.68	0.40	9.70	59.45	**0.40**	**9.62**	**59.94**
IH35E	FRANKFORD BRIDGE	0.490	9.91	0.52	9.96	56.65	0.51	10.09	57.55	0.48	10.11	61.51	0.50	10.26	58.49	0.52	10.22	56.65	**0.51**	**10.13**	**58.11**
IH35E	FRANKFORD ENTR	0.100	10.01	0.10	10.06	60.71	0.10	10.19	60.71	0.09	10.20	66.30	0.10	10.36	60.71	0.11	10.32	55.99	**0.10**	**10.23**	**60.71**
IH35E	SH121 (TOLLWAY) EX	0.400	10.41	0.43	10.49	56.01	0.40	10.60	59.45	0.39	10.59	61.96	0.42	10.78	57.12	0.40	10.73	59.45	**0.41**	**10.63**	**58.73**
IH35E	FR SH121 EX	0.230	10.64	0.25	10.74	55.83	0.22	10.82	62.02	0.22	10.81	62.07	0.26	11.04	52.34	0.24	10.97	57.74	**0.24**	**10.87**	**57.76**
Run Averages				-----	10.74	59.47	-----	10.82	59.01	-----	10.81	59.06	-----	11.04	57.83	-----	10.97	58.22	**-----**	**10.87**	**58.71**

Measured Travel Time (NB PGBT (SH190) EX to NB SH190 (PGBT) ENT)

FACILITY NAME: IH635 TO IH35E
ROAD TYPE: MAIN LANES
DIRECTION: NORTH BOUND
TIME PERIOD: PM PEAK

Filename:				*6EME16H2.16A*			*6EME16H2.16F*			*6EME16H2.17B*			*6EME16H2.17I*			*6EME16H2.18D*					
Start Time:				*16:00:02*			*16:29:49*			*17:05:13*			*17:42:24*			*18:19:12*			***Time Period Averages***		
Date:				*8/22/2006*			*8/22/2006*			*8/22/2006*			*8/22/2006*			*8/22/2006*					
TRAVELED FACILITY	**SEGMENT CHECKPOINT**	**INT DIST (miles)**	**CUMM DIST (miles)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**
IH635	OLYMPUS EN	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**	**-----**
IH635	MACAURTHUR BRID(	0.350	0.35	0.34	0.34	62.16	0.35	0.35	59.27	0.33	0.33	63.73	0.35	0.35	59.29	0.35	0.35	59.29	**0.35**	**0.35**	**60.69**
IH635	SB PGBT (SH190) EX	0.100	0.45	0.10	0.44	60.71	0.09	0.44	66.30	0.10	0.43	60.71	0.10	0.45	60.71	0.11	0.46	55.99	**0.10**	**0.44**	**60.71**
IH635	NB PGBT (SH190) EX	0.030	0.48	0.02	0.46	72.97	0.03	0.48	54.55	0.02	0.45	72.48	0.02	0.48	72.48	0.02	0.49	72.97	**0.03**	**0.47**	**68.18**
IH635	PGBT (SH190) BRIDGI	0.020	0.50	0.02	0.48	72.73	0.02	0.49	72.73	0.02	0.48	48.65	0.02	0.50	48.65	0.02	0.51	48.65	**0.02**	**0.49**	**56.07**
IH635	PGBT (SH190) ENTR	0.410	0.91	0.40	0.88	60.94	0.40	0.90	60.94	0.44	0.91	56.34	0.39	0.89	63.54	0.40	0.91	60.92	**0.41**	**0.90**	**60.44**
IH635	LUNA ROAD BRIDGE	0.970	1.88	1.01	1.89	57.90	0.93	1.83	62.51	0.92	1.84	63.08	0.91	1.80	63.64	0.92	1.84	63.08	**0.94**	**1.84**	**61.97**
IH635	NB IH35E EXIT	0.830	2.71	0.83	2.72	59.84	0.83	2.66	59.84	0.81	2.64	61.67	0.77	2.57	64.98	0.78	2.62	63.63	**0.80**	**2.64**	**61.93**
IH35E	IH635 EN	1.300	4.01	1.43	4.14	54.72	1.42	4.08	55.05	1.34	3.99	58.09	1.49	4.06	52.31	1.29	3.91	60.68	**1.39**	**4.04**	**56.02**
IH35E	VALLEY VIEW BRID(	0.250	4.26	0.28	4.42	53.57	0.33	4.41	45.50	0.30	4.28	50.56	0.28	4.34	53.54	0.26	4.16	58.75	**0.29**	**4.32**	**52.02**
IH35E	VALWOOD BRIDGE	1.100	5.36	1.19	5.61	55.63	1.57	5.97	42.16	1.59	5.87	41.51	1.43	5.78	46.04	1.63	5.79	40.46	**1.48**	**5.81**	**44.55**
IH35E	CROSBY BRIDGE	0.640	6.00	0.65	6.26	59.00	0.82	6.79	47.08	0.89	6.76	43.15	0.82	6.60	46.61	0.63	6.42	61.33	**0.76**	**6.57**	**50.44**
IH35E	BELTLINE BRIDGE	0.510	6.51	0.49	6.75	62.96	0.58	7.37	52.31	0.83	7.60	36.77	0.58	7.18	52.31	0.54	6.96	56.28	**0.61**	**7.17**	**50.46**
IH35E	NORTHSIDE BRIDGE	0.840	7.35	0.94	7.69	53.66	1.24	8.61	40.78	1.12	8.72	44.98	1.02	8.21	49.33	0.84	7.80	59.96	**1.03**	**8.20**	**48.86**
IH35E	SANDY LAKE BRIDGI	0.320	7.67	0.44	8.12	43.97	0.40	9.01	48.57	0.43	9.14	44.82	0.37	8.58	51.80	0.30	8.10	64.76	**0.39**	**8.59**	**49.81**
IH35E	SANDY LAKE ENTR	0.160	7.83	0.29	8.41	33.29	0.32	9.33	29.88	0.38	9.52	25.33	0.20	8.77	48.53	0.16	8.26	61.34	**0.27**	**8.86**	**35.74**
IH35E	SH190 (PGBT) EX	0.570	8.40	0.79	9.20	43.25	0.82	10.15	41.51	0.76	10.28	45.12	0.67	9.44	51.25	0.55	8.81	61.96	**0.72**	**9.58**	**47.61**
IH35E	FRANKFORD EX	0.390	8.79	0.40	9.61	57.94	0.40	10.55	59.17	0.38	10.66	61.74	0.94	10.38	24.92	0.37	9.18	63.10	**0.50**	**10.07**	**47.02**
IH35E	SH190 (PGBT) BRIDGI	0.050	8.84	0.05	9.66	60.81	0.06	10.60	52.02	0.05	10.71	60.61	0.11	10.49	27.99	0.04	9.22	72.87	**0.06**	**10.14**	**49.21**
IH35E	WB SH190 (PGBT) EN	0.180	9.02	0.16	9.82	65.52	0.18	10.78	59.56	0.19	10.90	56.99	0.61	11.10	17.71	0.17	9.39	62.43	**0.26**	**10.40**	**40.96**
IH35E	NB SH190 (PGBT) ENT	0.400	9.42	0.37	10.19	64.75	0.47	11.25	51.12	0.96	11.86	24.90	1.12	12.22	21.42	0.37	9.76	64.72	**0.66**	**11.06**	**36.42**
IH35E	FRANKFORD BRIDGE	0.490	9.91	0.51	10.70	57.55	2.45	13.70	12.01	3.24	15.10	9.08	2.38	14.60	12.35	1.43	11.19	20.63	**2.00**	**13.06**	**14.70**
IH35E	FRANKFORD ENTR	0.100	10.01	0.22	10.92	26.97	0.32	14.02	18.67	0.38	15.48	15.83	0.68	15.28	8.77	0.32	11.51	18.67	**0.39**	**13.44**	**15.56**
IH35E	SH121 (TOLLWAY) EX	0.400	10.41	1.17	12.09	20.52	1.81	15.84	13.24	1.37	16.85	17.55	1.56	16.84	15.41	1.43	12.93	16.84	**1.47**	**14.91**	**16.37**
IH35E	FR SH121 EX	0.230	10.64	0.44	12.53	31.60	0.80	16.63	17.27	0.68	17.53	20.18	0.62	17.46	22.34	0.45	13.39	30.45	**0.60**	**15.51**	**23.07**
Run Averages				-----	12.53	50.94	-----	16.63	38.38	-----	17.53	36.41	-----	17.46	36.57	-----	13.39	47.68	**-----**	**15.51**	**41.16**

Measured Travel Time

FACILITY NAME: IH35E TO IH635
ROAD TYPE: MAIN LANES
DIRECTION: SOUTH BOUND
TIME PERIOD: AM PEAK

Filename:				*3SMS16H2.06K*			*3SMS16H2.07E*			*3SMS16H2.08A*			*3SMS16H2.08I*					
Start Time:				*06:51:09*			*07:22:16*			*08:00:19*			*08:40:11*			***Time Period Averages***		
Date:				*8/24/2006*			*8/24/2006*			*8/24/2006*			*8/24/2006*					
TRAVELED FACILITY	**SEGMENT CHECKPOINT**	**INT DIST (miles)**	**CUMM DIST (miles)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**
IH35E	FR SH121 ENTR	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**	**-----**
IH35E	SH121 (TOLLWAY) EN	0.230	0.23	0.45	0.45	31.01	0.83	0.83	16.58	1.14	1.14	12.14	1.20	1.20	11.47	**0.90**	**0.90**	**15.26**
IH35E	FRANKFORD EX	0.420	0.65	1.06	1.51	23.71	1.15	1.99	21.85	1.30	2.44	19.36	1.24	2.44	20.39	**1.19**	**2.09**	**21.20**
IH35E	FRANKFORD BRIDGE	0.130	0.78	0.17	1.68	45.09	0.18	2.17	43.05	0.17	2.61	45.09	0.18	2.62	43.05	**0.18**	**2.27**	**44.05**
IH35E	EB SH190 (PGBT) EX	0.440	1.22	0.46	2.14	57.23	0.49	2.66	53.41	0.52	3.13	50.87	0.56	3.18	47.11	**0.51**	**2.78**	**51.89**
IH35E	SB SH190 (PGBT) EX	0.320	1.54	0.31	2.46	61.31	0.32	2.98	59.75	0.34	3.47	56.83	0.31	3.49	61.34	**0.32**	**3.10**	**59.75**
IH35E	FRANKFORD ENTR	0.280	1.82	0.27	2.73	61.80	0.34	3.32	49.73	0.32	3.79	52.28	0.27	3.76	61.80	**0.30**	**3.40**	**55.87**
IH35E	SH190 (PGBT) BRIDGE	0.030	1.85	0.03	2.76	54.55	0.05	3.37	36.49	0.03	3.82	54.55	0.03	3.80	54.55	**0.04**	**3.44**	**48.54**
IH35E	SH190 (PGBT) ENTR	0.370	2.22	0.38	3.14	58.60	1.22	4.59	18.21	0.41	4.23	53.88	0.40	4.20	55.00	**0.60**	**4.04**	**36.79**
IH35E	SANDY LAKE EX	0.540	2.76	0.54	3.68	59.58	1.23	5.82	26.39	1.77	6.01	18.29	0.99	5.19	32.77	**1.13**	**5.17**	**28.60**
IH35E	SANDY LAKE BRIDGE	0.250	3.01	0.25	3.93	60.69	1.13	6.95	13.29	0.58	6.58	26.01	0.83	6.02	18.03	**0.70**	**5.87**	**21.55**
IH35E	NORTHSIDE BRIDGE	0.310	3.32	0.31	4.24	59.42	0.79	7.74	23.51	0.47	7.05	39.60	0.72	6.74	25.95	**0.57**	**6.44**	**32.48**
IH35E	BELTLINE BRIDGE	0.840	4.16	0.84	5.08	59.96	1.59	9.33	31.70	1.35	8.40	37.30	1.43	8.16	35.36	**1.30**	**7.74**	**38.72**
IH35E	CROSBY BRIDGE	0.530	4.69	0.55	5.64	57.61	0.95	10.27	33.56	1.43	9.84	22.18	1.84	10.00	17.31	**1.19**	**8.94**	**26.67**
IH35E	VALWOOD BRIDGE	0.620	5.31	0.68	6.32	54.40	0.81	11.08	46.07	1.07	10.91	34.73	1.78	11.78	20.90	**1.09**	**10.02**	**34.27**
IH35E	VALLEY VIEW BRIDGE	1.100	6.41	1.19	7.51	55.63	1.39	12.47	47.40	1.52	12.42	43.54	2.87	14.65	23.02	**1.74**	**11.76**	**37.92**
IH35E	EB IH635 EX	0.190	6.60	0.21	7.71	55.34	0.25	12.72	46.12	0.23	12.65	49.42	0.55	15.20	20.65	**0.31**	**12.07**	**36.90**
IH35E	WB IH635 EX	0.620	7.22	0.64	8.35	57.90	0.70	13.42	53.12	0.73	13.39	50.73	0.69	15.89	53.74	**0.69**	**12.76**	**53.75**
IH635	SB IH35E EN	0.330	7.55	0.37	8.73	53.39	0.41	13.83	48.08	0.43	13.82	46.23	0.43	16.32	46.23	**0.41**	**13.17**	**48.31**
IH635	LUNA ROAD BRIDGE	1.140	8.69	1.17	9.89	58.47	1.15	14.98	59.73	1.19	15.01	57.25	1.13	17.45	60.59	**1.16**	**14.33**	**58.98**
IH635	VALLEY VIEW EX	0.650	9.34	0.60	10.50	64.84	0.63	15.61	61.47	0.67	15.68	58.44	0.64	18.09	60.70	**0.64**	**14.97**	**61.28**
IH635	PGBT (SH190) EX	0.210	9.55	0.21	10.70	61.17	0.21	15.82	61.17	0.23	15.91	54.62	0.21	18.31	58.79	**0.21**	**15.18**	**58.81**
IH635	PGBT (SH190) BRIDGE	0.450	10.00	0.44	11.15	60.70	0.48	16.30	56.51	0.48	16.39	56.51	0.46	18.77	58.53	**0.47**	**15.65**	**58.01**
IH635	PGBT (SH190) ENTR	0.270	10.27	0.28	11.43	57.82	0.28	16.58	57.86	0.30	16.68	54.61	0.28	19.05	57.82	**0.28**	**15.93**	**56.99**
IH635	MACARTHUR BRIDGE	0.680	10.95	0.71	12.14	57.59	0.71	17.29	57.57	0.74	17.43	55.02	0.68	19.73	59.68	**0.71**	**16.64**	**57.42**
IH635	OLYMPUS EX	0.310	11.26	0.33	12.47	56.42	0.35	17.63	53.76	0.37	17.80	50.18	0.33	20.06	56.42	**0.34**	**16.99**	**54.07**
Run Averages				-----	12.47	54.20	-----	17.63	38.32	-----	17.80	37.96	-----	20.06	33.68	**-----**	**16.99**	**39.77**

Measured Travel Time (SB SH190 (PGBT) EX to PGBT (SH190) ENTR)

FACILITY NAME: IH35E TO IH635
ROAD TYPE: MAIN LANES
DIRECTION: SOUTH BOUND
TIME PERIOD: MIDDAY

Filename:				*3SMS16H2.09J*			*3SMS16H2.10C*			*3SMS16H2.14C*			*3SMS16H2.15C*					
Start Time:				*09:45:01*			*10:14:11*			*14:13:05*			*15:10:48*			***Time Period Averages***		
Date:				*8/24/2006*			*8/24/2006*			*8/24/2006*			*8/24/2006*					
TRAVELED FACILITY	**SEGMENT CHECKPOINT**	**INT DIST (miles)**	**CUMM DIST (miles)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**
IH35E	FR SH121 ENTR	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**	**-----**
IH35E	SH121 (TOLLWAY) EN	0.230	0.23	0.27	0.27	50.77	0.28	0.28	49.26	0.30	0.30	46.54	0.30	0.30	46.54	**0.29**	**0.29**	**48.21**
IH35E	FRANKFORD EX	0.420	0.65	0.49	0.76	51.83	0.45	0.73	55.61	0.46	0.76	54.60	0.45	0.74	56.63	**0.46**	**0.75**	**54.61**
IH35E	FRANKFORD BRIDGE	0.130	0.78	0.14	0.90	55.71	0.13	0.87	59.17	0.14	0.90	55.71	0.13	0.87	59.17	**0.14**	**0.88**	**57.39**
IH35E	EB SH190 (PGBT) EX	0.440	1.22	0.44	1.34	59.35	0.44	1.30	60.46	0.44	1.34	59.35	0.43	1.30	61.63	**0.44**	**1.32**	**60.18**
IH35E	SB SH190 (PGBT) EX	0.320	1.54	0.30	1.65	62.99	0.30	1.61	62.99	0.32	1.66	59.75	0.30	1.61	62.99	**0.31**	**1.63**	**62.14**
IH35E	FRANKFORD ENTR	0.280	1.82	0.27	1.92	61.76	0.27	1.88	61.80	0.28	1.94	59.96	0.29	1.89	58.27	**0.28**	**1.91**	**60.41**
IH35E	SH190 (PGBT) BRIDGE	0.030	1.85	0.03	1.95	54.82	0.03	1.91	54.55	0.03	1.98	54.55	0.02	1.92	72.48	**0.03**	**1.94**	**58.22**
IH35E	SH190 (PGBT) ENTR	0.370	2.22	0.37	2.32	59.87	0.36	2.27	61.24	0.39	2.36	57.34	0.39	2.31	57.34	**0.38**	**2.32**	**58.90**
IH35E	SANDY LAKE EX	0.540	2.76	0.54	2.86	60.50	0.55	2.83	58.70	0.54	2.90	60.50	0.54	2.84	60.50	**0.54**	**2.86**	**60.04**
IH35E	SANDY LAKE BRIDGE	0.250	3.01	0.26	3.11	58.75	0.26	3.09	56.89	0.27	3.17	55.18	0.25	3.09	60.69	**0.26**	**3.12**	**57.80**
IH35E	NORTHSIDE BRIDGE	0.310	3.32	0.30	3.41	62.70	0.42	3.51	44.27	0.30	3.48	61.02	0.32	3.41	57.88	**0.34**	**3.45**	**55.40**
IH35E	BELTLINE BRIDGE	0.840	4.16	0.81	4.22	62.43	1.00	4.51	50.56	0.88	4.36	57.16	0.87	4.28	58.25	**0.89**	**4.34**	**56.77**
IH35E	CROSBY BRIDGE	0.530	4.69	0.53	4.75	60.30	0.67	5.17	47.65	0.56	4.92	56.77	0.57	4.84	55.95	**0.58**	**4.92**	**54.75**
IH35E	VALWOOD BRIDGE	0.620	5.31	0.64	5.39	57.88	0.80	5.97	46.55	0.64	5.56	57.88	0.68	5.53	54.40	**0.69**	**5.61**	**53.75**
IH35E	VALLEY VIEW BRIDG	1.100	6.41	1.17	6.56	56.42	1.38	7.35	47.97	1.21	6.77	54.49	1.19	6.72	55.25	**1.24**	**6.85**	**53.32**
IH35E	EB IH635 EX	0.190	6.60	0.21	6.76	55.34	0.24	7.59	47.70	0.22	6.99	51.27	0.21	6.94	53.23	**0.22**	**7.07**	**51.73**
IH35E	WB IH635 EX	0.620	7.22	0.63	7.39	59.41	0.72	8.30	51.89	0.69	7.69	53.74	0.63	7.56	59.41	**0.67**	**7.74**	**55.91**
IH635	SB IH35E EN	0.330	7.55	0.36	7.75	54.62	0.39	8.69	51.14	0.40	8.08	50.08	0.37	7.93	53.39	**0.38**	**8.12**	**52.25**
IH635	LUNA ROAD BRIDGE	1.140	8.69	1.10	8.85	62.42	1.08	9.77	63.37	1.07	9.15	63.86	1.14	9.07	60.16	**1.10**	**9.21**	**62.42**
IH635	VALLEY VIEW EX	0.650	9.34	0.64	9.49	60.70	0.59	10.36	65.75	0.59	9.75	65.75	0.64	9.71	60.70	**0.62**	**9.83**	**63.12**
IH635	PGBT (SH190) EX	0.210	9.55	0.21	9.71	58.79	0.20	10.56	63.74	0.21	9.95	61.17	0.21	9.93	58.79	**0.21**	**10.04**	**60.55**
IH635	PGBT (SH190) BRIDGE	0.450	10.00	0.44	10.15	60.70	0.43	10.99	63.01	0.44	10.40	60.70	0.44	10.36	61.83	**0.44**	**10.48**	**61.54**
IH635	PGBT (SH190) ENTR	0.270	10.27	0.28	10.43	57.82	0.27	11.26	59.60	0.27	10.67	59.60	0.26	10.63	61.48	**0.27**	**10.75**	**59.60**
IH635	MACARTHUR BRIDGE	0.680	10.95	0.73	11.16	55.65	0.67	11.93	61.14	0.68	11.34	60.38	0.69	11.32	58.95	**0.69**	**11.44**	**58.95**
IH635	OLYMPUS EX	0.310	11.26	0.34	11.50	55.06	0.34	12.27	55.06	0.32	11.67	57.88	0.34	11.66	55.08	**0.33**	**11.77**	**55.74**
Run Averages				-----	11.50	58.74	-----	12.27	55.07	-----	11.67	57.91	-----	11.66	57.95	**-----**	**11.77**	**57.38**

Measured Travel Time

FACILITY NAME: SH190 MAIN ROUTE
ROAD TYPE: MAIN LANES
DIRECTION: SOUTH BOUND
TIME PERIOD: PM PEAK

Filename:				*MRMS16H2.16G*			*MRMS16H2.16L*		
Start Time:				*16:33:53*			*16:59:09*		
Date:				*8/29/2006*			*8/29/2006*		
TRAVELED FACILITY	**SEGMENT CHECKPOINT**	**INT DIST (miles)**	**CUMM DIST (miles)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**
IH35E	FR SH121 ENTR	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IH35E	SH121 ENTR	0.230	0.23	0.26	0.26	52.91	0.25	0.25	55.83
IH35E	FRANKFORD EXIT	0.420	0.65	0.54	0.80	46.90	0.40	0.65	62.43
IH35E	FRANKFORD BRIDGE	0.130	0.78	0.16	0.96	47.32	0.12	0.77	63.16
IH35E	EB SH190 (PGBT) EXIT	0.440	1.22	0.49	1.46	53.41	0.42	1.19	62.83
IH35E	SB SH190 (PGBT) EXIT	0.320	1.54	0.32	1.78	59.75	0.31	1.50	62.95
IH35E	IH35E RAMP MERGE	0.370	1.91	0.40	2.18	55.00	0.40	1.90	55.00
SH190	IH35E ENTRANCE	0.190	2.10	0.20	2.38	57.67	0.21	2.11	55.34
SH190	SANDY LAKE EXIT	0.380	2.48	0.35	2.73	64.35	0.37	2.48	61.51
SH190	SANDY LAKE ENTRA	0.540	3.02	0.51	3.25	63.43	0.55	3.03	58.70
SH190	TOLLBRIDGE	0.460	3.48	0.43	3.67	64.44	0.44	3.48	62.05
SH190	BELTLINE EXIT	0.180	3.66	0.18	3.85	59.56	0.17	3.65	62.37
SH190	BELTLINE ENTRANCE	0.950	4.61	0.90	4.75	63.47	0.90	4.55	63.47
SH190	VALLEY VIEW EXIT	1.570	6.18	1.51	6.26	62.48	1.48	6.03	63.52
SH190	VALLEY VIEW ENTRA	0.260	6.44	0.26	6.52	61.06	0.25	6.28	63.12
SH190	WB IH635 EXIT	0.490	6.93	0.49	7.01	59.47	0.50	6.78	58.51
IH635	SB SH190 (PGBT) ENT	0.480	7.41	0.49	7.50	59.26	0.50	7.28	57.31
IH635	MACARTHUR BRIDGE	0.690	8.10	0.70	8.20	59.11	0.71	7.99	58.42
IH635	OLYMPUS EXIT	0.320	8.42	0.33	8.53	58.27	0.33	8.32	58.27
Run Averages				-----	8.53	59.25	-----	8.32	60.71

Filename:		*MRMS16H2.17E*			*MRMS16H2.17J*			*MRMS16H2.18D*		
Start Time:		*17:22:51*			*17:49:12*			*18:15:10*		
Date:		*8/29/2006*			*8/29/2006*			*8/29/2006*		
TRAVELED FACILITY	**SEGMENT CHECKPOINT**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**
IH35E	FR SH121 ENTR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IH35E	SH121 ENTR	0.76	0.76	18.27	0.28	0.28	49.58	0.23	0.23	59.83
IH35E	FRANKFORD EXIT	1.31	2.07	19.24	0.48	0.76	52.74	0.86	1.09	29.41
IH35E	FRANKFORD BRIDGE	0.16	2.23	47.32	0.13	0.89	59.17	0.16	1.24	49.79
IH35E	EB SH190 (PGBT) EXIT	0.47	2.70	56.23	0.43	1.32	61.61	0.45	1.70	58.26
IH35E	SB SH190 (PGBT) EXIT	0.30	3.00	62.99	0.31	1.63	61.34	0.31	2.01	61.34
IH35E	IH35E RAMP MERGE	0.40	3.40	56.13	0.41	2.04	53.88	0.40	2.41	55.00
SH190	IH35E ENTRANCE	0.20	3.60	57.62	0.21	2.25	55.34	0.19	2.60	60.16
SH190	SANDY LAKE EXIT	0.37	3.97	61.51	0.37	2.62	61.51	0.37	2.97	61.48
SH190	SANDY LAKE ENTRA	0.53	4.50	61.44	0.53	3.15	61.44	0.49	3.46	66.67
SH190	TOLLBRIDGE	0.44	4.93	63.21	0.43	3.57	64.44	0.40	3.86	68.37
SH190	BELTLINE EXIT	0.17	5.11	62.43	0.17	3.75	62.43	0.16	4.03	65.52
SH190	BELTLINE ENTRANCE	0.93	6.04	61.22	0.91	4.65	62.89	0.88	4.91	64.66
SH190	VALLEY VIEW EXIT	1.52	7.55	62.14	1.52	6.17	62.14	1.41	6.32	66.86
SH190	VALLEY VIEW ENTRA	0.26	7.81	61.06	0.25	6.42	63.12	0.25	6.57	63.12
SH190	WB IH635 EXIT	0.53	8.34	55.75	0.52	6.94	56.65	0.47	7.04	62.60
IH635	SB SH190 (PGBT) ENT	0.51	8.85	56.40	0.53	7.46	54.61	0.46	7.50	62.43
IH635	MACARTHUR BRIDGE	0.70	9.55	59.11	0.74	8.20	55.83	0.65	8.15	63.59
IH635	OLYMPUS EXIT	0.34	9.88	56.83	0.35	8.55	55.49	0.30	8.45	62.99
Run Averages		-----	9.88	51.11	-----	8.55	59.09	-----	8.45	59.76

Filename:		*MRMS16H2.18H*			*MRMS16H2.*	
Start Time:		*18:38:10*			*18:49:11*	
Date:		*8/29/2006*			*8/29/2006*	
TRAVELED FACILITY	**SEGMENT CHECKPOINT**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**
IH35E	FR SH121 ENTR	0.00	0.00	0.00	0.00	0.00
IH35E	SH121 ENTR	0.24	0.24	57.78	0.21	0.21
IH35E	FRANKFORD EXIT	0.42	0.66	59.98	0.39	0.59
IH35E	FRANKFORD BRIDGE	0.13	0.79	59.17	0.12	0.72
IH35E	EB SH190 (PGBT) EXIT	0.43	1.22	61.61	0.45	1.17
IH35E	SB SH190 (PGBT) EXIT	0.30	1.52	62.99	0.35	1.52
IH35E	IH35E RAMP MERGE	0.40	1.92	56.13	0.37	1.89
SH190	IH35E ENTRANCE	0.20	2.12	57.67	0.18	2.07
SH190	SANDY LAKE EXIT	0.36	2.48	62.90	0.36	2.43
SH190	SANDY LAKE ENTRA	0.48	2.96	67.81	0.50	2.93
SH190	TOLLBRIDGE	0.43	3.39	64.41	0.42	3.35
SH190	BELTLINE EXIT	0.18	3.57	59.61	0.16	3.52
SH190	BELTLINE ENTRANCE	0.90	4.47	63.47	0.86	4.37
SH190	VALLEY VIEW EXIT	1.42	5.88	66.47	1.42	5.79
SH190	VALLEY VIEW ENTRA	0.24	6.12	65.32	0.25	6.04
SH190	WB IH635 EXIT	0.50	6.62	58.49	0.53	6.57
IH635	SB SH190 (PGBT) ENT	0.49	7.11	59.26	0.49	7.06
IH635	MACARTHUR BRIDGE	0.70	7.81	59.11	0.80	7.86
IH635	OLYMPUS EXIT	0.30	8.12	62.99	0.38	8.24
Run Averages		-----	8.12	62.25	-----	8.24

Measured Travel Time (SB SH190 (PGBT) EXIT to SB SH190 (PGBT) ENT)

FACILITY NAME: SH190 MAIN ROUTE
ROAD TYPE: MAIN LANES
DIRECTION: NORTH BOUND
TIME PERIOD: AM PEAK

Filename:				*MRMN16H2.06E*			*MRMN16H2.06L*			*MRMN16H2.07I*			*MRMN16H2.08D*			*MRMN16H2.08I*					
Start Time:				*06:24:47*			*06:56:16*			*07:44:44*			*08:15:47*			*08:42:07*			***Time Period Averages***		
Date:				*8/29/2006*			*8/29/2006*			*8/29/2006*			*8/29/2006*			*8/29/2006*					
TRAVELED FACILITY	**SEGMENT CHECKPOINT**	**INT DIST (miles)**	**CUMM DIST (miles)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**
IH635	OLYMPUS ENTR	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**	**-----**
IH635	MACARTHUR BRIDGI	0.350	0.35	0.34	0.34	62.16	0.35	0.35	60.69	0.40	0.40	53.10	0.35	0.35	60.69	0.32	0.32	65.35	**0.35**	**0.35**	**60.11**
IH635	SB SH190 (PGBT) EXIT	0.100	0.45	0.09	0.43	66.18	0.12	0.46	52.02	0.10	0.49	60.71	0.10	0.44	60.71	0.10	0.42	60.71	**0.10**	**0.45**	**59.70**
IH635	NB SH190 (PGBT) EXI	0.410	0.86	0.39	0.82	63.54	0.39	0.85	63.51	0.39	0.88	63.51	0.40	0.85	60.94	0.38	0.80	64.91	**0.39**	**0.84**	**63.26**
SH190	EB IH635 ENTR	0.290	1.15	0.27	1.09	63.97	0.29	1.14	60.35	0.28	1.16	62.11	0.30	1.15	58.65	0.27	1.07	64.01	**0.28**	**1.12**	**61.75**
SH190	VALLEY VIEW EXIT	0.720	1.87	0.73	1.81	59.59	0.74	1.88	58.26	0.73	1.89	59.59	0.73	1.87	59.59	0.71	1.78	60.96	**0.73**	**1.85**	**59.58**
SH190	VALLEY VIEW ENTR	0.330	2.20	0.32	2.13	61.62	0.31	2.19	63.26	0.30	2.19	64.95	0.30	2.18	64.95	0.30	2.08	66.78	**0.31**	**2.15**	**64.26**
SH190	BELTLINE EXIT	1.790	3.99	1.62	3.75	66.47	1.65	3.84	65.18	1.67	3.86	64.22	1.62	3.80	66.17	1.65	3.72	65.18	**1.64**	**3.80**	**65.43**
SH190	BELTLINE ENTRANCI	0.920	4.91	0.83	4.58	66.33	0.86	4.70	64.42	0.89	4.75	62.05	0.83	4.63	66.33	0.82	4.54	67.67	**0.85**	**4.64**	**65.30**
SH190	TOLLBRIDGE	0.140	5.05	0.14	4.72	60.00	0.13	4.83	63.72	0.13	4.89	63.72	0.13	4.76	63.72	0.13	4.67	63.72	**0.13**	**4.77**	**62.94**
SH190	SANDY LAKE EXIT	0.450	5.50	0.41	5.13	65.53	0.40	5.23	66.89	0.43	5.31	63.01	0.42	5.18	64.26	0.41	5.08	65.56	**0.42**	**5.19**	**65.02**
SH190	SANDY LAKE ENTRA	0.530	6.03	0.49	5.63	64.33	0.47	5.70	67.71	0.52	5.83	61.27	0.56	5.74	56.75	0.47	5.55	67.71	**0.50**	**5.69**	**63.27**
SH190	IH35E EXIT	0.290	6.32	0.28	5.91	62.14	0.26	5.96	68.15	0.28	6.11	62.11	0.30	6.04	58.68	0.26	5.81	68.15	**0.27**	**5.97**	**63.63**
SH190	SB IH35E EXIT	0.210	6.53	0.21	6.12	58.79	0.20	6.15	63.69	0.23	6.34	54.62	0.22	6.26	56.63	0.20	6.01	63.69	**0.21**	**6.18**	**59.26**
IH35E	NB SH190 (PGBT) ENT	0.820	7.35	0.87	6.99	56.88	0.79	6.95	62.21	0.89	7.23	55.29	0.86	7.13	56.88	0.86	6.86	57.42	**0.85**	**7.03**	**57.64**
IH35E	FRANKFORD BRIDGE	0.490	7.84	0.46	7.45	63.73	0.45	7.40	64.88	0.48	7.71	61.53	0.51	7.64	57.55	0.57	7.43	51.72	**0.49**	**7.53**	**59.47**
IH35E	FRANKFORD ENTR	0.060	7.90	0.06	7.51	62.43	0.05	7.45	72.73	0.07	7.78	54.68	0.07	7.70	54.55	0.07	7.51	48.54	**0.06**	**7.59**	**57.48**
IH35E	SH121 (TOLLOWAY) E	0.450	8.35	0.46	7.97	58.50	0.42	7.87	64.26	0.45	8.23	59.58	0.51	8.21	52.87	0.53	8.03	51.22	**0.47**	**8.06**	**56.90**
IH35E	FR SH121 EX	0.230	8.58	0.26	8.22	54.05	0.22	8.09	62.07	0.26	8.49	54.05	0.25	8.46	55.83	0.25	8.28	55.83	**0.25**	**8.31**	**56.22**
Run Averages				-----	8.22	62.60	-----	8.09	63.63	-----	8.49	60.66	-----	8.46	60.84	-----	8.28	62.17	**-----**	**8.31**	**61.96**

Measured Travel Time

FACILITY NAME: SH190 MAIN ROUTE
ROAD TYPE: MAIN LANES
DIRECTION: NORTH BOUND
TIME PERIOD: MIDDAY

Filename:				*MRMN16H3.09H*			*MRMN16H3.09L*			*MRMN16H3.10D*			*MRMN16H3.14D*			*MRMN16H3.14H*			*MRMN16H3.14L*				
Start Time:				*09:37:25*			*09:57:57*			*10:18:53*			*14:15:41*			*14:37:50*			*14:58:58*			***Time Period Av***	
Date:				*8/30/2006*			*8/30/2006*			*8/30/2006*			*8/30/2006*			*8/30/2006*			*8/30/2006*				
TRAVELED FACILITY	**SEGMENT CHECKPOINT**	**INT DIST (miles)**	**CUMM DIST (miles)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**
IH635	OLYMPUS ENTR	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
IH635	MACARTHUR BRIDGI	0.350	0.35	0.31	0.31	67.09	0.33	0.33	63.70	0.31	0.31	67.09	0.32	0.32	65.35	0.35	0.35	60.69	0.36	0.36	57.93	**0.33**	**0.33**
IH635	SB SH190 (PGBT) EXIT	0.100	0.45	0.10	0.41	60.71	0.09	0.42	66.18	0.09	0.40	66.18	0.09	0.41	66.18	0.10	0.44	60.71	0.10	0.46	60.71	**0.09**	**0.43**
IH635	NB SH190 (PGBT) EXI	0.410	0.86	0.36	0.77	67.86	0.39	0.81	63.54	0.38	0.78	64.91	0.44	0.85	56.34	0.40	0.85	60.94	0.40	0.86	60.94	**0.40**	**0.82**
SH190	EB IH635 ENTR	0.290	1.15	0.28	1.05	62.11	0.27	1.08	64.01	0.30	1.08	58.65	0.31	1.16	55.56	0.29	1.14	60.35	0.30	1.16	58.65	**0.29**	**1.11**
SH190	VALLEY VIEW EXIT	0.720	1.87	0.72	1.77	60.27	0.70	1.78	61.68	0.69	1.77	62.43	0.77	1.93	56.38	0.73	1.87	58.91	0.73	1.89	59.59	**0.72**	**1.83**
SH190	VALLEY VIEW ENTR	0.330	2.20	0.31	2.08	63.26	0.31	2.09	63.26	0.31	2.08	63.23	0.32	2.25	61.62	0.32	2.19	61.62	0.30	2.19	64.95	**0.31**	**2.15**
SH190	BELTLINE EXIT	1.790	3.99	1.69	3.77	63.59	1.60	3.69	67.19	1.69	3.77	63.59	1.75	4.00	61.20	1.68	3.87	63.90	1.68	3.87	63.90	**1.68**	**3.83**
SH190	BELTLINE ENTRANCI	0.920	4.91	0.87	4.65	63.21	0.85	4.54	65.04	0.86	4.63	64.42	0.91	4.91	60.92	0.87	4.75	63.21	0.86	4.73	64.42	**0.87**	**4.70**
SH190	TOLLBRIDGE	0.140	5.05	0.12	4.77	68.02	0.13	4.67	63.72	0.14	4.77	59.93	0.14	5.05	59.93	0.14	4.89	60.00	0.13	4.86	63.72	**0.13**	**4.83**
SH190	SANDY LAKE EXIT	0.450	5.50	0.42	5.19	64.23	0.42	5.09	64.26	0.42	5.19	64.26	0.44	5.50	60.70	0.44	5.32	61.83	0.42	5.28	64.26	**0.43**	**5.26**
SH190	SANDY LAKE ENTRA	0.530	6.03	0.50	5.69	63.28	0.48	5.57	66.55	0.50	5.69	63.28	0.53	6.02	60.30	0.49	5.81	65.41	0.50	5.78	63.26	**0.50**	**5.76**
SH190	IH35E EXIT	0.290	6.32	0.27	5.96	64.01	0.25	5.82	70.40	0.27	5.96	64.01	0.27	6.29	64.01	0.27	6.08	64.01	0.27	6.06	64.01	**0.27**	**6.03**
SH190	SB IH35E EXIT	0.210	6.53	0.21	6.17	61.17	0.20	6.01	63.69	0.21	6.17	61.17	0.21	6.50	61.17	0.21	6.29	61.17	0.20	6.25	63.74	**0.20**	**6.23**
IH35E	NB SH190 (PGBT) ENT	0.820	7.35	0.82	6.99	60.32	0.83	6.85	59.13	0.82	6.99	60.32	0.91	7.41	53.80	0.86	7.14	57.42	0.82	7.07	60.32	**0.84**	**7.07**
IH35E	FRANKFORD BRIDGE	0.490	7.84	0.55	7.54	53.26	0.47	7.32	62.60	0.49	7.47	60.47	0.56	7.98	52.47	0.52	7.66	56.65	0.54	7.61	54.06	**0.52**	**7.60**
IH35E	FRANKFORD ENTR	0.060	7.90	0.07	7.61	48.54	0.07	7.38	54.68	0.07	7.55	48.54	0.07	8.05	48.65	0.07	7.73	54.55	0.07	7.68	54.68	**0.07**	**7.67**
IH35E	SH121 (TOLLOWAY) E	0.450	8.35	0.49	8.10	55.56	0.48	7.86	56.49	0.52	8.07	52.02	0.53	8.58	51.20	0.50	8.23	53.73	0.48	8.16	56.49	**0.50**	**8.16**
IH35E	FR SH121 EX	0.230	8.58	0.23	8.33	59.83	0.24	8.10	57.78	0.23	8.30	59.83	0.26	8.83	54.01	0.24	8.47	57.74	0.23	8.39	59.83	**0.24**	**8.40**
Run Averages				-----	8.33	61.81	-----	8.10	63.56	-----	8.30	62.05	-----	8.83	58.29	-----	8.47	60.78	-----	8.39	61.38	**-----**	**8.40**

Measured Travel Time

FACILITY NAME: SH190 MAIN ROUTE
ROAD TYPE: MAIN LANES
DIRECTION: NORTH BOUND
TIME PERIOD: PM PEAK

Filename:				*MRMN16H2.16E*			*MRMN16H2.16I*			*MRMN16H2.17B*			*MRMN16H2.17G*			*MRMN16H2.18A*			*MRMN16H2.18F*				
Start Time:				*16:20:04*			*16:44:34*			*17:09:44*			*17:34:57*			*18:01:59*			*18:25:26*			***Time Period Av***	
Date:				*8/29/2006*			*8/29/2006*			*8/29/2006*			*8/29/2006*			*8/29/2006*			*8/29/2006*				
TRAVELED FACILITY	**SEGMENT CHECKPOINT**	**INT DIST (miles)**	**CUMM DIST (miles)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**
IH635	OLYMPUS ENTR	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**
IH635	MACARTHUR BRIDGI	0.350	0.35	0.32	0.32	65.35	0.33	0.33	63.73	0.32	0.32	65.39	0.33	0.33	63.73	0.33	0.33	63.73	0.32	0.32	65.35	**0.33**	**0.33**
IH635	SB SH190 (PGBT) EXIT	0.100	0.45	0.09	0.41	66.30	0.10	0.43	60.71	0.09	0.41	66.18	0.09	0.42	66.18	0.09	0.42	66.18	0.10	0.42	60.71	**0.09**	**0.42**
IH635	NB SH190 (PGBT) EXI	0.410	0.86	0.40	0.82	60.92	0.40	0.82	62.20	0.40	0.82	60.94	0.39	0.81	63.54	0.39	0.81	63.54	0.39	0.81	63.54	**0.39**	**0.81**
SH190	EB IH635 ENTR	0.290	1.15	0.30	1.11	58.68	0.30	1.13	57.08	0.30	1.12	57.08	0.29	1.10	60.35	0.30	1.10	58.65	0.29	1.10	60.31	**0.30**	**1.11**
SH190	VALLEY VIEW EXIT	0.720	1.87	0.78	1.89	55.20	0.81	1.94	53.51	0.75	1.87	57.61	0.78	1.88	55.20	0.73	1.83	59.59	0.72	1.82	59.59	**0.76**	**1.87**
SH190	VALLEY VIEW ENTR	0.330	2.20	0.33	2.22	60.06	0.33	2.27	60.06	0.30	2.17	64.95	0.34	2.22	58.61	0.31	2.14	63.23	0.31	2.13	63.26	**0.32**	**2.19**
SH190	BELTLINE EXIT	1.790	3.99	1.71	3.94	62.67	1.76	4.03	60.92	1.69	3.86	63.59	1.72	3.94	62.37	1.75	3.89	61.49	1.71	3.84	62.97	**1.72**	**3.92**
SH190	BELTLINE ENTRANCI	0.920	4.91	0.91	4.84	60.92	0.92	4.95	59.82	0.89	4.75	62.05	0.90	4.84	61.47	0.88	4.77	62.61	0.87	4.71	63.21	**0.90**	**4.81**
SH190	TOLLBRIDGE	0.140	5.05	0.13	4.98	63.72	0.13	5.08	63.72	0.14	4.89	59.93	0.13	4.97	63.72	0.13	4.90	63.72	0.14	4.85	60.00	**0.13**	**4.95**
SH190	SANDY LAKE EXIT	0.450	5.50	0.41	5.39	65.53	0.42	5.50	64.26	0.43	5.32	63.04	0.42	5.39	64.26	0.43	5.33	63.04	0.42	5.27	64.26	**0.42**	**5.37**
SH190	SANDY LAKE ENTRA	0.530	6.03	0.50	5.89	63.28	0.49	6.00	64.33	0.54	5.87	58.47	0.52	5.91	61.27	0.49	5.82	64.33	0.51	5.78	62.25	**0.51**	**5.88**
SH190	IH35E EXIT	0.290	6.32	0.28	6.17	62.11	0.27	6.27	64.01	0.29	6.15	60.35	0.39	6.29	44.92	0.26	6.08	68.10	0.27	6.06	64.01	**0.29**	**6.17**
SH190	SB IH35E EXIT	0.210	6.53	0.21	6.38	61.17	0.21	6.48	61.17	0.22	6.38	56.63	0.23	6.53	54.62	0.21	6.29	61.21	0.21	6.26	61.17	**0.21**	**6.38**
IH35E	NB SH190 (PGBT) ENT	0.820	7.35	0.99	7.37	49.76	0.96	7.44	51.04	0.98	7.36	50.19	2.22	8.75	22.12	0.89	7.18	55.29	0.91	7.17	54.28	**1.16**	**7.54**
IH35E	FRANKFORD BRIDGE	0.490	7.84	1.17	8.54	25.13	1.33	8.77	22.17	1.89	9.25	15.51	2.24	10.99	13.12	1.34	8.52	21.89	1.57	8.74	18.68	**1.59**	**9.13**
IH35E	FRANKFORD ENTR	0.060	7.90	0.34	8.87	10.66	0.24	9.00	15.06	0.29	9.54	12.49	0.41	11.40	8.74	0.20	8.72	18.21	0.19	8.93	19.00	**0.28**	**9.41**
IH35E	SH121 (TOLLOWAY) E	0.450	8.35	1.03	9.90	26.22	0.89	9.89	30.34	1.23	10.77	22.00	1.11	12.51	24.28	1.02	9.74	26.43	0.96	9.89	28.01	**1.04**	**10.45**
IH35E	FR SH121 EX	0.230	8.58	0.26	10.17	52.34	0.28	10.17	49.29	0.29	11.06	47.83	0.26	12.77	54.01	0.30	10.03	46.54	0.25	10.14	55.83	**0.27**	**10.72**
Run Averages				-----	10.17	50.64	-----	10.17	50.60	-----	11.06	46.56	-----	12.77	40.31	-----	10.03	51.30	-----	10.14	50.76	**-----**	**10.72**

Measured Travel Time (NB SH190 (PGBT) EXI through NB SH190 (PGBT) ENT)

FACILITY NAME: SH190 MAIN ROUTE
ROAD TYPE: MAIN LANES
DIRECTION: SOUTH BOUND
TIME PERIOD: AM PEAK

Filename:				*MRMS16H2.06I*			*MRMS16H2.07L*			*MRMS16H2.08F*					
Start Time:				*06:40:43*			*07:56:46*			*08:28:48*			***Time Period Averages***		
Date:				*8/29/2006*			*8/29/2006*			*8/29/2006*					
TRAVELED FACILITY	**SEGMENT CHECKPOINT**	**INT DIST (miles)**	**CUMM DIST (miles)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**
IH35E	FR SH121 ENTR	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**	**-----**
IH35E	SH121 ENTR	0.230	0.23	0.44	0.44	31.02	0.66	0.66	20.94	0.75	0.75	18.41	**0.62**	**0.62**	**22.34**
IH35E	FRANKFORD EXIT	0.420	0.65	1.25	1.70	20.12	1.80	2.46	13.97	2.08	2.83	12.09	**1.71**	**2.33**	**14.70**
IH35E	FRANKFORD BRIDGE	0.130	0.78	0.17	1.87	45.09	0.33	2.79	23.66	0.21	3.05	36.42	**0.24**	**2.57**	**32.64**
IH35E	EB SH190 (PGBT) EXIT	0.440	1.22	0.68	2.55	39.08	0.61	3.40	43.30	0.86	3.91	30.81	**0.71**	**3.28**	**36.97**
IH35E	SB SH190 (PGBT) EXIT	0.320	1.54	0.33	2.88	58.24	0.33	3.73	58.27	0.33	4.23	58.27	**0.33**	**3.61**	**58.26**
IH35E	IH35E RAMP MERGE	0.370	1.91	0.40	3.27	56.16	0.40	4.14	55.00	0.39	4.62	57.31	**0.40**	**4.01**	**56.14**
SH190	IH35E ENTRANCE	0.190	2.10	0.20	3.47	57.62	0.19	4.33	60.16	0.19	4.81	60.21	**0.19**	**4.20**	**59.31**
SH190	SANDY LAKE EXIT	0.380	2.48	0.36	3.83	62.90	0.35	4.68	64.35	0.34	5.15	67.49	**0.35**	**4.55**	**64.85**
SH190	SANDY LAKE ENTRA	0.540	3.02	0.50	4.33	64.48	0.47	5.15	69.01	0.48	5.63	67.81	**0.48**	**5.04**	**67.04**
SH190	TOLLBRIDGE	0.460	3.48	0.43	4.76	64.41	0.41	5.56	66.99	0.42	6.05	65.69	**0.42**	**5.46**	**65.68**
SH190	BELTLINE EXIT	0.180	3.66	0.17	4.94	62.43	0.16	5.73	65.52	0.16	6.21	65.52	**0.17**	**5.62**	**64.46**
SH190	BELTLINE ENTRANCE	0.950	4.61	0.83	5.77	68.50	0.91	6.63	62.90	0.91	7.13	62.33	**0.88**	**6.51**	**64.46**
SH190	VALLEY VIEW EXIT	1.570	6.18	1.37	7.13	68.88	1.48	8.12	63.52	1.52	8.64	62.14	**1.46**	**7.96**	**64.72**
SH190	VALLEY VIEW ENTRA	0.260	6.44	0.22	7.36	70.11	0.25	8.36	63.12	0.25	8.89	63.12	**0.24**	**8.20**	**65.29**
SH190	WB IH635 EXIT	0.490	6.93	0.47	7.83	62.60	0.46	8.82	63.73	0.48	9.37	61.53	**0.47**	**8.67**	**62.60**
IH635	SB SH190 (PGBT) ENT	0.480	7.41	0.47	8.30	61.34	0.46	9.29	62.41	0.47	9.84	61.32	**0.47**	**9.14**	**61.68**
IH635	MACARTHUR BRIDGE	0.690	8.10	0.72	9.01	57.75	0.70	9.99	59.13	0.74	10.58	55.83	**0.72**	**9.86**	**57.54**
IH635	OLYMPUS EXIT	0.320	8.42	0.32	9.33	59.75	0.34	10.32	56.83	0.34	10.92	56.86	**0.33**	**10.19**	**57.78**
Run Averages				-----	9.33	54.12	-----	10.32	48.94	-----	10.92	46.28	**-----**	**10.19**	**49.57**

Measured Travel Time (from SB SH190 (PGBT) EXIT to SB SH190 (PGBT) ENT)

FACILITY NAME: SH190 MAIN ROUTE
ROAD TYPE: MAIN LANES
DIRECTION: SOUTH BOUND
TIME PERIOD: MIDDAY

Filename:				*MRMS16H3.09J*			*MRMS16H3.10B*			*MRMS16H3.14F*			*MRMS16H3.14J*			*MRMS16H3.15B*					
Start Time:				*09:47:47*			*10:08:45*			*14:26:07*			*14:48:43*			*15:09:35*			*Time Period Averages*		
Date:				*8/30/2006*			*8/30/2006*			*8/30/2006*			*8/30/2006*			*8/30/2006*					
TRAVELED FACILITY	**SEGMENT CHECKPOINT**	**INT DIST (miles)**	**CUMM DIST (miles)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**	**INT TIME (min)**	**CUMM TIME (min)**	**AVG SPEED (mph)**
IH35E	FR SH121 ENTR	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**	**-----**
IH35E	SH121 ENTR	0.230	0.23	0.24	0.24	57.74	0.24	0.24	57.78	0.26	0.26	52.34	0.28	0.28	49.26	0.27	0.27	50.77	**0.26**	**0.26**	**53.34**
IH35E	FRANKFORD EXIT	0.420	0.65	0.44	0.68	57.71	0.43	0.67	58.81	0.43	0.69	58.81	0.44	0.72	57.71	0.49	0.77	50.98	**0.44**	**0.70**	**56.64**
IH35E	FRANKFORD BRIDGE	0.130	0.78	0.13	0.81	59.17	0.12	0.79	63.16	0.13	0.82	59.17	0.14	0.86	55.71	0.14	0.91	55.71	**0.13**	**0.84**	**58.46**
IH35E	EB SH190 (PGBT) EXIT	0.440	1.22	0.42	1.23	62.83	0.41	1.20	64.08	0.42	1.24	62.83	0.47	1.33	56.21	0.45	1.35	59.33	**0.43**	**1.27**	**60.91**
IH35E	SB SH190 (PGBT) EXIT	0.320	1.54	0.30	1.52	64.72	0.30	1.51	62.99	0.30	1.54	64.76	0.33	1.66	58.27	0.30	1.66	62.99	**0.31**	**1.58**	**62.65**
IH35E	IH35E RAMP MERGE	0.370	1.91	0.40	1.92	56.16	0.39	1.89	57.34	0.38	1.92	58.58	0.39	2.04	57.34	0.40	2.05	56.16	**0.39**	**1.97**	**57.10**
SH190	IH35E ENTRANCE	0.190	2.10	0.20	2.12	57.62	0.20	2.09	57.67	0.19	2.11	60.16	0.20	2.24	57.62	0.20	2.25	57.62	**0.20**	**2.16**	**58.12**
SH190	SANDY LAKE EXIT	0.380	2.48	0.35	2.46	65.90	0.36	2.46	62.87	0.36	2.47	62.90	0.38	2.62	60.16	0.35	2.60	64.38	**0.36**	**2.52**	**63.18**
SH190	SANDY LAKE ENTRA	0.540	3.02	0.48	2.94	67.81	0.49	2.95	65.54	0.49	2.97	65.54	0.50	3.12	64.48	0.50	3.11	64.46	**0.49**	**3.02**	**65.54**
SH190	TOLLBRIDGE	0.460	3.48	0.42	3.36	65.69	0.42	3.37	65.69	0.44	3.40	63.21	0.43	3.55	64.41	0.43	3.53	64.44	**0.43**	**3.44**	**64.67**
SH190	BELTLINE EXIT	0.180	3.66	0.17	3.53	62.43	0.16	3.53	65.59	0.17	3.58	62.43	0.18	3.73	59.61	0.17	3.71	62.43	**0.17**	**3.62**	**62.44**
SH190	BELTLINE ENTRANCE	0.950	4.61	0.86	4.39	66.52	0.87	4.40	65.88	0.95	4.52	60.16	0.89	4.62	64.06	0.90	4.61	63.46	**0.89**	**4.51**	**63.94**
SH190	VALLEY VIEW EXIT	1.570	6.18	1.41	5.80	66.86	1.43	5.83	65.71	1.50	6.02	62.82	1.42	6.04	66.48	1.48	6.09	63.52	**1.45**	**5.96**	**65.04**
SH190	VALLEY VIEW ENTRA	0.260	6.44	0.24	6.04	65.27	0.24	6.07	65.27	0.25	6.27	63.12	0.25	6.29	63.12	0.25	6.34	63.12	**0.24**	**6.20**	**63.96**
SH190	WB IH635 EXIT	0.490	6.93	0.44	6.48	66.09	0.45	6.52	64.90	0.48	6.75	61.53	0.45	6.73	66.07	0.46	6.80	63.73	**0.46**	**6.66**	**64.42**
IH635	SB SH190 (PGBT) ENT	0.480	7.41	0.45	6.94	63.55	0.45	6.98	63.55	0.48	7.23	60.27	0.44	7.18	64.74	0.46	7.26	62.43	**0.46**	**7.12**	**62.87**
IH635	MACARTHUR BRIDGE	0.690	8.10	0.66	7.60	62.81	0.66	7.64	62.81	0.67	7.89	62.04	0.69	7.87	59.83	0.68	7.93	61.27	**0.67**	**7.79**	**61.73**
IH635	OLYMPUS EXIT	0.320	8.42	0.30	7.89	64.76	0.30	7.94	62.99	0.31	8.21	61.31	0.32	8.19	59.75	0.31	8.25	61.34	**0.31**	**8.10**	**61.98**
Run Averages				-----	7.89	64.01	-----	7.94	63.61	-----	8.21	61.56	-----	8.19	61.69	-----	8.25	61.26	**-----**	**8.10**	**62.41**

Measured Travel Time

APPENDIX B

SUMMARY OF TRANSACTION DATA

Data Set: All MLP9, 9-day, 100%-Revenue Tracts

Income Category (for internal discussion)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X-Axis Labels	≤ 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-75	75-100	100-125	125-150	150-200	≥ 200
	HH Income; Less than $10;000	HH Income; $10;000 to $14;999	HH Income; $15;000 to $19;999	HH Income; $20;000 to $24;999	HH Income; $25;000 to $29;999	HH Income; $30;000 to $34;999	HH Income; $35;000 to $39;999	HH Income; $40;000 to $44;999	HH Income; $45;000 to $49;999	HH Income; $50;000 to $59;999	HH Income; $60;000 to $74;999	HH Income; $75;000 to $99;999	HH Income; $100;000 to $124;999	HH Income; $125;000 to $149;999	HH Income; $150;000 to $199;999	HH Income; $200;000 or more
Number of Transactions	15	4	52	286	877	1735	4897	4222	4351	8398	11230	15381	4145	732	426	6
Number of Users	13	4	23	132	299	577	1387	1262	1267	2489	3553	5140	1448	276	156	4
Transactions/Users Ratio (Average Uses per Tag ID)	1.15	1.00	2.26	2.17	2.93	3.01	3.53	3.35	3.43	3.37	3.16	2.99	2.86	2.65	2.73	1.50
Population of Relevant Census Tracts	1,252	3,755	40,131	63,210	279,082	412,310	499,461	561,499	500,536	688,534	763,734	506,912	164,005	36,957	26,124	1,396
Number of Tracts	2	3	11	19	53	84	107	107	92	132	138	91	29	8	8	2
Number of Transactions per 1,000 population	11.98	1.07	1.30	4.52	3.14	4.21	9.80	7.52	8.69	12.20	14.70	30.34	25.27	19.81	16.31	4.30
Number of Users per 1,000 population	10.38	1.07	0.57	2.09	1.07	1.40	2.78	2.25	2.53	3.61	4.65	10.14	8.83	7.47	5.97	2.87
Transactions/Users Ratio (Average Uses per Tag ID)	1.15	1.00	2.26	2.17	2.93	3.01	3.53	3.35	3.43	3.37	3.16	2.99	2.86	2.65	2.73	1.50

Data Set: All MLP9, 9-day, 90%-Revenue Tracts

Income Category (for internal discussion)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X-Axis Labels	≤ 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-75	75-100	100-125	125-150	150-200	≥ 200
	HH Income; Less than $10;000	HH Income; $10;000 to $14;999	HH Income; $15;000 to $19;999	HH Income; $20;000 to $24;999	HH Income; $25;000 to $29;999	HH Income; $30;000 to $34;999	HH Income; $35;000 to $39;999	HH Income; $40;000 to $44;999	HH Income; $45;000 to $49;999	HH Income; $50;000 to $59;999	HH Income; $60;000 to $74;999	HH Income; $75;000 to $99;999	HH Income; $100;000 to $124;999	HH Income; $125;000 to $149;999	HH Income; $150;000 to $199;999	HH Income; $200;000 or more
Number of Transactions				162	507	1114	4183	3523	3717	7370	10289	14971	3988	693	399	
Number of Users				91	174	336	1120	931	1002	2009	3080	4907	1350	251	138	
Transactions/Users Ratio (Average Uses per Tag ID)				1.78	2.91	3.32	3.73	3.78	3.71	3.67	3.34	3.05	2.95	2.76	2.89	
Population of Relevant Census Tracts				2,187	42,960	64,194	168,523	170,225	177,735	253,411	422,235	388,476	104,980	17,129	7,344	
Number of Tracts				2	6	13	35	33	34	48	71	64	14	3	3	
Number of Transactions per 1,000 population				74.07	11.80	17.35	24.82	20.70	20.91	29.08	24.37	38.54	37.99	40.46	54.33	
Number of Users per 1,000 population				41.61	4.05	5.23	6.65	5.47	5.64	7.93	7.29	12.63	12.86	14.65	18.79	
Transactions/Users Ratio (Average Uses per Tag ID)				1.78	2.91	3.32	3.73	3.78	3.71	3.67	3.34	3.05	2.95	2.76	2.89	

Data Set: All MLP9, 9-day, 100%-Revenue Tracts, SB_PM

Income Category (for internal discussion)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X-Axis Labels	≤ 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-75	75-100	100-125	125-150	150-200	≥ 200
	HH Income; Less than $10;000	HH Income; $10;000 to $14;999	HH Income; $15;000 to $19;999	HH Income; $20;000 to $24;999	HH Income; $25;000 to $29;999	HH Income; $30;000 to $34;999	HH Income; $35;000 to $39;999	HH Income; $40;000 to $44;999	HH Income; $45;000 to $49;999	HH Income; $50;000 to $59;999	HH Income; $60;000 to $74;999	HH Income; $75;000 to $99;999	HH Income; $100;000 to $124;999	HH Income; $125;000 to $149;999	HH Income; $150;000 to $199;999	HH Income; $200;000 or more
Number of Transactions	4	1	6	46	159	323	847	705	855	1438	1540	1148	310	85	23	
Number of Users	4	1	4	29	83	164	376	333	362	640	711	666	167	45	19	
Transactions/Users Ratio (Average Uses per Tag ID)	1.00	1.00	1.50	1.59	1.92	1.97	2.25	2.12	2.36	2.25	2.17	1.72	1.86	1.89	1.21	
Population of Relevant Census Tracts	12	884	8086	27020	160325	238464	341511	328821	356618	531155	615058	485977	149469	31279	15150	
Number of Tracts																
Number of Transactions per 1,000 population	333.33	1.13	0.74	1.70	0.99	1.35	2.48	2.14	2.40	2.71	2.50	2.36	2.07	2.72	1.52	
Number of Users per 1,000 population	333.33	1.13	0.49	1.07	0.52	0.69	1.10	1.01	1.02	1.20	1.16	1.37	1.12	1.44	1.25	
Transactions/Users Ratio (Average Uses per Tag ID)	1.00	1.00	1.50	1.59	1.92	1.97	2.25	2.12	2.36	2.25	2.17	1.72	1.86	1.89	1.21	

Data Set: All MLP9, 9-day, 90%-Revenue Tracts SB_PM

Income Category (for internal discussion)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X-Axis Labels	≤ 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-75	75-100	100-125	125-150	150-200	≥ 200
	HH Income; Less than $10;000	HH Income; $10;000 to $14;999	HH Income; $15;000 to $19;999	HH Income; $20;000 to $24;999	HH Income; $25;000 to $29;999	HH Income; $30;000 to $34;999	HH Income; $35;000 to $39;999	HH Income; $40;000 to $44;999	HH Income; $45;000 to $49;999	HH Income; $50;000 to $59;999	HH Income; $60;000 to $74;999	HH Income; $75;000 to $99;999	HH Income; $100;000 to $124;999	HH Income; $125;000 to $149;999	HH Income; $150;000 to $199;999	HH Income; $200;000 or more
Number of Transactions				18	72	210	714	611	757	1282	1416	1094	289	76	21	
Number of Users				16	44	96	302	275	305	548	627	623	151	40	17	
Transactions/Users Ratio (Average Uses per Tag ID)				1.13	1.64	2.19	2.36	2.22	2.48	2.34	2.26	1.76	1.91	1.90	1.24	
Population of Relevant Census Tracts				2187	42960	64194	163329	170225	177735	253411	416925	388476	104980	17129	7344	
Number of Tracts																
Number of Transactions per 1,000 population				8.23	1.68	3.27	4.37	3.59	4.26	5.06	3.40	2.82	2.75	4.44	2.86	
Number of Users per 1,000 population				7.32	1.02	1.50	1.85	1.62	1.72	2.16	1.50	1.60	1.44	2.34	2.31	
Transactions/Users Ratio (Average Uses per Tag ID)				1.13	1.64	2.19	2.36	2.22	2.48	2.34	2.26	1.76	1.91	1.90	1.24	

Data Set: All MLP9, 9-day, 100%-Revenue Tracts, SB_MD

Income Category (for internal discussion)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X-Axis Labels	≤ 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-75	75-100	100-125	125-150	150-200	≥ 200
	HH Income; Less than $10;000	HH Income; $10;000 to $14;999	HH Income; $15;000 to $19;999	HH Income; $20;000 to $24;999	HH Income; $25;000 to $29;999	HH Income; $30;000 to $34;999	HH Income; $35;000 to $39;999	HH Income; $40;000 to $44;999	HH Income; $45;000 to $49;999	HH Income; $50;000 to $59;999	HH Income; $60;000 to $74;999	HH Income; $75;000 to $99;999	HH Income; $100;000 to $124;999	HH Income; $125;000 to $149;999	HH Income; $150;000 to $199;999	HH Income; $200;000 or more
Number of Transactions	3		4	47	107	243	542	473	427	963	1288	2047	655	110	50	1
Number of Users	3		4	41	74	192	394	347	331	701	1013	1592	516	92	48	1
Transactions/Users Ratio (Average Uses per Tag ID)	1.00		1.00	1.15	1.45	1.27	1.38	1.36	1.29	1.37	1.27	1.29	1.27	1.20	1.04	1.00
Population of Relevant Census Tracts	1252		12346	29860	117684	265949	331439	418780	420852	593303	721581	492789	164005	27941	16898	1092
Number of Tracts																
Number of Transactions per 1,000 population	2.40		0.32	1.57	0.91	0.91	1.64	1.13	1.01	1.62	1.78	4.15	3.99	3.94	2.96	0.92
Number of Users per 1,000 population	2.40		0.32	1.37	0.63	0.72	1.19	0.83	0.79	1.18	1.40	3.23	3.15	3.29	2.84	0.92
Transactions/Users Ratio (Average Uses per Tag ID)	1.00		1.00	1.15	1.45	1.27	1.38	1.36	1.29	1.37	1.27	1.29	1.27	1.20	1.04	1.00

Data Set: All MLP9, 9-day, 90%-Revenue Tracts SB_MD

Income Category (for internal discussion)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X-Axis Labels	≤ 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-75	75-100	100-125	125-150	150-200	≥ 200
	HH Income; Less than $10;000	HH Income; $10;000 to $14;999	HH Income; $15;000 to $19;999	HH Income; $20;000 to $24;999	HH Income; $25;000 to $29;999	HH Income; $30;000 to $34;999	HH Income; $35;000 to $39;999	HH Income; $40;000 to $44;999	HH Income; $45;000 to $49;999	HH Income; $50;000 to $59;999	HH Income; $60;000 to $74;999	HH Income; $75;000 to $99;999	HH Income; $100;000 to $124;999	HH Income; $125;000 to $149;999	HH Income; $150;000 to $199;999	HH Income; $200;000 or more
Number of Transactions				33	71	152	455	338	330	799	1121	1980	608	105	44	
Number of Users				30	46	118	321	233	253	568	866	1528	472	87	42	
Transactions/Users Ratio (Average Uses per Tag ID)				1.10	1.54	1.29	1.42	1.45	1.30	1.41	1.29	1.30	1.29	1.21	1.05	
Population of Relevant Census Tracts				2187	42960	64194	168523	165534	177735	253411	422235	388476	104980	17129	7344	
Number of Tracts																
Number of Transactions per 1,000 population				15.09	1.65	2.37	2.70	2.04	1.86	3.15	2.65	5.10	5.79	6.13	5.99	
Number of Users per 1,000 population				13.72	1.07	1.84	1.90	1.41	1.42	2.24	2.05	3.93	4.50	5.08	5.72	
Transactions/Users Ratio (Average Uses per Tag ID)				1.10	1.54	1.29	1.42	1.45	1.30	1.41	1.29	1.30	1.29	1.21	1.05	

Data Set: All MLP9, 9-day, 100%-Revenue Tracts, SB_AM

Income Category (for internal discussion)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X-Axis Labels	≤ 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-75	75-100	100-125	125-150	150-200	≥ 200
	HH Income; Less than $10;000	HH Income; $10;000 to $14;999	HH Income; $15;000 to $19;999	HH Income; $20;000 to $24;999	HH Income; $25;000 to $29;999	HH Income; $30;000 to $34;999	HH Income; $35;000 to $39;999	HH Income; $40;000 to $44;999	HH Income; $45;000 to $49;999	HH Income; $50;000 to $59;999	HH Income; $60;000 to $74;999	HH Income; $75;000 to $99;999	HH Income; $100;000 to $124;999	HH Income; $125;000 to $149;999	HH Income; $150;000 to $199;999	HH Income; $200;000 or more
Number of Transactions	1		1	15	38	65	322	296	173	752	1641	2895	778	125	126	
Number of Users	1		1	10	22	34	153	122	105	335	645	1234	318	58	34	
Transactions/Users Ratio (Average Uses per Tag ID)	1.00		1.00	1.50	1.73	1.91	2.10	2.43	1.65	2.24	2.54	2.35	2.45	2.16	3.71	
Population of Relevant Census Tracts	12		3285	12251	49564	112106	199663	209945	180242	329360	433136	367293	105267	17592	7344	
Number of Tracts																
Number of Transactions per 1,000 population	83.33		0.30	1.22	0.77	0.58	1.61	1.41	0.96	2.28	3.79	7.88	7.39	7.11	17.16	
Number of Users per 1,000 population	83.33		0.30	0.82	0.44	0.30	0.77	0.58	0.58	1.02	1.49	3.36	3.02	3.30	4.63	
Transactions/Users Ratio (Average Uses per Tag ID)	1.00		1.00	1.50	1.73	1.91	2.10	2.43	1.65	2.24	2.54	2.35	2.45	2.16	3.71	

Data Set: All MLP9, 9-day, 90%-Revenue Tracts SB_AM

Income Category (for internal discussion)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X-Axis Labels	≤ 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-75	75-100	100-125	125-150	150-200	≥ 200
	HH Income; Less than $10;000	HH Income; $10;000 to $14;999	HH Income; $15;000 to $19;999	HH Income; $20;000 to $24;999	HH Income; $25;000 to $29;999	HH Income; $30;000 to $34;999	HH Income; $35;000 to $39;999	HH Income; $40;000 to $44;999	HH Income; $45;000 to $49;999	HH Income; $50;000 to $59;999	HH Income; $60;000 to $74;999	HH Income; $75;000 to $99;999	HH Income; $100;000 to $124;999	HH Income; $125;000 to $149;999	HH Income; $150;000 to $199;999	HH Income; $200;000 or more
Number of Transactions				10	30	32	279	246	142	669	1568	2861	771	124	126	
Number of Users				7	16	16	133	93	86	282	602	1217	314	57	34	
Transactions/Users Ratio (Average Uses per Tag ID)				1.43	1.88	2.00	2.10	2.65	1.65	2.37	2.60	2.35	2.46	2.18	3.71	
Population of Relevant Census Tracts				2187	31140	31874	115091	94539	89898	180259	301914	321895	90463	11118	7344	
Number of Tracts																
Number of Transactions per 1,000 population				4.57	0.96	1.00	2.42	2.60	1.58	3.71	5.19	8.89	8.52	11.15	17.16	
Number of Users per 1,000 population				3.20	0.51	0.50	1.16	0.98	0.96	1.56	1.99	3.78	3.47	5.13	4.63	
Transactions/Users Ratio (Average Uses per Tag ID)				1.43	1.88	2.00	2.10	2.65	1.65	2.37	2.60	2.35	2.46	2.18	3.71	

Data Set: All MLP9, 9-day, 100%-Revenue Tracts, NB_PM

Income Category (for internal discussion)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X-Axis Labels	≤ 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-75	75-100	100-125	125-150	150-200	≥ 200
	HH Income; Less than $10;000	HH Income; $10;000 to $14;999	HH Income; $15;000 to $19;999	HH Income; $20;000 to $24;999	HH Income; $25;000 to $29;999	HH Income; $30;000 to $34;999	HH Income; $35;000 to $39;999	HH Income; $40;000 to $44;999	HH Income; $45;000 to $49;999	HH Income; $50;000 to $59;999	HH Income; $60;000 to $74;999	HH Income; $75;000 to $99;999	HH Income; $100;000 to $124;999	HH Income; $125;000 to $149;999	HH Income; $150;000 to $199;999	HH Income; $200;000 or more
Number of Transactions		1	7	20	29	88	331	251	269	753	1315	2528	607	97	65	
Number of Users		1	5	14	19	60	177	167	177	419	693	1292	341	54	34	
Transactions/Users Ratio (Average Uses per Tag ID)		1.00	1.40	1.43	1.53	1.47	1.87	1.50	1.52	1.80	1.90	1.96	1.78	1.80	1.91	
Population of Relevant Census Tracts		1774	9062	20318	75840	136373	237114	236452	295287	423751	576348	452867	132755	25349	12235	
Number of Tracts																
Number of Transactions per 1,000 population		0.56	0.77	0.98	0.38	0.65	1.40	1.06	0.91	1.78	2.28	5.58	4.57	3.83	5.31	
Number of Users per 1,000 population		0.56	0.55	0.69	0.25	0.44	0.75	0.71	0.60	0.99	1.20	2.85	2.57	2.13	2.78	
Transactions/Users Ratio (Average Uses per Tag ID)		1.00	1.40	1.43	1.53	1.47	1.87	1.50	1.52	1.80	1.90	1.96	1.78	1.80	1.91	

Data Set: All MLP9, 9-day, 90%-Revenue Tracts NB_PM

Income Category (for internal discussion)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X-Axis Labels	≤ 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-75	75-100	100-125	125-150	150-200	≥ 200
	HH Income; Less than $10;000	HH Income; $10;000 to $14;999	HH Income; $15;000 to $19;999	HH Income; $20;000 to $24;999	HH Income; $25;000 to $29;999	HH Income; $30;000 to $34;999	HH Income; $35;000 to $39;999	HH Income; $40;000 to $44;999	HH Income; $45;000 to $49;999	HH Income; $50;000 to $59;999	HH Income; $60;000 to $74;999	HH Income; $75;000 to $99;999	HH Income; $100;000 to $124;999	HH Income; $125;000 to $149;999	HH Income; $150;000 to $199;999	HH Income; $200;000 or more
Number of Transactions				11	14	62	284	202	213	660	1221	2487	597	92	64	
Number of Users				8	7	40	146	126	129	356	627	1256	331	49	33	
Transactions/Users Ratio (Average Uses per Tag ID)				1.38	2.00	1.55	1.95	1.60	1.65	1.85	1.95	1.98	1.80	1.88	1.94	
Population of Relevant Census Tracts				2187	24724	59798	135416	129922	146438	236506	375661	374291	96121	17129	7344	
Number of Tracts																
Number of Transactions per 1,000 population				5.03	0.57	1.04	2.10	1.55	1.45	2.79	3.25	6.64	6.21	5.37	8.71	
Number of Users per 1,000 population				3.66	0.28	0.67	1.08	0.97	0.88	1.51	1.67	3.36	3.44	2.86	4.49	
Transactions/Users Ratio (Average Uses per Tag ID)				1.38	2.00	1.55	1.95	1.60	1.65	1.85	1.95	1.98	1.80	1.88	1.94	

Data Set: All MLP9, 9-day, 100%-Revenue Tracts, NB_MD

Income Category (for internal discussion)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X-Axis Labels	≤ 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-75	75-100	100-125	125-150	150-200	≥ 200
	HH Income; Less than $10;000	HH Income; $10;000 to $14;999	HH Income; $15;000 to $19;999	HH Income; $20;000 to $24;999	HH Income; $25;000 to $29;999	HH Income; $30;000 to $34;999	HH Income; $35;000 to $39;999	HH Income; $40;000 to $44;999	HH Income; $45;000 to $49;999	HH Income; $50;000 to $59;999	HH Income; $60;000 to $74;999	HH Income; $75;000 to $99;999	HH Income; $100;000 to $124;999	HH Income; $125;000 to $149;999	HH Income; $150;000 to $199;999	HH Income; $200;000 or more
Number of Transactions	1	1	5	34	109	228	475	447	434	879	943	1401	429	68	33	2
Number of Users	1	1	4	26	66	170	343	316	299	629	751	1126	338	53	29	2
Transactions/Users Ratio (Average Uses per Tag ID)	1.00		1.25	1.31	1.65	1.34	1.38	1.41	1.45	1.40	1.26	1.24	1.27	1.28	1.14	
Population of Relevant Census Tracts	12	884	11277	26496	114003	259133	308070	370585	367880	554835	696356	484122	152408	27941	20512	1396
Number of Tracts																
Number of Transactions per 1,000 population	83.33		0.44	1.28	0.96	0.88	1.54	1.21	1.18	1.58	1.35	2.89	2.81	2.43	1.61	
Number of Users per 1,000 population	83.33		0.35	0.98	0.58	0.66	1.11	0.85	0.81	1.13	1.08	2.33	2.22	1.90	1.41	
Transactions/Users Ratio (Average Uses per Tag ID)	1.00		1.25	1.31	1.65	1.34	1.38	1.41	1.45	1.40	1.26	1.24	1.27	1.28	1.14	

Data Set: All MLP9, 9-day, 90%-Revenue Tracts NB_MD

Income Category (for internal discussion)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X-Axis Labels	≤ 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-75	75-100	100-125	125-150	150-200	≥ 200
	HH Income; Less than $10;000	HH Income; $10;000 to $14;999	HH Income; $15;000 to $19;999	HH Income; $20;000 to $24;999	HH Income; $25;000 to $29;999	HH Income; $30;000 to $34;999	HH Income; $35;000 to $39;999	HH Income; $40;000 to $44;999	HH Income; $45;000 to $49;999	HH Income; $50;000 to $59;999	HH Income; $60;000 to $74;999	HH Income; $75;000 to $99;999	HH Income; $100;000 to $124;999	HH Income; $125;000 to $149;999	HH Income; $150;000 to $199;999	HH Income; $200;000 or more
Number of Transactions				18	74	134	393	357	342	727	797	1336	401	61	27	
Number of Users				16	40	101	283	236	227	506	635	1066	313	46	24	
Transactions/Users Ratio (Average Uses per Tag ID)				1.13	1.85	1.33	1.39	1.51	1.51	1.44	1.26	1.25	1.28	1.33	1.13	
Population of Relevant Census Tracts				2187	42960	64194	168523	165534	173728	253411	418254	388476	104980	17129	7344	
Number of Tracts																
Number of Transactions per 1,000 population				8.23	1.72	2.09	2.33	2.16	1.97	2.87	1.91	3.44	3.82	3.56	3.68	
Number of Users per 1,000 population				7.32	0.93	1.57	1.68	1.43	1.31	2.00	1.52	2.74	2.98	2.69	3.27	
Transactions/Users Ratio (Average Uses per Tag ID)				1.13	1.85	1.33	1.39	1.51	1.51	1.44	1.26	1.25	1.28	1.33	1.13	

Data Set: All MLP9, 9-day, 100%-Revenue Tracts, NB_AM

Income Category (for internal discussion)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X-Axis Labels	≤ 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-75	75-100	100-125	125-150	150-200	≥ 200
	HH Income; Less than $10;000	HH Income; $10;000 to $14;999	HH Income; $15;000 to $19;999	HH Income; $20;000 to $24;999	HH Income; $25;000 to $29;999	HH Income; $30;000 to $34;999	HH Income; $35;000 to $39;999	HH Income; $40;000 to $44;999	HH Income; $45;000 to $49;999	HH Income; $50;000 to $59;999	HH Income; $60;000 to $74;999	HH Income; $75;000 to $99;999	HH Income; $100;000 to $124;999	HH Income; $125;000 to $149;999	HH Income; $150;000 to $199;999	HH Income; $200;000 or more
Number of Transactions	1		1	52	156	276	1029	764	995	1404	1269	726	210	49	6	
Number of Users	1		1	24	61	127	334	272	297	474	434	265	76	19	4	
Transactions/Users Ratio (Average Uses per Tag ID)	1.00		1.00	2.17	2.56	2.17	3.08	2.81	3.35	2.96	2.92	2.74	2.76	2.58	1.50	
Population of Relevant Census Tracts	12		1556	24849	125180	186329	285719	258213	278181	402186	472579	345207	110428	24805	10321	
Number of Tracts																
Number of Transactions per 1,000 population	83.33		0.64	2.09	1.25	1.48	3.60	2.96	3.58	3.49	2.69	2.10	1.90	1.98	0.58	
Number of Users per 1,000 population	83.33		0.64	0.97	0.49	0.68	1.17	1.05	1.07	1.18	0.92	0.77	0.69	0.77	0.39	
Transactions/Users Ratio (Average Uses per Tag ID)	1.00		1.00	2.17	2.56	2.17	3.08	2.81	3.35	2.96	2.92	2.74	2.76	2.58	1.50	

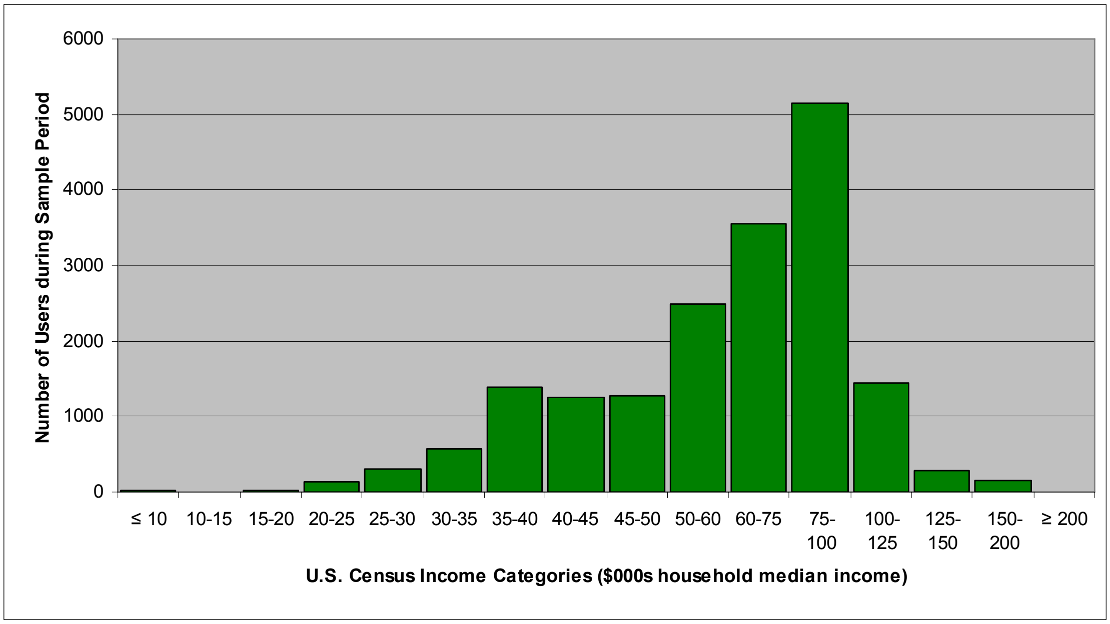
Data Set: All MLP9, 9-day, 90%-Revenue Tracts NB_AM

Income Category (for internal discussion)	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X-Axis Labels	≤ 10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-60	60-75	75-100	100-125	125-150	150-200	≥ 200
	HH Income; Less than $10;000	HH Income; $10;000 to $14;999	HH Income; $15;000 to $19;999	HH Income; $20;000 to $24;999	HH Income; $25;000 to $29;999	HH Income; $30;000 to $34;999	HH Income; $35;000 to $39;999	HH Income; $40;000 to $44;999	HH Income; $45;000 to $49;999	HH Income; $50;000 to $59;999	HH Income; $60;000 to $74;999	HH Income; $75;000 to $99;999	HH Income; $100;000 to $124;999	HH Income; $125;000 to $149;999	HH Income; $150;000 to $199;999	HH Income; $200;000 or more
Number of Transactions				28	75	216	883	677	917	1289	1205	701	203	44	5	
Number of Users				14	30	92	280	237	267	421	404	248	73	16	3	
Transactions/Users Ratio (Average Uses per Tag ID)				2.00	2.50	2.35	3.15	2.86	3.43	3.06	2.98	2.83	2.78	2.75	1.67	
Population of Relevant Census Tracts				2187	33846	64194	164787	150474	155670	224991	369643	300496	100088	17129	4959	
Number of Tracts																
Number of Transactions per 1,000 population				12.80	2.22	3.36	5.36	4.50	5.89	5.73	3.26	2.33	2.03	2.57	1.01	
Number of Users per 1,000 population				6.40	0.89	1.43	1.70	1.58	1.72	1.87	1.09	0.83	0.73	0.93	0.60	
Transactions/Users Ratio (Average Uses per Tag ID)				2.00	2.50	2.35	3.15	2.86	3.43	3.06	2.98	2.83	2.78	2.75	1.67	

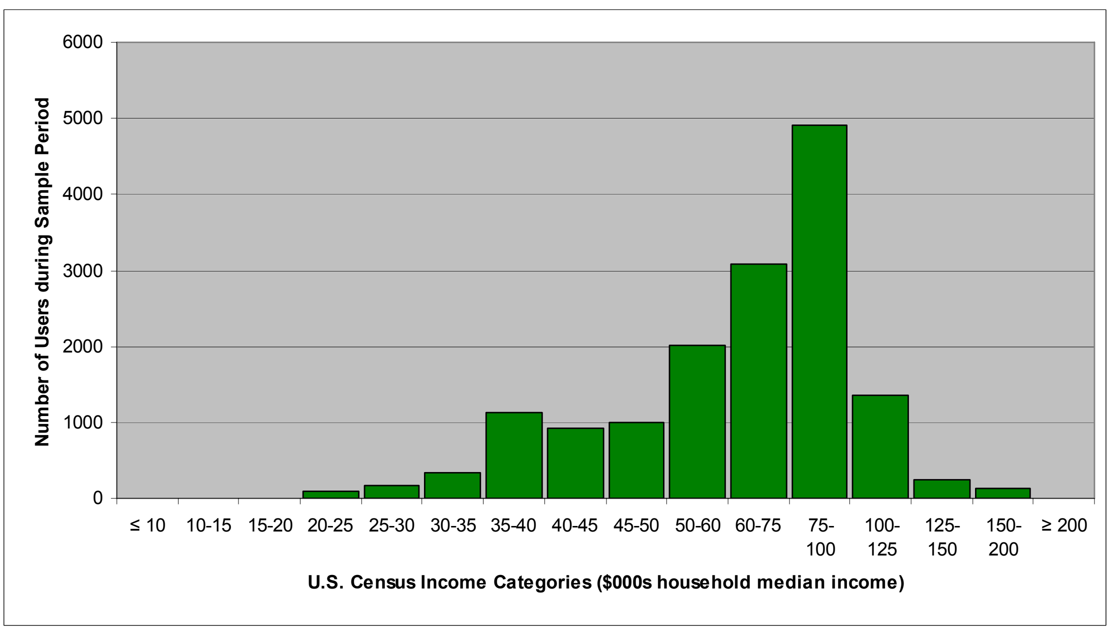
APPENDIX C

USERS AND TRANSACTIONS FOR 100 PERCENT AND 90 PERCENT SAMPLES

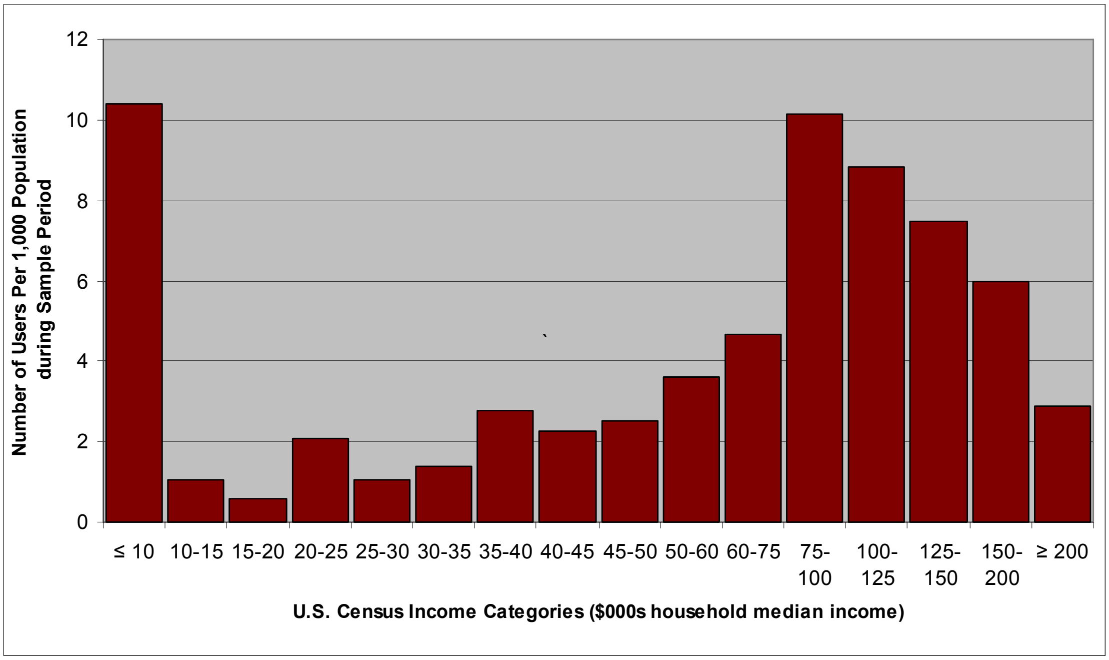
Number of Users during Sample Period for All Transactions



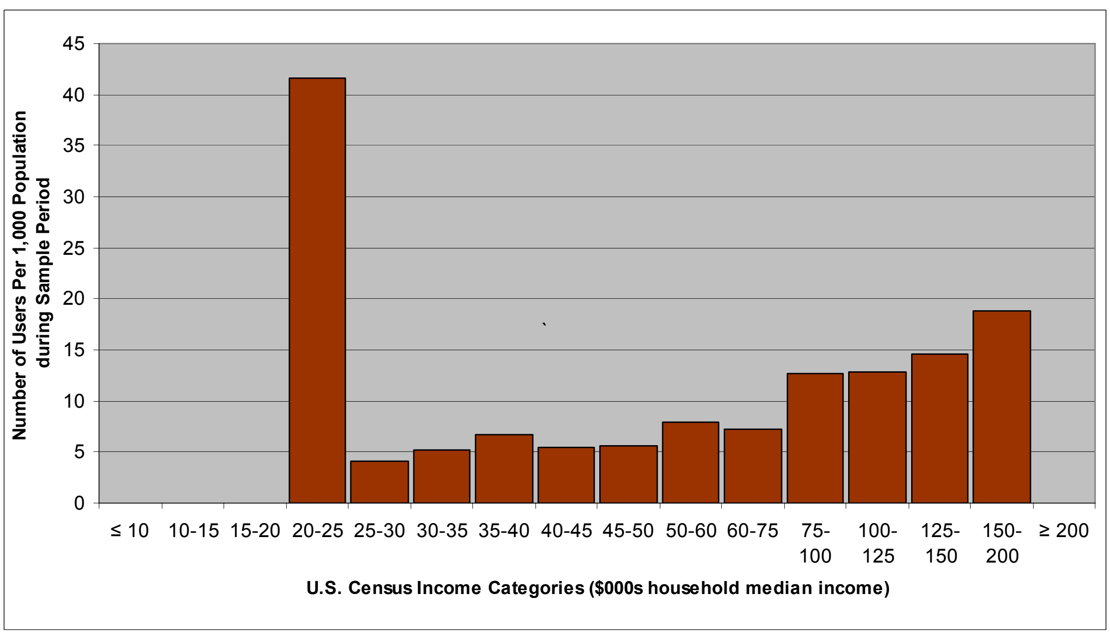
Number of Users during Sample Period Eliminating 10 Percent Least Frequent Users



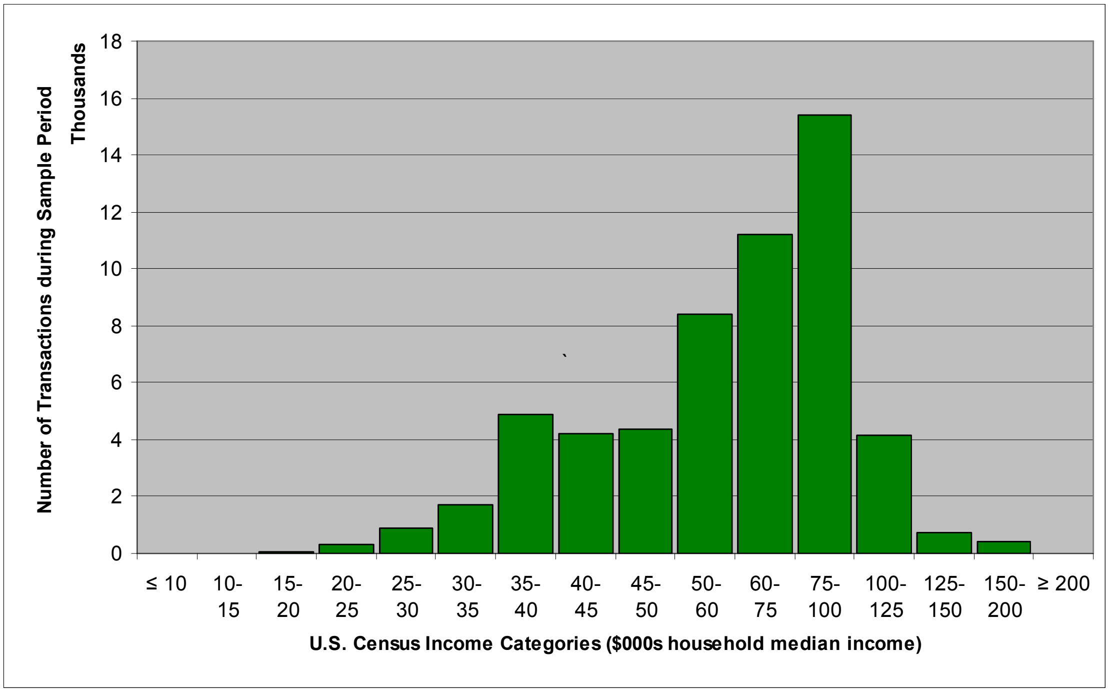
Number of Users per 1,000 Population during Sample Period



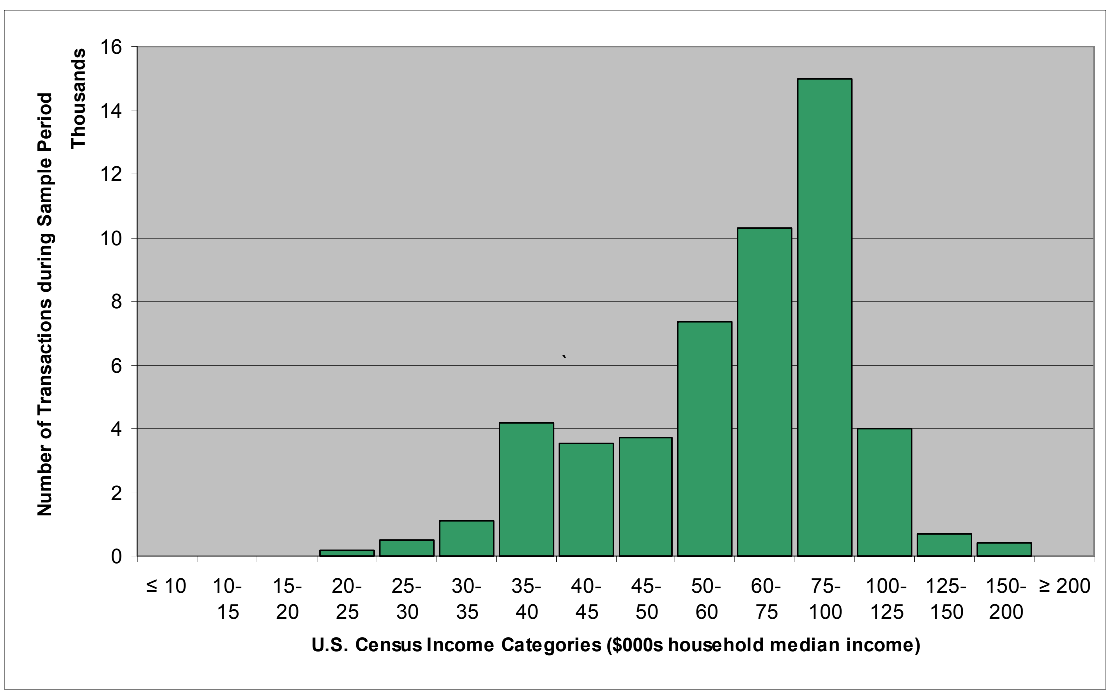
Number of Users per 1,000 Population during Sample Period



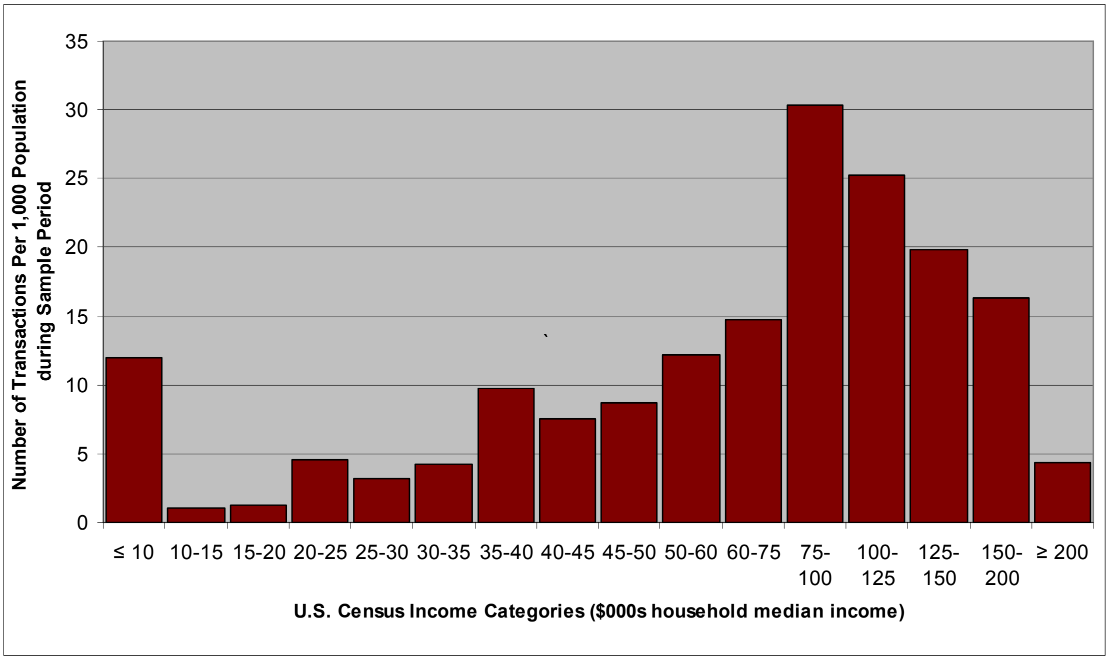
Number of Transactions during Sample Period



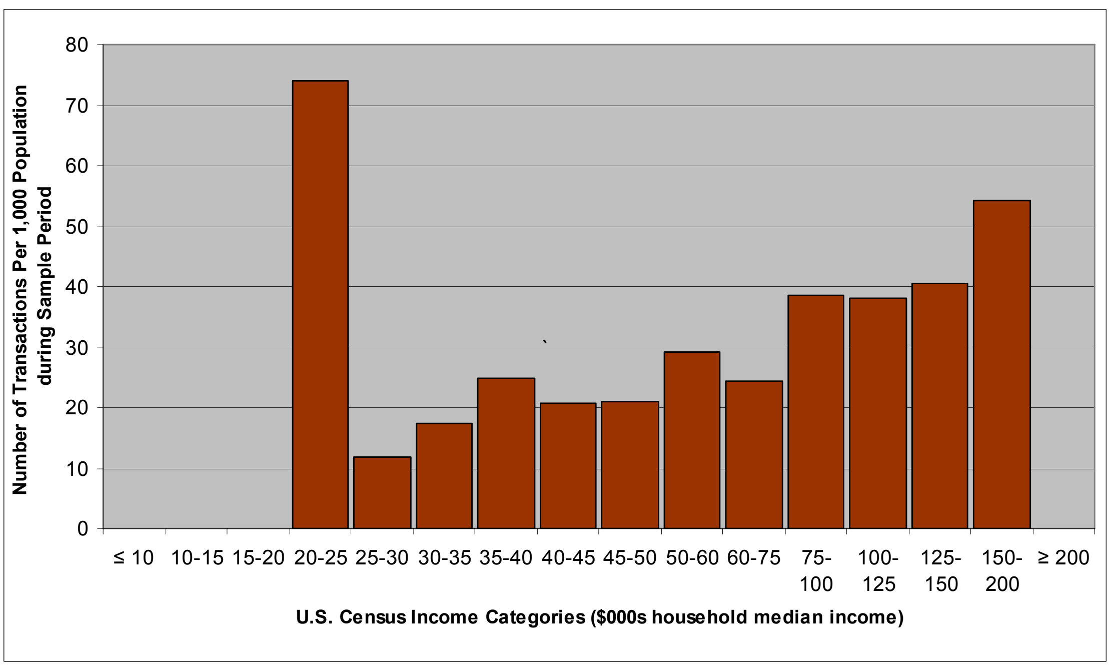
Number of Transactions during Sample Period



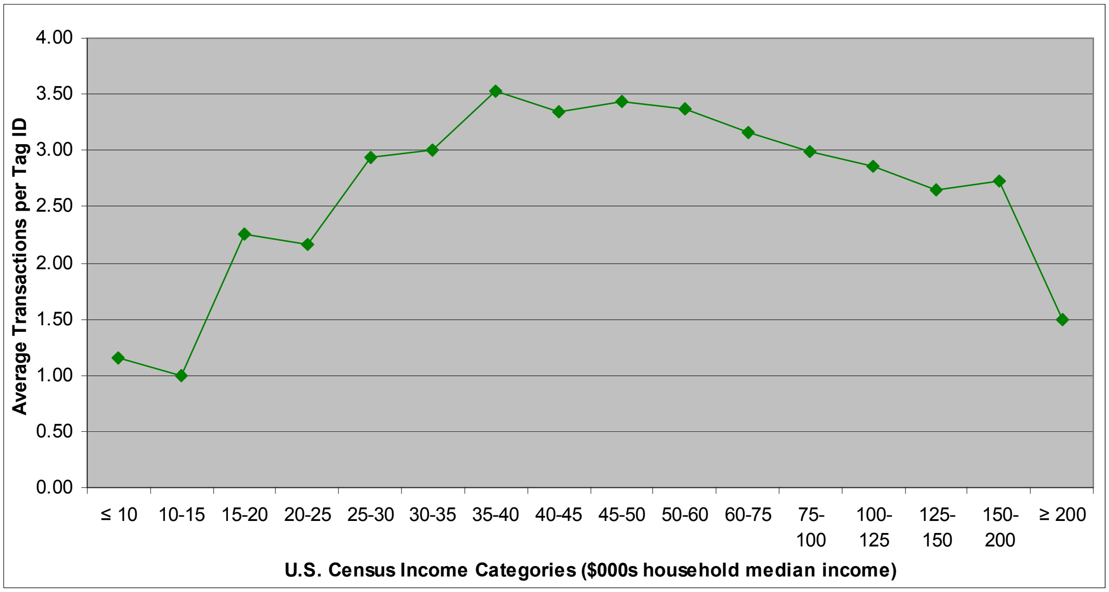
Number of Transactions per 1,000 Population during Sample Period



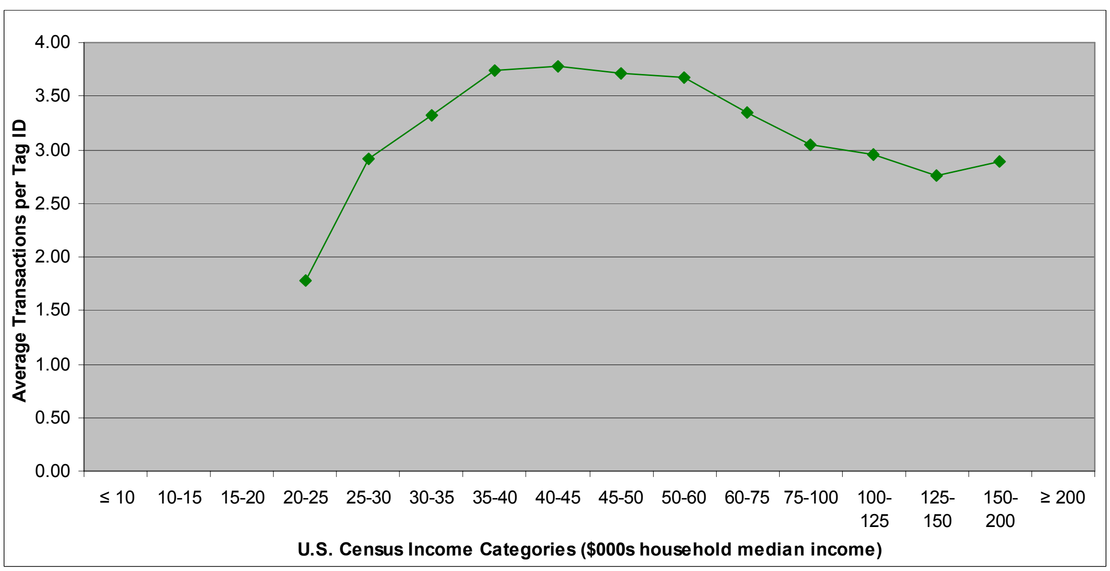
Number of Transactions per 1,000 Population during Sample Period



Average Transactions per User during Sample Period of All Transactions

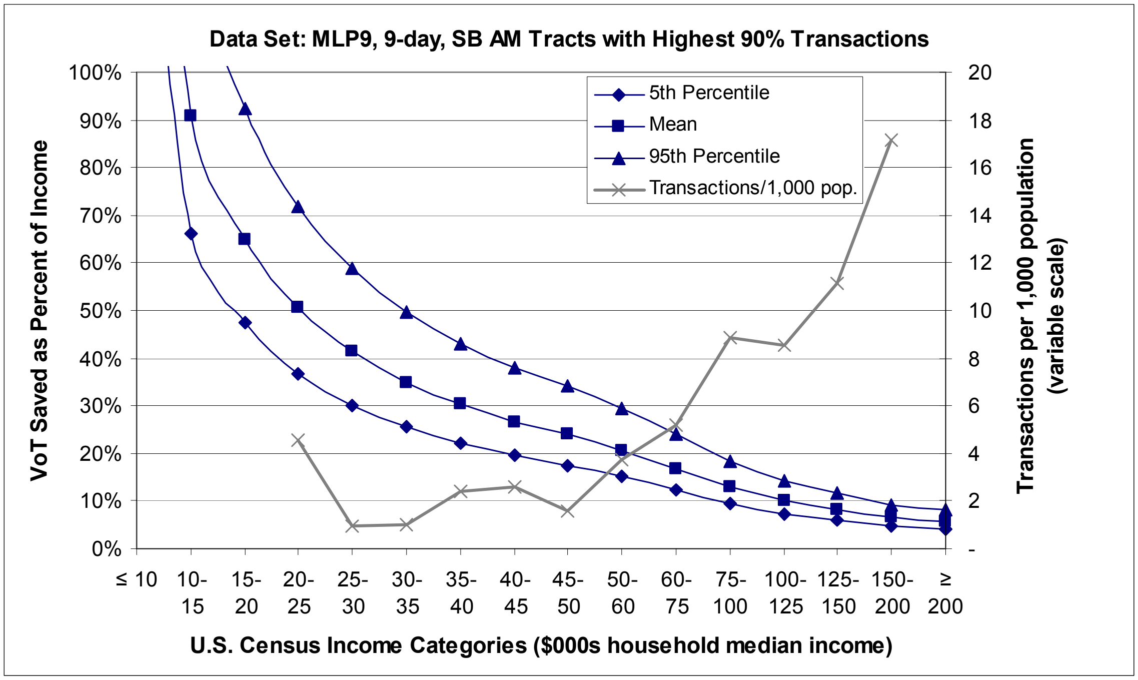


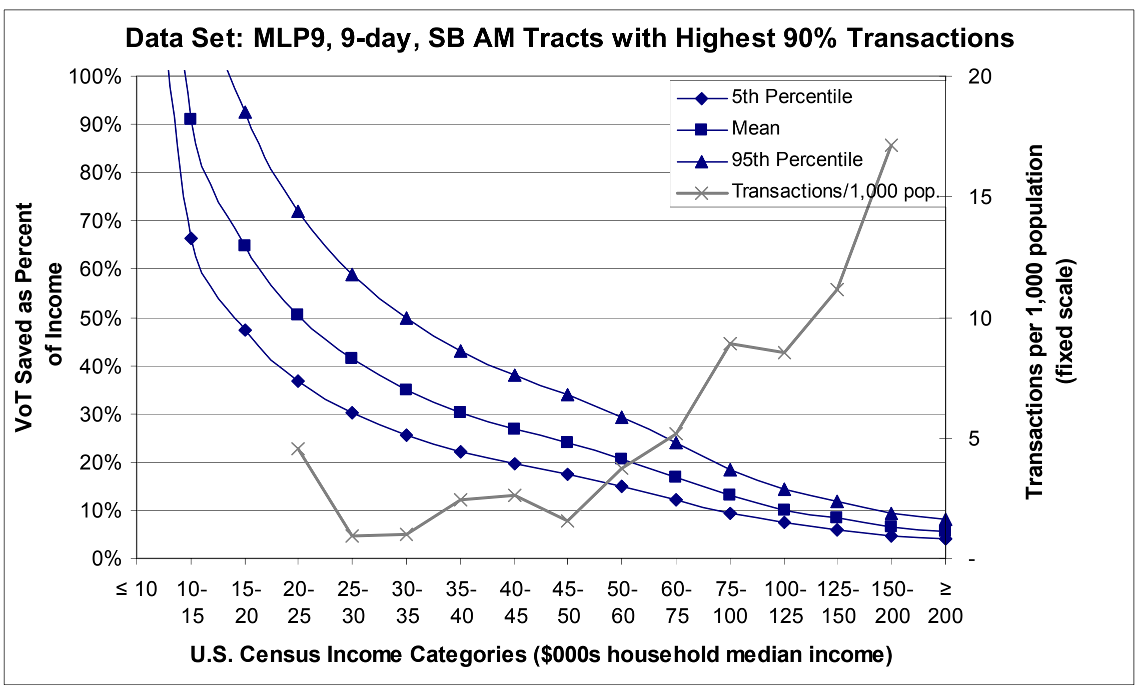
Average Transactions per User during Sample Period
Eliminating 10 Percent Least Frequent Users

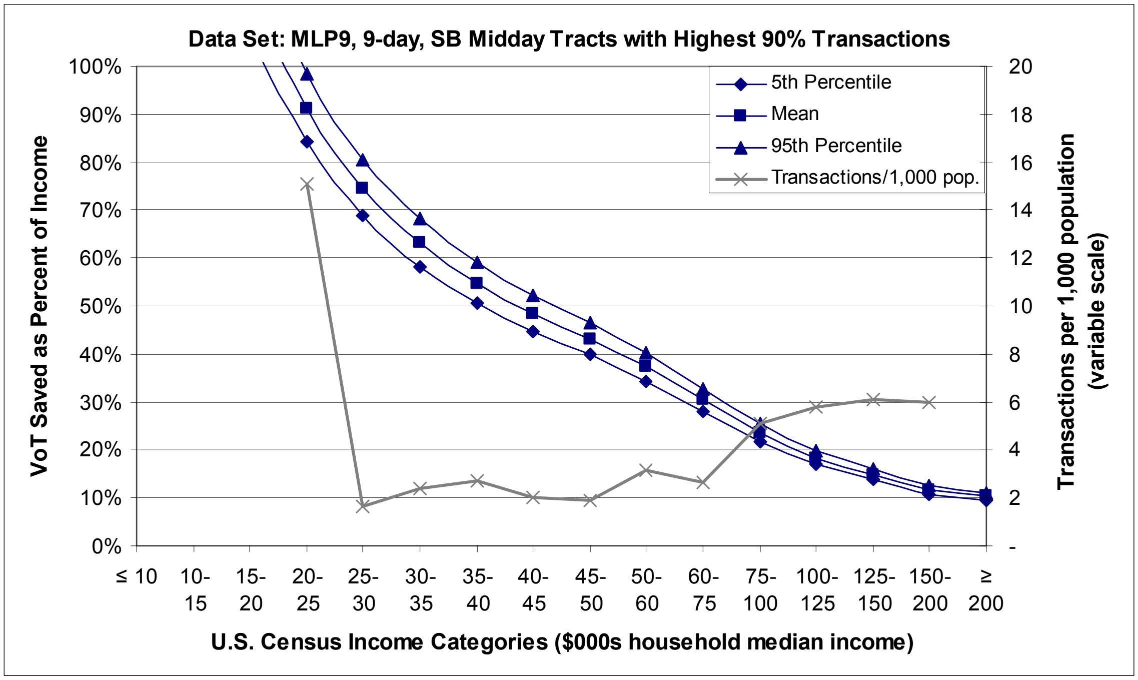


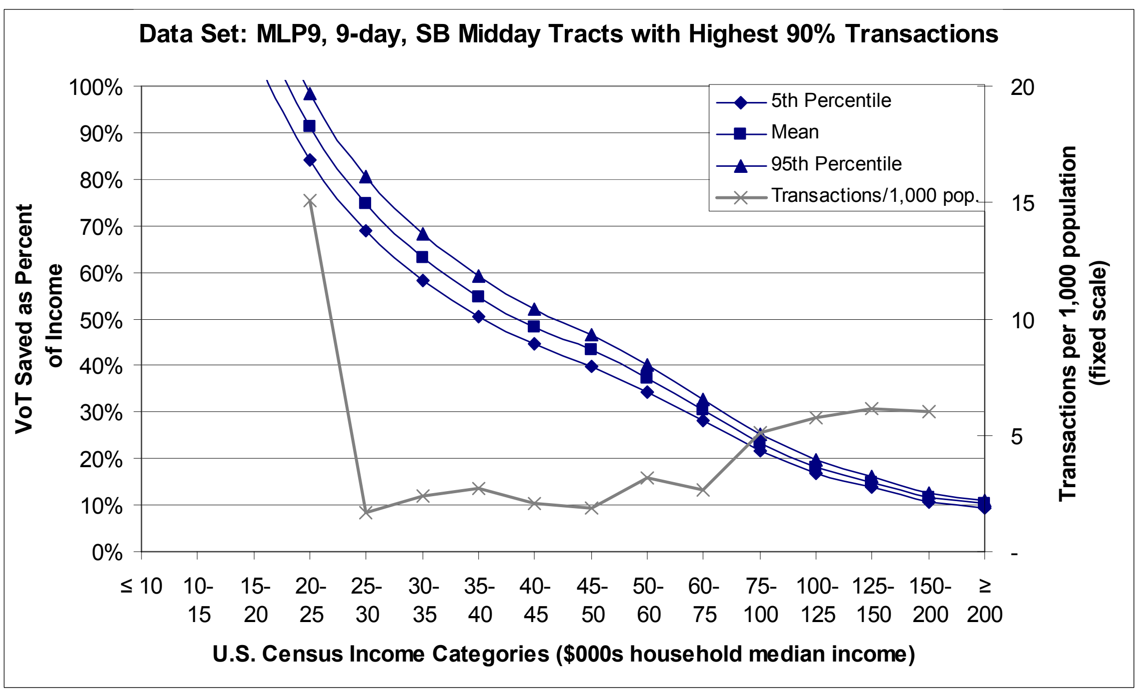
APPENDIX D

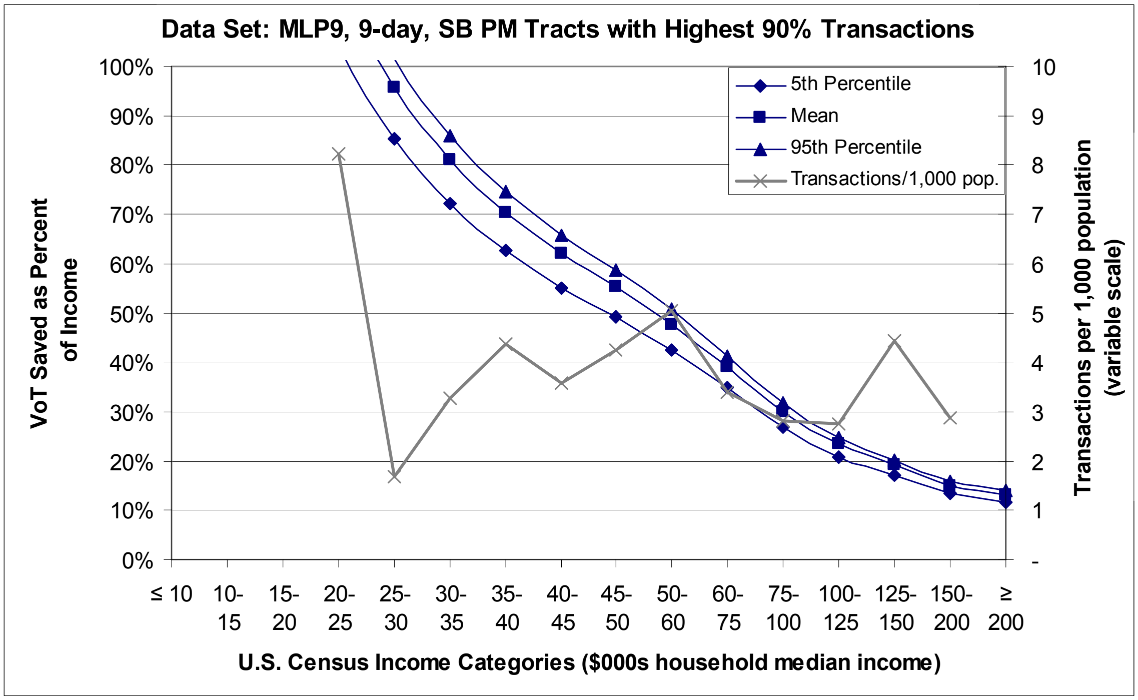
VALUE OF TIME SAVED PLOTS FOR FIXED AND VARIABLE SCALES AND FOR SAMPLES WITH LOWEST 10 PERCENT USAGE EXCLUDED

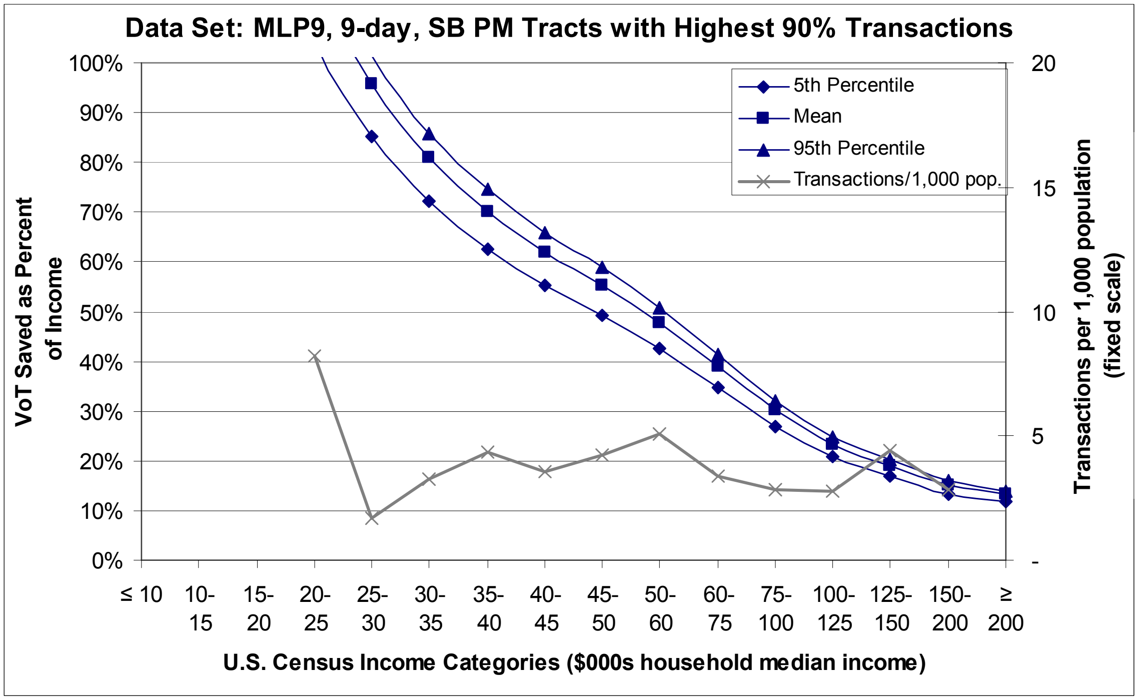

Data Set: MLP9, 9-day, SB AM Tracts with Highest 90% Transactions
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
VoT Saved as Percent of Income
Transactions per 1,000 population (variable scale)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
20
18
16
14
12
10
8
6
4
2
-
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200
U.S. Census Income Categories ($000s household median income)

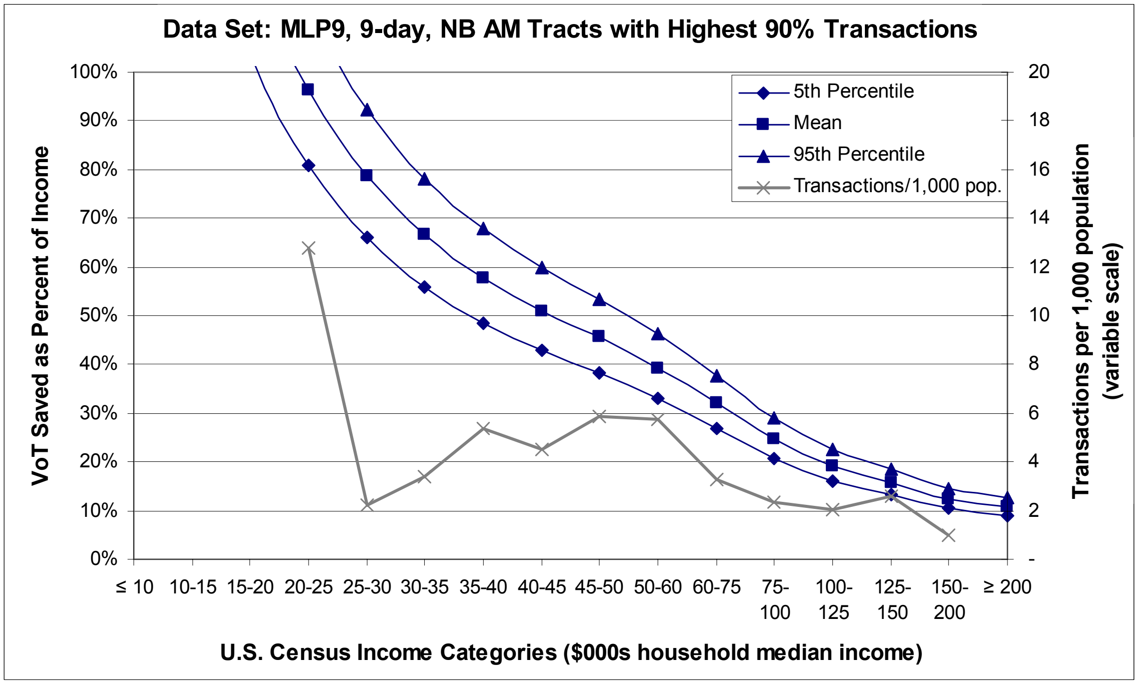

Data Set: MLP9, 9-day, SB AM Tracts with Highest 90% Transactions
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
VoT Saved as Percent of Income
Transactions per 1,000 population (fixed scale)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
20
15
10
5
-
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200
U.S. Census Income Categories ($000s household median income)

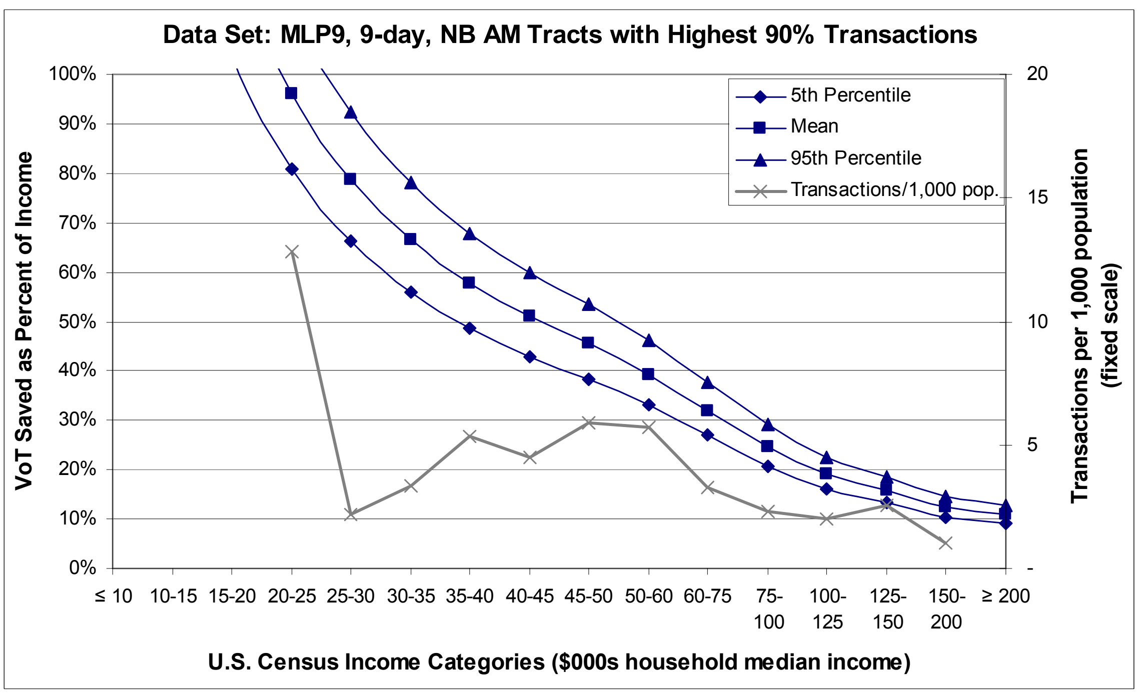

Data Set: MLP9, 9-day, SB Midday Tracts with Highest 90% Transactions
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
VoT Saved as Percent of Income
20
18
16
14
12
10
8
6
4
2
-
Transactions per 1,000 population (variable scale)
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200
U.S. Census Income Categories ($000s household median income)

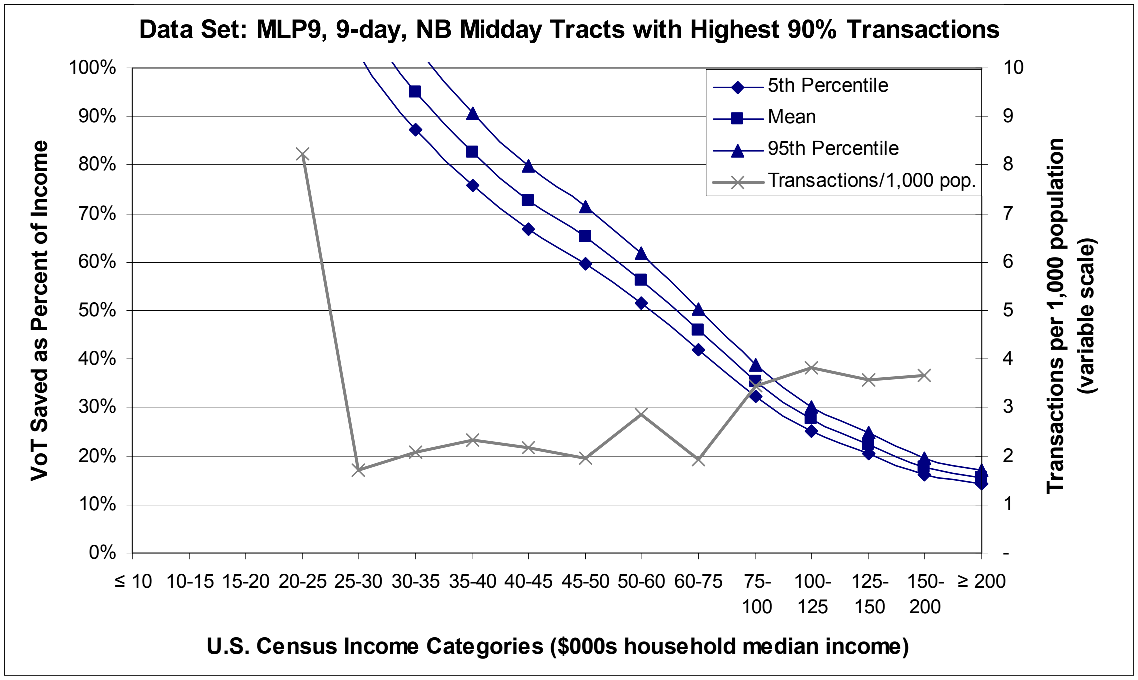

Data Set: MLP9, 9-day, SB Midday Tracts with Highest 90% Transactions
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
VoT Saved as Percent of Income
20
15
10
5
-
Transactions per 1,000 population (fixed scale)
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200
U.S. Census Income Categories ($000s household median income)


Data Set: MLP9, 9-day, SB PM Tracts with Highest 90% Transactions
VoT Saved as Percent of Income
Transactions per 1,000 population (variable scale)
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
U.S. Census Income Categories ($000s household median income)
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200


Data Set: MLP9, 9-day, SB PM Tracts with Highest 90% Transactions
VoT Saved as Percent of Income
Transactions per 1,000 population (fixed scale)
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
U.S. Census Income Categories ($000s household median income)
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200


Data Set: MLP9, 9-day, NB AM Tracts with Highest 90% Transactions
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
VoT Saved as Percent of Income
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
20
18
16
14
12
10
8
6
4
2
-
Transactions per 1,000 population (variable scale)
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200
U.S. Census Income Categories ($000s household median income)


Data Set: MLP9, 9-day, NB AM Tracts with Highest 90% Transactions
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
VoT Saved as Percent of Income
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
20
15
10
5
-
Transactions per 1,000 population (fixed scale)
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200
U.S. Census Income Categories ($000s household median income)


Data Set: MLP9, 9-day, NB Midday Tracts with Highest 90% Transactions
VoT Saved as Percent of Income
Transactions per 1,000 population (variable scale)
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
100%
90%
80%
70%
60%
50%
40%
30%
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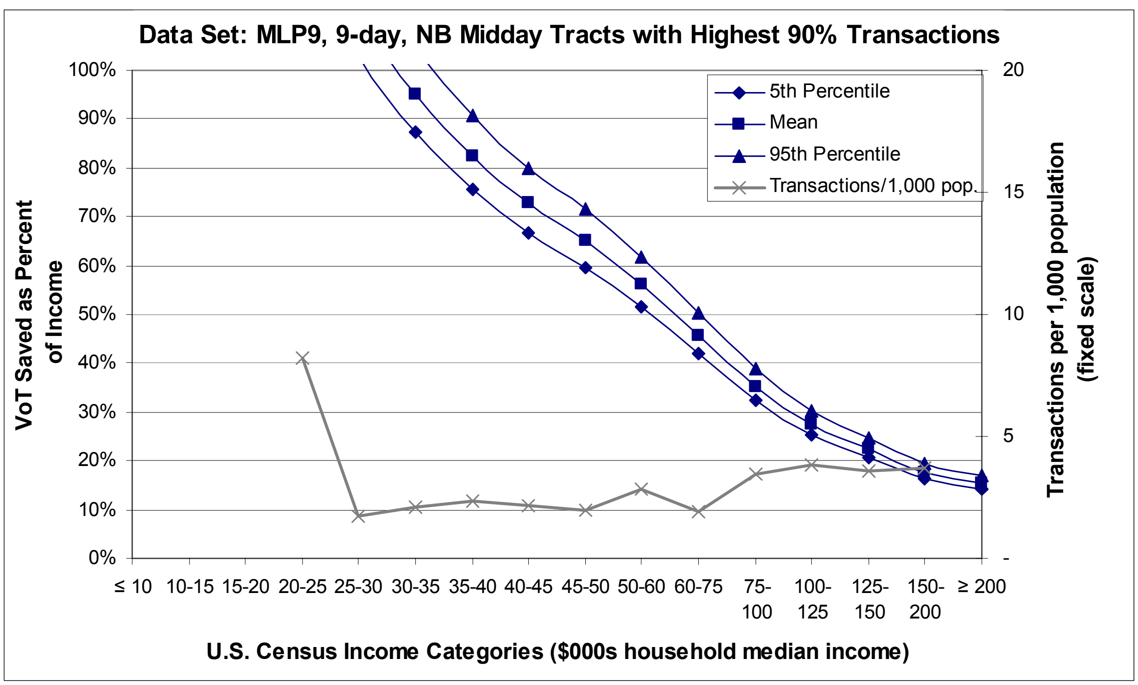
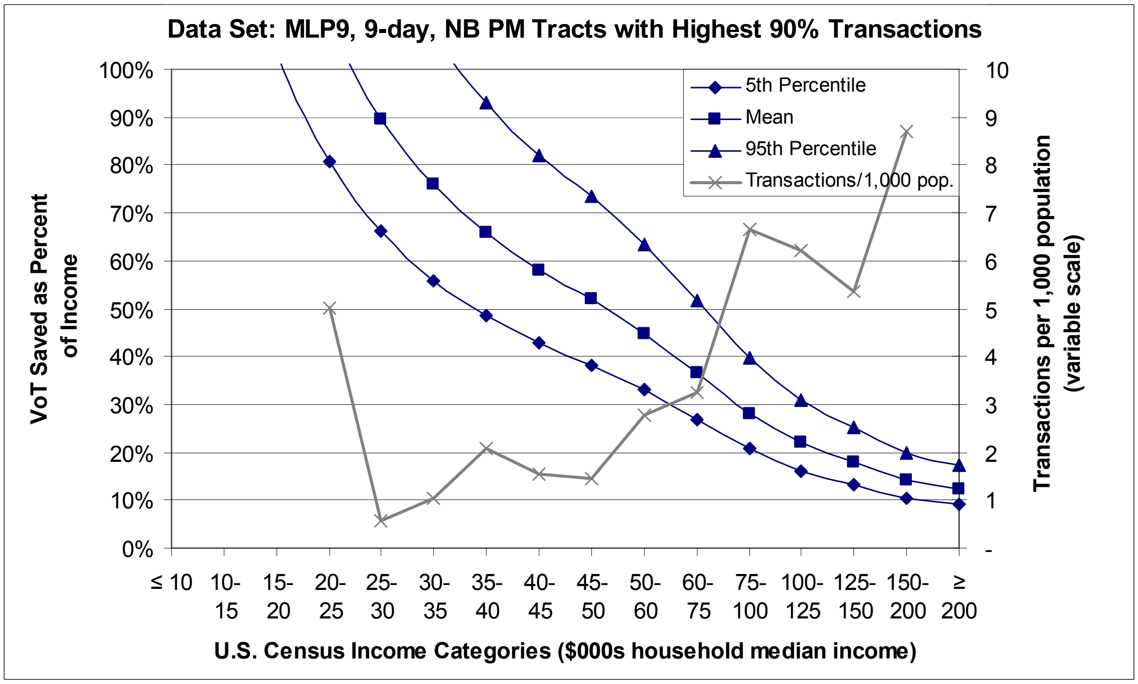
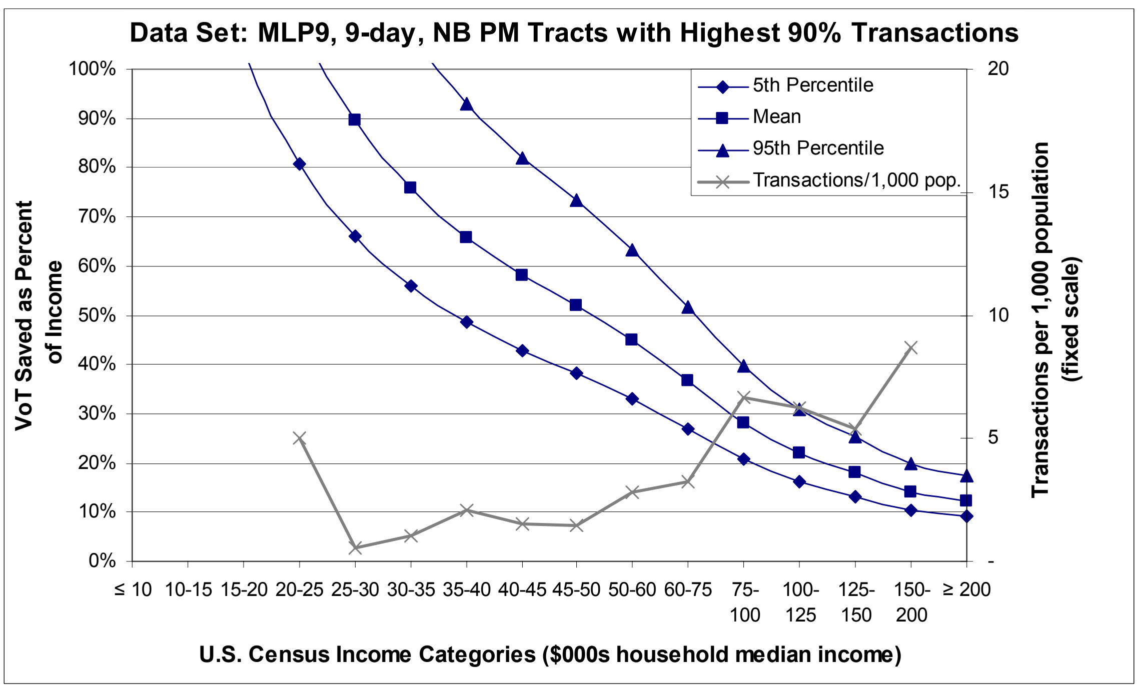
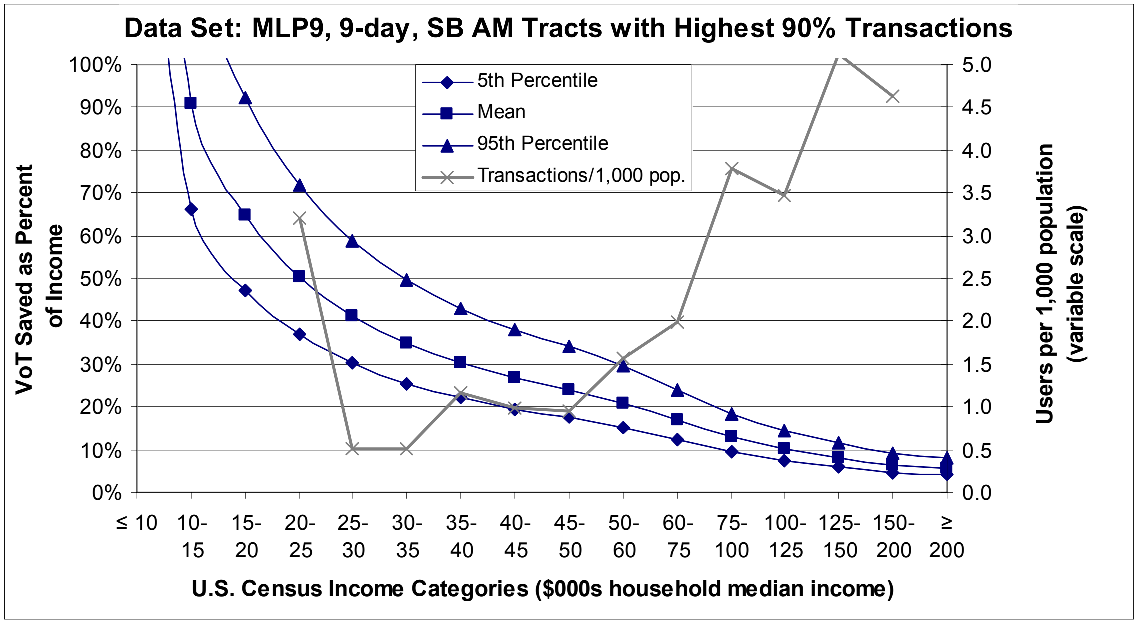
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200
U.S. Census Income Categories ($000s household median income)

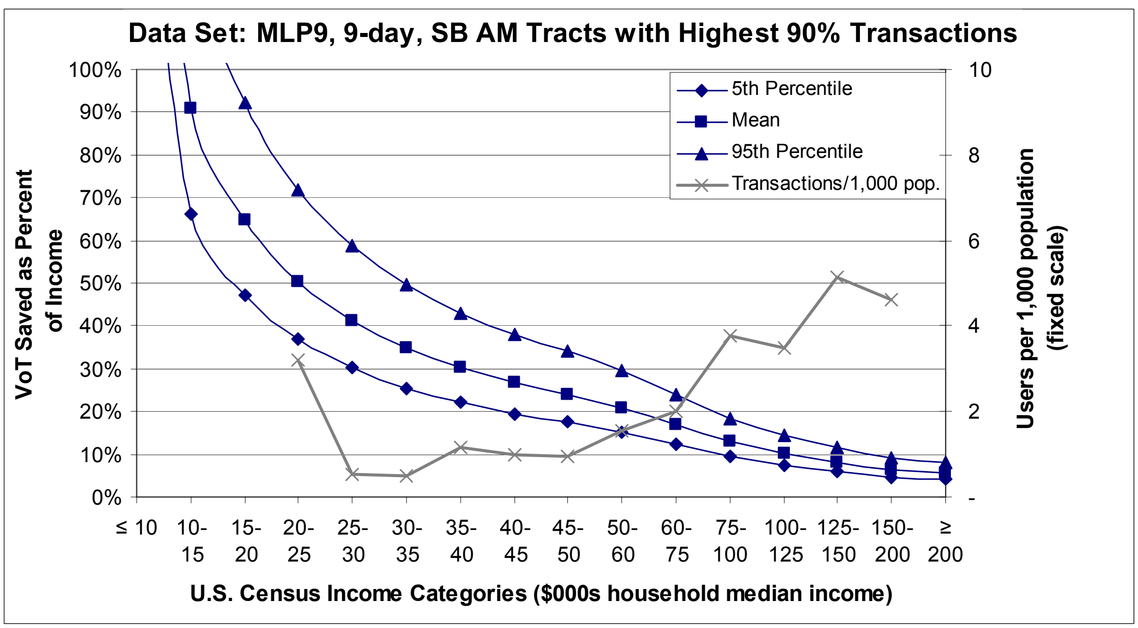

Data Set: MLP9, 9-day, NB Midday Tracts with Highest 90% Transactions
VoT Saved as Percent of Income
Transactions per 1,000 population (fixed scale)
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
20
15
10
5
-
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200
U.S. Census Income Categories ($000s household median income)


Data Set: MLP9, 9-day, NB PM Tracts with Highest 90% Transactions
VoT Saved as Percent of Income
Transactions per 1,000 population (variable scale)
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
10
9
8
7
6
5
4
3
2
1
-
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200
U.S. Census Income Categories ($000s household median income)

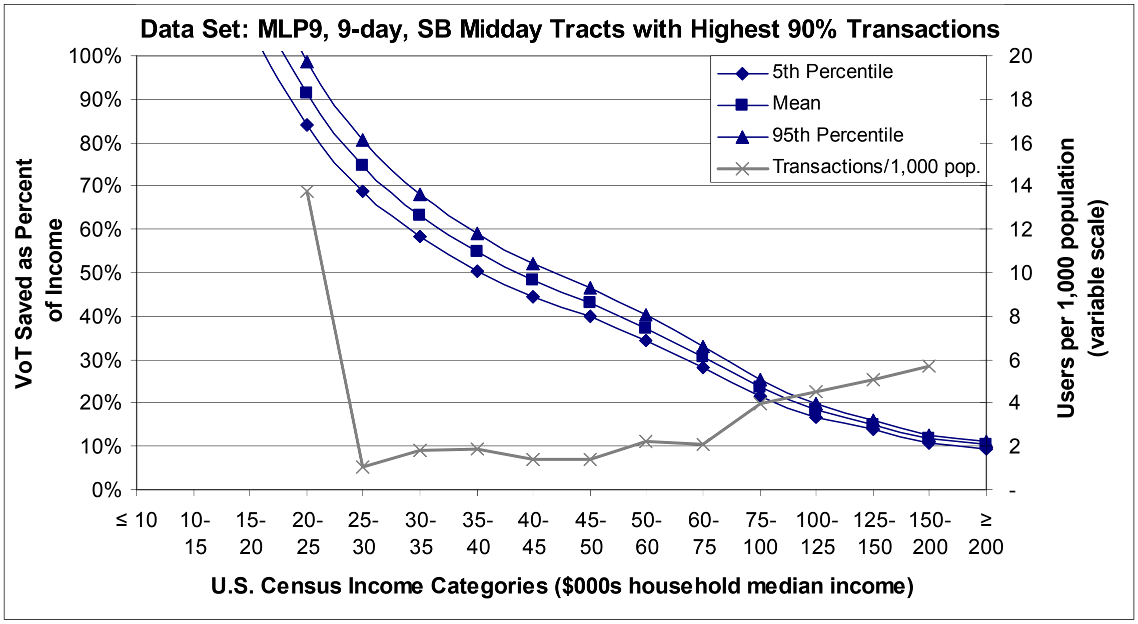

Data Set: MLP9, 9-day, NB PM Tracts with Highest 90% Transactions
VoT Saved as Percent of Income
Transactions per 1,000 population (fixed scale)
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
20
15
10
5
-
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200
U.S. Census Income Categories ($000s household median income)



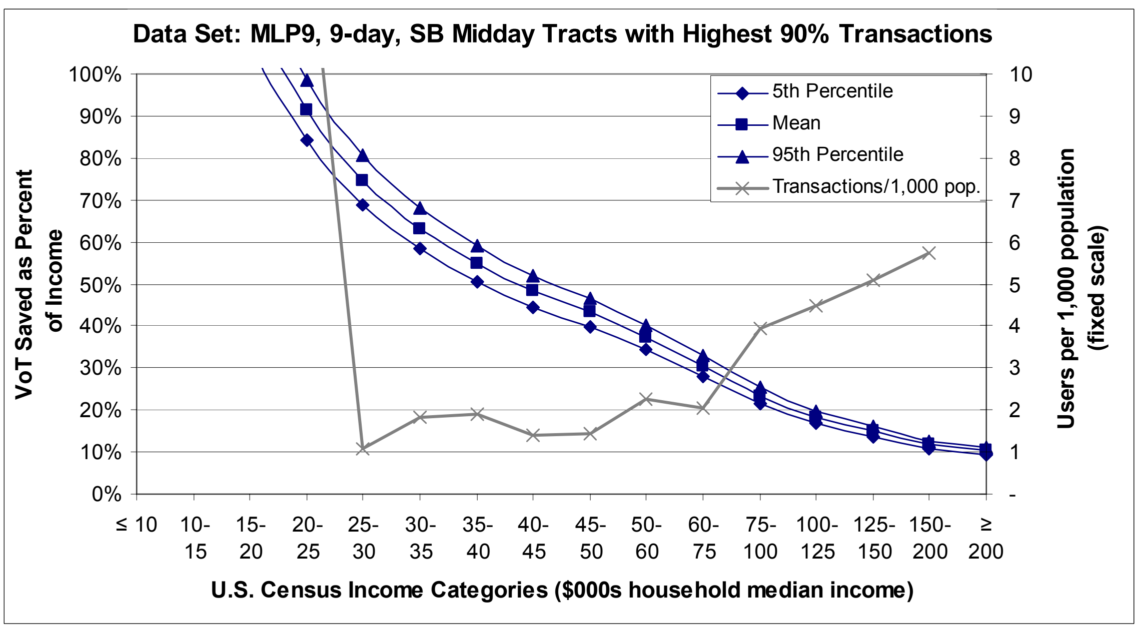
Data Set: MLP9, 9-day, SB AM Tracts with Highest 90% Transactions
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
VoT Saved as Percent of Income
Users per 1,000 population (variable scale)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200
U.S. Census Income Categories ($000s household median income)



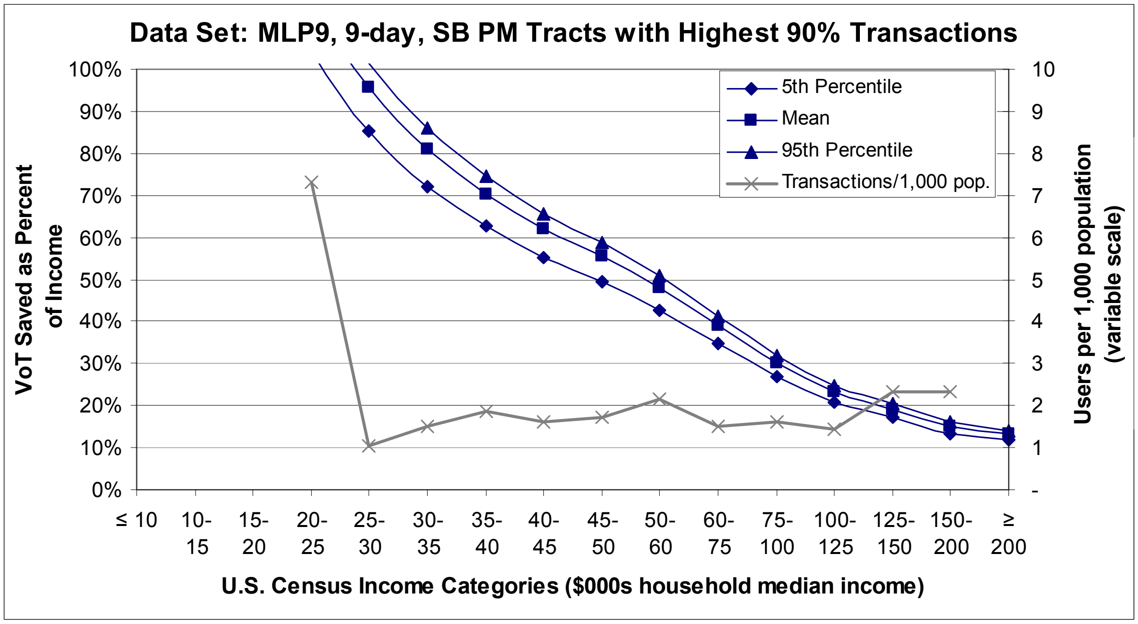
Data Set: MLP9, 9-day, SB AM Tracts with Highest 90% Transactions
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
VoT Saved as Percent of Income
Users per 1,000 population (fixed scale)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
10
8
6
4
2
-
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200
U.S. Census Income Categories ($000s household median income)



Data Set: MLP9, 9-day, SB Midday Tracts with Highest 90% Transactions
VoT Saved as Percent of Income
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Users per 1,000 population (variable scale)
20
18
16
14
12
10
8
6
4
2
-
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200
U.S. Census Income Categories ($000s household median income)



Data Set: MLP9, 9-day, SB Midday Tracts with Highest 90% Transactions
VoT Saved as Percent of Income
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Users per 1,000 population (fixed scale)
10
9
8
7
6
5
4
3
2
1
-
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-60
60-75
75-100
100-125
125-150
150-200
≥ 200
U.S. Census Income Categories ($000s household median income)


Data Set: MLP9, 9-day, SB PM Tracts with Highest 90% Transactions
VoT Saved as Percent of Income
Users per 1,000 population (variable scale)
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
10
9
8
7
6
5
4
3
2
1
-
≤ 10
10-15
15-20
20-25
25-30
30-35
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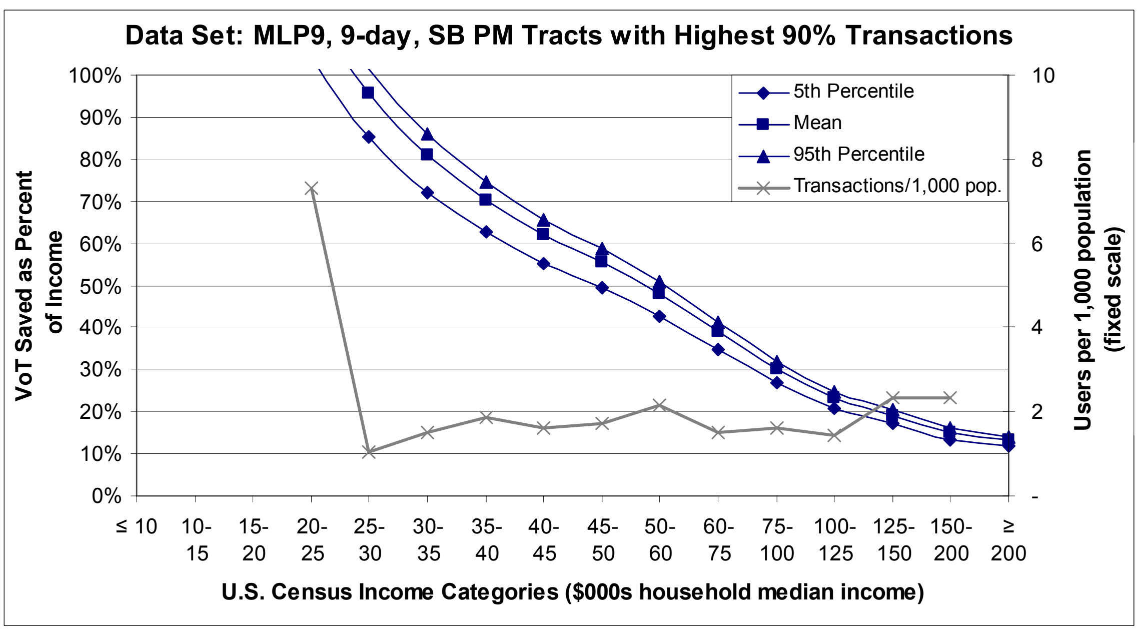
U.S. Census Income Categories ($000s household median income)


Data Set: MLP9, 9-day, SB PM Tracts with Highest 90% Transactions
VoT Saved as Percent of Income
Users per 1,000 population (fixed scale)
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
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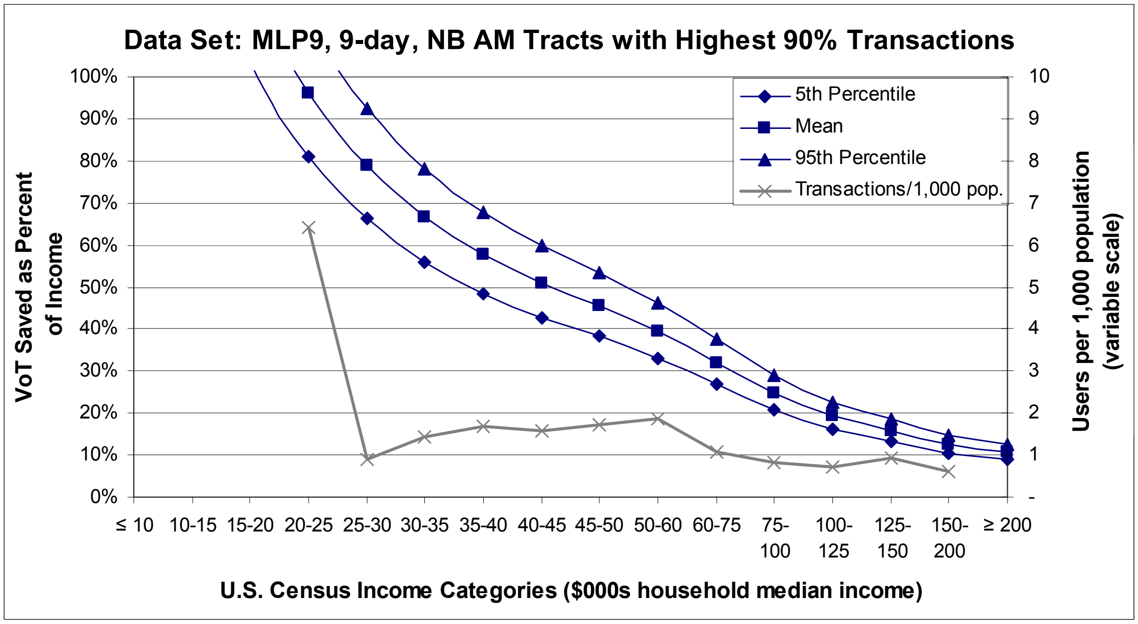
Data Set: MLP9, 9-day, NB AM Tracts with Highest 90% Transactions
VoT Saved as Percent of Income
Users per 1,000 population (variable scale)
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
≤ 10
10-15
15-20
20-25
25-30
30-35
35-40
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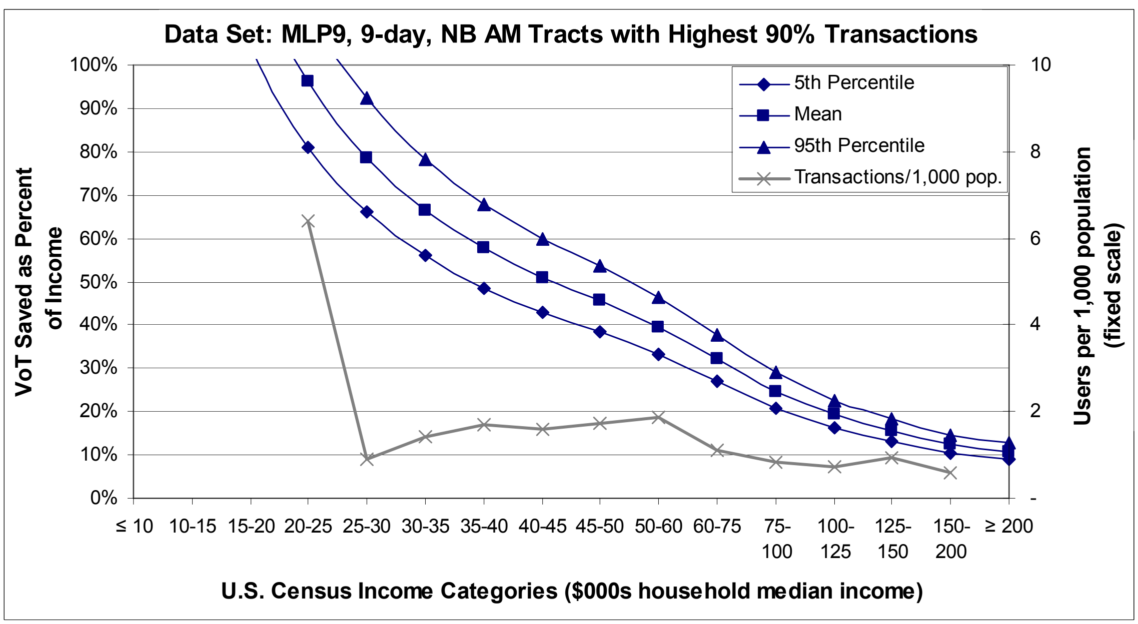
Data Set: MLP9, 9-day, NB AM Tracts with Highest 90% Transactions
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Users per 1,000 population (fixed scale)
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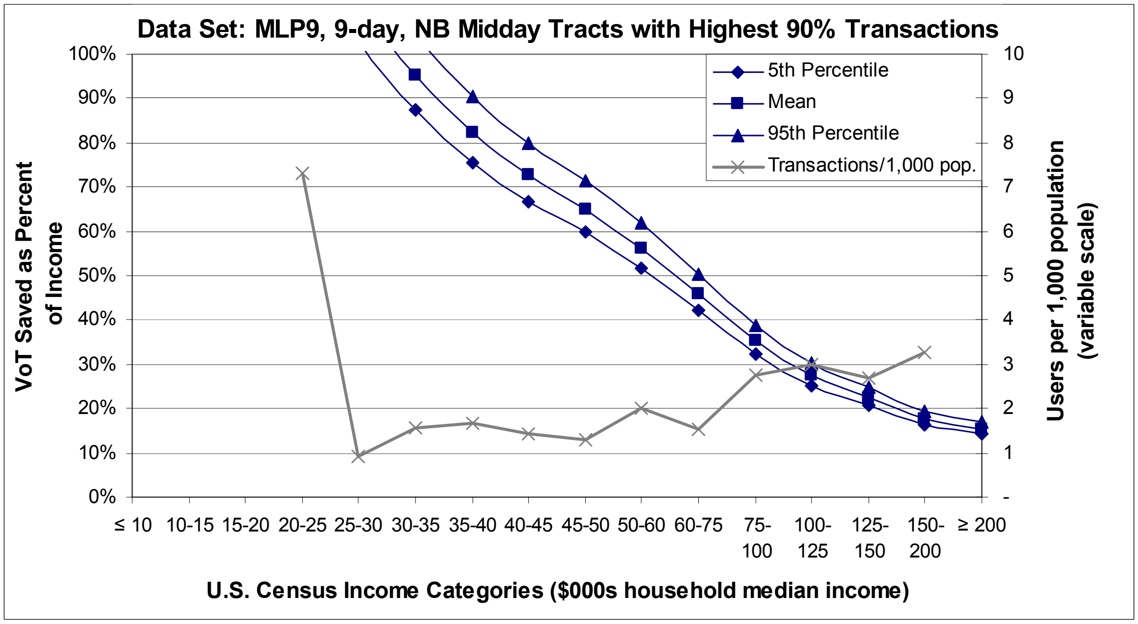
Data Set: MLP9, 9-day, NB Midday Tracts with Highest 90% Transactions
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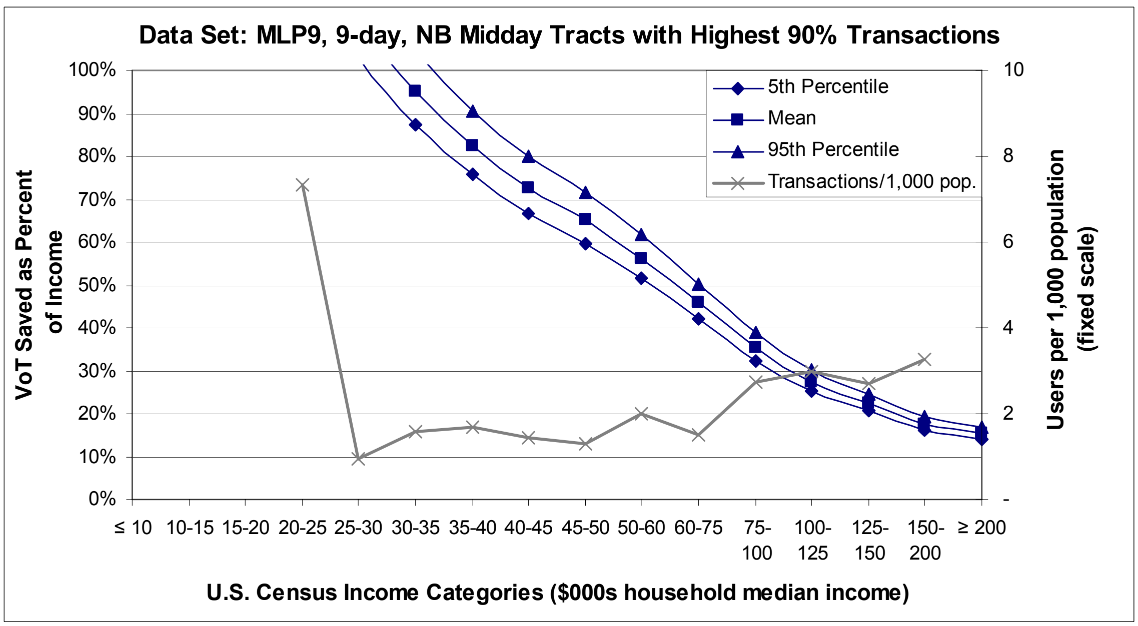
Data Set: MLP9, 9-day, NB Midday Tracts with Highest 90% Transactions
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
VoT Saved as Percent of Income
Users per 1,000 population (fixed scale)
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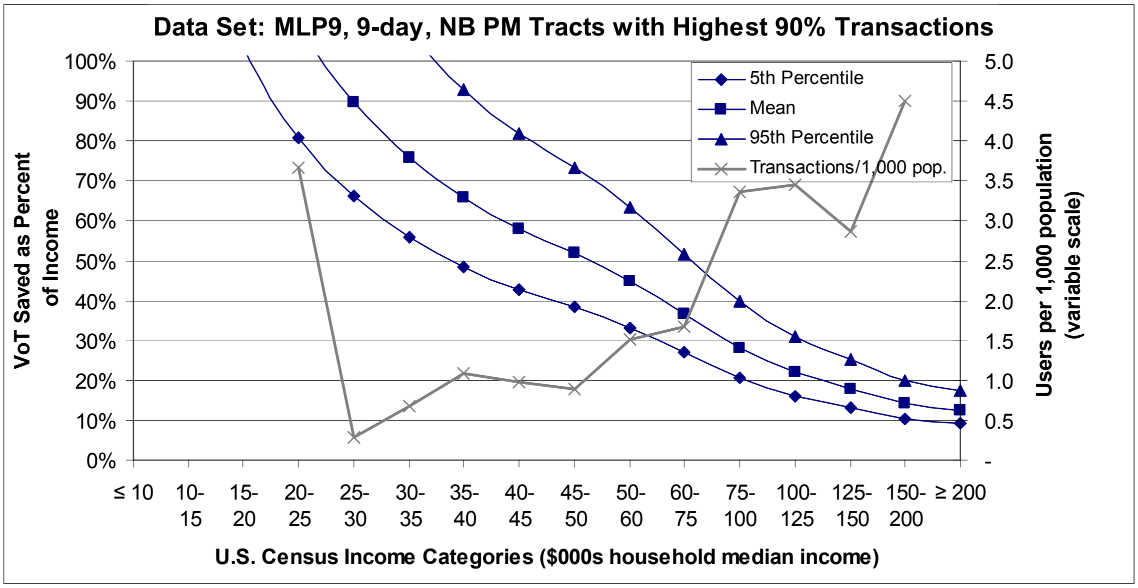
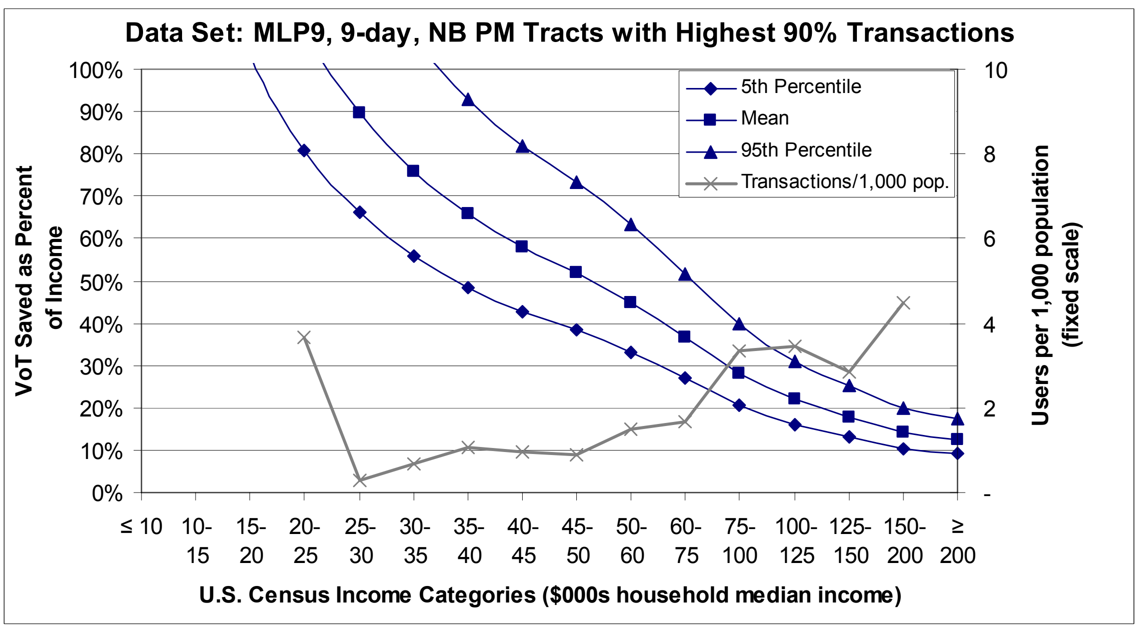

Data Set: MLP9, 9-day, NB PM Tracts with Highest 90% Transactions
VoT Saved as Percent of Income
Users per 1,000 population (variable scale)
5th Percentile
Mean
95th Percentile
Transactions/1,000 pop.
U.S. Census Income Categories ($000s household median income)


Data Set: MLP9, 9-day, NB PM Tracts with Highest 90% Transactions
VoT Saved as Percent of Income
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Mean
95th Percentile
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U.S. Census Income Categories ($000s household median income)