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ABSTRACT

In May of 2005, Interstate 394 became the third dynamically priced High Occupancy Toll (HOT) lane in the United States. Branded as the I-394 MnPASS lanes, they operate in a similar fashion to facilities in Southern California, where commuters purchase electronic transponders and drive through gantries, which automatically deduct the toll. Tolls are variable: the more congested the lane becomes, the higher the toll. In essence, Single Occupancy Vehicles (SOVs) are allowed to pay for the privilege of driving in the carpool lane. Carpools, transit service, and motorcycles remain free. Equity stands at the crux of implementation and public acceptance. What benefits do low-income members of the population receive from HOT lanes, aside from the preservation and possible expansion of transit and carpool lanes? Higher-income earners use the lane more frequently, but do infrequent users benefit as well? This paper hypothesizes that simply by owning a transponder and therefore a virtual insurance policy of an on time arrival at one's destination, that transponder owner receives a benefit, even if they only use it once per month. Regardless of socio-economic status, the small barriers to transponder ownership do not preclude one from owning a transponder and therefore receiving the benefits. To test this hypothesis a binary choice model was used to predict transponder ownership based on one's need to be where they are going on time. Support for this hypothesis was not found. However, refinements to the measuring technique may yield other results.

1.0 INTRODUCTION

1.1 I-394 MnPASS Overview

Minnesota implemented High-Occupancy Toll (HOT) lanes on Interstate 394 from downtown Minneapolis through its western suburbs in May 2005 (*1*). Branded as the I-394 MnPASS lanes, they operate in a similar fashion to facilities in Southern California, where commuters purchase electronic transponders and drive through gantries, which automatically deduct the toll. Tolls are variable and determined not by the number of commuters in the general purpose lanes, but rather by the number of commuters in the HOT lanes. The more congested the lane becomes, the higher the toll. Electronic signs update commuters as toll prices fluctuate; however, the price paid on entry remains valid for the entire commute. Typical peak period tolls run $1 to $4, but can reach as high as $8 during periods of unusual congestion. The system runs 11 miles in length and is divided into two sections: west of highway 100, the MnPASS lanes are separated from the general purpose lanes by a double white strip painted lines with multiple points of entry; and east of highway 100, the 2 lanes operate in the barrier-separated reversible section, with access points only at each end. The toll revenue pays not only for the capital costs, but is also reinvested into the corridor. The goal of the system is to maintain the free flow nature of the managed lane and improve the overall effectiveness of the corridor. By imposing a value on the amount of time saved, those with a high value of time (e.g. late for an airplane) pay for a congestion free trip, those that do not, benefit indirectly as fewer cars travel in the general-purpose lanes (*2,3*).

1.2 Justification and Thesis

Although other HOT lanes exist, they remain a new enough concept that there is little empirical information on their impacts for transportation planners and policy makers to use when making decisions about similar facilities. The uniqueness of this tolling situation has prompted many critics to react viscerally, arguing that these "Lexus lanes" benefit only the wealthy and that the gains in infrastructure efficiency are insufficient to counteract the uneven distribution of benefits. These equity concerns, if left unaccounted for, may render this innovative concept's potential stunted. Investigating a portion of this equity claim is the focus of this paper.

To more thoroughly understand who actually benefits from such facilities, an untangling process will help frame the arguments. Clearly those who lease transponders and use the HOT

lane on a regular basis derive a benefit; otherwise they would not use it. Those who do not lease a transponder also benefit from the HOT lane in three possible ways: (1) congestion-free transit and carpool options with reliable travel times, (2) decreases in traffic in the general purpose lanes, and (3) a funding source for transit and other improvements within the corridor. In the case of I-394, the High Occupancy Vehicle (HOV) lane was underutilized. Had it been converted to a general purpose lane, transit and carpool travel-time advantages and a potential funding source would have been lost. These equity arguments are discussed further in the next section in the context of similar projects in California and Texas. What this paper hypothesizes is that those who lease a transponder receive a benefit regardless of number of monthly uses, simply because the option exists to them. To measure this benefit, this paper proposes that the flexibility of arrival time at one's destination plays an important role in influencing the decision to lease a transponder. As such, the flexibility of arrival time should be a statistically significant variable in predicting whether an individual will lease a transponder and therefore be able to derive the benefit of having the option. The data for this investigation is taken from an attitudinal survey conducted before and after implementation and is discussed in the third section in greater detail.

Table 1 (found below) indicates that little variation in support for the project exists between demographic groups, such as income, gender, and education level. To measure the benefit of ownership, this paper uses a self-reported measure of how flexible their arrival times are to predict transponder ownership. Little variation in flexibility of arrival between income levels was found in the attitudinal survey data. For example, of the lowest-income respondents, 59 percent reported having less than 20 minutes of flexibility, while 53 percent of the highest-income respondents reported having the same flexibility. While those with inflexible arrival times may use the HOT lane option as a function of their income, the option created through ownership may be in part determined by their need to arrive on time. Sullivan, Supernak, and Burris all examined individuals' weekly use of HOT lanes, however, I suggest that that premise, while valuable, may be missing a critical benefit: transponder ownership[1]. Simply owning a transponder empowers the individual to guarantee a travel time. For example, a person may normally carpool (and therefore use the lane free of charge), however, when their partner is unable to ride (say once a month) they do not want to be without use of the HOT lane. Another

[1] On the I-394 MnPASS project transponders are leased for $1.50 per month. This services customers in a manner very similar to free ownership of the transponder coupled with a monthly service fee. This distinction is slight and will be ignored through the paper.

example might be someone on a tight budget, with a job that requires a certain time of arrival, and for whom carpooling and transit are not reasonable options. On a typical day, they wake early and leave early, but have purchased a transponder as a type of arrival time insurance. Although they rarely use the lane, a benefit is gained simply by knowing that a faster option exists, if and when they need it. A binary choice model is used to predict transponder ownership based on one's need to be where they are going on time.

Table #1: Perception of Allowing Single-occupant Vehicles to Use Carpool Lane by Paying a Fee
What do you think of allowing single drivers to use the carpool lanes by paying a toll?

Respondents*			
	Good Idea	Bad Idea	No Opinion
All Respondents	61%	26%	13%

Respondents by Income			
	Good Idea	Bad Idea	No Opinion
Less than $50K	65%	20%	15%
More than $50K	61%	27%	12%

Respondents by Gender			
	Good Idea	Bad Idea	No Opinion
Male	60%	28%	12%
Female	64%	23%	14%

Respondents by Education Level			
	Good Idea	Bad Idea	No Opinion
High School or Less	60%	25%	17%
College/Trade/Vocational	62%	24%	15%
BA/BS Degree	62%	26%	12%
Graduate Work	61%	26%	11%

**Respondents are randomly selected residents of I-394 and I-35W corridors.*
(Survey conducted from May and June 2006, N=944, Wave 3)

To address these equity concerns (among other concerns), a longitudinal attitudinal panel survey has been utilized. The Minnesota Department of Transportation, in conjunction with the State and Local Policy Program (SLPP) at the University of Minnesota's Humphrey Institute of Public Affairs and NuStats, a statistical survey firm, collaborated to measure how the public perceives MnPASS's effectiveness. This paper seeks a deeper understanding of the equity issues through evaluation of wave 3 data collected during May and June 2006, one year after operations began.

1.3 Related HOT Lane Projects Surveys

1.3.1 SR-91 Orange County

SR-91 opened in December 1995 as the first value-priced roadway in the nation. The 10-mile stretch connects the employment centers of Orange County and southern L.A. County through the addition of two express lanes in each direction. The lanes are separated from the general-purpose lanes by a "soft" barrier consisting of painted lines and pylons. Heavy commercial vehicles are not permitted on the route and carpools travel at a discounted rate. No tollbooths exist, only electronic gantries, users are required to purchase and display small electronic transponders.

Edward Sullivan, from Cal Poly State University in San Luis Obispo, has studied the corridor extensively. The objective of Sullivan's research was "to develop information and insights for improved understanding of travelers' reactions to market-based road pricing and the other innovative features of this unique facility (*4*)." To accomplish this goal, Sullivan's team conducted telephone surveys of approximately 500 drivers whose license plates had been captured while traveling on SR-91 the previous week. They were asked a series of questions in the fall of 1995 (prior to the opening) in regards to tolling. Approval rating for the tolling of roads came back at around 65 percent across user groups. When asked about variable priced tolling, respondents were significantly less enthused with an approval of about 45 percent.

Of note is Sullivan's examination of equity issues. He found that as incomes increased, the number of people who had never used the express lane decreased. However, Sullivan also learned that of the lane's frequent users, little variation existed between income levels between $40,000 and $100,000. Over $100,000, the level did increase significantly and stood nearly twice as large as those $40,000 to $100,000 users. Despite limitations due to the sample size, this difference was statistically significant at the 90% confidence interval.

Sullivan's evaluation was accomplished through a variety of opinion surveys, rather than maintaining a longitudinal panel throughout the study. The opinion survey conducted prior to the implementation of the SR-91 HOT lanes yielded results and a baseline from which to work, but it was unable to track the change in an individual's perception of SR-91 road pricing over time. Later Sullivan's team attempted to rebuild the panel; however, only 332 participants remained out of the original 500, leaving a panel supplemented with new participants. Additionally, no control group was included in Sullivan's survey (*5*).

1.3.2 I-15 San Diego

The successes on SR-91 contributed to the utilization of road-pricing solutions on the congestion-clogged I-15 (*6*). In December 1996, (one year after the opening on the SR-91 facility) a demonstration project began on an 8.5 mile stretch of I-15. The underutilized reversible "Express Lanes" were opened to SOV through a tolling system, transforming them into HOT lanes. The reversible lanes, which are separated from the general-purpose lanes by a barrier, allow inbound traffic in the morning hours and outbound traffic in the evening through one point-of-entry and one point-of-departure.

In the first phase, SOV drivers purchased monthly passes (dubbed ExpressPass) that permitted unlimited use of the facility, while carpools remained within the lanes without a charge. A little over a year later, in March 1998, the second phase introduced windshield-mounted transponders for automatic vehicle identification of SOV drivers wishing to use "FasTrak." The transponders allowed a change in the toll collection method from monthly permits to a per-trip fee that was based on congestion levels. When congestion appeared, variable tolls charged to SOVs rose to maintain free-flow conditions within the lanes. Carpools continued to travel free of charge (*7*).

Wilbur Smith Associates and Janusz Supernak, of San Diego State University, have been researching congestion pricing on Interstate 15 since conception. While Wilbur Smith Associates conducted the baseline market survey, Supernak and a host of other researchers have investigated the impacts and attitudes of those directly affected by the changes. In the fall of 1996, Wilbur Smith Associates' baseline survey targeted SOV and HOV drivers as well as transit/vanpool riders who use I-15 from Ted Williams Parkway to the SR-163 split. A random dial telephone survey of 400 homes, three focus groups, and 141 face-to-face interviews with transit riders were employed by the firm to extract the public's attitude prior to the implementation of the changes. Approximately 70 percent of those polled expressed at least "somewhat" favorable view of tolling. Opposition by carpoolers stood at over 70 percent expressing at least a "somewhat" opposed view of tolling (*8*).

Supernak and his team of researchers developed a panel study to assess changing public attitudes over a three-year period with five surveys. A control group was set up within the I-8 corridor to allow for identification of any regional changes and attempt to reduce outside influences, such as gas price fluctuations. The Wave 1 survey was administered to

approximately 1,500 residents in fall 1997 with the successive waves following at approximately six month intervals. Supernak found that FasTrak customers differed from other users of I-15 in seven significant ways: more highly educated, mostly 35-54 years old, homeowners, household incomes over $80,000, more likely to be female, members of two vehicle households, and use the one onramp to the system, Ted Williams Parkway (*9,10*).

During the second wave of the study, in spring 1998, following the switch to variable pricing and FasTrak, researchers replaced those who refused a second interview or could not be found or moved away with similar category users. Thirty-four percent (516 of 1,501) of the participants had to be replaced for Wave 2; similar attrition took place between Waves 2 and 3. As a whole, commuters recognized a reduction in commute time. While carpooling remained fairly constant on the control corridor (I-8), it increased on I-15 (*11*).

1.3.3 Houston HOT Lane (QuickRide Program)

Although the reversible HOT lane on the Katy Freeway is not dynamically priced and does not allow SOV drivers, the equity issues are similar. In January 1998, two passenger vehicles were permitted to enter the lane for a fee of $2, while vehicles with three or more passengers continued to travel for free.

Mark Burris and Robert Hannay, both from Texas A&M in College Station, specifically examined equity issues associated with the lane. Together, they compared surveys sent to QuickRide enrollees and non-participants. Burris found that people significantly overstated their use of the program, however, this overstatement did not vary across the socio-economic characteristics. Interestingly, Burris also uncovered evidence that use of the lane varied little depending on household income, occupation, household size, and income.

Burris followed his findings with a discussion suggesting that, while only ten respondents had income of less than $40,000, research such as his may leave a portion of the story untold. He pointed to the requirement of a credit card for opening an account and other cost increasing fees as possible pressures prohibiting many lower-income potential users from joining the program. He concluded his report by proclaiming that, “no individuals were worse off due to the program (*12*).”

2.0 DEFINING EQUITY

Multiple definitions of equity exist and in order to evaluate it properly, a definition must first be established. The following three definitions may be considered:

1. Horizontal equity spotlights issues of cost / benefit fairness across similar groups.
2. Vertical equity, in terms of income and social class, focuses on the distribution of costs / benefits among income and social classes.
3. Vertical equity, in terms of an individual's need for mobility and ability to actually move, evaluates an individual's transportation needs by placing them in the context of the rest of the community (*12*).

For the purposes of this paper, the second and third definitions addressing vertical equity will be examined. While horizontal equity is important it was beyond the scope of this paper, as most critics of HOT lanes are concerned with vertical equity issues.

3.0 I-394 WAVES 1, 2, AND 3 SURVEY METHODS

The attitudinal panel survey for the I-394 MnPASS evaluation was developed to build on the work of Sullivan and Supernak. It consisted of three periods (or waves) of data collection, with the first wave taking place before implementation of the HOT lane (November and December 2004), the second wave occurring after six months of operation (November and December 2005), and the third occurring at the one year anniversary (May and June 2006). To assist in determining causality in future waves, control samples were collected simultaneously with the treatment sample. The treatment sample consisted of households selected from the I-394 travel shed, and the control sample consisted of households in the I-35W travel shed. I-35W was selected as the control because it was the other highway in the region with an HOV lane.

The sample was not only defined geographically, but also defined based on roadway usage. The I-394 Wave 1 stratum was comprised of persons who used I-394 between Highway (Hwy) 101 and I-94, or a parallel segment of Hwy 55, in the five weekdays prior to being interviewed. The I-35W Wave 1 stratum was comprised of persons who used I-35W between Hwy 62 and Hwy 13 or a parallel segment of Hwy 77, in the five weekdays prior to being interviewed. The allocation of sample across each of the waves attempted to optimize the number of interviews within the I-394 stratum. The Wave 1 or baseline survey design assumed that 750 interviews (out of 1,000) would be completed with households in the I-394 stratum.

Wave 2 of the survey supplemented the existing panel with 250 transit users and 151 MnPASS transponder owners, for a total of 950 participants after panel attrition. This was done in an effort to ensure that all users groups would be adequately represented. Wave 3 supplemented the Wave 2 pool further with the addition of 601 randomly selected residents of I-394 and I-35W, for a total of 1,228 participants (after attrition). Those 601 additional respondents also included a stratum to the west of the I-394 corridor. They were included in response to the high number of transponder owners in that location. All three waves were conducted over the telephone and lasted approximately twenty minutes. As experienced by previous evaluations, panel attrition necessitated a supplemental sample.

3.1 Methodology

A binary choice model was selected to evaluate if flexibility of arrival time would predict whether someone owned a MnPASS transponder or not. To refine the model, only people who had traveled at least one trip during the preceding five weekdays in the I-394 travelshed were included, reducing the total number of respondents to 933. This was done to eliminate those participants in the control corridor, I-35W, and to insure that those included actually traveled the corridor on a regular basis. Further reducing the participants were those missing information. This reduced the number of participants to 538. To test whether flexibility of arrival time would be a predictor in an individual's decision to purchase a transponder, four logistic regressions were run. The independent variables for the first one were:

- Male – a dummy variable for gender of respondent (male vs. female)
- EducationLevel – education level of respondent with three bins: some college or less/technical or vocational, a BS/BA degree, and graduate work beyond a BS/BA degree.
- Age1 – age of respondent with four bins: 18-34, 35-44, 45-54, 55 and older
- Income –income of respondent with six bins: $49,999 or less, $50,000 - $74,999, $75,000 - $99,999, $100,000 - $124,999, $125,000 - $149,999, and $150,000 or more.
- White – a dummy variable for race of respondent (white vs. non-white)
- SelfEmployed – a dummy variable for self employed (self employed vs. not self employed)
- OwnHome – a dummy variable for home ownership (own home vs. do not own home)

The second, third, and fourth logistic regressions all included a dummy variable, measuring the respondents' flexibility of arrival time. The phone survey asked the respondents to categorize their arrival time into one of six bins.

1. Have to be there at a specific time
2. Have to be there at a specific time plus or minus 10 minutes
3. Plus or minus 30 minutes
4. Or did you have more flexibility in arrival time than that
5. Did not know
6. Refused

The second, third, and fourth regressions were run with dummy variables, capturing information on how flexible schedules were. Nobody refused to answer the question of did not know how flexible their arrival times were, leaving only the bins 1-4.

- Flex3 was the most flexible, capturing anyone with less than plus or minus 30 minutes.
- Flex2 was a midpoint, capturing anyone with less than plus or minus 10 minutes.
- Flex1 was the most inflexible, capturing anyone that had to arrive at a specific time.

3.2 Results and Analysis

Case Processing Summary

Unweighted Cases(a)		N	Percent
Selected Cases	Included in Analysis	**538**	57.7
	Missing Cases	395	42.3
	Total	933	100.0
Unselected Cases		0	.0
Total		933	100.0

a If weight is in effect, see classification table for the total number of cases.

First Regression (Baseline)

Variables in the Equation

Dependent Variable: Transponder Ownership

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1(a)	Male	-.293	.230	1.629	1	.202	.746
	EducationLevel	.252	.161	2.447	1	.118	1.287
	Age1	-.032	.119	.071	1	.790	.969
	Income	.423	.078	29.692	1	**.000**	1.527
	White	.505	.596	.718	1	.397	1.657
	SelfEmployed	.201	.273	.541	1	.462	1.222
	OwnHome	1.026	.629	2.663	1	.103	2.790
	Constant	-4.785	.940	25.940	1	.000	.008

a Variable(s) entered on step 1: Male, EducationLevel, Age1, Income, White, SelfEmployed, OwnHome.
Findings in bold are significant (p<.05)

Second Regression (with flex3)

Variables in the Equation

Dependent Variable: Transponder Ownership

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1(a)	Male	-.289	.230	1.575	1	.209	.749
	EducationLevel	.246	.162	2.315	1	.128	1.279
	Age1	-.029	.120	.058	1	.810	.972
	Income	.424	.078	29.683	1	**.000**	1.528
	White	.493	.596	.683	1	.409	1.636
	SelfEmployed	.200	.273	.536	1	.464	1.222
	OwnHome	1.024	.628	2.658	1	.103	2.784
	Flex3	.162	.223	.530	1	.466	1.176
	Constant	-4.864	.946	26.458	1	.000	.008

a Variable(s) entered on step 1: Male, EducationLevel, Age1, Income, White, SelfEmployed, OwnHome, Flex3.
Findings in bold are significant (p<.05)

Third Regression (with flex2)

Variables in the Equation

Dependent Variable: Transponder Ownership

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1(a)	Male	-.272	.231	1.395	1	.238	.762
	EducationLevel	.257	.162	2.526	1	.112	1.293
	Age1	-.026	.120	.047	1	.828	.974
	Income	.421	.078	29.332	1	**.000**	1.524
	White	.494	.596	.687	1	.407	1.639
	SelfEmployed	.190	.274	.483	1	.487	1.210
	OwnHome	1.017	.628	2.623	1	.105	2.766
	Flex2	.244	.221	1.217	1	.270	1.277
	Constant	-4.907	.948	26.806	1	.000	.007

a Variable(s) entered on step 1: Male, EducationLevel, Age1, Income, White, SelfEmployed, OwnHome, Flex2.
Findings in bold are significant (p<.05)

Fourth Regression (with flex1)

Variables in the Equation

Dependent Variable: Transponder Ownership

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1(a)	Male	-.287	.231	1.548	1	.213	.750
	EducationLevel	.252	.161	2.445	1	.118	1.287
	Age1	-.032	.119	.070	1	.791	.969
	Income	.423	.078	29.684	1	**.000**	1.526
	White	.512	.597	.736	1	.391	1.668
	SelfEmployed	.196	.274	.513	1	.474	1.217
	OwnHome	1.031	.629	2.688	1	.101	2.805
	Flex1	.069	.279	.062	1	.804	1.072
	Constant	-4.812	.947	25.841	1	.000	.008

a Variable(s) entered on step 1: Male, EducationLevel, Age1, Income, White, SelfEmployed, OwnHome, Flex1.
Findings in bold are significant (p<.05)

3.2.1 General Findings

All the flexibility of arrival times variables were statistically insignificant (the p values were higher than the accepted limit of p<.05) and therefore the null hypothesis cannot be rejected. This finding suggests that arrival time flexibility does not influence peoples' decisions to purchase MnPASS transponder.

Furthermore, the regression does reinforce a previously known relationship. As one's income increases, so does the likelihood that they will own a transponder. Of note, gender, education level, age, whiteness, self employment, and home ownership were not found to predict transponder ownership.

Additionally cross-tabulations of transponder ownership and flexibility of arrival time were run and are included in Tables 2a and 2b. They serve to augment the regression results and provide a reference point for reader. Of note in Table 2b is the small difference in percentage of transponder owners between groups.

Table #2a: Flexibility of Arrival Time and Transponder Ownership (Values)

Cross-tabulation of Flexibility in Arrival Time and Transponder Ownership (Values)

		Flexibility in Arrival Time				
		At Specified Time	Within +/- 10 Minutes	Within +/- 30 minutes	Greater Flexibility	Total
Transponder Status	Own	30	38	17	59	144
	Do Not Own	164	177	97	351	789
	Total	194	215	114	410	933

Table #2b: Flexibility of Arrival Time and Transponder Ownership (Percent)

Cross-tabulation of Flexibility in Arrival Time and Transponder Ownership (Column Percents)

		Flexibility in Arrival Time				
		At Specified Time	Within +/- 10 Minutes	Within +/- 30 minutes	Greater Flexibility	Total
Transponder Status	Own	15.5%	17.7%	14.9%	14.4%	15.4%
	Do Not Own	84.5%	82.3%	85.1%	85.6%	84.6%
	Total	100.0%	100.0%	100.0%	100.0%	100.0%

For Tables 2a and 2b, only people who had traveled at least one trip during the preceding five weekdays in the I-394 travelshed were included (total number of respondents to 933).

4.0 DISCUSSION

As shown, the binary choice model and the cross-tabulations do not demonstrate that flexibility of arrival time is a contributing factor in determining whether one will purchase a transponder for the MnPASS system. Consequently, this suggests that the benefit received through ownership and the choice it affords is not large enough to overcome the $18 annual service/leasing fee ($1.50 per month), time-costs associated with opening an account, and any resulting usage costs. This leads to a five possible points/conclusions.

1. No benefit associated with ownership exists.
2. A benefit associated with ownership exists, but it is not large enough to justify the costs associated.
3. A benefit associated with ownership exists, but it is not clear to people with inflexible schedules how their lives might be improved. These residents might be more cautious to invest in the system and may need increased assurance that the trip time will be virtually guaranteed.
4. A benefit associated with ownership exists, but the survey question asked about flexibility of arrival time is too general and does not assess flexibility precisely enough. It should be broken down into multiple questions trying to assess how frequently people need to arrive exactly on-time and include some component regarding the consequences of late arrival.
5. A benefit associated with ownership exists for some inflexible schedule residents, but they do not travel during peak congestion periods, or during the hours of MnPASS operation, or do not drive a car to their destination that would take advantage of the benefit.

The first point is what the model was unable to refute. However, arguing that additional choices (e.g. the MnPASS lanes) do not create benefits is a challenging task. Barry Schwartz does make a compelling case for this in his popular book *The Paradox of Choice*, arguing that people fail to account for the decision time and personal angst as a portion of the cost and therefore actually experience a lower utility when new options are presented to them. While it is theoretically possible that people are not buying transponders in an effort to simplify their lives, Schwartz explains that most Americans still perceive choices as benefits (*14*).

The remaining four points assume that the benefit exists and offer reasons as to why the model failed to measure that benefit. The second and third points really focus more the associated costs. The $1.50 month fee and small cost accrued from occasional usage are such a small a percentage of the total cost associated with owning and operating a vehicle. However, household transportation budgets may already be stretched, leaving little room for extra costs, even if a benefit exists. Should the marginal cost of driving increase any farther (e.g. an increase in gas prices), those on tight budgets may simply switch modes. Another contributing factor that may be that MnDOT did not market MnPASS (after the initial campaign which concluded in June 2005) until after the completion of wave 3 and people may have been unaware of the cost/procedure of transponder ownership (*3*).

The fourth point is the most compelling and relates to the survey itself. The question regarding flexibility of arrival time is somewhat vague and does not allow people to more fully explain their work schedules. Some people may have inflexible schedules a few days a week, but greater flexibility on other days; how should somebody in that situation respond to the existing question? In this survey, the respondent decided. The question also neglects to measure the consequences associated with a tardy arrival. Severe consequences would increase the value of a guaranteed travel time, light repercussions would diminish the value.

The fifth factor relates to the time these potential users drive. Blue-collar jobs, which are typically lower income, may start and end at different times than white-collar jobs. The congestion at 6:30am is far less than the congestion at 7:30am. It is possible that many potential inflexible arrival time beneficiaries experience less congestion and therefore would not derive as great a benefit from the lane as those who drive during the peak.

Relating these thoughts to criticism of the lanes based on equity issues stands as the natural next step. As defined for purposes of this paper, vertical equity is the distribution of costs and benefits between income levels and social classes. Many on first learning of the HOT

lane concept react viscerally, arguing that the rich would only use these "Lexus Lanes." While a closer investigation also yields the understanding that the advantages to carpools and transit services remain. These advantages benefit everyone by increasing the throughput on the system without the addition of expensive infrastructure. This investigation does not dispute those benefits, but questions why inflexibility of arrival time did not predict transponder ownership. In theory it should. In this study of I-394, it did not.

5.0 CONCLUSION

The results of the study did not support the hypothesis that inflexible arrival times would be a predictor of transponder ownership, thereby failing to support the idea that simply having the option to use the MnPASS lane provides a benefit, even if the lane is only occasionally utilized. Despite this shortcoming, the discussion section provided a number of plausible reasons as to why an existing benefit may not have been measured using the current method. The paper, however, does find consistencies with previous research. Income predicts ownership of a transponder. The higher the income, the greater the disposable income and the more likely one is to purchase a transponder. With little imagination it seems clear that higher income people can afford to experiment with the new technology, while those with lower incomes are less willing. If increasing the equitability of the system is an objective, an investigation might be done into the possible elimination of the monthly fee and/or reduced rates for lower income families.

There may be many reasons to support the proliferation of HOT lanes, but this analysis shows that, as of now, the inflexible arrival time and the benefit of having the option to use it when needed is not one of them. Equity concerns stand firmly at the core of the resistance to the construction of HOT lanes throughout the United States. HOV to HOT conversions not only preserve the benefit to transit, but also reopen the possibility of constructing / converting general purpose lanes into HOT lanes and therefore increasing the benefit to transit. Increasing the effectiveness of the nation's highways translates to increasing person throughput by managing travel demand. The distribution of the costs and benefits across social class, income levels, etc., play an important role in assessing how equitable the system is. A closer examination of these benefits and costs is warranted.

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