

**TxDOT Research Project 0-5286**  
**THE ROLE OF PREFERENTIAL TREATMENT FOR**  
**CARPOOLS ON MANAGED LANE FACILITIES**

**SURVEY RESULTS**

**INTRODUCTION**

Sponsored by the Texas Department of Transportation (TxDOT), researchers at the University of Texas Arlington (UTA) and the Texas Transportation Institute (TTI) are conducting a research project that investigates the benefits and drawbacks of providing preferential treatment to high-occupancy-vehicles (HOVs) on managed lanes. To gain information for the study, an Internet survey was conducted from May to July in 2006. The survey, tailored for two different cities, was available in both English and Spanish on separate Dallas and Houston web sites at [HoustonTravelSurvey.org](http://HoustonTravelSurvey.org) and [DallasTravelSurvey.org](http://DallasTravelSurvey.org). The Internet survey customized questions so that only relevant questions were asked to each respondent.

The survey collected data on:

- Personal travel patterns including reasons for choosing the current travel mode(s)
- Managed lane opinions
- Stated preference on mode choice based on hypothetical travel and toll scenarios
- Demographic information

With various outreach efforts made to increase public awareness of the survey and to encourage participation from low-income and minority groups, the survey generated a total number of 4,634 responses, with 2,026 from the Dallas / Fort Worth (Dallas) area and 2,562 from the Houston area.

**SURVEY DATA**

Table 1 presents race/ethnicity, income, and travel mode distributions of the survey sample. It also compares the sample with the 2005 American Community Survey (ACS) data representing the general population in the Tarrant, Denton, Collin and Dallas counties for the Dallas area and Harris, Montgomery and Fort Bend counties for the Houston area.

The results show that the survey sample consists of a large proportion of white and high-income survey respondents as compared to the 2005 ACS population for the two areas. The distribution of travel mode is close to the 2005 ACS, with a slightly high proportion for the non-single occupancy vehicle (SOV) groups. Approximately 31 percent of Houston respondents and 43 percent of Dallas respondents were currently using a toll road.

**TABLE 1. COMPARISON OF SURVEY SAMPLE AND THE 2005 ACS**

	Dallas		Houston	
	Survey	ACS2005	Survey	ACS2005
<b>Race/Ethnicity</b>				
<b>White</b>	78.00%	57.68%	75.00%	48.54%
<b>African-American</b>	8.10%	14.97%	7.30%	17.06%
<b>Hispanic</b>	7.00%	20.22%	10.60%	27.04%
<b>Asian</b>	3.00%	5.17%	3.90%	6.02%
<b>Native American</b>	1.30%	0.35%	0.80%	0.23%
<b>Others</b>	2.60%	1.62%	2.40%	1.10%
<b>Total</b>	100%	100%	100%	100%
<b>Income</b>				
<b>Less than \$15,000</b>	4.35%	12.14%	3.77%	13.95%
<b>\$15,000 to \$24,999</b>	2.64%	11.20%	2.42%	12.32%
<b>\$25,000 to \$34,999</b>	4.63%	11.61%	5.42%	11.42%
<b>\$35,000 to \$49,999</b>	10.68%	15.43%	10.64%	14.80%
<b>\$50,000 to \$74,999</b>	17.24%	18.62%	19.41%	17.74%
<b>\$75,000 to \$99,999</b>	19.00%	11.93%	18.94%	10.80%
<b>\$100,000 to \$199,999</b>	34.42%	15.17%	33.18%	15.12%
<b>\$200,000 or more</b>	7.05%	3.91%	6.23%	3.86%
<b>Travel Mode *</b>				
<b>SOV</b>	74.8%	80.2%	64.8%	78.0%
<b>HOV2</b>	12.4%	8.7%	14.1%	9.2%
<b>HOV3+</b>	3.4%	3.0%	5.3%	3.6%
<b>Transit</b>	7.0%	1.7%	10.0%	3.1%
<b>Other</b>	2.4%	6.5%	5.8%	6.2%

\*Travel mode in the survey refers to a mode used for typical trips at the time of survey. ACS travel mode refers to commute mode for workers aged 16 and over.

## **WEIGHTING OF SURVEY DATA**

In order to more accurately represent the general population in each metropolitan area, weights were developed to adjust the survey sample for analysis of interest in managed lanes. Procedures for weighting the survey data include three major steps:

1. create data weighting parameters according to census data;
2. adjust the percentage of interest in managed lanes based on the weighting parameters created at step 1; and
3. adjust scores for given reasons using the weighting parameters.

Data for carpool analysis were not weighted due to three reasons: (1) the sample size of carpoolers was too small to yield significant observations for carpool questions by race/ethnicity and income; (2) the carpool sample catches the population that is most likely to be affected by managed lane policies because middle- or high-income users are choice carpoolers; and (3) research on carpool decisions and formation of this specific population will provide useful information for managed lane policy-making.

## **RESPONSES TO CARPOOL ISSUES**

In the survey, respondents who identified themselves as carpoolers were asked a number of questions regarding reasons for carpooling, types of carpooling, and carpool formation time. The results are presented in this section. In addition, SOV responses to reasons for NOT carpooling are also presented to provide information about the SOV perspective.

### **Reasons for Carpooling**

In the survey, carpool respondents were given a list of literature-based reasons that might affect decisions on carpool formation. They were asked to rate them on a scale of importance from 1 to 5, with 1 indicating the least important and 5 being the most important.

Table 2 summarizes HOV respondents' mean rankings of importance among the 14 potential options proposed. There were between 84% and 89% response rates on most of the potential factors in their decision. *Access to HOV lanes* and *relaxation while traveling* had the

top two mean scores at 3.77 and 3.60. Other carpooling reasons that were ranked relatively high by the survey respondents were:

- Enjoy traveling with others
- Help environment
- Travel time saving

**TABLE 2. REASONS FOR CARPOOLING**

<b>Factors</b>	<b>Frequency Selected</b>	<b>% of Total (N = 789)</b>	<b>Mean</b>	<b>Std. Deviation</b>
Access to HOV lanes	699	89%	3.77	1.54
Relaxation while traveling	77	10%	3.60	1.38
Enjoy travel with others	691	88%	3.26	1.48
Help environment and society	684	87%	3.23	1.45
Travel time saving	690	87%	3.16	1.68
Other	109	14%	3.16	1.89
Sharing vehicle expenses	703	89%	3.15	1.70
Reliability of arrival time	666	84%	2.93	1.66
Splitting tolls on toll roads	159	20%	2.38	1.61
Get work done while traveling	79	10%	2.24	1.52
Drop off kids at school/day care	674	85%	2.23	1.60
Carpool partner matching program	680	86%	2.07	1.44
Encouraged by program at work	677	86%	2.00	1.40
Preferred parking at work	687	87 %	1.94	1.40

### **Reasons for Not Carpooling**

The respondents who indicated SOV as their primary mode choice were later asked to identify their most important reasons for *not* carpooling, and were allowed to check all that apply from the list shown in Table 3.

**TABLE 3. REASONS FOR NOT CARPOOLING**

<b>Main Reasons</b>	<b>Frequency</b>	<b>Percent of Total SOV Users Who Selected</b>
Location and schedule limitation	1682	55 %
Travel flexibility	1394	45 %
Need a vehicle during the day	1190	39 %
Need to make other stops during trip	862	28 %
Appreciate alone time	567	19 %
No program to encourage me	417	14 %
Like to listen to radio that others do not	175	6 %
Potential partners have disagreeable traits	125	4 %
Other	248	8 %

The most important reasons cited for their decision-making were *difficulty of finding someone with the same location and schedule*, *flexibility of driving alone*, and *needing a vehicle during the day* (55%, 45%, and 39% of SOV respondents, respectively). The *need for making chain trips* was perhaps a little less important but still notable with 28% choosing it.

### **Carpool Formation**

In the survey, carpoolers were asked whom they traveled with on their most recent trip. The results of the responses by HOV2 and HOV3+ travelers are shown in Table 4. Results exceeded 100% as survey respondents could check more than one passenger type when appropriate. Overall, HOV users carpooled with their family members most of the time. When the rates of adult family member and child carpoools are combined, 75% of responses included those two. The second most popular type of carpool was between co-workers and/or someone who worked in a nearby office building. The prevalence of this type of carpool was about 26%. Casual and neighbor carpoools were both marked about 4% of the time, and examples of other types of carpoools, which made up about 9% of the responses, include boy/girl friends, roommates or housemates, as well as significant others.

**TABLE 4. TYPES OF CARPOOLS**

<b>Carpool Passenger*</b>	<b>HOV2</b>		<b>HOV3+</b>	
	<b>Frequency</b>	<b>% of Valid Responses</b>	<b>Frequency</b>	<b>% of Valid Responses</b>
Adult family member	335	57 %	94	48 %
Co-worker/nearby office building	141	24 %	51	26 %
Child	91	15 %	95	48 %
Casual carpooler	22	4 %	14	7 %
Neighbor	17	3 %	10	5 %
Other	33	6 %	7	4 %

\*Survey respondents were asked to check all that apply

### **Carpool Formation Time**

Carpoolers were also asked to enter in the amount of time, in minutes, it takes them to form their carpoools. In other words, how much extra time they spent picking up and dropping off their passengers that they otherwise would have saved by traveling straight to work. The results

are shown in Table 5. About 55% of HOV2 and 42% of HOV3+ users reported they spent no extra time due to their carpools. Another 20% of HOV2 and 23% of HOV3+ took five or fewer minutes to do so. An additional 11% of HOV2 and 14% of HOV3+ spent 6 to 10 minutes, meaning that a full 86% of HOV2 respondents and 76% of HOV3+ respondents spent 10 minutes or less in carpool formation. The remaining spent 11 or more minutes doing so. The average time of carpool formation was about 5 minutes with a standard deviation of 8.3 for HOV2s, and 7.8 minutes with a standard deviation of 13.1 for HOV3+s.

**TABLE 5. CARPOOL FORMATION TIME**

Extra Time for Forming Carpool	HOV2		HOV3+	
	Frequency	% of Valid Responses	Frequency	% of Valid Responses
0 Minute	278	55 %	69	42 %
1 – 5 Minutes	100	20 %	37	23 %
6 – 10 Minutes	56	11 %	23	14 %
11 – 15 Minutes	41	8 %	17	10 %
16 – 30 Minutes	29	6 %	12	7 %
31 – 90 Minutes	5	1 %	6	4 %

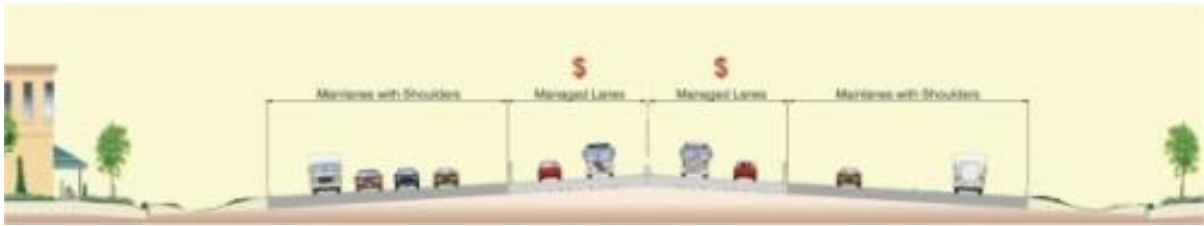
## **RESPONSES TO MANAGED LANES**

This section focuses on three issues related to managed lanes: (1) interest in using managed lanes; (2) reasons for interest in managed lanes; and (3) reasons for NOT being interested in using managed lanes.

### **Interest in Using Managed Lanes**

After an explanation of managed lanes (ML) (as illustrated in Figure 1) survey respondents were asked to respond to the question: “would you be interested in using managed lanes?” The responses were analyzed by user characteristics. The results presented in Tables 6 thru 9 were adjusted with the 2005 ACS data.

**Figure 1: Managed Lanes**



**TABLE 6. INTEREST IN HOUSTON AND DALLAS BY USER CHARACTERISTIC**

Characteristic	Percentage Interested in Managed Lanes			
	Toll Users		Non-Toll Users	
	Dallas	Houston	Dallas	Houston
<b>Household Income</b>				
Less than \$25,000	74.5%	71.8%	64.1%	70.5%
\$25,000 - \$50,000	80.1%	74.2%	75.7%	67.0%
\$50,000 - \$100,000	77.6%	72.4%	70.2%	66.4%
Greater than \$100,000	87.3%	84.5%	77.4%	77.0%
<b>Ethnicity</b>				
Caucasians	78.1%	77.2%	72.5%	71.4%
Afro-American	67.0%	72.4%	70.1%	73.2%
Hispanic	88.6%	69.9%	74.8%	68.9%
Others	90.1%	85.4%	59.0%	52.7%
<b>Trip Purpose</b>				
Commute	81.7%	72.3%	74.7%	71.4%
Recreational	74.9%	77.5%	67.2%	66.1%
Work	82.6%	75.7%	72.8%	63.4%
School	63.6%	46.7%	56.2%	72.0%
Other	56.1%	15.2%	65.8%	70.7%
<b>Mode</b>				
SOV	84.8%	78.6%	74.8%	69.0%
HOV-2	79.7%	84.9%	72.4%	70.8%
HOV-3+	95.9%	68.4%	73.0%	69.6%
Vanpool	94.6%	87.4%	79.7%	72.4%
Transit	63.3%	60.6%	54.1%	58.6%
Motorcycle	83.4%	74.4%	76.4%	72.1%
<b>Total</b>	80.7%	75.1%	73.3%	69.3%

There was considerable interest in the managed lane concept in both Houston and Dallas. In general, the interest in Dallas area was slightly

higher than that in the Houston area. Current toll road users also indicated higher interest rate than non-toll road users. There was no apparent pattern in response to interest in using managed lanes among income groups in both areas. However, data did show some differences in interest in using managed lanes by race/ethnicity, trip purpose, and travel mode. In Dallas, the percentage interest of African-American users was lower than that of white and Hispanic groups. The percentage interests of commute, SOV, HOV3+, and vanpool users were higher than that of their counterpart groups. In Houston, Hispanic user groups showed a lower interest rate than those of white and African-American groups. Conversely, toll road users on recreational trips, HOV travelers and vanpool users indicated higher interest rates than their counterparts.

Results in Tables 7 to 9 confirmed that, overall, current toll road users showed a higher interest in using managed lanes than non-toll road users. In addition, overall survey results indicated that private vehicle users, as well as households with two vehicles, were more interested in using managed lanes than transit users and other vehicle ownership users. Overall the sample did not show a clear correlation between level of interest and household income, although the percentage interest of users with household incomes over \$100K, regardless of toll road usage, was much higher than with other income groups.

**TABLE 7. INTEREST IN MANAGED LANES BY MODE**

MODE	Percentage Interested in Managed Lanes	
	Toll Users	Non-Toll Users
SOV	81.9%	72.1%
HOV2	82.3%	71.6%
HOV3+	82.3%	71.3%
Vanpool	90.9%	75.2%
Transit	62.0%	56.1%
Motorcycle	79.8%	74.2%

**TABLE 8. INTEREST IN MANAGED LANES BY HOUSEHOLD INCOME**

Household Income Group	Percentage Interested in Managed Lanes
------------------------	--

	<b>Toll Users</b>	<b>Non-Toll Users</b>
<b>&lt;\$25K</b>	73.2%	67.3%
<b>\$25K - \$50K</b>	77.4%	71.7%
<b>\$50K - \$100K</b>	75.3%	68.5%
<b>&gt;\$100K</b>	86.0%	77.2%
<b>Total</b>	77.4%	70.7%

**TABLE 9. INTEREST IN MANAGED LANES BY VEHICLE OWNERSHIP**

<b>Number of Vehicles Owned</b>	<b>Percentage Interested in Managed Lanes</b>	
	<b>Toll Users</b>	<b>Non-Toll Users</b>
<b>0</b>	73.6%	22.6%
<b>1</b>	76.2%	72.6%
<b>2</b>	82.1%	71.8%
<b>3</b>	69.8%	68.9%
<b>4+</b>	64.0%	65.9%
<b>Total</b>	77.7%	70.9%

### **Reasons for Interest in Using Managed Lanes**

In the survey, each respondent who expressed an interest in using managed lanes was given a chance to rank different reasons why they were interested in using the managed lanes. The ranking was on a 1 to 5 scale, 5 being the most important. Table 10 presents the average scores computed for each reason given by different mode users after weighting by the 2005 ACS data.

Overall, *travel time savings* (4.6) and *increased travel time reliability* (4.6) ranked as the strongest contributing factors for interest in managed lane use. The scores for both questions indicated that all user groups tend to rank these reasons as very important. The reasons of *less stressful* and *no large trucks on managed lane* were ranked after the above two reasons, with an adjusted score of about 4.2. Overall results are consistent for both toll and non-toll users. The results indicated that Texas travelers supported the idea of prohibiting large trucks from using managed lanes and will want to use managed lanes because they provide superior operational performance to the general-purpose lanes.

The total average score for the reason of *able to use carpool/vanpool on the managed lane* was the lowest among all factors. While it is not surprising that SOV travelers ranked this factor lower than other modes except for motorcycle, it is interesting to observe that most current carpool and vanpool users ranked the reason of *ability to use the managed lanes while driving alone* higher than the reason of *ability to use the managed lanes while carpooling*. This finding was important because without additional incentives to remain in a carpool, at least some current carpools are likely to revert to SOVs.

**TABLE 10. AVERAGE SCORES GIVEN FOR INTEREST IN MANAGED LANES**

Reason	SOV		HOV2		HOV3+		Vanpool		Transit		Motorcycle		Total	
	Toll	Non-Toll	Toll	Non-Toll	Toll	Non-Toll	Toll	Non-Toll	Toll	Non-Toll	Toll	Non-Toll	Toll	Non-Toll
<b>Able to travel alone and still use ML</b>	2.20	4.31	4.45	3.97	4.08	4.07	4.49	4.36	3.83	3.98	3.27	4.09	3.98	4.19
<b>Able to use transit on the ML</b>	3.96	2.12	5.00	4.19	3.85	3.03	5.00	5.00	3.99	3.93	0.00	0.00	3.96	3.44
<b>Able to travel faster than GPL</b>	4.72	4.57	4.62	4.57	4.31	4.31	4.71	4.87	4.46	4.38	4.32	4.51	4.56	4.55
<b>Travel time reliability</b>	4.69	4.54	4.62	4.64	4.37	4.41	4.77	4.61	4.55	4.33	4.24	4.51	4.56	4.55
<b>Able to use carpool / vanpool on ML</b>	2.39	2.39	3.55	4.10	3.48	3.95	3.74	4.30	3.59	3.74	3.01	2.22	2.77	2.88
<b>No large trucks on ML</b>	4.19	4.05	4.42	4.41	4.36	4.58	4.72	4.65	4.42	4.05	3.87	3.94	4.20	4.16
<b>ML less stressful</b>	4.39	4.13	4.49	4.41	4.40	4.61	4.75	4.57	4.49	4.22	3.90	4.10	4.34	4.22
<b>Other factor</b>	4.79	4.28	4.70	4.23	4.75	4.19	2.54	4.80	4.56	4.20	4.87	4.93	4.63	4.29

**Note: # observations: Number of people responded to the questions**  
**Score: The average score weighted by census data**

## Reasons for No Interest in Using Managed Lanes

Those respondents who were not interested in managed lanes were directed to a different set of questions to rank why they were not interested in managed lanes. As for the reasons of interest, the ranking of disinterest was also on a scale of 1 to 5, with 5 being the most important. Table 11 presents the average scores computed for each reason given by different mode users after adjusted by the 2005 ACS data.

The primary reason travelers were not interested in using managed lanes appears to be an opposition to the tolls required for their use, as seen from an average score of 3.8 for current toll road users and 4.4 for non-toll road users. This is not surprising as tolls are generally unpopular with the public. The opposition to managed lanes can be found from the specific reasons provided by respondents in the *other factor* category, as the most often cited reason in that category being that taxes already paid for the road. This reason was similar to that of ranking the toll as a major impediment to managed lane use.

The loyalty to current carpool and transit modes makes the managed lanes concept undesirable, as seen from the relatively high scores for reasons of *use bus or train, will not change* and *carpool, will not change* in Table 11. This is understandable as managed lanes would require current carpool and transit users to share their current facility with SOVs or become an SOV and pay a toll.

The low scores given to reasons involved with some operational or technical issue are also interesting. These results show that the main opposition to the concept of managed lanes does not rise from the fact that users may need to have credit card or install a transponder in their vehicles in order to be able to access these lanes, nor was it a result of the expected higher perceived complexity of these facilities compared to general-purpose lanes. This does not necessarily indicate that these issues are completely unimportant; however, they were at most secondary concerns.

**TABLE 11. AVERAGE SCORES GIVEN FOR DISINTEREST IN MANAGED LANES**

Reason	SOV		HOV2		HOV3+		Vanpool		Transit		Motorcycle		Total	
	Toll	Non-Toll	Toll	Non-Toll	Toll	Non-Toll	Toll	Non-Toll	Toll	Non-Toll	Toll	Non-Toll	Toll	Non-Toll
<b>Do not have a credit card to establish account</b>	1.44	1.59	1.37	1.96	1.71	1.90	1.79	1.97	1.91	1.48	1.27	2.20	1.68	1.72
<b>Use bus or train, and will not change</b>	1.46	1.09	1.00	2.00	3.75	1.00	0.00	0.00	3.69	3.51	0.00	0.00	3.64	2.80
<b>Do not want a toll transponder in my car</b>	1.37	1.91	1.33	2.14	2.40	2.65	2.54	3.00	2.14	2.25	1.00	1.82	1.64	2.04
<b>ML is complicated or confusing</b>	2.00	2.18	2.42	2.21	3.68	2.56	3.03	2.31	2.80	2.00	1.55	2.38	2.33	2.29
<b>I have flexibility to travel at less congested times</b>	2.31	3.07	2.81	3.07	3.29	2.69	2.61	2.64	2.69	2.72	3.14	2.10	2.52	3.04
<b>Do not want to pay the toll cost</b>	3.97	4.39	4.10	4.04	4.39	4.10	5.00	4.71	3.58	4.18	4.45	4.26	3.82	4.35
<b>Carpool. Will not switch to drive alone</b>	0.00	0.00	2.67	3.32	2.35	3.26	0.00	0.00	0.00	0.00	0.00	0.00	2.79	3.03
<b>Travel on uncongested roads. Will not switch to ML</b>	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Other factor*</b>	4.23	4.59	4.29	4.32	3.89	4.38	5.00	5.00	4.51	4.35	5.00	4.92	4.16	4.46

\* This was dominated by comments along the lines of "I already pay for the roads with my taxes"

## **CONCLUSIONS**

Data analyses have provided a sketch about the composition of the survey respondents, their current travel patterns, reasons behind their current travel mode choice, as well as their propensity to managed lanes. The information is useful for TxDOT and metropolitan planning organizations in planning managed lane facilities and developing policies related to managed lane implementation and operation.

The research team would like to acknowledge the support and contributions provided by members of our project advisory committee, the individuals, organizations, and press agencies who facilitated the survey, and all survey participants who shared their thoughts on managed lanes.

### **Organizations Involved**

Federal Highway Administration (FHWA) - Texas Division  
TxDOT - Research and Technology Implementation (RTI)  
TxDOT - Texas Turnpike Authority Division (TTA)  
TxDOT - Federal Transit Authority (FTA)  
TxDOT - Traffic Operations Division (TRF)  
TxDOT-Dallas District  
TxDOT-Houston District  
TxDOT-El Paso District  
TxDOT-San Antonio District  
North Central Texas Council of Governments (NCTCOG)  
Houston Galveston Area Council (HGAC)  
Metropolitan Transit Authority of Harris County (METRO)  
Dallas Area Rapid Transit (DART)  
North Texas Tollway Authority (NTTA)  
Harris County Toll Road Authority (HGAC)  
Houston TMA - TREK  
The Houston Chronicle  
The Dallas Morning News  
Dallas Regional Mobility Coalition (DRMC)  
Texas Institute of Transportation Engineers (TexITE) – Dallas Section  
Texas Institute of Transportation Engineers (TexITE) – Houston Section  
Dallas City Council  
Dallas Hispanic Chamber of Commerce  
Houston Libraries  
Dallas Libraries  
Dallas Black Chamber of Commerce  
Houston Commute Solutions  
Houston Minipool  
Houston Citizens Chamber of Commerce  
Houston Hispanic Chamber of Commerce  
VIA Metropolitan Transit – San Antonio  
Central Texas Regional Mobility Authority (CTRMA)  
San Antonio Bexar County Metropolitan Transportation Planning Organization  
Capital Area Metropolitan Planning Organization (CAMPO)