

# Public Attitudes Toward Conversion of Mixed-Use Freeway Lanes to High-Occupancy-Vehicle Lanes

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Increasing public concerns over air quality and traffic congestion call for a reevaluation of the idea of converting an existing mixed-use freeway lane into a high-occupancy-vehicle (HOV) lane. A study was undertaken of freeway HOV lane perceptions that included an extensive literature review, focus groups, and a survey of over 1,000 California residents. The telephone survey, conducted in May 1993, provided a quantitative assessment of public opinion toward HOV lanes and their conversion. The majority of respondents in the survey agreed that carpool lanes are a strong incentive to get people to carpool and that carpool lanes are fair to nonusers and those who cannot carpool. When given a choice of three HOV alternatives for a freeway that they use, shoulder rebuilding garnered support from 40 percent of the respondents, whereas building a new lane and lane conversion received 30 percent support. Respondents also expressed a strong preference for HOV lane conversion compared with more restrictive traffic management policies, such as road pricing, gas tax increases, and monthly parking surcharges. Interestingly, support for conversion did not vary much with socioeconomic characteristics or mode (carpool or drive alone). Respondents were more likely to support conversion if they believed freeway congestion would be better after the HOV lane was operating. These findings suggest that urban Californians may be more supportive of HOV lane conversions than was previously thought.

A common belief appears to have been formed that the conversion of an existing mixed-use freeway lane into a high-occupancy-vehicle (HOV) lane will not gain public acceptance. This belief presumably dates back to the ill-fated conversion attempt on the Santa Monica Freeway in the 1970s (1). All of the freeway HOV lanes implemented in California since then have been newly constructed lanes or conversions of medians and shoulders that were designated as HOV lanes from the first day of operation.

However, as metropolitan areas continue to grow and as demand for freeway capacity continues to increase, the conversion of existing lanes into HOV lanes is becoming a logical freeway operation scheme. Furthermore, with increasing public concerns about air quality and traffic congestion, it is conceivable that urban residents in California are now more receptive to the idea of converting an existing mixed-use freeway lane into an HOV lane. This calls for the reevaluation of public perceptions and attitudes toward HOV lanes in general and lane conversions in particular.

At the request of the California Department of Transportation (Caltrans) and the California Air Resources Board, researchers at

the University of California, Davis, undertook a project to assess the public's perceptions of converting a mixed-use freeway lane to an HOV lane.

In late 1992 a literature review on HOV lanes and their conversion was prepared (2). This was followed by a series of focus groups to qualitatively assess public perceptions of HOV lanes. The results of the focus groups assisted in refining the telephone survey questionnaire. A computer-aided telephone interview (CATI) system was used to conduct the telephone survey in May 1993. This paper summarizes the literature review and focus group findings and describes the survey methodology and results. A more detailed description of the survey methodology and findings is contained in the project research report. (3).

## LITERATURE REVIEW

An immediate finding of the literature review was that very little research has been done on public perceptions and attitudes toward converting a mixed-use freeway lane into an HOV lane. However, numerous studies have examined public reactions to implementations of HOV lanes in general (2).

The anticipated lack of public acceptance generally is attributed to the probable increase in congestion in the remaining mixed-use freeway lanes that is likely to accompany a conversion.

Many researchers believe that public reaction today would be similar to that which occurred during the Santa Monica Diamond Lanes experiment. On March 15, 1976, the median lane in each direction of a 12-mi, eight-lane segment of the Santa Monica Freeway was reserved during peak traffic hours for the exclusive use of buses and carpools carrying three or more persons. After the implementation, carpool ridership increased by 65 percent, and bus ridership more than tripled (1). However, energy savings and air quality improvements were insignificant. Accidents increased significantly and noncarpoolers lost more time than carpoolers gained. Prompted by heated public outcry, poor press notices, and derisive new commentary, the project was terminated after only 21 weeks. The failure of this project forced the delay or cancellation of several other Caltrans-sponsored HOV lane projects.

A 1990 study in Washington State examined public opinion and behavior toward different HOV alternatives. A variety of questions were asked to gain insights into Seattle residents' views on current transportation problems and potential solutions. A majority of residents (57 percent) in the Seattle area would be inclined to support the conversion of an existing mixed-use freeway lane to an HOV lane if it were converted for peak hours only. About 39 percent

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of residents believed that a lane conversion would be very effective in easing traffic congestion on I-5 between Seattle and Tacoma. Of respondents who favored a lane conversion, the most often stated reasons for support included additional incentive to carpool and improved traffic flow (4).

The conclusions of the literature review are that most people have no strong opinion on HOV lanes and would be willing to give HOV lanes a try. It seems to be nearly unanimous that early and continued public involvement and support are necessary for the success of any HOV lane implementation.

## FOCUS GROUP SUMMARY

A series of six focus groups was conducted by Fairbank, Maslin, Maullin & Associates to explore public attitudes toward the potential conversion of mixed-use freeway lanes to HOV lanes. The focus groups were held in West Covina, San Francisco, and Anaheim, California, during October 1992 and January and February 1993 (5). At each site, one group consisted of those who currently drive alone to work, and the other consisted of those who ride-share (carpool, vanpool, or use public transit). All focus group participants commuted on freeways with HOV lanes. Each session lasted approximately 2 hr. The focus group participants expressed the following perceptions of HOV lanes and related ridesharing issues:

1. The main reason for ridesharing is economic. The availability of an HOV lane is a positive, although secondary, consideration.
2. HOV lanes currently are underutilized. Those who drive alone generally, but not exclusively, resent their presence.
3. Although the moderator used the term 'HOV lane' consistently, respondents tended to use the term 'diamond lane' or 'carpool lane' instead.
4. HOV lanes and current ridesharing incentives are not compelling enough to make a difference in driving decisions. Only two factors would really make people rethink the drive-alone decision: adequate mass transit and painful economic disincentives.
5. Participants generally rejected the idea of building a new lane for HOV purposes. They believed that there were enough roads already and that this would be too costly and take too long. Focus group members also expressed concern that there would be significant delays to current traffic during construction.
6. Although most participants recognized that it would be far less costly (compared with building a new lane) to restripe existing lanes or rebuild a shoulder to create an HOV lane, they believed that the safety tradeoffs were too high. They were concerned that there would be no place to pull off the road when necessary and that emergency vehicles would have no way of moving through traffic.
7. Although acknowledged as the least expensive way to add an HOV lane to a freeway, the conversion of an existing lane to an HOV lane received only lukewarm support. Most participants believed that this option would only make the situation worse by forcing the same number of solo drivers into fewer lanes of freeway. Many drive-alone commuters were incensed by this proposal, vowing to fight it.
8. Once understood, the idea of creating an HOV lane network was greeted warmly. Many ridesharers expressed frustration over the sudden end of HOV lanes.

9. Congestion pricing, increasing parking fees, removing older cars from the road, and having solo drivers pay to use HOV lanes during rush hour were all strongly opposed. Most participants when forced to make a choice would agree to give up a mixed-use lane to HOV before accepting any of these alternatives.

## SURVEY METHODOLOGY

Strategic Consulting and Research (SCR) was hired to conduct a telephone survey of urban northern and southern California residents. SCR's CATI system was utilized to automate all skipping patterns and ensure that respondents were asked questions appropriate to their local freeways and their personal commuting patterns.

Before surveying began, the survey questionnaire was reviewed in detail by SCR. Care was taken to word each question in an unbiased manner. The large number of stated preference questions was randomly ordered using the CATI system to prevent fatigue bias (responses from later questions usually less accurate) or "order of alternative" bias (earlier-mentioned alternatives not chosen because of a respondent's lack of total recall).

A sample of 1,085 persons 18 years or older was taken from cities located adjacent to freeways with HOV lanes. The cities were sampled in proportion to their population with a few exceptions. Cities near HOV lanes with extraordinarily high or low HOV lane usage were oversampled by doubling the sampling for that city. Heavily populated cities such as San Francisco, Los Angeles, and San Diego were scaled down (to one-fifth of their population) to get a more geographically varied sample.

For selected cities, calls were made by first randomly selecting an active prefix for the city even if there was only one working number in the prefix. A randomly generated four-digit number is used as the last four digits of the phone number. The random selection of the last four digits ensures that there is no bias in the sampling that occurs from households with unlisted numbers.

Calling was conducted between 5:00 and 9:00 p.m. on weekdays and between 9:00 a.m. and 9:00 p.m. on Saturday and Sunday. When persons under the age of 18 answered the phone, interviewers asked to talk to one of their parents. There was a minimum of 2 days between callbacks to increase the likelihood of reaching residents who may have been away for a few days. Seven callbacks were made before the number was abandoned. This prevents a bias from households that do not spend much time at home.

To ensure that the survey was conducted in an unbiased manner and that all data collected are both consistent and accurate, surveyors were monitored on a random basis using a silent monitoring system. Completed surveys were randomly reviewed by a project supervisor for consistency and accuracy of responses. When inconsistent responses were identified, the supervisor recontacted the respondent to clarify the responses [see project report (3) for further methodologic details].

## SURVEY RESULTS

### Socioeconomic Characteristics

A total of 1,085 individuals made up the sample. Table 1 divides the sample by geographic region. In addition to the geographic

TABLE 1 Sampling Distribution by Geographical Region

Region	Number of Respondents
Los Angeles Metropolitan Area	460 (42.4%)
San Diego	50 (4.6%)
San Francisco Bay Area	575 (53.0%)
Total	1085 (100%)

distribution, other sample characteristics included the following: English was used to survey 92 percent of the respondents; females made up 55 percent of the sample; almost three-fourths (72 percent) of the respondents said they were employed; roughly 94 percent of the respondents had driver's licenses. In addition, about 60 percent of the respondents owned their own home.

On average, northern California respondents seemed to be slightly older, better educated, and more affluent than southern California respondents. A considerably higher percentage of Hispanics were interviewed in southern California. Vehicle ownership and housing type appear to be similar for both regions.

### Sampling Representativeness

In most surveys it is important that the sample resemble the population of interest. In this survey the subjects were purposely drawn from cities located near HOV lanes so that a substantial percentage of respondents would have some familiarity with HOV lanes. Therefore, it is reasonable to expect that for each county's sample, the socioeconomic characteristics and commuting habits will differ slightly from those found in the 1990 census for the county as a whole.

Nonetheless, they should bear some resemblance to one another. Table 2 compares the socioeconomic characteristics and

commuting habits of each county's sample with comparable variables found in the 1990 census and the 1992 California Statistical Abstract. For each county, household size, percent dwelling units owned, and gender all were compared statistically using a *t*-test. The asterisk denotes statistical differences at the 95 percent confidence level.

Only data from Los Angeles, Orange, Alameda, Marin, and Santa Clara counties were compared with those of the census because of sample size limitations. The samples taken from San Diego, San Francisco, Riverside, Contra Costa, and San Mateo counties were too small for comparison with census data. Telephone survey responses generally result in an oversampling of large households because someone is more likely to be home in a larger household than in a small household. This helps explain why average household size for three of the five counties was statistically different from the 1990 census figure for that county. Women were oversampled (in all five counties), possibly because they are more likely to answer the phone than men. This bias resulted in statistically significant differences for two counties. Age and average household income are only qualitatively comparable because the survey asked only for their age or income category. Exact numbers have been estimated through interpolation. Average household income seems consistently low across counties relative to the census figures.

TABLE 2 Representativeness of Survey Sample by County

Characteristic by County	Los Angeles	Orange	Alameda	Marin	Santa Clara
Sample Size	221	194	200	79	219
Household Size (Survey/1990 Census)	3.48/ 2.91 *	3.21/ 2.87 *	2.83/ 2.59 *	2.46/ 2.33	3.00/ 2.81
% Dwelling Units Owned (Survey/1990 Census)	53.5/ 48.2 *	65.1/ 60.0	55.1/ 53.3	60.8/ 62.1	63.7/ 59.1
Age (Survey/1990 Census)	30.4/ 30.6	34.4/ 31.2	36.4/ 32.6	41.4/ 38.0	35.9/ 31.8
Household Income (Survey/1990 Census)	28,930 34,965	41,710 45,922	33,490 37,544	44,940 48,544	46,460 48,115
Gender (%male) (Survey/1990 Census)	43.0/ 49.9 *	45.0/ 50.4	40.4/ 49.3 *	39.2/ 49.5	48.2/ 50.7
% Transit Users (Survey/1990 Census)	10.4/ 6.5	2.1/ 2.5	10.5/ 10.0	13.0/ 10.3	5.1/ 3.0
% Carpoolers (Survey/1990 Census)	13.6/ 15.5	15.7/ 13.7	12.9/ 12.8	10.9/ 12.4	5.7/ 12.3

\*Statistical differences at 95 percent confidence level.

In general, the proportions of transit users and carpoolers derived from census data would be expected to exceed those of the survey. This is because the census counts someone who drives alone and carools as both. In the survey, they were forced to choose only one of the two. Despite this, transit user percentages exceeded the census percentages for the majority (four out of five) of counties. Two of the five counties had carpooler percentages that exceeded the census percentages.

Overall, it appears that the sample from each county generally resembles the county as a whole. There appear to be no important differences in socioeconomic or commute characteristics between each county's sample and the census. Differences that have been found to exist statistically generally are implicit limitations of this type of surveying (biases toward larger households and women). These differences are not expected to play a role in the analysis of data and identification of important perceptions of HOV lane conversions.

### Commute Characteristics

A total of 736 respondents stated that they were employed and commuted to work. Table 3 gives a breakdown of the modes they took to get to work.

Many respondents had both driven alone and either used public transit or carooled to work within the 2 weeks before the survey. Table 4 illustrates average commute distance and differences in travel times for these individuals. Cells that contain dashes indicate a nonapplicable comparison. The Drive Alone/Carpool category has about the same travel times for each mode. One of the main reasons for carpooling is to save time. These respondents may have had ulterior motives for carpooling part time because they do not in fact save time by carpooling. The 16 commuters who both drive alone and used transit suffered greatly in travel time (18.44-min difference) when taking transit instead of driving alone.

### HOV Lane and Carpooling Characteristics

A series of questions was asked to test the respondents' exposure to HOV lanes and carpooling. Of the 132 respondents who had carooled within 2 weeks of the telephone interview, money savings was by far the most common reason cited. Reduced travel time and company on the trip rated second and third, respectively, in terms of importance in the decision to carpool. Reasons such as no need to own a car, dislike driving, parking incentives, and employer incentives were not generally stated as important in the respondent's decision to carpool. These findings were consistent with results found in the literature review and focus groups: the main reason for carpooling is economic with secondary consideration given to travel time reduction through the use of HOV lanes.

Table 5 summarizes the 736 employed respondents' exposure to HOV lanes and ridesharing. About 39 percent of respondents said that their employer had provided them with information on HOV lanes. Only 16.7 percent of the respondents' employers had a subsidized vanpool program, whereas about 8 percent of the respondents indicated that they did not know. Employer-provided matching lists were accessible to 30.4 percent of the respondents. About 38 percent of the respondents' employers provided information on ridesharing programs.

### Opinions Concerning HOV Operations

A series of attitudinal questions was asked of all respondents to measure their opinions of HOV lanes. Table 6 summarizes responses to five attitudinal statements, partitioning the sample by region (i.e., NORCAL is the San Francisco Bay Area; SOCAL is southern California, including San Diego). The allowable responses were as follows: strongly agree (S.A. in Table 6), agree, neutral, disagree, and strongly disagree (S.D.).

TABLE 3 Modes Taken to Work

Mode	Number of Respondents
Drive Alone	569 (77.4%)
Bus, Train, or Trolley	59 (8.0%)
Carpool	86 (11.7%)
Walk	12 (1.6%)
Bike	7 (0.9%)
Other	3 (0.4%)
Total	736 (100%)

TABLE 4 Commute Characteristics of Respondents Who Had Driven Alone and Either Used Public Transit or Carooled to Work Within Two Weeks of Survey Date

Variable	Drive Alone / Carpool	Drive Alone / Transit
# of Respondents	68	16
Commute Distance (miles)	15.06	14.84
Average Drive Alone Travel Time	23.69	26.56
Average Carpool Travel Time	24.65	-----
Average Transit User Travel Time	-----	45.0
Average Drive Alone Travel Time Savings	.96	18.44

TABLE 5 HOV Lane and Ridesharing Exposure

Questions:	Yes	No	Not Sure
Has your employer provided you with any information on carpool lanes?	288 (39.1%)	432 (58.7%)	16 (2.2%)
Has your employer provided you with any information on ridesharing programs?	276 (37.5%)	440 (59.8%)	20 (2.7%)
Does your employer have a subsidized vanpool program?	123 (16.7%)	556 (75.5%)	57 (7.8%)
Does your employer provide access to a carpool/vanpool matching list?	224 (30.4%)	456 (62.0%)	56 (7.6%)

TABLE 6 Participant Response to Selected Statements by Region

	NORCAL SOCAL	S.A.	AGREE	NEU- TRAL	DIS- AGREE	S.D.
Carpool lanes...						
are not fair to non-users and those who can't carpool.	23 (4.0%)	96 (16.7%)	50 (8.7%)	339 (59.0%)	67 (11.7%)	
	12 (2.4%)	86 (16.9%)	46 (9.0%)	314 (61.6%)	52 (10.2%)	
are a strong incentive to get people to carpool.	75 (13.0%)	330 (57.4%)	51 (8.9%)	103 (17.9%)	16 (2.8%)	
	73 (14.3%)	315 (61.8%)	37 (7.3%)	75 (14.7%)	10 (2.0%)	
are a safety hazard.	12 (2.1%)	83 (14.4%)	38 (6.6%)	374 (65.0%)	68 (11.8%)	
	10 (2.0%)	114 (22.4%)	41 (8.0%)	299 (58.6%)	46 (9.0%)	
regulations are generally poorly enforced.	35 (6.1%)	148 (25.7%)	148 (25.7%)	224 (39.0%)	20 (3.5%)	
	33 (6.5%)	168 (32.9%)	116 (22.7%)	178 (34.9%)	15 (2.9%)	
are underutilized.	77 (13.4%)	274 (47.7%)	75 (13.0%)	144 (25.0%)	5 (0.9%)	
	41 (8.0%)	252 (49.4%)	61 (12.0%)	145 (28.4%)	11 (2.2%)	

The majority of all 1,085 respondents disagreed (653 disagreed and 119 strongly disagreed) with the statement that carpool lanes are not fair to nonusers and those who cannot carpool. This perception of carpool lanes as being "equitable" was held in both regions. An even higher percentage (645 agreed and 148 strongly agreed) of respondents supported the position that carpool lanes are a strong incentive to get people to carpool. Yet in general, carpoolers reported that the main reason for carpooling was money savings and not HOV lanes.

The majority of both southern and northern California respondents disagreed with the statement that carpool lanes are a safety hazard. Northern California respondents disagreed with this statement more often than southern California respondents (78.6 percent versus 67.6 percent). There was no consensus on the issue of carpool lane regulation enforcement in either region. Many respondents in both northern and southern California believed that carpool lanes are underutilized. However, a significant portion (more than 25 percent in each region) believed differently.

Some of these results are in contrast to what was found in the focus groups. Focus group members seemed to be more critical of HOV lanes in general. They believed that the lanes are cur-

rently underutilized and are a safety hazard. Some solo drivers resented the devotion of a lane to such a small minority of the cars on the road. Focus group members also criticized HOV lanes as being difficult to move into and out of. In general, the survey responses seemed more supportive of HOV.

It is difficult to definitively deal with the different inferences drawn from the two methods. Each focus group clearly contained opinion leaders, the majority of which were negative concerning HOV. Despite the best efforts of the moderator, this vocal minority could have influenced the expressed opinions of others. This is not unlike the public debate concerning HOV lanes in California: weak-to-moderate support by the majority but very strong opposition by a small minority.

#### HOV Lane Addition Preferences

A series of questions was asked about the conversion of a mixed-use freeway lane to an HOV lane and respondents' perceptions of the attributes of various HOV alternatives. Specifically, the respondents were given three alternatives: (a) build a completely

new carpool lane; (b) rebuild the shoulder, restripe the lanes, and make the additional lane a carpool lane; or (c) convert a general-use lane into a carpool lane. Table 7 summarizes their preferences to achieve a particular objective (e.g., least expensive).

The majority of respondents perceived the inexpensiveness of the lane conversion alternative (62.5 percent) relative to the two other alternatives. The build-a-new-lane alternative was chosen as the alternative that would make the biggest improvement in overall traffic flow. Interestingly, the lane-conversion alternative was chosen by 19.6 percent of the respondents for the given objective. When asked which alternative was, overall, the most preferable on a freeway respondents take, the rebuilding of the shoulder was preferred by a plurality of respondents (39.3 percent). The lane-conversion alternative tied with the build-a-new-lane alternative with about 30 percent support.

These results are similar to those of the focus groups. In both cases opinion varied on the best HOV lane addition alternative. A majority of the focus group members and survey respondents did perceive the inexpensiveness and low delay cost of the conversion alternative.

Table 8 divides the sample by region. Northern California respondents seemed slightly more receptive to HOV lane conversion than their southern California counterparts but less receptive to building a new lane for HOV purposes. A higher percentage of northern California respondents perceived the inexpensiveness of the conversion alternative. There were minor regional differences concerning perceptions of traffic flow improvement and delay time. Additional comparisons were made of carpoolers and solo drivers; surprisingly, there were virtually no differences in attribute perceptions between these two groups.

Several additional questions were asked to gauge respondents' reactions to and opinions of the conversion of a mixed-use freeway lane into an HOV lane. For example, "After an HOV lane conversion, do you think congestion in the remaining mixed-use lanes would be much better, better, about the same, worse, or much worse than before?" The responses can be found in the last column of Table 9.

Although about 57 percent of respondents anticipated that congestion would become worse, a surprising number of respondents (30.9 percent) thought that congestion would be better or much better in the remaining lanes after an HOV lane conversion. Respondents with these perceptions may be expecting a significant number of solo drivers to begin carpooling, using the freeway at a different time, or using a different route.

Participants were asked whether they would support the conversion of a mixed-use freeway lane to an HOV lane if it were to complete an HOV lane network. The results showed strong support for the idea. About 67 percent supported it, 25 percent opposed it, and 8 percent were not sure. This is much stronger support than is shown in Table 7. Respondents were also asked whether an HOV lane conversion would help or hinder their commute. Although 20 percent said it would help, the majority (74 percent) said that it would not. When asked whether they would seriously consider taking an alternate route if a freeway they often used were to have a mixed-use lane converted into an HOV lane, the majority of respondents (69.7 percent) answered no.

Additional categorical analyses tested for independence between HOV lane addition preferences and several socioeconomic and commute characteristics. Table 9 demonstrates that the respondents who thought congestion would be much better, better,

TABLE 7 Preferred HOV Lane Addition Alternative for Particular Objective (1,085 respondents)

Objective	Build a New Lane	Rebuild Shoulder	Lane Conversion
Least Expensive to Implement	69 (6.4%)	338 (31.1%)	678 (62.5%)
Biggest Improvement in Overall Traffic Flow	509 (46.9%)	363 (33.5%)	213 (19.6%)
Least Amt. of Traffic Delay & Const. Time	88 (8.1%)	359 (33.1%)	638 (58.8%)
Overall Preference on Freeway You Take	330 (30.4%)	426 (39.3%)	329 (30.3%)

TABLE 8 Preferred HOV Lane Addition Alternative for Particular Objective (575 NORCAL Respondents and 510 SOCAL Respondents)

Objective	NORCAL		Build a New Lane	Rebuild Shoulder	Lane Conversion
	SOCAL				
Least Expensive to Implement	25 (4.3%)		170 (29.6%)	380 (66.1%)	
	44 (8.6%)				168 (33.0%)
Biggest Improvement in Overall Traffic Flow	271 (47.1%)		196 (34.1%)	108 (18.8%)	
	238 (46.7%)				167 (32.7%)
Least Amt. of Traffic Delay & Const. Time	41 (7.1%)		185 (32.2%)	349 (60.7%)	
	47 (9.2%)				174 (34.1%)
Overall Preference on Freeway You Take	162 (28.2%)		223 (38.8%)	190 (33.0%)	
	168 (32.9%)				203 (39.8%)

**TABLE 9** Congestion in Remaining Mixed-Use Lanes After HOV Lane Conversion versus HOV Lane Addition Preference

Congestion change....	BUILD NEW LANE	REBUILD SHOULDER	CONVERT A LANE	TOTAL
MUCH BETTER	12	12	23	47
BETTER	72	107	110	289
ABOUT THE SAME	39	42	52	133
WORSE	108	155	106	369
MUCH WORSE	99	110	38	247
<b>TOTAL</b>	<b>330</b>	<b>426</b>	<b>329</b>	<b>1085</b>
Pearson Chi-Square= 51.068    DF= 8    Prob.= 0.000				

or about the same generally favored the conversion alternative over the alternatives for the freeway they take. Similarly, those who thought congestion would be worse or much worse tended to choose either the new-lane or rebuild-the-shoulder alternative over the conversion alternative.

For mode, age, schooling, household income, reverse commuter status, and perceived traffic conditions, the hypothesis of independence could not be rejected. This implies that the mode taken to work is independent of the HOV lane addition preference. The fact that household income showed no dependence on HOV lane addition preference suggests that people are equally offended by or supportive of an HOV lane conversion regardless of income. The only other variable to display any sort of dependence on HOV lane addition preference was gender ( $p = 0.0625$ ). Males tended to support the two other alternatives over the conversion alternative.

Respondents were offered only HOV alternatives; they were not given a "do-nothing" option. However, given that much of the freeway capacity expansion in coming years in California will be dedicated to HOV, the comparisons remain valid.

#### Comparisons of HOV Lane Conversion to Transportation Demand Management Alternatives

To understand how HOV lane conversions compare with other transportation demand management (TDM) alternatives, four alternatives were presented to the respondents. The alternatives included congestion pricing (\$0.10/mi), a monthly parking fee of \$100, a gasoline tax increase (\$0.10/gal), and an HOV lane conversion. The personal daily cost of the parking fee, congestion pricing, and the gasoline tax was calculated using the respondents' specified commute distance and the assumption of 25 mi/gal. Each alternative and its associated costs were randomly read to the respondents, who were instructed to rank the alternatives from favorite to least favorite. The results are given in Table 10.

The HOV-lane-conversion alternative was preferred by the most respondents (480 supporters). The gasoline tax was second with 407 supporters followed by congestion pricing (142 supporters) and finally, the monthly parking fee (56 supporters). The possibility exists that a respondent condition effect is partially responsible for the high level of HOV lane conversion preference. The large number of questions regarding HOV lanes may have influenced respondents' preferences.

Nonetheless, people may look upon HOV lane conversions with less resentment than such painful driving disincentives as congestion pricing, parking fees, and gasoline taxes. This is consistent with the findings of the focus groups. One focus group member characterized the choice as follows: "Which is worse, a kick in the stomach or a punch in the face?"

#### SUMMARY

With increasing public concerns over worsening air quality and traffic congestion, it is conceivable that urban California residents are now more receptive to the idea of converting an existing mixed-use freeway lane into an HOV lane. This paper has summarized a study whose aim was to assess public attitudes and perceptions toward HOV lane conversions.

A literature review and six focus groups were conducted to support the design of a telephone survey. The telephone survey took place in May 1993. The target areas included the San Francisco Bay Area, Los Angeles, and San Diego. Cities located adjacent to freeways with HOV lanes were sampled. A CATI system was utilized to ensure that the 1,085 respondents were asked questions appropriate to their local freeways and their personal commuting patterns. Care was taken to construct an unbiased survey questionnaire and to have it implemented in an unbiased manner.

Respondents were asked a variety of questions about commuting, ridesharing, HOV lanes, and traffic conditions. About 77 percent of employed respondents reported that they drove alone to

**TABLE 10** Ranking of TDM Alternatives

TDM Alternative	1st	2nd	3rd	4th
Congestion Pricing	142	260	349	328
Monthly Parking Fee	56	137	345	548
Gas Tax	407	328	217	137
HOV Lane Conversion	480	360	174	72

work, whereas 12 percent carpooled, and 8 percent took public transit. Money savings was the most common reason cited for carpooling. Solo drivers were generally older and had higher incomes than carpoolers or transit users.

Several attitudinal questions were asked of all respondents to measure their opinions of HOV lanes. A majority of the respondents agreed that carpool lanes are a strong incentive to get people to carpool and that carpool lanes are fair to nonusers and those who cannot carpool.

Respondents were given three alternatives for putting an HOV lane on a freeway: (a) build a completely new carpool lane; (b) rebuild the shoulder, restripe the lanes, and make the additional lane into a carpool lane; or (c) convert a general-use lane into a carpool lane. They were then asked, "Which alternative would you prefer on a freeway you take?" The rebuilding-of-the-shoulder alternative garnered support from 40 percent of the respondents, whereas the build-a-new-lane and lane-conversion alternatives both received 30 percent support. This level of support breakdown was similar across region, household income, age, commute modes, and schooling.

Participants were also asked whether they would support the conversion of a mixed-use freeway lane to an HOV lane if it were to complete an HOV lane network. The results showed strong support for the idea with 67 percent supporting it, 25 percent opposing it, and 8 percent unsure. Respondents were given four TDM alternatives and told to rank them by preference. The fact that the HOV lane conversion alternative was preferred over a gasoline tax, congestion pricing, and a monthly parking fee suggests that people may view HOV lane conversions with less resentment than these other driving disincentives.

There appear to be a great many variables affecting the respondents' choices regarding HOV lane addition preferences, possibly some that were not or cannot be measured. Overall, it appears that the public will be most receptive to a potential HOV lane conversion if the conversion completes an HOV lane network. Support will also be strong when the public is made to feel that the conversion will alleviate congestion. There seems to be no clear trend of HOV lane addition preference on the basis of socioeconomic or commuting characteristics.

Some of these conclusions are based on respondents' preferences in the abstract. The validation of these findings must await the actual implementation of an HOV lane conversion. The possibility exists that the informed opinions (having knowledge of cost, delays, traffic flow implications, etc., of the different HOV alternatives) of the respondents could be quite different. This possibility highlights the importance of public involvement in the planning process when different HOV lane treatments are considered.

Research on HOV lane conversions will continue at University of California, Davis. Additional surveying will be able to capture the effect of HOV experience and transit availability on HOV lane addition preference. Insights also may be gained into situations (in terms of proper implementation timing, freeway design, operation policies) in which an HOV lane conversion can be successful. Future research may also focus on developing a methodology for measuring changes in attitudes and perceptions associated with HOV lane conversions.

The results presented in this paper suggest that urban California residents may now be ready for HOV lane conversions. The results from actual HOV lane conversion implementations are necessary to validate these findings. Nonetheless, transportation professionals should not summarily dismiss the HOV lane conversion option.

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