Incentives and Disincentives of Ride Sharing

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This research examines consumer motivation concerning ride sharing, particularly carpooling, according to a market segmentation approach. A sequential design permitted (a) developing hypotheses about ride-sharing motivation based on qualitative data from intensive discussions in decision analysis panels, (b) testing those hypotheses by means of quantitative data obtained by survey, (c) developing program strategies on the basis of the results and pretesting those strategies with an additional series of decision analysis panels. The major market segmentation involved dividing the sample by commuting mode and pattern and by occupation type, although additional independent variables were also utilized. This paper concentrates on the carpooling attitudes and perceptions of carpoolers versus solo drivers. Illustrative findings are also presented by occupation group, commute pattern, and sex to illustrate the power of the finer market segmentation. The factors discussed include, first, attitudes toward costs or interpersonal aspects of carpooling (including match methods), time variables, carpool routes, parking management and convenience issues and, second, demographic characteristics of the two types of commuters. A special analysis focuses on the attitudes of those solo drivers who stated that

tempt to predict actual mode choice.

The establishment of stronger links to actual choice behavior awaits further study in which trade-off factors manipulated in hypothetical mode-choice situations can be measured accurately for each individual in the sample and decision models can be calibrated for individual consumers.

Once clear links are established between rating responses in abstract settings and actual mode-choice behavior, the stage will be set for the most useful application of the behavior-modeling approach. The derivation of decision-making models through carefully designed experimental tasks can be used to predict future responses to changes in transportation systems. Existing stochastic demand models seem theoretically weak for such purposes. Behavioral models can be used to directly estimate latent demand for alternative transportation opportunities. In the present study, for example, the mode-choice model without the availability constraint might be thought of as measuring such demand.

The relative degree of success of this study in predicting mode choice directly from attitudinal data is noteworthy. The functional measurement approach appears to be a means of side-stepping traditional issues related to the identification and measurement of all the relevant variables in mode-choice decision making. By combining experimental design and demographic analysis, a variety of variables affecting mode choice can be studied directly; other factors can also be shown to exert their influences through individual differences in response bias and the weighting of information.

The general paradigm proposed in this paper is one that seeks to advance our understanding of human travel behavior through a concerted program of laboratory experimentation and real-world verification. If laboratory behavior in simulated transportation environments can be shown to be predictive of that observed outside the laboratory, then such simulation would provide a powerful tool in the testing and development of theories of travel behavior.

This research provided some initial support for such a link. Nevertheless, the research program remains at an embryonic stage, and many basic questions related to the utility of behavioral models in the prediction of travel behavior remain unanswered. We hope the results of this research will encourage additional efforts in this direction.

REFERENCES

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they were interested in carpooling versus those who stated that they were not. The purpose is to highlight the motivation of a prime target group toward three carpool strategy areas: carpool match methods, parking management, and dedicated carpool routes. Notable findings include the limited appeal of external efficiency factors such as cost savings, the power of social aspects of carpooling that can act as either barriers or incentives, and the need for personalized carpool programs that also reach out to actively involve the potential pooler. Specific program strategies are offered.

Despite some examples of successful ride-sharing programs, neither carpooling nor other forms of ride sharing have yet become widely popular. This study, which focused on social as well as economic aspects, provides evidence that a significantly larger portion of the population can be induced to share rides if attention is paid to the different needs, perceptions, lifestyles, resources, and values of various market segments within the population.

The work has had three objectives: (a) to develop and refine methods for assessing the effects of given psychological, social, and economic factors on mode choice, (b) to discover and explain ways in which these factors facilitate or inhibit carpooling, and (c) to devise carpool-promoting strategies based on traveler needs and attitudes and to obtain a traveler-based pretest of the effectiveness of these strategies.

The investigation differs from previous studies, therefore, in terms of the scope of the objectives. It also differs in methodology, which, although it has been reported in detail previously (1), will be reviewed here briefly to provide context for the findings that follow.

METHODOLOGY

The special problem addressed in the study was the lack of sophisticated data about consumer attitudes. Little systematic, in-depth information existed about the specific and different behavioral incentives and disincentives that can act as either barriers or incentives, and how these might affect ride sharing. A sequential in-depth study design was therefore devised and carried out in the Washington, D.C., metropolitan area.

Phase 1

The first step involved going to the consumer to listen to his or her preferences, complaints, problems, and the trade-offs he or she might or might not be willing to make in choosing to carpool. This was done in a series of open-ended discussions with small consumer groups (5-9 people), or decision analysis panels. The methodology required considerable expertise in managing and analyzing group dynamic process and does not focus discussion or limit findings to a predetermined set of issues. It provided a hypothesis-generating phase for the study and yielded qualitative data about the perceptions, attitudes, and transportation behavior of carefully segmented groups of consumers. The 21 decision analysis panels were selected according to age, sex, occupation, commuting pattern, and other lifestyle variables. The findings were used to build a survey questionnaire for the second phase of the study.

Phase 2

In this hypothesis-testing phase, traveler attitudes discovered in phase 1 were quantified. Five hundred and sixteen people were individually interviewed according to a stratified sampling process that provided the distribution shown in Table 1, where the blue- and white-collar and managerial/executive/professional (MEP) workers are divided equally into three groups (33.3 percent each). Data were analyzed by multivariate analysis of variance in order to assess the significance of differences between groups on intercorrelated measures (2).

Phase 3

The quantified results were then utilized to build two types of program strategies: (a) those having broad appeal and (b) those having special strategies aimed at particular market segments of the population. Finally, these strategies were pretested with 25 new decision analysis panels.

The selection of commuters for this last series of panels included a disaggregation by occupation and commuting pattern. However, their current mode choice differed from the survey. Four panels were made up of carpoolers, two of carpool rejectors (defined as people who had lost an opportunity to carpool but who did not take it), and six of groups with mixed commuting modes.

MOTIVATIONAL COMPARISON OF SOLO DRIVERS AND CARPOOLERS

Demography of Carpoolers versus Solo Drivers

Carpoolers tended to be older males with regular work hours from households where more than one adult was employed full time. They commuted a greater distance than the solo drivers, but total trip time averaged nearly the same, about half an hour. This was not necessarily due to greater travel speed.

Panel data had indicated a considerable emphasis by carpoolers on efficient driving and route selection. Women tended to drive alone more than men. The solo drivers tended to be younger, and from lower income households than carpoolers. As expected, more solo drivers worked at jobs with shift changes or with official irregular work hours.

So far, this picture is much like that of other studies. A new finding in our sample was that the delays of carpool matching services produced a significant negative effect. Among those who had participated in a carpool campaign, the solo drivers reported having had to wait longer for a response than carpoolers.

In general, the most surprising finding was not in the ways that the two kinds of commuters differed, but in the similarity of their commuting resources. They both tended to show the same ratio of licensed drivers to cars in the household and availability of alternative ways to commute. On the average, both had lived at the same address and worked at the same address for the same length of time. Finally, less than a third of either type of commuter could say that they had ever been exposed in the past to a carpool campaign.

Attitudinal Factors Affecting Mode Choice

Cost

Cost is often considered the most important appeal of carpool programs. This is understandable. It is clear that carpooling does cut commuting costs; carpoolers are often eager to talk about the money they save; carpool campaigns emphasize the bargain. Even the solo drivers in our sample perceived carpooling as a financial gain; in fact, they considered it a better bargain
than the carpoolers did. However, this research did not bear out the importance of cost as the most influential factor affecting the decision to carpool. This is particularly true for a large part of the solo driving population, with whom we are primarily concerned.

We asked respondents a series of trade-off questions to rate the cost savings of carpooling against such drawbacks as the time it takes to pick up members, not being free to run errands at will on the way home, etc. Results are presented in Table 2 (p = 0.001).

Depending on the trade-off, approximately 67-85 percent of the carpoolers were in favor of the cost savings, as expected. The solo drivers were quite different. While half of them did agree that "the fact that carpooling is less expensive than driving alone to work makes it well worth the effort," even this level dropped sharply with the mention of specific drawbacks. Only 38 percent favored the cost saving over the time it takes to pick up members, or over the desire to run errands on the way home. Only 34 percent thought the saving was worth having to depend on other people, and a mere 23 percent considered that the money compensated for waiting for

Table 1. Phase 2 survey sample design.

<table>
<thead>
<tr>
<th>Commuting Pattern</th>
<th>Blue Collar</th>
<th>White Collar</th>
<th>MEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suburb to central business district (CBD)</td>
<td>5.5-</td>
<td>5.5-</td>
<td>5.5-</td>
</tr>
<tr>
<td>Suburb to congested suburb (66.7%)</td>
<td>11.3-</td>
<td>11.3-</td>
<td>11.3-</td>
</tr>
</tbody>
</table>

Table 2. Cost savings opinions.

<table>
<thead>
<tr>
<th>Opinion Statement</th>
<th>Total Sample</th>
<th>Solo Drivers</th>
<th>Carpoolers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpooling is cheaper and worth the effort (agreement)</td>
<td>515</td>
<td>68.0</td>
<td>257</td>
</tr>
<tr>
<td>Insurance problems are a drawback (disagreement)</td>
<td>514</td>
<td>56.6</td>
<td>258</td>
</tr>
<tr>
<td>Pickup time is not worth the saving (disagreement)</td>
<td>512</td>
<td>54.9</td>
<td>259</td>
</tr>
<tr>
<td>Errands are more important than the saving (disagreement)</td>
<td>512</td>
<td>53.5</td>
<td>257</td>
</tr>
<tr>
<td>Depending on others is not worth the saving (disagreement)</td>
<td>513</td>
<td>51.9</td>
<td>257</td>
</tr>
<tr>
<td>Carpooling is cheaper but not worth waiting for late members (disagreement)</td>
<td>514</td>
<td>46.7</td>
<td>258</td>
</tr>
</tbody>
</table>

Table 3. Cost savings and shifting to carpooling.

<table>
<thead>
<tr>
<th>Question Choices</th>
<th>Response</th>
<th>No.</th>
<th>$</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>How likely would you be to carpool if that way your share of the parking costs were 1/2 of what you now pay</td>
<td>191</td>
<td>46.3</td>
<td>6.6 (NS)</td>
<td></td>
</tr>
<tr>
<td>would be</td>
<td>180</td>
<td>52.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Would you change to carpooling or the bus if your parking costs increased over what you pay now by :</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$5/month</td>
<td>235</td>
<td>28.8</td>
<td>38.5 (p = 0.001)</td>
<td></td>
</tr>
<tr>
<td>$10/month</td>
<td>234</td>
<td>45.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$20/month</td>
<td>234</td>
<td>67.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Would you shift to carpooling or the bus if the price of gas went to :</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$0.90/gal</td>
<td>257</td>
<td>56.7</td>
<td>20.6 (p = 0.001)</td>
<td></td>
</tr>
<tr>
<td>$1.30/gal</td>
<td>255</td>
<td>71.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$2.00/gal</td>
<td>254</td>
<td>77.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Results of multivariate analysis of agreement on the significance of social factors in carpooling.

<table>
<thead>
<tr>
<th>Opinion Statement</th>
<th>Total Sample</th>
<th>Solo Driver</th>
<th>Carpooler</th>
<th>Occupation</th>
<th>Mode</th>
<th>Occupation</th>
<th>White Collar</th>
<th>MEP</th>
<th>Mode x Occupation</th>
<th>Mode x Site</th>
<th>Mode x Sex</th>
<th>Carpoolers</th>
</tr>
</thead>
</table>
late carpool members. Before leaving this chart, we should note that even the carpooler's enthusiasm about cost as the prime factor cooled under the pressure of trade-off conditions.

However, the disincentive of greatly increased commuting costs for solo drivers had more effect. As Table 3 indicates, substantial numbers of solo drivers (67 percent) said that they might switch from solo driving if parking costs increased by $20 a month, and 77 percent said the same should gas prices rise to $2.00/gal.

It is important to note here that such predictions of future behavior change cannot be taken literally. People consistently overpredict their future behavior in the face of a hypothetical change of nearly any type. Despite this, these solo drivers did not predict a change in their commuting method for the reward of lower parking costs. Also, much less prediction of change occurred at lower levels of increased parking and gas costs—if gas went to $0.90 or $1.10/gal, for instance. During the decision analysis panels, cost had emerged as a more significant factor for blue-collar workers than for the other groups. The survey confirmed this. Among solo drivers, the blue-collar workers (regardless of income level) were more concerned with costs and more willing to put up with possible carpool problems in order to save money than were other occupation groups. With this exception, however, the fact must be faced that, in this largely affluent society, cost savings alone cannot be relied on to make most people carpool. To confirm the finding, when people were asked what their major commuting problem is, only 5 percent mentioned any kind of economic factor.

Interpersonal Aspects of Carpooling

If the most commonly emphasized factor, cost, emerged to be of relatively low concern to many solo drivers, the most neglected aspect of carpooling programs was found to be the most important: the personal and social.

Helping a neighbor or having company were common motivations to carpool. Disagreements or personal incompatibilities frequently caused carpools to break up. The very situation of being in a carpool is perceived as a combined business and personal arrangement, and one for which we do not have well-established social customs. Both carpoolers and solo drivers found the socializing that a carpool offers to be pleasant, but the solo drivers had more misgivings about handling specific problems. Because 65 percent of these solo drivers had been in a carpool at some time in the past, their misgivings cannot simply be due to lack of experience.

The results for a sampling of 516 people are presented in Table 4 (p = 0.001). Only 39 percent of the solo drivers thought talking shop during the ride would be pleasant, versus 66 percent of the carpoolers. Even fewer, only 24 percent, could say that the chance to socialize was worth personal disagreements that might have to be ironed out (versus 41 percent of the carpoolers), and a strong 64 percent disliked the idea of rule making for the carpool (versus 57 percent of the carpoolers). The results for work site and sex were not significant.

As an illustration of the power of analyzing these data by more finely drawn groups, among solo drivers, women were a little more wary than men about how pleasant the socializing might be and about having to handle disagreements. Solo drivers who work in the suburbs are somewhat more willing to take on the disagreements than those commuting into town. There may be an urban "hassle factor" that adds tension to the trip.

Choosing Carpoolers

Choosing carpool mates emerged as an extremely personal matter. Both types of commuters tended to react the same way, as can be seen in Table 5. Some 87 percent wanted to meet prospective members once before making any arrangements, and 39 percent felt they would actually have to know the people first, a concern felt by more blue- and white-collar workers than MEPs.

Carpoolers were more relaxed than solo drivers about riding with people who do not work at similar jobs, but this area is a sensitive one, because people tend to be reluctant to admit what might seem to be a prejudice. On the whole, male solo drivers were most vocal about wanting to ride with people at similar job levels; 43 percent of the men versus 19 percent of the women solo
drivers expressed this. There were, however, no significant differences by occupation group.

When 516 respondents were also asked to rate different matching systems for carpooling, both carpoolers and solo drivers ranked the match methods in the same way (Table 6), favoring personal methods most. It is evident that the two most common systems used—locator lists and computerized match systems—have the least appeal. Interest in (a) being contacted by a carpooler, (b) having the help of a neighborhood coordinator, or (c) having no help at all is significantly greater (by chi-square analysis) than the response to either locator lists or computer matches. Expressed preferences for the latter two were not significantly different from chance. This is true at least as these methods now operate, that is, impersonally. The strongest preference was to be contacted by another commuter forming a pool (71 percent of the total sample); the next strongest was to be helped by a local neighborhood carpool coordinator (69 percent); and the third choice was to have no help at all, which was the only match method where solo drivers and carpoolers differed. The solo drivers felt a little less confident about handling things alone; only 65 percent of them endorsed this, versus 72 percent of the carpoolers.

It is clear that people do not want to become involved with others they know nothing about. For several population segments, it does not appear from the decision analysis panels to be the computerized matching in itself so much as the fact that the system does not include a person who could be contacted in the neighborhood or at work and who would know something about the specific individuals on the matching list or could offer advice about handling the combined personal and business situation of a carpool. However, there are also privacy issues arising from computerization that have been dealt with in the full report (5).

Commuting Time and Carpooling

Time was of great importance to all commuters interviewed, but the big barrier carpooling time represents to solo drivers appears to be the perception that carpoolers make one late. Both types of commuters were actually getting to work in about the same amount of trip time. When the misperceptions about carpooling trip time were analyzed, one another related to uncertainty about possible trip delays, rather than speed of travel. Carpooling is seen as fraught with potential time problems that are unnecessary if there are clear rules about how long to wait for late members, what to do when a driver cannot meet the pool, etc.

Carpool Lanes and Parking Management

These two important issues are presented together, because what the commuters in this study want is a smooth, hassle-free trip to work—a clear and open road and a place to park at the end of it.

The single greatest complaint, and the only one initiated by a significant portion of the people sampled, was traffic congestion, the primary problem to 37 percent of those interviewed. Dedicated roadways open to multi-occupancy vehicles (vanpools, carpools, and buses) received a resounding endorsement by solo drivers, provided that the roadway is available for significant portions of the trip (see the table below).

From the table, only 37 percent predicted they would carpool if a lane were available for a quarter of the trip, while 58 percent would do so for a lane available for three-fourths of the trip. Where dedicated routes were rated against carpool drawbacks, the pervasive unwillingness of the solo driver to leave work at a fixed time each day was much less powerful; 56 percent of the solo drivers still rated the lane positively. It must be noted, however, that those commuting to the urban downtown still remained reluctant indeed to leave work at a fixed time each day, even for the incentive of a dedicated lane for "much of" the trip. Only 21 percent agreed. This probably relates to the congested trip time left before they get to their destination. The difference may suggest that dedicated lanes on highways encircling cities may be even more powerful incentives than those on highways radiating from them.

The strongest disincentive for using the dedicated routes was the need to depend on others, although even here 48 percent of the solo drivers thought the lane worth it. The finding may relate to the experience of the Washington, D.C., sample, who tend to think of carpool lanes in terms of the stringent requirement for four riders on the local Shirley Highway lane; that may be too many people to wait for.

Parking at work was, of course, extremely important to both types of commuters. The effectiveness of possible employer bans on parking for solo occupant autos was widely admitted, but private employers interviewed in panels considered it impossible to implement because of the risk of losing the competition to hire and retain quality employees.

People in the sample took parking for granted. Over 70 percent parked free in employer lots. Few turned to commercial lots. Few worked at organizations where any incentive for carpooling was offered—either guaranteed parking, cheaper parking, or parking closer to the work entrance.

In general, the solo drivers were very reluctant to accept carpooling, even if that were the only way to get a guaranteed parking space at work, when they considered it in relation to having to leave work at a fixed time each day (the single greatest time barrier to carpooling).

However, the disincentives of the alternatives to guaranteed parking were more powerful, as shown in the following table. Only 21 percent of the solo drivers would be willing to hunt for a parking space for 20 min and only 10 percent for half an hour. A mere 8 percent would risk a ticket five times a month, and only 2 percent would say they would run a daily risk of getting a ticket in order to park at work.

<table>
<thead>
<tr>
<th>Disincentive Question for Solo Drivers</th>
<th>Sample Size</th>
<th>Percentage Agreeing</th>
</tr>
</thead>
<tbody>
<tr>
<td>To continue driving alone to work, would you be willing to look for a parking space, if you had to, for:</td>
<td>251</td>
<td></td>
</tr>
<tr>
<td>10 min</td>
<td>45.0</td>
<td></td>
</tr>
<tr>
<td>20 min</td>
<td>20.8</td>
<td></td>
</tr>
<tr>
<td>30 min</td>
<td>10.4</td>
<td></td>
</tr>
<tr>
<td>To continue driving alone to work, would you be willing to risk getting a parking ticket:</td>
<td>246</td>
<td></td>
</tr>
<tr>
<td>Once a month</td>
<td>31.7</td>
<td></td>
</tr>
<tr>
<td>5 times a month</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td>Every day</td>
<td>2.0</td>
<td></td>
</tr>
</tbody>
</table>
Things Called "Convenience"

It was necessary to ask highly specific questions under the heading of "convenience," because the panels had made clear that it has multiple meanings and tends to be used as shorthand or euphemism for any difficulty that bothers a commuter.

Solo drivers were altogether more concerned about convenience factors than carpoolers. A large majority—76 percent—thought rearranging and adjusting schedules to suit the needs of other people a serious problem in carpooling, and 51 percent felt that there would not be enough room to carry and store packages. This concerns the tool-carrying blue-collar and errand-running white-collar workers more than the MEPs. When carpoolers and the 65 percent of solo drivers who had carpooled in the past were asked why they had carpooled, 22 percent of the solo drivers versus only 14 percent of the carpoolers mentioned convenience factors.

Solo drivers but not carpoolers perceived carpools as physically crowded. They thought the carpool ride less relaxing than carpoolers, and they worried about not being able to start the trip when they wanted to. They hesitated more than carpoolers in feeling they could rely on a carpool or have door-to-door service.

MOTIVATING THE SOLO DRIVER TO CARPOOL

The purpose of this section is to highlight the differences between those solo drivers who expressed some interest in carpooling and those who stated they had none. When solo drivers were asked "Are you interested in carpooling to work?" 17 percent responded "Yes, definitely"; 23 percent said "Yes, possibly"; 16 percent replied "Not sure"; and 43 percent said "No." With such a wide variation of interest, one high priority strategy would be to tailor carpool programs to the interested solo drivers. A special analysis was therefore performed concerning solo drivers’ attitudes toward three important strategy or policy areas: carpool matching system, parking management, and dedicated carpool routes.

A discriminant function procedure was chosen, since this technique highlights the differences between groups (4). It has been used successfully in transportation research to predict mode choice from beliefs about buses, carpools, and single-occupant autos (5). Solo drivers were classified according to their interest in carpooling as a function of their attitudes toward the three policy areas.

A high collinearity that would distort the results emerged among some variables in each area, so variables were first combined by classical factor analysis (6) into composite variables.

The solo drivers were grouped into two categories: those 40 percent interested in carpooling (definitely or possibly) and those 43 percent definitely not interested. The 16 percent who answered "not sure" were excluded from analysis. The range of responses indicated that a statistically necessary assumption that this group was in between the interested and not interested groups could not be made. The responses, of course, are important to consider in future analyses since many might carpool if their particular needs were met.

Carpool Matching

The three composite variables were "advance knowledge of carpool mates," "no assistance desired in forming carpools," and "assistance desired." By far the most powerful discriminator was attitudes toward having assistance. Those interested in carpooling desired help—

and by personal more than impersonal match systems—although they tended to favor any help (discriminant function coefficient of 1.08 versus 0.20 and 0.21 on "advance knowledge" and "no assistance").

Those not interested in carpooling were far less positive about assistance, should they at some time want to become involved in a pool. Responses to the questions relating to advance knowledge of carpool mates did not delineate the two groups; all solo drivers analyzed wanted to meet carpoolers in advance, although all did not necessarily require people they already knew or job peers in a carpool.

The "no assistance" variable also failed to discriminate. It was a split composite. All solo groups favored forming carpools without help, and all rated computer matching negatively.

Parking Management

Five composite variables involved either the incentives for carpooling or the disincentives for solo driving that follow.

Incentives for Carpooling

Carpooling favored for cost savings and convenience

Guaranteed parking worth carpooling time concessions

Disincentives for Solo Driving

Solo driving favored over paying parking cost increases

Solo driving favored despite risk of parking tickets

Solo driving favored despite parking space hunt

The carpooling incentives distinguished the two groups (coefficients of 0.51 and 0.58, respectively), which appealed to those interested in carpooling. The disincentives did not; all found them onerous.

Carpool Lanes and Roads

Two composite variables emerged: the "use of express lanes and roads considered in isolation" and "express routes versus dependence on others." The first was an excellent discriminator (discriminant function 0.86), which indicates that express routes considered by themselves appeal strongly to solo drivers interested in carpooling. However, the trading off of the use of such routes versus being tied to a fixed departure time and depending on others discriminated poorly (coefficient 0.21). Concerns about departure times and about relying on others during one's commute appeared pervasive among all solo drivers.

Combined Variables

One last discriminant analysis combined all composite variables from all three policy areas. The two best discriminators were

1. Guaranteed parking for carpoolers being worth fixed departure times, extra commuting time, and waiting for late members (0.41) and
2. Likelihood of carpooling if an express lane or road were available for a sizeable portion of the trip (0.39).

Those interested in carpooling responded to these incentives and were best distinguished from those not interested in carpooling by their responsiveness.
Summary

Clearly, in aiming programs at the most likely to carpool solo drivers, the incentives of guaranteed parking—where parking is otherwise a problem—and express routes will tend to be high-payoff strategies, as will assistance with personal match methods. It will also, of course, be vital for transportation planners to consider, in addition, the social dynamics and other elements discussed in previous sections.

RECOMMENDATIONS

The recommendations offered are based on the findings from panels that privately owned auto transportation is likely to continue to dominate personal travel in the foreseeable future. Carpooling can be a viable private means of dealing with transportation and energy problems, but, if it is to succeed, a long-range, well-planned, high-priority effort is required. In addition, a blend of economic and behavioral incentives will be required. Any effort to replace a highly valued activity has to employ equally powerful motivations. Disincentives or purely economic incentives are insufficient in a nation of affluent and independent individuals who already have investments in the automobile.

Several demographic characteristics have been confirmed as predisposing individuals to carpooling and so defining some preferred target populations:

1. Those with long commutes,
2. Drivers over 30 years old,
3. Commuters living in multiperson households,
4. Those with regular hours in the case of MEP and white-collar commuters to the central business district and blue-collar workers to congested suburban sites, and
5. Availability of parking incentives.

However, the strategies that follow are recommended for more resistant groups. Each has value with a broad range of population segments; each may also provide different incentives to different subgroups.

In order to address the needs of different transportation program personnel, the full report deals with all the critical variables found, such as parking, cost, social factors, and convenience, and relates strategies concerning each to the needs of each specific population segment. We will abbreviate the process here by describing the major recommendations and how they would motivate the particular subgroups to share rides.

These recommendations emerge from an integration of findings from the decision analysis panels of phases 1 and 3 and from the survey.

Strategy 1: A Personalized System

The most important recommendation is that the carpooling formation system be personalized and that it offer a quick response and an active outreach program. Passive systems, such as lobby locator lists, place the burden of understanding the system on the individual. They require the highly motivated to go through the various steps and to overcome obstacles required to form a carpool and to have the perseverance, understanding, and resources to achieve and maintain a compatible carpool. For example, there are large segments of the population who are interested in carpooling but who hesitate to telephone a stranger. The reasons range from sheer timidity to fear of becoming caught in an unpleasant situation that one could not comfortably terminate. This is a socially awkward situation for both women and men.

Strategy 2: Appeal to Population

Subsegments

It is critical that a carpool program concentrate on appeals that are appropriate to particular subsegments of the population. We have described how motivation for and problems with carpooling vary according to occupation type and conditions, experience with carpooling, size of employment site, age, income, sex, length of commute, and so on. Therefore, it is vital that the program planners know and be governed by the characteristics of the people in the community as well as its geography.

Strategy 3: Local Carpool Coordinator

One method for achieving these criteria is the use of the local carpool coordinator. Located at the work site or at the home end, whichever provides the best leverage, the local coordinator would serve the functions of:

1. Learning about his or her population’s needs and nature,
2. Providing information about carpooling,
3. Initiating and coordinating personalizing strategies,
4. Assisting in forming new carpools via various substrategies including bringing people together or employing existing groups,
5. Assisting in enlarging current carpools,
6. Providing early warning of trouble and helping to deal with problems in existing carpools, and
7. Providing emergency service when carpools break down temporarily.

The coordinators may eventually move into another transportation energy-saving activity, such as buspools to athletic or other events.

It is important that the local coordinator understand the factors that motivate people to carpool and that contribute to a good carpool. He or she must be taught that no single factor is preeminent but that an introduction of multiple factors such as distance, time, and especially social and personal dynamic factors produce an effective program. It is also important that the local coordinator become a resource to the community rather than a burden. He or she must also learn to enlist existing enthusiasts or community leaders to achieve his or her objective rather than do things alone. In doing so, he or she obtains community consensus and pressure in behalf of ride sharing. A handbook for local coordinators would be needed.

A local coordinator is someone at the work site who relates well to people and has their confidence and can handle the concepts described. The benefit to the employer of assigning a good person will derive from increased promptness, morale, and productivity (interest in workers by management), and possibly from land economics as less is needed for parking.

At the home end, local coordinators may be retired or disabled persons with the need to continue productivity, housewives with limited mobility during the day, but time to use the phone, or civic leaders with a desire to make a contribution and time to do so.

The local coordinator can make use of computer printouts where computerized matching systems exist. These can be strengthened through his or her capacity for personalizing the match and taking the initiative.

He or she can arrange special carpools, such as no smoking, "silent in the morning," all one sex, or what-
ever is required by the constituency.

He or she can eliminate much of the hassle and doubt that interferes with carpool formation and can help solve the problems that result in carpools breaking up.

The local coordinator's strategy would be directed to all potential carpool targets. However, it would be most effective with those populations where hesitancy, need for guidance, and assistance with problem solving are important factors—in short, for the marginal carpoolers who constitute a significant part of the population. Further, the presence of such an energy-related agent in the community will provide direct evidence of the reality of the national program.

Strategy 4: Preparation of a Handbook

Strategy 4 involves the preparation of a "how to carpool" handbook to be used as part of the enrollment campaign and to contribute to a higher level of carpool continuation. This concept was very strongly endorsed by all phase 3 panels and would provide the information about carpooling, such as how to deal with problems and gripes, that this research and other sources have determined to be important. This was, in fact, the target population for this strategy. It includes those who might be resistant to or puzzled by some aspects of the carpooling situation that they do not understand or have misconceptions about.

Strategy 5: Parking Strategies

Parking is not a problem for a large part of the population examined. However, effective strategies can be addressed to blue-collar workers who have difficulty finding parking spaces and are least able to risk parking tickets. Here parking for carpools will have value. For white-collar populations (largely women in this sample), the avoidance of frightening walks on dark winter evenings may motivate carpool formations. Close-in, covered, guaranteed parking is also likely to motivate the status-conscious executive to carpool.

Strategy 6: Personal Safety

The survey and decision analysis panels suggest that blue-collar workers and female white-collar workers were both concerned about waiting for carpools at the work end on streets or roads that were often unsafe. In other cases, such rendezvous points as fringe parking lots were frightening. Secure meeting points will be valuable.

Strategy 7: Cost Incentives

This is not the critical variable it was assumed to be, but it remains important to some segments of the population. Carpooling as a money saver will appeal to the lowest end of the income distribution. However, these are largely blue-collar and low-level white-collar workers for whom carpooling also has a special drawback: they are frequently docked in pay or may soon lose their jobs if they are late. Special adjustments to meet this problem will have to be made in cooperation with employers.

Strategy 8: Familiarization Methods

In conjunction with the activities of the local coordinator, neighborhood or work meetings before forming carpools are particularly important to blue- and white-collar workers. This is particularly true of women, who want to know more about potential carpool mates before committing themselves.

Strategy 9: Carpool Lanes as Powerful Incentives

Despite the fact that the MEP group was the least responsive of the three occupation types, this incentive is strong enough to lure many managerial personnel away from their "unpredictable hours" excuse for not carpooling. Blue-collar workers are the strongest advocates of the carpool lane, probably because of their fear of being made late by congestion with subsequent loss of wages. There is reason to believe that carpool lanes on ring roads would be even more powerful incentives and would address the majority of commuters.

OCCUPATION GROUPS

Blue-collar workers have high potential for ride sharing, with sociability factors at the fore. They have little need to achieve mastery by controlling their own transportation mode. There are two large subgroups, one concerned with cost and another involved in long commutes. Particular care is needed in legitimizing the setting of rules for a carpool. Because blue-collar workers tend to drive the more unreliable, older autos, the availability of standby cars via the carpool becomes an asset.

White-collar workers are a high potential group for carpooling but have many special needs. These include knowing a great deal in advance about whom one may carpool with and arrangements for shopping at lunch hour and on the way home. Particular care must be taken in making it legitimate to set rules for a carpool. White-collar workers will respond well to outreach programs, to meetings where difficulties can be aired, and, for the large proportion who are women, to the opportunity to talk with currently carpooling in order to understand in what ways it can be workable.

MEPs form a high dominance group with many status and mastery needs, and desires for flexibility in terms of departure time at the end of the work day. They would be responsive as a group to carpools with staggered hours, to the opportunity to be part of an advisory board that sets up the carpooling program at a work site or in a neighborhood civic association, and to carpools limited to medium-sized and larger cars.

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REFERENCES

Attribute Importance in Multiattribute Transportation Decisions

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This report describes a study of the relative importance of various travel attributes as influences on commuters' choices among car, bus, and Bay Area Rapid Transit (BART) for traveling to work in the San Francisco Bay area. A sample of commuters was interviewed, and each was asked to rate his or her satisfaction with car, bus, and BART on each of the attributes studied. The relative importance of the attributes was inferred by examining the ratings and the relationships between the ratings and the usual choice of travel mode. The study differed from previous similar research in that attribute importance was measured with a statistic that estimated how much each attribute contributed to differences in utility among the choice alternatives. Most previous research failed to consider an essential component of the quantity measured by this statistic, namely, average differences in utility among alternatives caused by average differences among alternatives in the levels of each attribute. Among the attributes judged to be most important were safety from crime, seat availability, and dependable arrival, which are ordinarily not included in quantitative planning procedures such as travel demand forecasting and cost-benefit analysis.

To a large extent, the experience of urban travel by any method can be described in the abstract as a composite of varying travel attributes. This paper describes a study of ten different travel attributes and their relative importance as influences on commuters' choices among car, bus, and Bay Area Rapid Transit (BART) for traveling to work in the San Francisco Bay area. The attributes were (a) cost, (b) total travel time, (c) dependability, (d) relaxation, (e) safety from accidents, (f) time use while traveling, (g) flexibility, (h) seat availability, (i) safety from crime, and (j) waiting time.

A sample of commuters were interviewed and each was asked to rate his or her satisfaction with car, bus, and BART on each of the ten attributes. The relative importance of the attributes was inferred by examining these ratings and the relationships between the ratings and the usual choice of travel mode. The research was intended to have some immediate applications as a general diagnostic tool in transportation planning for evaluating the relative importance of various attributes that might otherwise be misjudged or overlooked. Primarily, however, the research was considered exploratory, the first stage in a multistage research strategy. Applications to quantitatively detailed planning procedures—such as travel demand forecasting or cost-benefit analysis—require additional research to identify policy variables that underlie the attributes identified as important and to determine how these policy variables are related to utility and behavior.

In basic objectives and methodology, this research was similar to a number of recent studies (2, 3, 4, 5, 6, 7, 8). The study differed from previous research, however, in that attribute importance was measured with a statistic that estimated how much each attribute contributed to differences in utility among the choice alternatives, for the people in the study sample. Most previous research has failed to consider an essential component of the quantity measured by this statistic, namely, average differences in utility among alternatives caused by average differences among alternatives in the levels of each attribute.

To demonstrate the importance of this difference, one must consider some theoretical and methodological issues in detail. This is done in the following section of the report. Readers interested primarily in the substantive conclusions of the research could skip to the section on data collection without loss of continuity.

MEANING AND MEASUREMENT OF ATTRIBUTE IMPORTANCE

The theoretical concepts underlying this study can be summarized in the form of a linear utility model. For a detailed discussion of linear utility models and their applications to research on travel behavior see Domenich and McFadden 9. The model is

\[ U_{mk} = \sum B_j X_{jmk} + c_{mk} \]  

where

\[ U_{mk} \] = utility of travel mode m for person k,

\[ X_{jmk} \] = measured value of attribute j for mode m and person k,

\[ B_j \] = coefficient representing the influence on utility of attribute j as measured with variable \( X_{jmk} \), and