Direct Comparison of Commuters' Interests in Using Different Modes of Transportation

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Interest in express bus service and carpooling was low (10 to 20 percent) among commuters surveyed in a western suburb of Honolulu, and the potential time savings of high-occupancy-vehicle lanes offered little incentive for creating the latter. Interest in both alternatives rose in response to increasing parking costs. Interest in rail transit was 36 percent higher than interest in local bus service at a comparable fare (50 cents), and rail transit appears to be equally attractive to people who now carpool and to many solo drivers, as well. But car commuters that explicitly object to carpooling (34.6 percent of all commuters) as being too time-consuming and unreliable also resist using rail, and interest in rail drops to 21 percent among all commuters if the one-way fare is raised to $1. The most widely preferred alternative among all commuters was paratransit that provides better service and a guaranteed seat. Interest reached 91 percent for door-to-door service at a $1 fare; substantially lower interest was exhibited for rail transit than paratransit, regardless of fare or access. These results suggest that if paratransit served the same area as a rail system, it could take at least two to four times more cars off the road than rail would. Because paratransit can serve wider areas at considerably less cost than rail—possibly at a profit—it is recommended that private providers be permitted to establish such service. The time has come to consider market solutions to transportation problems.

Mounting traffic congestion throughout the United States has caused government officials and transportation planners to search for alternative modes of transportation to entice commuters out of their automobiles (*1*,*2*). Even cities that have rapid transit systems are finding that other means are needed to stem the rising tide of congestion (*3*–*5*).

The intangible personal costs of traditional types of mass transit deter its use. Generally, the individual costs of such transit have more to do with time than money; they include time in getting to and from transit stops, time waiting at stops, and time making transfers. Add to these costs the sacrifice in comfort usually associated with mass transit (*6*,*7*), and it is not surprising that most people commute by car even when train or bus service is available (*3*,*5*). Carpools and vanpools carry two to three times as many commuters as standard forms of mass transit in the United States, but attempts to increase ridesharing have yielded minimal effects at considerable cost (*1*,*2*) and further expansion in this area is probably limited (*8*,*9*).

Economic and psychological factors both have major influences on commuters' choice of transportation mode (*9*,*10*). Economics affect the choice situation by placing constraints on it, such as car ownership and the amount of money available to spend on transportation (*11*,*12*). Personality variables and past experience set further limits and dispose the commuter to favor certain choices over others (*6*,*13*,*14*). Beyond this, a consumer's choice of travel mode represents a balance between personal costs and benefits, for example, time, convenience, and comfort (*13*,*15*,*16*). Although this cost-benefit analysis may not be a conscious process (*17*), it is rational in the economic sense of the word. Given the cost and service characteristics of transportation alternatives now available, the automobile is the rational choice for most people, and people's attitudes reflect this fact (*6*,*12*,*18*).

The interest of automobile commuters in using various transportation modes, including carpools and different forms of mass transit or paratransit, is examined. The study area encompassed a discrete subdivision in the western suburbs of Honolulu, on the Hawaiian island of Oahu, whose population has been particularly vocal in its support for a fixed-guideway, rapid transit system. For convenience, such a system is referred to as rail transit, or simply rail.

METHOD

Sample

As part of the Mililani Neighborhood Board's effort to assess support for a rail system and other commuter transportation alternatives, a questionnaire was sent to each of the approximately 8,400 households in its jurisdiction. A total of 908 questionnaires were returned, but not all of them were fully completed, possibly because of the questionnaire's extended length (nine pages) and some peculiarities in its format that were imposed by the neighborhood board.

Given the low return rate, the sample may not be representative because of nonresponse bias. To the degree that this is so, it is expected that the results are biased in favor of rail transit, because the community has vocally supported rail and opposed HOV lanes for carpools. The use of ratings instead

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of forced-choice measures and the mathematical adjustment of the ratings to reflect actual behavior may have helped to overcome this bias.

Measures and Analyses

The survey instrument was designed to be similar to that previously used to collect data on commuting behavior and consumer attitudes towards using various transportation alternatives (*10,19,20*). Although the questionnaire was designed with great care, its final form differed substantially from what was originally intended. Among other things, the questionnaire more than doubled in length because the neighborhood board included numerous questions on related and unrelated topics at the insistence of board members and because the board decided to use computer-readable scoresheets that restricted the number of questions per page.

Interest in each alternative was typically measured by a series of related questions that described the alternative in terms of its cost and service characteristics. The respondent was asked to rate each alternative under different sets of hypothetical conditions rather than to choose between or among alternatives, per se. This approach permits the data to be analyzed by repeated-measures analysis of variance and higher-order factorial designs. Because these parametric techniques take individual (within-subject) variability into account and can statistically control for differences in sample size, they are less sensitive to sampling bias than nonparametric analyses of nominal (forced-choice) data. Nonparametric techniques, such as chi-square, were also used when appropriate.

Previous research suggests that people may respond more favorably to some alternatives than would be expected given their own behavior. Solo drivers, for instance, may express an interest in carpooling, whereas other car commuters may say they are interested in taking the bus, even though they do not take it. This response bias was corrected by weighting responses in terms of actual behavior. Thus, car commuters were asked to rate their interest in using the bus with the current fare and service characteristics (i.e., local bus service). Their rating of interest in local bus service was then used to calculate an adjusted score of their relative interest in other transit alternatives, according to the formula

$$\text{Adjusted score} = (\text{rating of alternative} - \text{rating of bus})/(\text{rating of bus})$$

These adjusted scores yielded a percentage measure of relative interest in which interest in using local bus service provided a zero baseline. Each person's interest in local bus service provided a baseline for that individual's relative interest in transit and paratransit alternatives. A similar formula was devised to adjust ratings of solo drivers' interest in carpooling.

RESULTS AND DISCUSSION

Current Commuting Conditions

The automobile is by far the most common mode of commuting (91.3 percent) among the people sampled. The bus (3.8 percent) came in a distant second, but below the combined total (4.9 percent) for all other modes (walk, bicycle, and motorcycle). Among those who drive to work, 74.7 percent drive alone (68.2 percent of all commuters), whereas the remaining 25.3 percent carpool (23.1 percent of all commuters). The extremely small samples of respondents that commute by modes other than the car make it impossible to perform any meaningful comparisons among them, or between them and car commuters. They therefore were excluded from further analyses.

In accord with previous work (*19,20*) done on Oahu, the present results indicate that almost two-thirds (64 percent) of carpools in the sample area contained only two people and the other one-third or so (36 percent) contained three people or more. The percentage of family carpools (72.3 percent) is also comparable with studies of other communities, but far higher than the nationwide average (*9*). Relatively few people (26.8 percent) in the sample commute with friends, and very few (<1 percent) carpool with coworkers.

Approximately 36 percent of the car commuters sampled worked in or around downtown Honolulu, 16 to 20 mi from home, and another 20 percent worked at sites just east of Pearl Harbor, in the same direction as downtown but only 11 to 13 mi away. The remainder are employed at less centralized work sites.

Carpool commuters differ significantly from solo drivers in terms of commute distance (chi-square = 25.59, df = 4, $p < .001$). Although the proportions of carpoolers (59.1 percent) and solo drivers (56.5 percent) who commute distances of 11 to 20 mi (one way) are similar, carpoolers are less likely to commute shorter distances and are more likely to commute longer distances than this, than are solo drivers. Carpoolers and solo drivers also differed significantly in terms of their parking costs (chi-square = 27.82, df = 4, $p < .001$). Roughly 82 percent of solo drivers park for free, compared with 64 percent of carpoolers; among those that pay to park, solo drivers tend to pay less. No relationship was found between carpool size or carpool composition and either commute distance or parking costs.

Interest in Carpools

Approximately 10 percent of solo drivers expressed positive interest in carpooling, more than half (51.2 percent, or 34.9 percent of all commuters) said they would refuse to carpool under any circumstances, and the remainder were essentially neutral. Those who refused to carpool were more likely to work in downtown Honolulu (chi-square = 9.63, df = 4, $p < .05$) and to pay significantly more for parking (chi-square = 9.86, df = 4, $p < .05$) than other solo drivers. They were also more likely to have longer travel times (chi-square = 10.03, df = 4, $p < .05$).

So why do they refuse to carpool? Table 1 provides at least a partial answer to this question. A technique used earlier by Margolin and Misch (*10*) and other researchers (*21*) was used to compare different characteristics of carpooling and driving alone with one another in a series of statements to which respondents were asked to agree or disagree. The statements are presented in Table 1 in abbreviated form, along with the percentage of respondents in each group that agreed with each statement. Significant differences were found among groups

TABLE 1 PERCENTAGE OF CAR COMMUTERS, BY CATEGORY, WHO AGREED WITH STATEMENTS ABOUT COSTS AND BENEFITS OF CARPOOLING

Statement	Won't Carpool	May Carpool	Do Carpool
Ability to do errands with own car outweighs HOV time-savings	69.4%	47.7%	42.3%
Ability to do errands outweighs monetary savings of carpooling	68.7%	44.8%	41.4%
Monetary savings of carpooling not worth the cost in time	65.1%	51.6%	50.2%
Having to depend on others not worth the money saved by carpool	61.8%	40.4%	35.6%
Having to depend on others not worth the time savings of HOV	57.8%	35.1%	34.9%
Time involved in carpooling outweighs its monetary savings	54.1%	36.3%	35.8%
Time picking up pool members cancels out time savings of HOV	51.3%	33.0%	34.4%

on each item (chi-square values ranged from 22.7 to 50.8, df = 4, $p < .001$ for all comparisons). The pattern of differences is consistent with previous research indicating that attitudes reflected mode choice and were good predictors of subsequent changes from one mode to another (*7,18*).

As indicated in the table, those who refused to carpool (labeled Won't Carpool) differed from other car commuters (May Carpool and Do Carpool) in their evaluations of the costs and benefits of carpools. They appeared to place a higher value on their time and independence, and they were wary of having to depend on others. Moreover, they tended to believe that the monetary savings of carpooling and the potential time savings of high-occupancy–vehicle (HOV) lanes were outweighed by the time spent picking up carpool members. In short, they thought that the costs of carpooling outweighed its benefits, at least under current conditions.

When asked if increasing the time saving provided by HOV lanes would encourage them to carpool, neither group of solo drivers (Won't Carpool and May Carpool) responded strongly to such incentives. Whether this response reflected the community attitude against restricting lane use or a skeptical attitude toward the ability of HOV lanes to actually provide time saving cannot be discerned. (Current HOV lanes only bring drivers into the congestion bottleneck.)

Solo drivers appear to be more likely to opt for carpooling in the face of disincentives. Solo drivers who may carpool and those who say they won't carpool express increasing interest in doing so, as measured by their adjusted scores, when faced with higher parking costs ($F = 56.18$; df = 4, 2448; $p < .001$). At an increase of $10 per month, some 35 percent of those who say they won't carpool change their minds, whereas interest in carpooling among those who may carpool rises to 53 percent. At increases of up to $50, almost 65 percent of those who are against carpooling decide that they would, and the interest of other solo drivers goes up to 81 percent.

Interest in Mass Transit

Roughly 21 percent of respondents currently in carpools and 15.5 percent of those who drive alone claim to be interested in express bus service. Interest among downtown and Pearl Harbor workers (20.1 percent) is nearly twice as high as that of car commuters that work elsewhere (11.8 percent). So why don't people use express buses instead of their cars? As presented in Table 2, the answers vary somewhat, depending on who was asked. People who won't carpool are more likely than others to claim that they sometimes need their cars for work (chi-square = 23.10, df = 2, $p < .001$) and that the bus does not match their schedule (chi-square = 13.18, df = 2, $p < .001$). But these are also the most frequent explanations chosen by other car commuters. (Respondents could give more than one answer.) The two other most common reasons that respondents select are that they do not like to stand on the bus and that there is no express bus service near their home.

Hypothetical increases in parking costs increase relative interest in express bus service ($F = 63.86$; df = 4, 2588; $p < .001$), but not as much as they do for carpooling. Even at parking costs of $50 more per month, interest in express bus service (which costs only $15 per month) is still less than 45 percent among all three groups of car commuters.

At 36 percent, relative interest in using rail transit (as measured by adjusted scores) is substantially higher than that for express buses, even though it was explicitly stated that the

TABLE 2 REASONS GIVEN BY THREE GROUPS OF CAR COMMUTERS FOR NOT USING EXPRESS BUSES

Reason	Won't Carpool	May Carpool	Do Carpool
Bus schedule does not match my work schedule	57.5%	50.5%	40.9%
I sometimes need my car for work	59.6%	40.7%	44.7%
I do not like to stand on the bus	29.1%	22.1%	33.0%
No express-service between where I live and work	20.0%	22.0%	20.5%

access to the train (the average distance to the nearest train stop) will be 5 mi from the Mililani subdivision. Because the higher capital and operating costs of a rail system may lead to fares increases, it was necessary to see if respondents were willing to pay higher fares. Other factors included in the analyses were worksite (broadly defined) and present mode of commuting.

Overall, relative interest in rail is reduced to 21 percent at a $1 fare each way, and to 3 percent at a one-way fare of $2. At more than $2, interest in rail transit becomes negative relative to interest in local bus service. Although worksite was not found to play a significant role in determining interest in rail transit, relative interest was highest among respondents working in and around downtown Honolulu and Pearl Harbor—those most likely to be served by the rail system.

The relative interest of downtown and Pearl Harbor commuters (approximately 56 percent of all commuters in the sample) is shown in Figure 1. Fare is the primary variable affecting interest in the train, among car commuters into these (and other) work locations ($F = 83.19$; df = 3, 1833; $p < .001$). Current commute mode (solo drivers versus carpoolers) also has an effect, but this effect is mainly attributable to differences between solo drivers that won't carpool and other car commuters, in response to different fares ($F = 2.55$; df = 6, 1883; $p < .05$). At lower fares, at least, rail appears to be an equally attractive alternative to many carpoolers and solo drivers. But it is far less attractive to solo drivers that do not want to carpool and these make up 34.9% of all commuters in our sample.

Interest in Paratransit

On the basis of previous research (*15,22,23*), including that of the authors (*12,19,20*), it was decided to examine how two service characteristics and fare contributed to people's interest in using paratransit. The service variables chosen for study were seating (a guaranteed seat versus no guaranteed seat) and access—the distance (or time) to transit stops from a commuter's origin and destination (*12,19,24*). Three levels of access were considered: (a) door-to-door service (door/door); (b) a 5-min walk between origin and pick-up point and be-

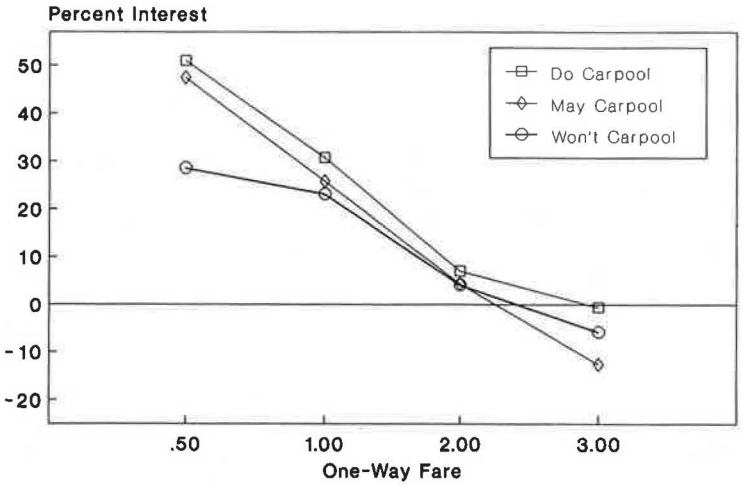

FIGURE 1 Interest in downtown and Pearl Harbor car commuters in using rail transit.

TABLE 3 RELATIVE INTEREST OF CAR COMMUTERS IN USING PARATRANSIT AS A FUNCTION OF FARE, ACCESS, SEAT AVAILABILITY, AND WORKSITE

			One-Way Fare		
Worksite	Seating	Access	$1.00	$2.00	$3.00
Downtown and Pearl Harbor	Seat	Door/Door	99.8	49.3	11.9
		5 Minutes	81.7	31.2	1.1
		10 Minutes	52.5	18.6	-5.1
	No Seat	Door/Door	67.9	24.1	-4.9
		5 Minutes	48.8	6.5	-14.3
		10 Minutes	24.5	-4.1	-15.3
All Other Worksites	Seat	Door/Door	77.9	31.4	-1.3
		5 Minutes	66.2	17.4	-9.2
		10 Minutes	35.6	3.2	-14.2
	No Seat	Door/Door	59.6	17.1	-2.5
		5 Minutes	43.8	4.6	-11.2
		10 Minutes	20.0	-4.0	-15.1

tween drop-off point and destination (5 min); and (c) a 10-min walk (10 min). Hypothetical fares of $1 or more were used because it seems unlikely that lower fares could cover the costs of the services being considered. Current mode and worksite were included in the statistical analyses along with fare, access, and seating.

Table 3 indicates that interest in paratransit relative to local bus service is high. Relative interest, in terms of adjusted scores, decreases with increasing fare (F = 203.18; df = 2, 1222; $p < .001$), with a fare increase from $1 to $2 reducing the relative interest by one-half or more. Increases in access time produce a similar, though less pronounced, effect (F = 112.44; df = 2, 1222; $p < .001$). At a $1 to $2 fare, each increment in access time reduces relative interest by 15 to 30 percent, depending on worksite and seating (F = 2.73; df = 4, 1222; $p < .05$). Yet these access times are probably far shorter for most of the people in the sample than those now afforded by local bus service.

Although downtown and Pearl Harbor workers place a greater value on a seat than do other workers (F = 9.06; df = 1, 611; $p < .01$), a guaranteed seat significantly increased relative interest in paratransit by 20 to 30 percent, overall (F = 51.04; df = 1, 611; $p < .001$). More important, a guaranteed seat can partially compensate for increases in fare (F = 22.44; df = 2, 1222; $p < .001$) and, to a lesser degree, so can decreases in access (F = 3.04; df = 2, 1222; $p < .05$). No significant effects of mode were found.

Interest in Paratransit versus Rail Transit

A direct comparison between paratransit and rail transit reveals a pronounced preference for paratransit with a guaranteed seat (F = 96.11, df = 3, 1845, $p < .001$), regardless of access time (Fs = 84.20 to 122.25, $p < .001$ for all three paired comparisons). As shown in Figure 2, there is greater relative interest in paratransit at all fare levels (F = 54.20, df = 6, 3690, $p < .001$), as measured by adjusted scores. All three of the paratransit options shown in Figure 2 (i.e., service variations in terms of access) received higher relative interest at a $1 fare than the 36 percent relative interest for rail at a 50-cent fare (not shown), whereas door-to-door service with a seat commands 42 percent interest even at a $2 one-way fare.

CONCLUSIONS AND RECOMMENDATIONS

As found in earlier studies (*12*,*19*,*20*), interest in carpools among Oahu's commuters is low and the proposed time saving of HOV lanes does not appear to provide a strong enough incentive to attract a substantial proportion of solo drivers to ridesharing. Under current conditions, the market for carpooling is limited; perhaps 10 percent of all solo drivers are willing to carpool. Most drivers regard the price of carpooling, in terms of loss of independence and added time, to be too high for incentives to make it worth their while. Hence, wide-scale efforts to encourage carpooling would not appear to be worth the cost, although targeting specific markets may be worthwhile.

Express bus service may offer an alternative for some 20 percent of people who now drive to work. But it would have to be expanded and operated in a way to overcome current criticisms about scheduling and crowding. What role parking costs play in determining current mode choice is not as clear because so few commuters pay for parking now. But increas-

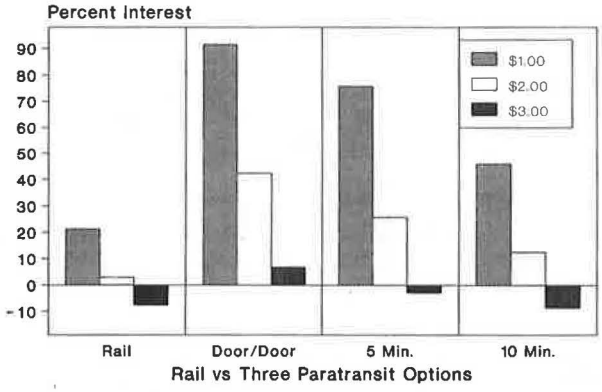

FIGURE 2 Interest in rail versus paratransit options with guaranteed seat, as function of fare.

ing those costs appears to be a powerful disincentive to driving alone, which could increase both express bus ridership and carpooling. Serious attention might be given to using disincentives once improved bus service was in place.

Rail transit is looked on more favorably by car commuters than either carpools or express buses, with rail receiving 36 percent interest at a 50-cent fare. It is equally attractive to people who now carpool and to many solo drivers, but those who are resistant to carpooling (34.6 percent of all commuters) are also resistant to using rail, presumably because it has some of the same limitations. Interest in rail declines quickly in the face of rising fares—down to 21 percent at a $1 fare—which would have to be imposed, in all likelihood, to help offset the higher capital and operating costs of a rail system.

As found in the past (*19*), the most widely accepted alternative mode is paratransit providing better service. The combination of reduced access and a guaranteed seat produces interest that is far higher than that exhibited for rail or any other mode. The same people, using the same rating scale, who express a 36 percent interest in rail at a 50-cent fare, express a 91 percent interest in paying $1 for door-to-door service with a guaranteed seat. In addition, paratransit is capable of attracting those same commuters that most strongly resist using other alternatives. Because interest in paratransit is substantially higher than interest in rail transit at all fares, it seems unwise to invest in a rail system for Honolulu when a far less expensive and apparently attractive alternative has yet to be tried.

It is not yet clear how the interest measures studied here translate into potential ridership (*19,24*). But regardless of the absolute numbers involved, the relative magnitude of the effects should be the same across all of the alternatives. If this is so, whatever the number of car commuters that a rail system will attract, two to four times that number could be expected to use paratransit serving the same areas. Paratransit systems could also attract comparable levels of ridership in areas that will not be served by the proposed rail system and, it appears, that paratransit is able to do so without the imposition of disincentives. Moreover, it is possible that such service could be provided without subsidy. But if subsidies are necessary, they would be far less than those needed for a rail system and they should be more cost effective.

Simply providing the transportation consumer with better service at a reasonable price may be the alternative that government officials and planners have long sought (*25*). Instead of investing in a rail system for Honolulu, opening up the transit market to private businesses, with government providing limited subsidies as needed, is urged.

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