DIAL-A-RIDE PROJECT IN ANN ARBOR: PUBLIC RESPONSE

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Ann Arbor, like most other U.S. cities, is almost totally dependent on private automobiles for the movement of people. Those who have access to automobiles have certain obvious advantages: They can go wherever and whenever they want to; they can choose those who occupy their vehicles; and many of the costs of their driving are heavily subsidized by members of the nondriving public.

Conversely, there are strong disadvantages when a transportation system is so heavily dependent on the automobile as its only type of vehicle. For individuals, it is relatively expensive in terms of total cost per passenger trip, and it is inefficient in terms of the number of hours per day, week, or year that the automobile is actually operated. For a community, it is wasteful of scarce urban land necessary for streets and parking facilities, it generates more air pollution per trip than other modes, and it excludes or seriously disadvantages those who are unable to operate or afford private vehicles.

Any effort to provide a more diverse transportation system in Ann Arbor implies that serious efforts will have to be made to shift a significant proportion of those trips now being made by private automobile to other modes, primarily public transit. To state this necessity, however, is a long way from beginning to bring about such a change. The change that is envisioned in the discussion that follows will be extremely difficult to accomplish precisely because, for so many individuals and households, the present, single-mode system seems to be working so well. However, the Transportation Authority believes that Ann Arbor has much to gain from the effort.

A transportation system may be characterized as a method for moving people and goods. The 2 major components are the technological system that effects the movement and the human beings who use it.

During the past decade, there has been much research on transit technology in the areas of systems, hardware, and cost-effectiveness relations. In economic terms, the supply side of the transportation equation has been intensively studied.

Much less attention has been paid to the demand side of the equation: who uses a given system? How much? What are the factors that encourage and discourage the use of alternative modes? One reason, it seems to me, for a de-emphasis of the demand side of the transportation equation has been the difficulty in analyzing the demand factors as precisely as the supply factors have been analyzed. For example, although it may be relatively easy to develop cost analyses for various alternative transportation modes, it is much more difficult in analyses of consumer behavior to quantify the components of demand.

In simplest terms, the supply cost of a unit of transportation includes annualized capital costs plus operating costs per unit moved. As long as we are willing, as we have been traditionally, to ignore the many externalities associated with transportation enterprises, we are able to calculate relatively simply the supply prices for various transportation alternatives.

Unfortunately, the same has not been true in the analysis of demand for transportation. We have simply made the assumption that some set of preferences somehow related perceived cash cost, travel time, convenience, reliability, and comfort in some way to produce individual demand functions for each consumer. These demand functions can somehow be aggregated to produce a single demand curve for a given transit service. When that curve is intersected with the relevant

supply curve, an equilibrium price and quantity are produced.

But what, in fact, are the components of the demand function for transportation? Take cash cost as one example. According to Lansing and Hendricks (1), whose work was based on data gathered in 1963 and 1965 in an extensive national survey, fewer than 1 out of 3 drivers has ever calculated what it costs to make the journey to work by automobile; even fewer agree on those costs. Yet economic theory is based on the assumption that consumers are knowledgeable about the costs of options they face and that they tend, at least in the aggregate, to make rational decisions among them.

Again, even if consumers were aware of the cash costs of various transportation choices, how would they trade these costs against noncash factors such as travel time, convenience, comfort, and privacy? We really do not have the beginning of a set of comprehensive data regarding these crucial questions—let alone a theory that would relate these data if they existed.

In Ann Arbor, when it became clear that there would be an experimental demand-responsive transit system implemented in a portion of the city, we decided that, in addition to the usual work on cost factors, we would place some emphasis on studying the demand for such a system. We began by conducting a mail survey in the political subdivision of the city in which the experiment was to be conducted. Because there had been little publicity regarding dial-a-ride prior to the completion of the survey, we felt that the responses would provide a reasonable set of "before-experiment" data, which could later be compared with "after-experiment" data.

Some 6,300 four-page questionnaires were consequently mailed to an address list generated from the city clerk's computerized registered voter file. Comparison with a list of households that had been created by a census of the proposed dial-a-ride service neighborhood revealed that approximately 90 percent of all households in the neighborhood were discovered by a computer canvass of the registered voter file.

A second survey was conducted during a 1-month period, beginning during the thirteenth week after the system went into operation. The sample for this survey consisted of 40 percent of all households in the original dial-a-ride service neighborhood—approximately 840, of which 675 were actually interviewed.

Finally, a third major source of data about consumers consisted of the dispatch records kept. Ideally, every single passenger trip made on dial-a-ride is assigned to a specific household. The other end of the trip is also recorded as well as the number of persons in the household making the trip and the method of payment (cash, ticket, or flash pass).

One problem that developed in data from dispatch records, was the inability of the system to distinguish particular apartment numbers within a multiple unit street address. For this reason, trip data assigned to 96 households at multiple-family addresses have been deleted from the following data. The balance of this paper, then, consists of a discussion of several of the items collected from each of the remaining 579 single-family households located in the original dial-a-ride service neighborhood. Particular attention will be given to significant differences between using and nonusing households and to differences among various levels of use among user households. What we are attempting to do is to isolate those factors most strongly associated with and, therefore, best predictive of levels of household use

during the first 13 weeks of the experimental project.

One aspect of the experiment that was under control of the researchers had to do with the paid advertising for the new system. Given an unrealistically low item for marketing in the project budget, the Transportation Authority decided that paid advertising for the service should be limited to direct mail inasmuch as all other forms of advertising would go in large proportion to households not in the service area. (As originally constituted, the service neighborhood comprised less than 7 percent of all households in the city of Ann Arbor; this represented an even smaller fraction of the circulation delivered by local printing or broadcasting media.)

The direct-mail format consisted of a series of 8 two-page or four-page newsletters mailed to 80 percent of the households in the service area during the course of the 15-week period beginning about 2 weeks before service was initiated. The 20 percent of households that did not receive the newsletters consisted of half of the total 40 percent sample that was surveyed in December and January. For the marketing impact experiment, the 20 percent constituted the control group, whereas the 80 percent that did receive the newsletters were the treatment group, 25 percent of whom were drawn into the survey sample.

As with trip data, we also found that treatment data (i.e., information as to whether the household had received the newsletters) were unrealiable for multifamily units. This resulted from the fact that in apartment units the typical method of distributing bulk mail is to leave a pile of the pieces in some central place near the apartment mailboxes rather than to distribute one piece to each mail box. In many apartment complexes, some households were supposed to receive the marketing treatment and some were not. In fact, however, this distinction was not made by the U.S. Postal Service; consequently, households that were part of multiple-unit complexes were all assigned missing data codes to indicate their status on the newsletter mailing list.

We are then left with 579 single-family units out of a total of 2,066 units in service area A for which we have both survey data and reliable trip and marketing data. Of these 579 units, 410 or 71 percent never used the dial-a-ride service during the monitoring period, and 169 or 29 percent used the service at least once.

Table 1 gives relevant variables, where available, for the 675 survey households, the 306 single-family units that received newsletters, and the 273 single-family units that were not mailed newsletters.

First, consider simply the following distribution of the 579 households by number of trips made during the study period.

Use	Percent
Did not use	71
Did use	29
1 trip	7
2-3 trips	7
4-8 trips	7
9 or more trips	7

The maximum number of trips by a single household was 140. The maximum number of trips generated by any family in the entire dial-a-ride service area during the 13 weeks under consideration was 345, or about 4½ percent of all trips made by the almost 2,100 households in the neighborhood.

From data collected in almost 600 home interviews, what can we say about differences in households, given differences

Table 1. Variables for survey households.

Variable	Households		
	All	Received Newsletters	Did Not Receive Newsletters
Percentage using system 1 or more times in first 13 weeks	—[a]	30.0	28.4
Use during first 13 weeks			
Mean	—[a]	2.76	3.68
Standard deviation	—[a]	9.57	16.23
Mean number in household	3.14	3.5	3.45
Median income class	$15,000 to 20,000	$15,000 to 20,000	$15,000 to 20,000
Median education of male head of household	Bachelor's degree	Bachelor's degree	Bachelor's degree
Mean number of automobiles	1.72	1.76	1.83
Mean number of licensed drivers	2.07	2.10	2.18
Mean number of full- or part-time employees	1.37	1.36	1.44

[a]Data not available.

in use of the service? First of all, we know that use or nonuse of the service was related to the following items that were collected in the survey data: the respondent's attitude toward the interrelation between the automobile and the city environment; the number of teenagers in the household; the ratio of number of persons over age 5 in the household to number of automobiles registered to household members; and educational attainments of male and female heads of households.

Perhaps the most interesting item in this list is that dealing with attitudes toward the automobile and the city's environment. Thirteen items were constructed to attempt to probe this relation. Factor analysis was then performed on the scores on these items, and from them 6 items were selected that seemed to capture most of the information they contained. Respondents were asked to evaluate whether they agreed or disagreed, along a 5-point scale that was provided, with the following 6 statements:

1. There are too many private automobiles in Ann Arbor today.
2. More people in Ann Arbor should get out and walk or ride bicycles instead of driving their cars.
3. Ann Arbor would be better off if part of the central business district were closed to private automobiles.
4. Many familes in Ann Arbor would be better off if they could spend less of their incomes on owning and operating private automobiles.
5. Ann Arbor's future is seriously threatened by the growth of private automobile ownership.
6. My family would be willing to replace some of our trips by private automobile with trips by public transit.

The scores on these 6 items were summed and averaged. The more a respondent agreed with these statements, the more likely was it that the household was one of those using dial-a-ride. We are now in the process of analyzing these data to produce an algorithm for predicting the probability that a given household will use this kind of service.

Within the smaller group of 169 households who used the system one or more times and on whom we have reliable use and survey data, there is a rather interesting distribution of the variable "number of trips." The distribution is negative exponential for the values between 1 and about 30 trips. Beyond this limit, because of the existence of extreme

cases, the distribution becomes curvilinear even when expressed in logarithms.

We have broken the set of user families into the 156 households that used the system between 1 and 29 times, the straight-line exponential portion of the curve, and the 13 households that used the system more than 29 times during the 13 weeks under study. (Incidentally, these 13 households, representing only about 7 percent of all user households in the sample, generated collectively almost exactly half of all trips recorded by this sample.)

Once we have identified a user family, another set of variables appears to explain the actual number of trips that any given household will actually make, given that it will make 1 or more trips. Here the strongest variables on which we collected data are ratio of number of persons in the household to number of automobiles; length of time the family had lived at its present address; number of residents in the household; household income; number of full-time employees; educational attainment of the heads of household; and number of licensed drivers in the household. Interestingly, the set does not include the index of attitude toward the automobile and the environment.

It should be possible to develop a prediction formula, based on regression analysis, for this subset of the sample. How we will handle the extreme 8 percent of cases that have, in this particular sample, accounted for approximately half of the total trips is not yet clear. Perhaps the best first approximation will be simply to use a multiplier on the number of trips predicted out of the straight-line portion of the sample.

In any case, it is hoped that predictions generated from this kind of household survey analysis can do a far more accurate job in the future of setting the range of potential ridership than traditional aggregated modal-split and origin-destination models have done in the past. As a result of using these aggregated models, the weekly ridership per household predicted in our application for state demonstration grant funds was 6 times what the actual figure turned out to be after the system stabilized and allowances were made for changes in the scope of the service area from what had initially been projected.

One other aspect of our survey seems worthwhile of attention at this time. We asked all respondents whether, if the localized dial-a-ride system could be expanded to a city-wide service that would cost the taxpayers about $5 per person or about $500,000 per year, they would vote for or against such a tax. Of 883 respondents, 64 percent answered "Yes", 23 percent answered "No", and 13 percent answered "Don't know." Support was about as high among those households who had used the system one or more times as among those who had not.

We were interested in predictors of this variable measuring political support for funding such a system. Table 2 gives a 2-dimensional comparison of households: those in the service area and not in the service area and those sent the newsletter and not sent the newsletter. Initially, we predicted that the effects of these 2 variables on level of support for a city-wide system supported by a half-million dollars in taxes would be both positive and additive. That is, we hypothesized that people in the service area would, on the average, exhibit more support for the service than those not in the service area; and we hypothesized that, in either case, people who received the 8 newsletters—would be more favorable to to a tax-supported city-wide system, regardless of where they lived, than those not so treated.

Table 2. Support for dial-a-ride subsidy by service and marketing treatment.

Marketing Treatment	Response	Service		No Service		All	
		Number	Percent	Number	Percent	Number	Percent
No newsletter	Yes	185	61	39	68	224	62
	No	77	25	12	21	89	25
	Don't know	43	14	6	11	49	13
	Total	305	100	57	100	362	100
Newsletter	Yes	179	67	39	66	218	67
	No	54	20	12	20	66	20
	Don't know	36	13	8	14	44	13
	Total	269	100	59	100	328	100
All	Yes	364	63	78	67	442	64
	No	131	23	24	21	155	23
	Don't know	79	14	14	12	93	13
	Total	574	100	116	100	690	100

We found that, however, 63 percent of the households receiving service and 67 percent of those not receiving service supported the imposition of a tax to provide city-wide dial-a-ride service. The data also showed that 62 percent of households that did not receive the newsletter and 67 percent of those that did supported the tax. Again, the difference is marginal.

These variables proved to be interactive rather than additive. That is, the setting on one variable predicted a different rate of change, and indeed of direction of change, on the other variable. Whereas, in the service neighborhood, support for the city-wide system subsidy went up, as predicted, with application of the newsletter marketing, it went down, under the marketing treatment, in those households that were not in the dial-a-ride service area. The differences are relatively small, so that a good deal of caution must be exercised both in accepting and in interpreting these results.

What preliminary conclusions can be drawn from Ann Arbor's dial-a-ride experiments to date? First of all, and perhaps most important, it is extremely difficult to wean any large number of individuals away from deeply entrenched travel behavior patterns, particularly when travel modes are strongly reinforced by existing institutional arrangements. The American city is currently based on the premise that most people will make intraurban trips by privately owned and operated motor vehicles. And a person's automobile is widely recognized as a symbol of his wealth and status. Further, because most of the cost of automobile ownership and operation is not related to the number of miles the vehicle is driven, being heavily dominated by the fixed costs of depreciation, insurance, and licensing, the marginal cost of any given trip by private automobile is relatively low.

The ability to bring about significant trip diversion, then, is heavily dependent on the rate of automobile ownership in a community. In Ann Arbor, that rate is about 1.75 per household, or 7 cars for every 4 households. As long as there is any significant proportion of desired trips that can only be made by private automobile, most affluent families will choose to own enough automobiles to be able to

make those trips. Yet, because of the low marginal cost of any trip, once fixed costs of ownership have been met, many of the trips that could have been made by public transit are more cheaply and conveniently made by private vehicle.

Yet, Ann Arbor seems to be in the process of reevaluating its transportation preferences and habits. Evidence of this is still scattered, but it is sufficient to encourage the Transportation Authority in its efforts to expand the percentage of trips made on public transit vehicles. Last year, for the first time in recent memory, a road improvement bond issue was voted down by about a 2 to 1 majority. Most of the opposition came from groups and individuals who said that the city needed to rethink its transportation patterns and should explicitly attempt to divert trips from private to public transportation.

In March, 1972, the question of supporting a city-wide dial-a-ride system at a cost to the taxpayer of approximately $5 per person, or $500,000 per year, was included in a survey of voter attitudes in a sample drawn from the entire city. Here again, the favorable response won majority support, 56 to 35 percent, with 8 percent undecided.

Finally, during the past 2 years that the city budget has been under consideration, the dial-a-ride project has had additional money voted for it, i.e., more than that in the recommended budget of the city administrator. These decisions came during an era when the city's fiscal condition has been more precarious than at any other time in the past 2 decades. These and other scattered pieces of evidence indicate, at least to members of the Transportation Authority, that the public and its elected representatives are rethinking basic transportation issues in Ann Arbor.

Within a few months, the authority will propose to city government and the voters a specific policy that calls for major efforts to increase the scope of public transit in the city. That increase will come in the form of a city-wide system of neighborhood dial-a-ride feeders offering coordinated transfers to an express trunk-line system for interneighborhood transportation and to major trip generators such as the university, hospitals, shopping centers, and the downtown central business district.

Thus, we project a reversal of the downward trend in public transit that has characterized urban life in the United States since World War II. That reversal is apparently under way in Ann Arbor and in other cities throughout the country and indeed throughout North America. That dial-a-ride has a major place in the planning for this reversal now seems assured.

REFERENCE

1. Lansing, J. B., and Hendricks, G. Automobile Ownership and Residential Density. Institute for Social Research, Ann Arbor, Mich., 1967, Ch. 4.