limitations include the lack of independent data on mobility, such as trip lengths or vehicle kilometers of travel by the various social groups. Also, there was no information available on pedestrian movements, which would complement the investigation of instrumental needs that can be fulfilled without making a trip at all.

A number of implications for transportation research and policy may be outlined. First, survey techniques should include specific life-style variables and be administered in panel-type longitudinal surveys, so as to obtain more direct information on travel behavior. Second, a reconsideration of the population to be investigated in such surveys is required, so that subgroups who might respond more rapidly to transportation policy measures could be identified. Finally, the relations shown in this study precede the energy crisis. In view of the high probability that travel costs will increase in the future, the likely effect of this trend on the elasticities of the various socioeconomic variables should be investigated.

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Public Attitudes Toward Transit Features and Systems

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An attitudinal survey was made in the Dallas-Fort Worth metropolitan area in 1973-1974 to obtain representative public attitudes toward a comprehensive array of urban public transit features and systems. The sample population surveyed were demographically representative of the area. The questionnaire was structured such that the reasons for some of the attitudes could be deduced. It consisted of a series of questions about transit features or operational elements and a section about whole transit systems. An unbiased, informative audiovisual presentation accompanied the administration of the questionnaire, calling attention to various human factors, aesthetics, economics, and innovations regarding public transit. The questionnaire also incorporated a provision for quantification of attitudes by adding a question about money to be invested in a transit-system feature to the usual qualitative scale of answers. The importance scales were compared to the money-investment scales by using factor analysis, regression analysis, and other techniques. The five transit systems in the questionnaire were improved bus, dual rail, other-tracked vehicle, dual mode, and demand responsive (bus). This type of research is consistent with a contemporary philosophy of system development that emphasizes user-oriented techniques as an approach to enhancing public transit usage.

The initial objects of this research were two. The first was to determine the nature and type of human design factors that the public believe are important and should be incorporated in the transportation system. The second was to determine what type of overall system people prefer. Subsequent aspects of the study involved examining the data and determining any interrelations among the various parameters. The final step was to identify the underlying factors that influence regional attitude and behavior patterns in the public's decision to ride or not to ride any public transit system. Such attitudinal information should allow transit planners to be more sensitive to the desires of the public. This study was sponsored by the Urban Mass Transportation Administration of the Department of Transportation.

The experimental design and the data analysis attempted to determine the answers to a series of propositions about attitudes toward transit in the Dallas-Fort Worth metropolitan region.

The first phase of the research was the development of an attitudinal-survey, or questionnaire, form. This required several exploratory sessions, reviews, interviews, and revisions. The next phase of the research involved the presentation of the questionnaire to a representative sample population. Regional demographic characteristics such as income, sex, age, distance to work, and others have been compared to those of the sample, and the sample is considered to be reasonably representative. Weighting the survey toward those groups of people who were using mass transit was considered, but rejected because such a sample, while yielding certain useful information, would fail to consider potential customers not then using the available transit. The demographic characteristics of the sample were cross tabulated with their attitude and desire categories to determine whether users or nonusers of public transit were demographically homogeneous or not.

Statistical techniques (factor analysis and multiple regression analysis) were applied to the data to determine the interrelations between population attitudes toward public transit and the total range of demographics, human factors in design, preferences for different types of systems, and resultant projected behavior (to ride or not to ride).

Someone will ultimately have to pay for any transportation system selected, whether it is through the farebox or in taxes. The economic-aspects section of the questionnaire attempted to determine attitudes about how a system should be financed. Public opinion is important because these people will be those voting on bond issues and otherwise deciding how to finance new transit systems.

SURVEY METHODOLOGY

The development of the data-gathering methodology was the first task of the research. The first major decision, which had greater importance than originally envisioned, was to use a group-presentation technique rather than a personal interview. The questionnaire was developed over a period of 6 months. A five-person team that included a sociologist, a transportation engineer, a human-factors engineer, and two graduate students met and debated the questions to be asked and their wording and ordering on the questionnaire. After several pilot tests, given to and critiqued by different socioeconomic groups, to reduce the bias of the questionnaire, the final form was developed.

Audiovisual Program Development

During the initial trials of the questionnaire, it was realized that the respondents would need some kind of informative material preceding or accompanying it. This had the potential of reducing the validity of the survey if the presentation introduced bias. The audiovisual presentation consisted of 35-mm slides synchronized with a taped commentary to ensure consistency. The operation was automatic and all respondents were shown the same information in the same manner. The slides were selected of a wide range of both present and proposed transit vehicles and systems. Some slides were prepared by the research team, and others were obtained from system operators and the manufacturers and developers of such systems, vehicles, and equipment. The slides were selected to hold the interest of the viewers, as well as for the presentation of unbiased information. Human-factors considerations were pointed out, but none were labeled as good or bad. Transportation innovations and features were shown that were predicted to be available in the future, as well as those that were currently available. The slides were especially important in explaining the different types of transportation systems. Many of the respondents had not previously seen examples of some types of systems, and a correct interpretation based only on a verbal description would have been very difficult. The audiovisual presentation required that a trained announcer be used for the narrative and that the slides be of high quality and closely follow the subject matter. Consideration was also given to the amount of time the slides were projected on the screen and the moment of introduction of each slide. To lend a more personal atmosphere, personal or live greetings and introductions were included, as well as a question-and-answer period after the session for those desiring more information.

Questionnaire Design

The final version of the survey questionnaire was divided into four sections. The first section—personal information—was designed to obtain personal statistics. The respondents were asked not to identify themselves by name and were assured complete anonymity. Items such as income, age, sex, household questions, and background information about the use of present mass transit facilities were necessary to distinguish answers from special groups, such as the turnpike users.

The second section of the questionnaire dealt with the socioengineering factors of mass transportation systems and was an attempt to determine the more desirable features for future systems. A unique part of this section was the provision of an investment column for dollar amounts to be allocated each year for the development of desired features. This column gave a further quantification of preference and could also serve to test the validity of the answers. It was seriously examined during the pilot studies. Although it did create some confusion, its benefits greatly outweighed its disadvantages, and so it was retained in the final design.

The investment column was set up in a manner that required forced choices, because some features had to receive no money. If the minimum investment was made in each case, a maximum of 20 of the 26 features could receive allocations for development. If strong preferences were shown by the allocation of more than the minimum amount to one or more features, fewer than 20 could receive financial aid. It was felt that this manner of investment was preferable from two points of view. First, it forced the respondent to think and quantify his or her preferences, because it was not possible to just go down the page and distribute money according to the importance given to each feature. Second, it could be used as a finer scale for interpreting the importance ratings, as well as providing a cross reference for validity.

The third section was designed to determine public reactions to transit issues such as maximum walking distance to and from the transit system, maximum waiting time for vehicles to arrive, and maximum costs per unit distance for fares. This section also sought data on the extent of agreement by the public about ownership, fare subsidization, use of public taxes, bond issues, and the desirability of extra service for extra fares (such as first-class airline tickets). The respondents were then asked whether they would use a good transit system if it existed today and whether they thought they would be using one within the next 30 years, and why.

The fourth section—preferences for transportation systems—used a different approach to determining attitudes. Five different transportation systems were described during the audiovisual portion of the presentation and the respondent was asked to bid on each system according to how he or she felt it would serve the needs of the people in the Dallas-Fort Worth area. Slides depicting some features of each of these systems were collected from representative firms and agencies. To eliminate any bias in the slide presentation, approximately the same number and quality of slides were selected to show the features of each system. The five systems selected were improved bus, dual rail, other-tracked, dual mode, and demand operation. The questionnaire contained a brief printed summary of each system to refresh the respondents' recollections. In addition, a combination category was established to determine a combination of any two systems the respondent felt would provide a good overall system for the area. Because great differences exist in the costs of development and installation of each system, it was felt that some kind of cost-range information was necessary. However, exact ranges, if such were available, would probably have had a greater influence on the amount bid than would relative cost ranges such as high, medium, and low. This last section was largely educational; it was designed to acquaint the public with some of the proposals for future transportation development and to measure their reactions to such systems. It was expected that the socioengineering-design questions of the second section would still be fresh in their minds and that they would look for some of these human-factors considerations in formulating their bids for each system.

To keep the questionnaire from becoming too long, all design-related human factors could not be included. In the category of engineering design, noise, illumination, air quality, and pollution have been the subjects of several previous studies, and so they were excluded. By excluding these bioenvironmental factors it was not implied that they were less important, rather that the lack of space necessitated their removal in favor of less studied factors.

The questionnaire was organized so that a minimum of contamination between sections would occur. The sequence was especially important in the last section covering the five proposed systems. The section about investment in transportation systems was placed last in the hope that the human-factors considerations of earlier sections would be remembered and perhaps used in the system selection. The economic and convenience aspects were deliberately placed after the design section to allow more candid answers to the design-features questions without the financial aspects influencing the ranking of importance of the features presented. The general-aspects section was inserted between the design section and the proposed-system section to determine existing attitudes before the introduction of proposed systems.

ANALYSIS OF QUESTIONNAIRE DATA

The problem of determining significant relations was complicated. Because of the large number of variables and relations present in the questionnaire, only selected interrelations were investigated. These included the following:

1. People in this region will be willing to ride an improved public transit system that incorporates public needs and desires.
2. There are certain human factors involved in transit preferences and attitudes that are more important than others.
3. There is a significant relation between the level of importance given to such human factors and the demographic characteristics of a person or group of persons.
4. There is a positive correlation between the importance a person places on any particular feature and the amount of money that person would be willing to invest in achieving its inclusion in a transit system.
5. Certain human factors or other design features are common to all transit systems and do not vary in kind and intensity among systems.
6. There is a positive correlation between a person's attitude toward public transit and his or her personal decision to accept and use a transit system.
7. There is a significant relation between the type of public transit system preferred and the person's socioeconomic or other demographic characteristic.
8. There is general apathy toward mass transit in the Dallas-Fort Worth metropolitan area.

To test these propositions, correlation analysis (largely in the form of contingency tables) and a standard factor analysis were used. These tests were selected because most of the propositions deal with significant relations between the variables at the first level. Simple contingency tables easily show such first-level relations. (A first-order relation assumes that all variables have the same weight, and thus determines the relations between one variable and the others, but not those between a combination of two or more variables and the others.)

Demographic Comparison

The survey was intended to be representative of the voting-age population in the Dallas-Fort Worth metropolitan area. The demographic characteristics of the sample are compared with those from actual census data in Table 1. The sample is slightly weighted towards the upper income end with a mean income of $12 500 (compared with an income of $12 000 for the census-data population). The mean number of persons in the household (3.42) for the sample population is almost identical to that (3.44) of the census-data population. The midcities area is overrepresented, and Dallas is underrepresented; however, growth patterns show the midcities area to be expanding more rapidly than either Dallas or Fort Worth, and the sample fits future population projections. Overall, the survey data are reasonably representative of the area under consideration.

In the study area, 88.3 percent of the working population actually drive to work in an automobile, and in the sample 90.1 percent drove to work. This indicates the minor current role of mass transportation at present. The survey respondents drive an average of 13.3 km (8.3 miles) to work and have an average of 2.17 persons having a driver's license/household and an average of 2.04 automobiles/household. Their replies to questions about other transportation characteristics are shown below.

Question	Response	Percentage of Total
Do you use any kind of public transportation	Yes	29.5
	No	70.5
Do you car pool to work	Yes	10.0
	No	90.0
Do you drive as part of your work	Yes	40.3
	No	59.7
How often do you use the bus	Daily	3.1
	Weekly	4.6
	Monthly	5.5
	Yearly	16.2
	Never	70.6

Essentially, the table above indicates that there is an automobile for every person with a driver's license and that only 13.2 percent of the population ride the bus (the only mass transit mode available in this metropolitan area) more than once a year.

Design Features

The 26 design features measured are listed in Table 2, which also includes the mean values of their importance ratings (on a scale of five for very important to one for very unimportant) and the mean values of the money investments for each.

To interpret the money aspect of the questionnaire, it is necessary to understand the instructions for that portion of it. The following is an excerpt from those instructions:

If you and your community were going to be actively developing public transportation for this urban area, please indicate just how you would be willing to invest a maximum of $2 000 000 toward this purpose.

If you feel that a particular feature is desirable and think that money should be invested for its development, we ask that you invest at least $100 000. To keep calculations easy, please invest in multiples of a 100 000 (for example, $0, $100 000, $200 000, $300 000, and so on). Remember that, because the total amount invested cannot be more than $2 000 000, you are not going to be able to invest in every design feature.

Table 1. Demographic characteristics.

Characteristic	Sample (percentage of total)	Actual (percentage of total)
Age		
<26 years	8.4	18.9
26 to 35 years	31.7	23.5
36 to 45 years	29.5	19.0
46 to 55 years	15.5	16.7
56 to 65 years	9.0	11.3
>65 years	5.9	10.6
Sex		
Male	46.5	47.3
Female	53.5	52.7
Marital status		
Single	13.2	21.3
Married	82.2	71.1
Other	4.6	7.6
Home		
Rent	20.9	37.8
Own	79.1	62.2
Family income		
$0 to $3 000	3.5	7.2
$3 000 to $6 000	8.0	13.3
$6 000 to $9 000	5.8	19.4
$9 000 to $12 000	9.6	20.5
$12 000 to $15 000	15.7	15.4
$15 000 to $25 000	32.9	18.4
>$25 000	24.0	5.7
Geographic location		
Fort Worth	20.9	21.9
Midcities	30.4	11.1
Dallas suburbs	20.3	19.5
Dallas	28.4	47.0

Table 3 shows that the respondents put great emphasis on a safe and efficient system. It also pinpoints some of the design features that are lacking in many mass transit systems, but important to the potential riding public. Features such as a nice and clean vehicle and system, fast routing information, weather protection, and station accessibility are all high on the importance list. On the other hand, the table shows that comparatively few seem to care about passenger privacy, house-to-destination routing, or socially attractive stations.

There are some interesting differences between the importance ratings and the money ratings. This was expected for the following reasons:

1. It was emphasized to the respondents that there need not be correlation between the two.
2. Some people may consider a feature very important, but think that its relative cost is low.
3. Some people may consider a feature very important, but not be willing to spend money on it.
4. Some people may consider a feature not too important and realize that its cost is very high.

Table 3 gives the average money allocated to each feature, based on the total completed questionnaires. There is a large variation, ranging from $214 900 for vehicle-accident safety to $16 100 for passengers helping with the establishment of rules. Several respondents allocated $800 000 (40 percent) or more of their money to the safety design feature. It seems logical that passengers helping establish the rules received a very low money allocation because time, rather than money, would be needed to fulfill this design feature.

Some variables have quite different relative positions on the money allocation scale, as compared to the importance scale. In particular, eight features were rated far higher on the importance scale than on the perceived

Table 2. Ratings for 26 design features.

Design Feature	Importance Rating		Money Investment ($)	
	Value	SD	Value	SD
Trip time (avg speed) is a primary design factor	3.851	0.979	119 200	109 200
Smooth ride (not bumpy, swaying, or jerky) is a necessity	3.833	0.965	94 100	83 200
Comfort inside the vehicle is important (such as comfortable seats, back rest, leg room, and elbow room)	3.662	0.931	91 300	88 000
Vehicle should be extremely safe from accident or collision	4.650	0.652	214 900	159 400
Vehicle should have considerable privacy for its passengers	2.261	1.114	16 700	47 600
Vehicle should have rest-room facilities	2.837	1.370	38 800	60 800
Vehicle must be modern and of the latest design	3.111	1.046	61 000	93 700
Design must easily accommodate the handicapped (be accessible to wheel chairs, crutches, and blind)	4.086	1.007	107 000	95 000
Vehicle must have built-in safety for passengers from hazards such as robbery and assault	3.985	1.065	105 300	119 400
Vehicle must be designed to deal with emergencies of passengers (such as accidents, seizures, and heart attacks)	3.640	1.156	82 800	92 800
Vehicle should be under automatic control (e.g., controlled by a computer)	2.741	1.281	66 100	105 900
Vehicle, its stations, and pathways must fit in with the natural surroundings	3.340	1.065	72 800	91 900
Passenger should have some physical control over the vehicle (e.g., a means to cause the vehicle to stop in case of emergencies and to stop at the passenger's station)	3.312	1.311	51 000	64 200
Vehicle stations should offer protection from the weather	4.246	0.836	92 900	77 800
Vehicle stations must provide safety for patrons from hazards such as robbery and assault	4.092	1.002	93 200	98 500
Vehicle stations should provide route information such as maps and time tables	4.040	1.052	47 600	54 900
Vehicle stations should be attractive socially (i.e., equipped with facilities such as neighborhood meeting rooms, television rooms, and game rooms)	1.880	1.091	17 200	39 400
Transportation system should have fast and easy-to-understand information on routing (e.g., where the vehicle stops and goes and when it arrives)	4.289	0.924	69 400	68 700
Vehicle should pick you up at your house and take you to your destination door	2.140	1.211	20 900	58 200
Vehicle should be extremely dependable and not break down because of mechanical failure	4.333	0.856	157 100	110 800
Vehicles should be extremely punctual	4.016	0.873	60 000	76 000
Passengers should help establish the rules and regulations for the riders	2.767	1.346	16 100	39 800
Vehicle system must be adaptable to changing needs (e.g., it should have the ability to change routes, directions, and number of vehicles easily)	3.658	1.045	78 900	83 200
Vehicles and system property should be kept nice and clean	4.294	0.759	82 100	65 200
If the station is not at my front door, then it should be easy to get to from my residence and from my place of work	4.179	0.937	89 300	116 500
Management of the transportation system must consider the customers, employees, and community when establishing policy and procedures	4.250	1.024	56 700	75 800

cost of providing them. These were (a) nice, clean vehicles and systems, (b) fast information on routing, (c) management considering the community, (d) protection from weather at stations, (e) station accessibility (easy to get to), (f) protection of station patrons from crime, (g) route information at stations, and (h) punctual vehicles. The importance of rest-room facilities, passengers helping establish the rules, and passenger control of the vehicle showed the greatest variability of response.

Transit Issues

The results of the third section of the questionnaire are given in Table 3. These questions dealt mainly with attitudes towards transit issues. It is noteworthy that the sample population definitely agreed that a public mass transportation system would be worthwhile, even considering its limitations and that they might be taxed for its upkeep, and would be willing to use a good system today (and even more so in 20 years). There was average agreement that tax money should be used to keep fares low. People generally desired a system that ran frequently (no more than 7 min waiting) and came close to their home (no more than 2.25 blocks away).

The data were analyzed to determine whether certain features or issues varied significantly with age, sex, or family income. The results found by using a 90 percent confidence limit ($\alpha = 0.10$) are given in Table 4.

Ratings of Transit Systems

The following instructions for rating the five major types of transit systems (improved bus, dual rail, other-tracked, dual mode, and demand operations) were given to the respondents for the fourth section of the questionnaire.

If you (and your community) were now to begin developing an urban public transportation system that would be completed within about 20 years, please indicate your preference for each of the different systems. Bear in mind that the different systems would cost different amounts and that your bidding represents the best offer you are willing to make for each system. For your benefit, a brief description of the basic features of each of the different systems has been provided on the following pages.

The urban public transportation systems listed below are distinctly different. Each, alone, could be developed to provide transportation throughout the city. In fact, citywide travel (rather than longer distance travel between different cities) is the object of each of these different types of transit systems.

1. Improved bus system: This system would involve a citywide system that used new types of buses with improved comfort, lowered door steps, spaces on board for the handicapped, and on-board information services. There would be improved bus stops and stations featuring

Table 3. Attitudes toward transit issues.

Attitude	Mean Response
Longest distance person should have to walk getting to and from vehicle station, blocks	2.25
Longest time person should have to wait for vehicle at station, min	7
Highest cost per kilometer customer should have to pay for transit, ¢	3 to 4
Public transportation systems should be privately (not publicly) owned	Slightly below avg agreement
If system is publicly owned, fares should be kept low by public taxes	Avg agreement
If system is publicly owned, it should be built by tax money (not bonds)	Below avg agreement
Should be first-class section with extra service for those who want it	Below avg agreement
I realize the limitations of a public transportation system and that I may be taxed for its upkeep, but think it will be worthwhile in this area in the next 20 years	Above avg agreement
I believe I would use a good public transportation system instead of an automobile if it were available today	Slightly above avg agreement
If I am living in this area 20 years from now, I think I would use a good public transportation system instead of an automobile	Above avg agreement

Table 4. Variables that varied significantly with age, sex, or income.

Variable	Varied Significantly With Age	Variable	Varied Significantly With Sex	Variable	Varied Significantly With Income
Importance of trip time	Younger find more important	Importance of vehicle accident safety	Females find more important	Importance of vehicle accident safety	Lower income find more important
Importance of passenger privacy	Middle aged find more important	Importance of restroom facilities	Females find more important	Importance of restroom facilities	Lower-middle income find more important
Importance of passenger safety from crime	Older find more important	Importance of accommodating the handicapped	Females find more important	Importance of accommodating the handicapped	Lower income find more important
Importance of automatic control over vehicle	Older find more important	Importance of passenger safety from crime	Females find more important	Importance of passenger safety from crime	Lower income find more important
Importance of looks of vehicles and stations	Middle aged find less important	Importance of handling passenger emergencies	Females find more important	Importance of handling passenger emergencies	Lower income find much more important
Importance of socially attractive stations	Middle aged and older find more important	Importance of weather protection at stations	Females find more important	Importance of passengers helping establish rules	Middle income find more important
Importance of on-time vehicles	Older find less important	Importance of protecting station patrons from crime	Females find more important	Walking distance to and from station	Lower-middle income willing to walk less
Importance of station accessibility	Younger find more important	Importance of route information at stations	Females find more important		
Agree public transportation should be privately owned	Younger disagree more	Importance of socially attractive stations	Females find more important		
		Importance of fast information on routing	Females find more important		
Agree to use taxes to keep fares low	Middle aged disagree more	Importance of passengers helping establish rules	Females find more important		
Agree system to be built by tax money	Middle aged disagree more				
Agree would use a good transportation system today	Middle aged disagree more	Importance of station accessibility	Females find more important		
		Walking distance to stations	Females find it should be less		
		Agree to use taxes to keep fares low	Males agree less		
		Agree system to be built by tax money	Males agree less		

protection from the weather, good lighting, bus route maps, and free telephone information about routing, schedules, and fares. Express busways would be provided along selected corridors in the city and give rapid or express service. The express buses would operate on exclusive rights-of-way or freeway lanes. The citywide system would provide feeder service or connections to the express busways.

2. Dual-rail system: This system would consist of a combination of commuter trains, rail rapid transit on exclusive rights-of-way, and trolleys or streetcars on public streets. The characteristics of this system are that the vehicles use the standard two-rail track system, and it is generally not possible to have at-grade crossings on city streets, except for the trolleys or streetcars that provide local service. Construction can be elevated (overhead tracks) or subway (tunnel) as preferences and relative costs dictate. Improved equipment featuring more comfortable cars, on-board attendants, reserved seat sections, and automatic control is incorporated. Terminals or waiting stations would provide protection from the weather, good lighting, and route and schedule information.

3. Other-tracked system: This system would involve transit vehicles that operate with an exclusive track, such as monorail or channel. These special tracks may not be placed at grade with any street system, but must be constructed either over or under the existing street system. The vehicles might be small (5 to 10 passengers), be suspended on a cushion of air or ordinary pneumatic tires, and have electric, turbojet, or conventional gasoline engines. There would be express routes featuring larger vehicles (or several smaller ones connected into a train) that would have fewer stops and higher speeds. There would also be a distribution network of special tracks throughout the city with more frequent stops and lower average speeds. At least some of the vehicles might be automatically controlled. The terminals or station stops would feature the same modern conveniences available to the dual-rail system.

4. Dual-operation system: The dual-mode system consists of small vehicles (similar to automobiles) that are manually operated by the driver on parts of the city street system. There would, however, also be a network of major guideways in the city on which the vehicles could be operated automatically. The driver would drive the vehicle onto the guideway and manually indicate his or her destination, and the vehicle would be automatically operated down the guideway to the exit point. The driver would then operate the vehicle manually to reach the precise destination. Such a vehicle would have pneumatic tires for operation on the city streets and use either those wheels or possibly another set of a different type (rail, for example) for operation on the guideway. Power could be provided by batteries for operation while off the guideway. Electrical power from the guideway could be used to power the vehicle and to charge its batteries while it is operating on the guideway. In the initial development of such a system, a gasoline or diesel engine could be used, and buses (or larger transit vehicles) could operate on fixed routes off the guideway and be powered along the guideway for express bus service.

5. Demand-operation system: This system would involve various sizes of modern buses ranging from small minibuses carrying 5 to 10 passengers to large 50-passenger buses. The buses would pick up passengers at their trip origins while possibly picking up and discharging other passengers en route. The passengers would call the dispatcher and state where they were to be picked up and where they wished to go. The system is controlled by the dispatcher's computer and two-way radio to continuously direct the vehicles. Some deviation from the most direct route is allowed so that the buses may pick up and deliver other passengers. A maximum waiting time for pick up is given the prospective passenger by the computer when the call requesting service is made, and the passengers are assured that their trip will require no more than some stated maximum time. The computer determines the vehicle best situated to fulfill each request without violating any assured times or overloading any vehicle. Because of the nature of its operation, the system acts like a slow, shared taxi service and operates on the city streets.

Indicate your best offer by bidding an annual amount in millions of dollars for each system. Your bid can be as high as 10 million and as low as 0 million (if you think the system would not be worth anything). For example, if you think one system would be fairly good for your city's needs (and your trips as well), you might bid an annual 4 million or 5 million; if you think another system would be very worthwhile for you and your city, you might bid 9 million or 10 million.

The results of the bidding are given below.

System	Cost Range	Avg Annual Amount Bid ($)
Improved bus	Low	4 003 000
Dual rail	High	3 756 000
Other tracked	High	4 221 000
Dual operation	Medium	2 622 000
Demand operation	Medium low	3 235 000

The improved bus system was awarded much higher bids in relation to its costs. Significant amounts were bid for dual-rail and for other-tracked systems, but because of their much greater implementation costs, the improved bus system is considered the clear-cut public preference.

It is possible that one important factor was that people were simply willing to invest the most money in the systems they were most familiar with. Residents of this metropolitan area had seen very little of either dual-mode or demand-operation systems before viewing them during the presentation, and their bids probably reflected this lack of familiarity.

Following the bids on the five major types of systems was an opportunity to bid on any combination of two of the five. The instructions for responding to this question were

Combining your choice of two of the previously described systems, you may provide the desirable transit for your city. Indicate the two systems you prefer to combine.

A probable transit system of the future would be a combination system, not one exclusive type. The responses to this question are shown below.

Combination	Preference (percentage of responses)
Improved bus and demand operation	17.3
Improved bus and other tracked	16.9
Improved bus and dual rail	15.7
Other tracked and demand operation	11.4
Other tracked and dual mode	9.4
Dual rail and other tracked	7.2
Dual mode and demand operation	6.7
Improved bus and dual mode	5.9
Dual rail and demand operation	5.9
Dual rail and dual mode	3.4

An improved bus system combined with either a demand-operation, an other-tracked, or a dual-rail system accounted for more than 50 percent of the responses. This, again, may be partially explained by the fact that these were the most familiar combinations.

CONCLUSIONS

There is a need and a latent demand for a good mass transit system in northern Texas. A large segment of the public wants a system that will approach the convenience of the automobile. Other segments of the public need transit systems that can accommodate their particular set of travel needs. In designing new systems, some features must be given more attention than others. According to this study, punctuality, care for passengers, weather protection, route information, station accessibility, community consideration, and safety are wanted the most. Passenger privacy, socially attractive stations, and house-to-destination routing are far less important.

The population sample used in this study was representative of the Dallas-Fort Worth metropolitan area. Bias in answering the questionnaire was greatly reduced by the use of a prerecorded audiovisual program.

The findings of this research were confirmed through the use of a correlation analysis that used a 90 percent confidence level. The following propositions were found to be true:

1. People in this region will be willing to ride an improved public transit system that incorporates public needs and desires.
2. Certain human factors involved in transit preferences and attitudes are more important than others.
3. There is a significant relation between the level of importance given to such human factors and the demographic characteristics of a person or group of persons.
4. There is positive correlation between the importance a person places on any particular factor and the amount of money that person would be willing to invest in achieving the inclusion of the factor in a transit system.
5. Certain human factors or other design features are common to all transit systems and do not vary in kind and intensity among systems.
6. There is positive correlation between a person's attitude toward public transit and his or her personal decision to accept and use a transit system.

The following proposition was found to be false: There is a significant relation between the type of public transit system preferred and the person's socioeconomic or other demographic characteristic.

The following proposition was found to be probably true: There is general apathy toward mass transit in the Dallas-Fort Worth metropolitan area.

Thus, the planner might realize that, no matter which system is implemented, it will be equally attractive for use by most segments of the population. He or she does not have to worry about implementing one system for one portion of the community and another for a different portion. This argument could be used to overcome political obstacles when extending the transportation system across city and county lines.

There will be an increasing need for mass transportation in the Dallas-Fort Worth metropolitan area. At present, people are unwilling to leave their automobiles, but they generally see the long-term necessity for transit because of pollution, overcrowding, and energy problems. Although people will not be lured from their automobiles to transit by choice, they seem to feel that they may be required to use transit more in the future. The results of this study could be used to determine the most acceptable forms of transit for the future.

There was a slight preference for a tracked-vehicle system or an improved bus system, with a dual-rail system ranking third, as indicated by the money allocations for the five different systems. The costs of the bus system would be significantly less than those of the other systems (for the total urban area system required), and the public's willingness to allocate money for such a system makes it clearly the cost-effective choice.

The proposition that apathy exists towards mass transit is probably true. While no questions dealt directly with this issue and the analysis of the questionnaires cannot prove the hypothesis, the results indicated that it is true. This indicates the need for a publicity campaign to inform the public of the availability of transit now and the important issues that lie ahead for transportation in the urban areas of the future.

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**Deceased.*