

handicapped community. The project has had to limit the total number of individual trips an individual can make due to budgetary limits, but trip costs are favorable to other programs where public transit agency vehicles are used and trip lengths are shorter and service less frequent (see Table 4). A paper on social service agency transportation by Rosenbloom and Cox in this Record shows real costs for client services studied to be \$6.83 to 10.90/trip. We confirmed that private taxi operations could be cost-effective alternatives to independently operated special transportation systems.

The STS program also overcomes the accessibility problem that disabled persons have in even getting to a bus. While the Urban Mass Transportation Administration thinks that accessible buses are necessary to comply with the 504 regulations of the U.S. Department of Health, Education, and Welfare, basic mobility ailments plague STS users in Dade County. Thus, accessible buses may not be a solution to a problem when mobility to a bus stop is impaired. This is confirmed by the 83 percent of the STS users who can use regular nonlift-equipped vehicles that pick them up at the curb.

The STS program has been judged successful in meeting transportation needs of the county's handicapped residents based on random user surveys and public support for the program. The potential for using the same type of program in other transportation service areas ap-

pears to be excellent. The continuity of so many aspects of the program over the 10-month period and since then may be useful to other communities in setting up transportation for the handicapped.

In summary, a number of key observations about the handicapped were evident. The disabled could use a taxi in 80 percent of the cases, and lift-equipped vehicles accounted for 20 percent of the vehicle trips. The ridership composition was 17 percent wheelchair-bound users, 74 percent transferable users, and 9 percent companions. Out of 1.5 million residents, approximately 5200 people applied for STS during the first 10 months. The applicants alone represent less than 0.4 percent of the population. The age profile indicated 72 percent of the users were over 50 years old and slightly less than 45 percent were 65 years old or over. Costs per person-trip correspond well with costs estimated and reported in Atlanta and Denver, where the transit authorities operated their own services in more limited programs.

The STS program has increased the mobility of handicapped people served in Dade County to the extent that they are able to plan and make trips without having to depend on friends, neighbors, and relatives. Reduction of the number of vouchers allowed was necessary due to financial limitations, but this has not negated the benefits or the original program goal of providing an accessible mode of transportation to the handicapped.

Factors Affecting the Use of Taxicabs by Lower Income Groups

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This study investigates the propensity of poor persons to use taxicabs. An evaluation of existing data on the use of taxicabs by different income groups shows that in larger urban areas lower income groups display a relatively high rate of taxi use. A critical analysis of previous work suggests, however, that the data analysis contained therein actually underestimated the reliance of the poor on the taxi. An analysis of the limited work on taxi use in small- and medium-sized urban areas reveals an even greater dependence of the poor on the taxicab. This work is supported by a survey of taxi drivers and an analysis of the origins of taxi trips. The factors that create this pattern of use are also examined. Previous studies and our data suggest that the poor often choose taxis because they are the principal option when an automobile is not available. Taxis appear to be chosen over conventional transit (when it exists) because they offer greater service flexibility, convenience, and duration of service, as well as better meeting the security demands of the poor. Increased availability of taxi service by reduced market entry restrictions and reduced cost of taxi service by permitting group riding and providing subsidies would increase the mobility of the poor.

Although it has been largely overlooked in the past, the taxicab plays an important role in urban public transportation. A survey conducted by the International Taxicab Association in 1970 revealed that 7200 fleets operated 120 000 fully licensed taxicabs, three times the number of vehicles operated by the remainder of the public transit systems in the United States (1). To this figure must be added the many nonfleet, owner-driven taxicabs, livery vehicles, and illegal (or gypsy) operations; al-

though the number of vehicles in these three categories is unknown, the number is probably substantial (2). In thousands of communities the taxicab provides the only form of public transportation. A 1973 survey by the International Taxicab Association demonstrated that more than three times as many communities were served by taxicabs as were served by bus and other forms of transit combined (3).

The Transportation Institute of the North Carolina A&T State University undertook a 2-year study of taxicab use among low-income groups as part of its ongoing paratransit project. The low-income population was chosen because several studies indicate that the poor are among the most severely transportation disadvantaged (4) and, as such, should be a focus of concern for transportation planners. In addition, available data tend to indicate a high rate of taxicab use by low-income individuals. This paper will focus primarily on the relative frequency of taxicab use by low-income groups and the reasons underlying that behavior.

RELATIVE FREQUENCY OF TAXICAB USE AMONG LOWER INCOME GROUPS

Since serious investigation of the taxicab and other paratransit alternatives has surfaced only recently among urban public transportation planners, a limited quantity

and quality of data are available concerning the income characteristics of taxicab patrons. However, the preponderance of available data indicates that lower income groups, particularly those in small- and medium-sized urban areas, display a relatively high rate of taxicab use.

Three distinct measurement techniques have been employed in the literature to determine the relative frequency of ridership among the income categories:

1. Comparison of the income distribution of taxicab person-trips by the income distribution of the relevant population,
2. Comparison of the income distribution of taxicab person-trips by the income distribution of person-trips for all modes of transportation, and
3. Comparison of the distribution of all trips by mode across the various income categories.

Type 1 Data

Most of the literature that examines the relative frequency of taxicab ridership by the poor relies on a measurement technique where the investigator finds the distribution of taxicab person-trips by income and contrasts the results with the distribution of income within the sample area. Although this technique offers some indication of the relative frequency of taxicab use among the various income groups, this measurement tends to obscure the concept of relative reliance and thereby underestimates the importance of taxicab transportation to the poor.

For example, the poor display a significantly lower transportation demand than do other income groups (5). It is to be expected that the poor would be less likely to take a trip by taxicab. Since the type 1 measurement technique does not allow for differences in aggregate travel demand among the various income groups, the final comparison fails to reflect accurately relative reliance among income groups. The poor may actually rely on taxicabs for a greater percentage of their total trip making than do upper income groups, but due to their superior aggregate transportation demand, the upper income group occupies a greater relative percentage of total taxicab trips. Thus the type 1 measurement technique may underemphasize the importance that the taxicab plays in the transportation of the poor. The innate bias of this measurement technique should be kept in mind when examining the existing studies.

Most of the information available for type 1 comparison comes from studies conducted in large urban areas. The only national data are derived from home interview studies conducted in major urban areas across the nation from 1964 to 1970 as part of the Federal Highway Administration's National Personal Transportation Study. This study indicates that families whose annual income is below \$4000 composed only 14 percent of the survey population (1), but persons in this income bracket accounted for 21.2 percent of all taxicab trips. Similarly, data from the 1963 Eastern Massachusetts Regional Planning Project reveal that although 11 percent of the Boston survey residents belonged to families whose incomes were under \$4000, passengers in this income category accounted for more than 14 percent of all taxicab trips (6) and 20 percent of the taxicab revenues in the city (7). Finally, a 1970 Pittsburgh study reveals that 44 percent of taxicab patrons had annual family incomes below \$7500 but only about 25 percent of all families in the city fell within that income classification (2).

Some studies in large urban areas, on the other hand, fail to report high taxicab use rates among low-income

residents. While not providing a specific distribution of taxicab person-trips by income, data from home interview surveys conducted for the 1956 Chicago Area Transportation Study provide evidence of low use of taxicabs by the poor. However, the analysis only measured the number of taxicab trips within certain sections of the city without inquiring into the individual taxicab rider (8). The possibility that some of the taxicab activity within wealthier sections of Chicago was conducted by lower income persons who might have worked, shopped, or visited in the area cannot be ruled out.

A 1969 survey of the greater New York City metropolitan area provides more concrete figures, which indicate low usage of taxicabs by the poor. This home interview survey reveals that although 20.5 percent of the regional population earn less than \$4000 annually, only 8.5 percent of the regional medallion taxicab users fell into this category (9). However, this survey only dealt with medallion or legal taxicabs. As such, it may have been biased in favor of the upper income taxicab patron, who uses medallion cabs; low-income riders tend to use equal numbers of gypsy and livery vehicles. By ignoring the nonmedallion taxicab riders, the tri-state survey underestimates the amount of taxicab ridership among lower income residents of New York City.

The argument is strengthened by the results from a home interview survey conducted in 1969 in the central Brooklyn model cities area, a predominantly low-income section of New York City. The data from this survey reveal that 39.7 percent of all households in the area earned less than \$4000 annually, but 43.5 percent of all taxicab riders fell into this category (10). Importantly, 85 percent of all taxicab trips in the area were provided by nonmedallion vehicles.

The evidence from large urban areas, although equivocal, tends to demonstrate a relatively heavy use of taxicab services by the poor. Although it is reasonable to assume differences between large and small urban areas, before the present study was commenced the only data available concerning taxicab ridership characteristics in small urban areas were reported by Midendorf and others in their examination of experimental taxicab arrangements in Hicksville, New York, and Davenport, Iowa (11). However, in the time since the present study was initiated, Gilbert and others have published a well-prepared report that documents taxicab user characteristics in eight small-to medium-sized urban areas in North Carolina (12).

The results confirm that the lower income residents of small- and medium-sized cities display relatively higher taxicab use rates than their large city counterparts. As Table 1 indicates (12), whereas 11.4 percent of the households in the sample cities earned less than \$3000 annually, three times as many taxicab patrons fell into this income bracket. On the other side of the income spectrum, converse results appear. Although 42 percent of the households earned more than \$10 000 annually, less than one-half as many taxicab users are from this category.

Type 2 Data

The type 2 technique compares the income distribution of taxicab riders with the income distribution of users of all modes of transportation combined, thereby eliminating the bias created by differences in aggregate transportation demand. If a type 2 survey reveals that a particular income group accounts for a greater percentage of taxicab demand than aggregate transportation demand, the researcher could conclude that the particular income group relied more heavily on the taxicab as a form of transportation than did an income group that

occupied a greater percentage of total transportation demand than taxicab demand.

The only known published type 2 data are provided by the Nationwide Personal Transportation Study. As shown in Table 2 (1), a significant disparity exists between the percentage of aggregate transportation demand and the percentage of taxicab person-trips generated by low-income families. The disparity is even more pronounced when person-kilometers are used as an indication of taxicab demand. It seems clear from these data that low-income persons in major urban areas across the nation rely more heavily on taxicabs than do higher income individuals.

Type 3 Data

The final measurement technique employed by transportation researchers involves a comparison across income groups of the percentage of total trips in that income group for which a taxicab is used. The technique is similar to the type 2 measurement in that it emphasizes a reliance on taxicabs by a particular income class. It could be argued, moreover, that the type 3 measurement provides an even more simple and direct indication of such reliance.

Two sets of existing data, one from a large urban area and one from a medium-sized urban area, use this type of measurement of taxicab use by the poor. The data from the 1968 home interview survey conducted by the Metropolitan Washington Council of Governments reveal that a distinct decline in reliance on taxicab transportation occurs as income rises, especially among the nonwhite respondents (4).

An interesting comparison is provided by the data from the 1970 Origin and Destination Survey for Greensboro, North Carolina, an industrial Piedmont city of approximately 145 000 in 1970. The table below reveals that, as in Washington, D.C., reliance on taxicabs declines as the income of the resident rises, particularly among the nonwhite population.

Income (\$)	Taxicab Travel by Race	
	Nonwhite (%)	White (%)
Poverty—0 to 3999	12	4
Low—4000 to 5999	1	0
Middle—6000 to 9999	2	0
High—10 000+	0	0

Table 1. Income distribution of taxicab riders and sample population for North Carolina study.

Income (\$)	Taxicab Passenger		Survey Population (%)
	Early Month (%)	Late Month (%)	
0 to 2999	33.3	34.0	11.4
3000 to 4999	21.0	22.4	12.1
5000 to 7499	19.8	18.4	34.6
7500 to 9999	10.7	11.1	
Above 10 000	15.2	18.2	42.0

Table 2. Income distribution of person-trips and person-km for taxicabs and all modes of travel.

Family Income (\$)	Person-Trips		Person-km	
	Taxicabs (%)	All Modes (%)	Taxicabs (%)	All Modes (%)
Low—0 to 4999	25.3	16.0	130.9	13.7
Middle—5000 to 9999	44.1	38.2	35.2	36.7
High—10 000+	22.2	38.0	21.2	40.8
Not reported	8.4	7.8	12.0	8.8

Note: 1 km = 0.6 mile.

Importantly, there was greater reliance on taxicabs by poverty-level individuals and a sharper decline in reliance among higher income groups in the smaller urban area of Greensboro than in Washington, D.C. Thus, the type 3 data seem consistent with the type 1 data provided by Gilbert, which demonstrate a higher relative frequency of taxicab use among the poor in the small urban areas.

THE TRANSPORTATION INSTITUTE STUDY

In September 1974 the Transportation Institute of North Carolina A&T State University undertook an investigation of taxicab use among low-income groups. The first part of the investigation was an examination of the frequency of taxicab use by the poor.

The mean income for a family of four in Greensboro was \$10 166 in 1970; 9 percent of such households reported an annual income below the poverty level. The city has a substantial minority population—29 percent of the city's residents were reported in 1970 to be nonwhite. Greensboro's population size, income, racial composition, and transit service provided researchers with an environment that is similar to that found in many other small- to medium-sized urban areas. Two separate survey techniques were used to explore the frequency of ridership by the poor. The first investigation was performed through an onboard survey of taxicab drivers. The second investigation used origin analysis.

The Taxicab Driver Survey

During the fall semester 1974, several undergraduate research assistants developed a survey instrument designed to measure the driver's perception of the income of their patrons through a series of onboard interviews. The researchers were aware that such a survey would not indicate the empirical rate of taxicab use by low-income persons since the drivers' perception of the income of their passengers is almost entirely subjective. However, the researchers felt that an investigation of the perceptions of the drivers was important since many of the experimental proposals involving taxicabs and mobilization of lower income transportation disadvantaged individuals depend on current drivers to participate and cooperate in such efforts.

The data show that the lower income residents in this urban area are frequent taxicab patrons. Using the type 1 measurement technique (which, as was noted earlier, contains biases in the direction of upper income riders), the significance of these data becomes evident—although the poverty-level households account for only 9 percent of the Greensboro population, the drivers indicate that eight times as many taxicab patrons come from the ranks of the poor.

The researchers are aware that these data do not approach a standard of statistical accuracy, but it is important to note that the drivers' perceptions are consistent with Gilbert's finding reported earlier—the poor in medium-sized urban areas display a high rate of taxicab use and the rate is generally higher than that reported for low-income residents of large urban areas.

The Origin Analysis

The A&T research team conducted an origin analysis for Greensboro taxicab trips. The first step in such an investigation is to gather data concerning the origin of taxicab trips in Greensboro. Student researchers contacted the three major taxicab companies and obtained daily trip records for 5 d in November 1970. Cognizant

of the results from the perception survey, which indicated that use rates differ during different times of the week and month, the research team was careful to select the observation dates in order to eliminate seasonal bias.

The next step was to plot the taxicab origins. For this purpose, 100 trips were drawn randomly from the records of each observation date and plotted on a Greensboro city map. An overlay of the census tracts was superimposed on the plot map and the number of trips in each tract was recorded, allowing the research team to calculate the daily trips per thousand population in each census tract.

The final step in the origin analysis was to relate the frequency of taxicab ridership to income, a task that was accomplished by contrasting the average family income with the number of daily taxicab trips per thousand population for each census tract.

The aggregate result of this analysis is given below.

Annual Income (\$)	Daily Taxi Trips/ 1000 Population
Below 5000	6.3
5000 to 7499	1.5
7500 to 9999	0.4
Above 10 000	0.2

It is clear from these data that taxicab trips originate far more frequently in low-income Greensboro census tracts. Interestingly, the results of this origin survey are in direct contradiction to the origin-destination analysis conducted by Beimborn in Chicago. Thus, the Greensboro data tend to support the thesis emphasized throughout this section that the low-income residents of smaller urban areas demonstrate higher rates of taxicab use than their large city counterparts.

One could argue that these results do not necessarily indicate a higher frequency of taxicab use by the poor since the income of the particular passenger taking the observed trips is not examined. Indeed, the trips originating in the low-income neighborhoods of Greensboro might be carrying persons from higher income areas. However, it is equally probable that many of the trips

that originated in the wealthier neighborhoods carried passengers from low-income sections of town. This seems likely since Gilbert's data from Greensboro indicate that some 11 percent of all taxicab trips are taken by domestic household workers, who typically work in high-income residential areas but live in low-income areas. In addition, according to Gilbert's data, 85 percent of Greensboro taxicab trips originate from the home. Hence, it is highly likely that trips originating in lower income areas carried passengers who reside in those same areas.

In sum, the first part of the A&T investigation reinforced earlier data reported in the literature that indicated that low-income individuals are frequent taxicab riders. Moreover, the data from the driver perception survey and the origin analysis reinforce Gilbert's data on small- to medium-sized urban areas.

FACTORS INFLUENCING TAXICAB USE BY LOWER INCOME GROUPS

The lack of an automobile often explains an individual's reason for summoning a taxicab. This factor provides perhaps the most obvious explanation of the high rate of taxicab ridership by the poor—the poor are significantly less likely to own an automobile (4).

Data from a 1963 Pittsburgh survey demonstrate that automobile ownership definitely influences the selection of the taxicab as a means of transportation. The table below indicates that persons from automobileless households are more than twice as likely to take a taxicab than are members of one-automobile households and one-and-a-half times more likely than members of households owning two or more automobiles (13). The rise in taxicab ridership in the final group indicates that financial considerations still have some influence in the selection of a taxicab.

Household Ownership Class	Taxicab Passenger Trips/1000 Households
No automobile	46
1 automobile	22
2 or more automobiles	33

Table 3. Distribution of taxicab trip purposes in large urban areas.

Trip Purpose	Place			
	Chicago (d)	Pittsburgh (d)	New York City Poverty Area (d)	Tri-State (d)
Home	42.4	49.6	50.4	30.0
Work	13.4	9.2	6.2	28.0
Shopping	3.1	4.4	10.6	4.0
School	0.8	5.0	-	2.0
Social or recreational	16.5	13.7	14.9	12.3
Personal business	19.9	15.2	17.8	23.3
Eating	3.9	2.9	-	-

Table 4. Distribution of taxicab person-trips by hour and purpose (1970).

Hour Trip Started	All Purposes (d)	Work (d)	Medical and Dental (d)	Shopping (d)	Other Family Business (d)	Educational, Civic, and Religious (d)	Social or Recreational (d)
4:00 to 6:00 a.m.	4.6	12.0	- ^a	- ^a	2.7	- ^a	- ^a
7:00 to 9:00 a.m.	17.1	31.3	11.2	7.8	18.3	5.6	- ^a
10:00 a.m. to 12 n.	18.9	5.8	39.5	2.3	47.9	27.0	7.5
1:00 to 3:00 p.m.	23.0	11.8	27.5	44.0	23.7	13.1	29.0
4:00 to 6:00 p.m.	18.2	18.4	11.1	26.0	- ^a	- ^a	15.2
7:00 to 9:00 p.m.	8.1	3.4	- ^a	19.9	3.7	- ^a	28.9
10:00 p.m. to 12 m.n.	7.4	11.3	10.7	- ^a	3.7	- ^a	13.0
1:00 to 3:00 a.m.	2.7	6.0	- ^a	- ^a	- ^a	- ^a	6.4

^aData insufficient for analysis.

The influence of automobile availability is so marked that taxicab riders are most likely to be automobileless. The 1956 data from Chicago reveal, for example, that 55 percent of taxicab passengers did not have driver's permits (8). Data from the 1969 home interview survey of poverty neighborhoods in New York City demonstrate that 72 percent of taxicab patrons were from automobileless households (10). A 1970 survey of Pittsburgh residents produced similar results (2). As is shown in the preceding table, by either standard (lack of automobile ownership or lack of driver's permit) taxicab patrons in Pittsburgh generally do not have the option of taking the

trip by automobile. Finally, the data from the eight cities in North Carolina reveal that, by any standards, the automobileless condition of taxicab riders extends to small- and medium-sized urban areas as well as to large urban areas.

Moreover, many of those automobiles available to the poor are unreliable. Data gathered in Watts revealed that 20 percent of the automobiles owned by the ghetto residents were not in a condition safe for driving on expressways and 40 percent of them were uninsured (7).

Service Characteristics

A review of the available information reveals that perhaps the best explanation for the lower income group's frequent choice of taxicabs over fixed-route transit lies in the flexibility and convenience offered by taxicabs. Unlike fixed-route systems, taxicabs (a) provide door-to-door transportation between any points within the service area, (b) provide this transportation along reasonably direct routes, (c) provide this transportation service on demand, and (d) in many cases, provide the service 24 h a day.

Perhaps the most important service demand that the taxicab fulfills better than fixed-route transit systems is service flexibility. The inflexible nature of fixed-route transit is inherent in the concept of fixed routes. Hence, the fixed-route transit systems frequently provide inadequate service to health facilities, shopping areas, and other places of interest to the non-work-oriented traveler. For example, the early A&T Greensboro survey revealed that the relatively extensive bus system provides inadequate service to the major health facilities in the city (14).

Moreover, even when a fixed-route system travels to a particular destination, it might require a long walk to the transit stop. Data from the central Brooklyn model cities area project revealed that low-income residents showed a considerable decline in transit trips when distance to the transit stop was increased. Those households located within 305 m (1000 ft) of subway stations produce an average of 2.35 trips/household, but other households located 914 m (3000 ft) or more from subway stations generate an average of only 1.55 trips/household (15). When asked why they had not taken a bus, North Carolina taxicab passengers interviewed in Gilbert's survey frequently answered that the walk was too long and difficult.

Data concerning travel options indicate that the poor are attracted by the demand-responsive flexibility of taxicabs. The earlier A&T survey of low-income Greensboro residents showed that the poor most often call a taxicab when their regular mode of transportation is unavailable (12).

Reason for Taking Taxicab	Number	Percent
Difficult to walk to bus stop	133	8
Packages are too hard to handle on bus	105	6
Do not know routes	111	7
Bus takes too long	380	24
Bus does not stop often enough	428	27
Other	450	28
Total	1607	100

Thus, instead of using the more inexpensive yet more inconvenient bus system, the poor are more likely to opt for the convenience of the taxicab.

Unpublished results from Gilbert's survey of small- to medium-sized North Carolina cities support this conclusion (12).

Mode Chosen	Number	Percent
Taxicab	41	30.4
Friend	20	14.8
Bus	25	18.5
Stay home	15	11.1
Other	34	25.2
Total	135	100.0

It is evident that taxicab riders are dissatisfied with the inconvenience of traveling on a fixed-route bus system. Responses indicating that walks to the bus stops are too far and that the bus does not stop often enough imply a demand among taxicab riders for more door-to-door convenience in public transit. The response indicating that the bus takes too long implies that the indirect routes, transfers, and in-transit delays accompanying bus transportation force many potential transit riders to taxicabs. Finally, it should be noted that some of the inconvenience of using fixed-route systems is an informational problem—the riders are unfamiliar with routes and thus are unable to utilize the service. This problem, moreover, is particularly troublesome for semi-illiterate poor persons, who find it difficult to locate and interpret schedules and maps. Faced with this informational problem, these riders are likely to summon a taxicab driver to whom they can give oral instructions (7).

Taxicab trip purpose data from large urban areas are summarized in Table 3. The Chicago data came from the Beimborn study (8), the Pittsburgh data from the Harris study (13), the New York City data from the study by Lee and others (10), and the Tri-State data from the Tri-State Transportation Commission study (9). Aside from trips home, the two categories of purposes that consistently occupy a significant percentage of taxicab trips are social or recreational and personal business. Data from a driver questionnaire survey in Boston also support this conclusion (6). Typically, trips for these two purposes are journeys for which flexibility in scheduling and door-to-door service would be most desired. Importantly, data from Pittsburgh (13) and Chicago (8) also confirm that the percentage of bus riders in these two purpose categories is significantly smaller than for their taxicab-riding counterparts. The inflexible, fixed-route bus system fails to provide the level of convenience necessary to attract these passengers.

In sum, data from characteristic preference surveys, travel option surveys, open-ended questionnaires, taxicab travel patterns, and taxicab trip purposes point to a predictable conclusion: Taxicabs attract many passengers (and presumably, many poor passengers) because they are better able to meet their travel flexibility needs than are fixed-route bus systems.

Duration

Related to the convenience factor is the availability of the respective transportation service at all hours of the day. Although the level of taxicab service offered drops significantly late at night when the level of demand is lower, even this level of service is of advantage to a potential rider when fixed-route transit service has been phased down or discontinued.

Convincing support for the thesis that service duration plays a role in mode choice is provided by the data from the Nationwide Personal Transportation Survey, contained in Table 4 (1). The data show, for example, that trips for earning a living have the normal peaks at 7:00 to 9:00 a.m. and 4:00 to 6:00 p.m. Yet, during a significant percentage of the late night period, fixed-route transit provides minimum service. Since it is the poor

who frequently are forced to take late night jobs, this income class is particularly hard hit by the severe curtailment of bus service late at night (7) and are more likely to be forced to choose taxi service.

Space

In addition to deficiencies in service flexibility and duration, there is a lack of suitable package space on fixed-route transit. The low-income shopper finds it easier to take a taxicab when burdened with a number of packages. The data are limited, yet generally support this observation. Data from Gilbert's North Carolina survey show that for a recordable (albeit small) number of respondents, difficulty with packages was cited as the primary reason for choosing the taxicab over the bus.

Trip data from the early A&T Greensboro survey provide more convincing evidence that mass transit space constraint is an important modal choice factor. The table below shows the modal distribution of travel to and from shopping expeditions in Greensboro.

Mode	To Shopping (%)	From Shopping (%)
Drove	45.0	44.6
Rode with family member	14.5	12.3
Rode with friend	11.9	10.7
Bus	11.5	7.3
Taxi	8.5	16.9
Carpool	0.3	1.2
Walked	6.7	5.3
Other	1.4	1.5

It is important to note that the most significant changes in mode between the two legs of the journey occur with respect to bus and taxicab transportation; the journey home from shopping experiences a significant increase in the amount of taxicab trips and a significant decline in bus trips. The implication is obvious—the transit-dependent members of this low-income sample frequently took the bus on the way to shopping but had to summon a taxicab to handle the packages on the journey to home.

Security Demands

Taxicabs provide a more secure form of transportation in many circumstances than do fixed-route alternatives. Thus, lower income transit-dependent individuals, influenced by this factor, are likely to choose taxicabs over fixed-route service. Although the data are somewhat limited, the available information lends support to this hypothesis. The most extensive data on this subject cover the fear of assault during the use of fixed-route transit service.

Widespread dissatisfaction with the bus system characterized the responses in the earlier A&T Greensboro survey. One of the major complaints mentioned by this predominantly low-income sample was the dislike of waiting at potentially unsafe street corners for bus service (14). Similarly, 94 percent of a San Antonio sample of retired people told interviewers that they felt lonely and afraid while waiting for the bus (16). The most recent data come from a survey of residents in six communities in southeastern Chicago, where the sample population was predominantly lower middle income, black, female, and young. The authors of that study point out that, although only 42.7 percent of the population indicated that either they or members of their families had experienced unpleasant incidents while taking public transit, 66.1 percent of the respondents indicated a fear of using public transit (17). The Chi-

cago study of fear found that users rated security higher than nontransit users, and it was inferred from this finding that the perceptions of safety are a factor in modal choice.

POLICY IMPLICATIONS

Many policymakers have been concerned with increasing the mobility of the poor. The research reported here suggests that if the availability of taxicabs was increased and the cost of taxi service was decreased, this goal would be met in most urban areas but particularly in smaller urban areas.

This study and other research suggest that increasing the supply of taxicabs will enhance the mobility of the poor. One way to do this is to remove or reduce the market entry restrictions on taxis that exist in most urban areas. Numerous critics have pointed out that these entry restrictions severely reduce the supply of taxicabs below that which would have been present under a free market situation. Cities where entry is less restricted have substantially more taxicabs per capita and thus a higher level of service available to the areas' residents (18).

This study and other research also suggest that taxis can be made less expensive for individual travelers without direct subsidies if group riding were permitted or encouraged. Unfortunately, in most cities a restriction either disallows sharing rides or requires a separate fare from each rider discharged at a different location. Thus, ride sharing as a technique for lowering costs is precluded. However, shared-ride systems have been tried successfully in a number of cities and seem to hold promise for increasing the mobility of the poor.

Finally, individual traveler costs might be reduced by direct or indirect government subsidies. Indirect subsidies are currently being provided by cities using taxicabs to supplement their transit service in low-density areas or during off-peak hours. The taxicab operator is paid by the transit operator on an hourly or per-trip basis. This purchase-of-service arrangement is cheaper for the transit operator and provides a more responsive transportation mode for users.

Taxicabs are often used in a subsidized mode as part of the human service delivery system. Social service and health agencies hire taxicabs to provide mobility for their clients. It is usually cheaper for these agencies to purchase services from taxicab operators than to purchase vehicles, hire drivers, and start their own system. It is also possible to provide selected travelers with direct subsidies in the form of cash or taxi vouchers. Such policies are also under way in several cities as a response to the elderly and handicapped regulations issued by the Urban Mass Transportation Administration on April 30, 1976. The regulations require that specific plans be made in every city to provide for the mobility of elderly and handicapped persons. Many of these local plans suggest that a direct or indirect subsidized taxi system for special groups is the most cost-effective way to raise their level of mobility.

Increasing the availability and lowering the cost of taxi service will increase the mobility of the poor. But it should also be noted that taxicabs offer improved mobility to other transportation-disadvantaged groups, such as elderly and handicapped persons (3). All of the suggestions that would increase the supply of taxicabs or reduce their costs to the poor would have corresponding positive impacts on these other groups.

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Social Service Agencies Transportation Services in Texas: Potential for Other Paratransit Modes

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This study analyzes the current transportation operations of social service agencies in three prototype communities in Texas: urban, rural, and rural with urban interface. The study was designed to identify and analyze the costs of direct provision of client transportation by social service agencies and to develop comparative cost indexes for the same or similar classes of trips if delivered by alternative providers, including taxi operators, transit systems, and nonprofit providers. Common classes of trips are identified and categorized by major operational characteristics, and actual and perceived cost data are developed for trips provided directly

by social service agencies to their own clients. Actual cost figures, including expenses borne externally or through grants, are developed to allow policymakers to evaluate effectively the costs of direct transportation provision by social service agencies. Since federal and state subsidies exist and will be used, perceived cost figures are developed to allow social service agencies to compare the advantages of alternative service provision to their out-of-pocket costs. Although no other provider was found to be cost-effective for all client trips, some social service agencies are found to be operating inefficient or ineffective transportation systems