

## PROFILE OF A CARLESS POPULATION

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A survey was carried out in which 401 respondents in Buffalo, New York, were queried on car accessibility, activity choice, travel mode choice, and attitude toward travel modes and activities. The purpose of the survey was to examine the differences in travel behavior between those who had access to and use of a car and those who did not. Of the households without cars, only 21 percent never had access to a car. The carless sample showed a profile that was predominately low income, female, elderly, and unemployed. The largest segment of those identified as carless lived in the most densely populated portions of the city. Discriminating among modal-use patterns and activities of the various respondent groups was possible. The carless shopped for groceries more often (by walking) and participated in other neighborhood-centered activities more often than did those with cars. Paid social activities were engaged in much less frequently by the carless group. Walking was an important mode for the carless, but the bus was used by most of them, at least occasionally, for all but grocery trips.

•AN IMPLICIT belief among planners is that those without cars belong to a larger group referred to as the transportation disadvantaged (1, 2, 3). To gain some measure of the degree of disadvantage of this group, we have made a study of the travel habits and needs of those without cars.

The carless are not a homogeneous group. In a previous paper (4), various subgroups of this population have been identified, and their general locations within a large metropolitan area have been established. The field location of members of these groups is not as simple a task as may be assumed from a study of the literature cited (1, 2, 3, 4). One major purpose of the study was to locate a significant group of respondents to whom an in-depth survey would be administered. The survey instrument contained a variety of socioeconomic questions, detailed travel questions, and questions relating to travel behavior, modal choice, and, in a limited fashion, opportunity choice.

This paper deals with 2 aspects of this study. The first presents a description of the theory and methodology of the survey. The second gives a socioeconomic and travel profile of those respondents in the survey who lived in households in which no car was owned or in which a car was generally unavailable. As will be seen, car ownership is in itself a poor substitute for car availability. Of the respondents surveyed in carless households, only 21 percent indicated that they never had access to a car. Of the remaining 89 percent of the respondents, 18 percent of that portion, or 14 percent of the entire sample, indicated that they generally did not use a car for traveling to and from any of 14 selected activities. In sum, 65 percent of the basic "carless" population indicated that they traveled by car at least occasionally either as driver or rider to any of a variety of activities.

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## SURVEY

A major task of the study of the carless was the development of a survey to analyze problems that this group incurs when attempting to travel to activities of varying levels of priority. The design of the questionnaire focused on 2 major purposes: (a) identification of the problems of the carless and their categorization by extent and (b) information necessary to propose alternative solutions to these problems. As such, the resulting design was necessarily complex because the subset of applicable problems could not be surmised before the information necessary for postulating corresponding solutions was obtained. The survey was divided into 2 basic sections. The first dealt with the collection of basic household and demographic data, that is, identifications and establishments of respondent groups; the second dealt with the travel and activity behavior and attitudes of the respondent.

A conceptual diagram of the application of the information obtained from the first section is shown in Figure 1. In addition to the usual socioeconomic data, the household data contain extensive information on the household's accessibility to existing forms of transportation and are used to identify carless households and estimate level of mobility (trip frequencies and purposes) for household members. This information, when coupled with system characteristics, such as bus frequency and route information and locations of public facilities, will lead to the development of a measure of opportunity to complete desired activity selection. This process enables the categorization of the study population according to levels of mobility and opportunity, a feature that will be important in the subsequent development of behavioral models of activity and modal selection among the carless.

The second section of the survey was subdivided into 3 components. The first aimed at obtaining information on a group of daily activities as well as desired changes in these patterns; the second was concerned with information on attitudes toward the various activities and priorities among activities; the third focused on information associated with attitudes toward various existing modes of transportation as alternatives for the various activities. The relationships among these 3 components are shown in Figure 2.

Information on the activity pattern of the respondent is obtained in the form of usual frequencies among the various activities, location of the activities, and usual means of transportation to and from the activities. In addition, coupled with each activity is a set of questions on any desired changes in the activity pattern. The potential use of this information is clearly shown in Figure 3 in which simple Venn diagrams are used to demonstrate conceptually the analysis of the data obtained in this section. In com-

Figure 1. Flow for collection of data.

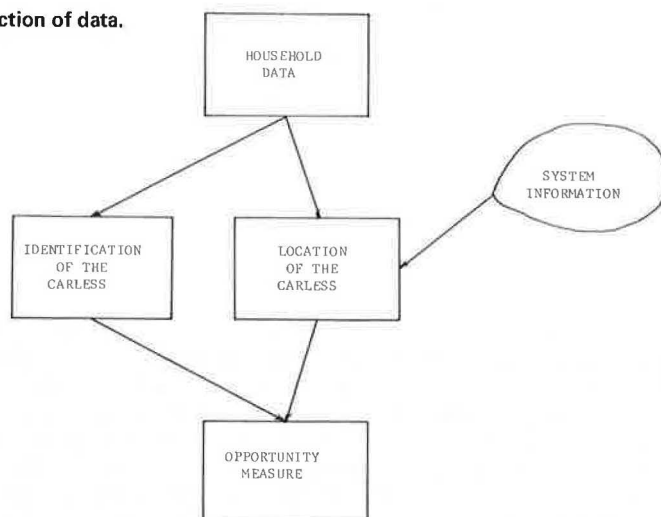


Figure 2. Data collection and analysis.

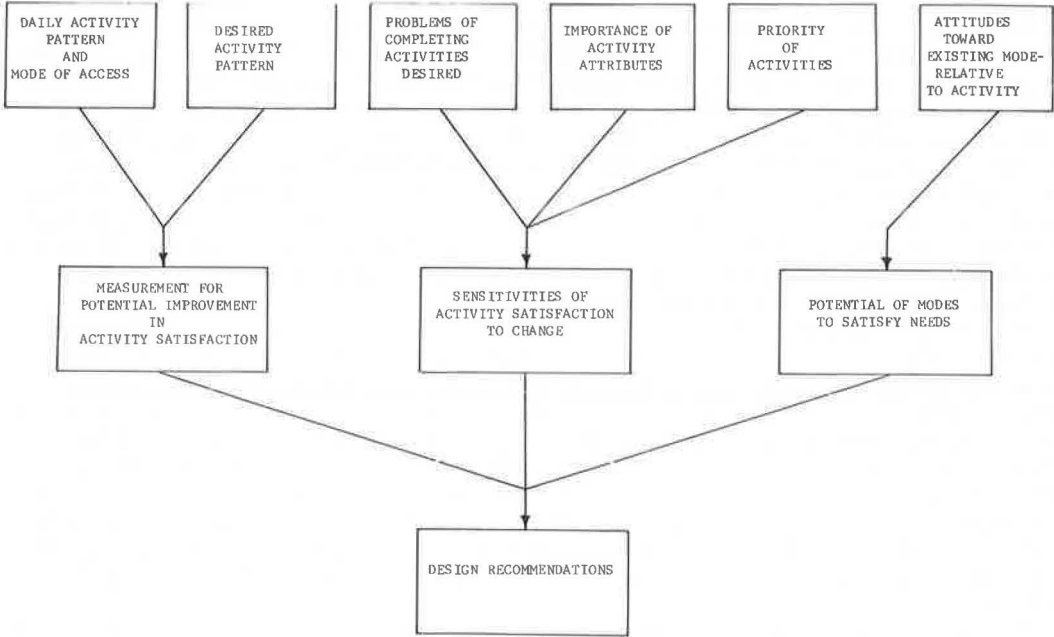
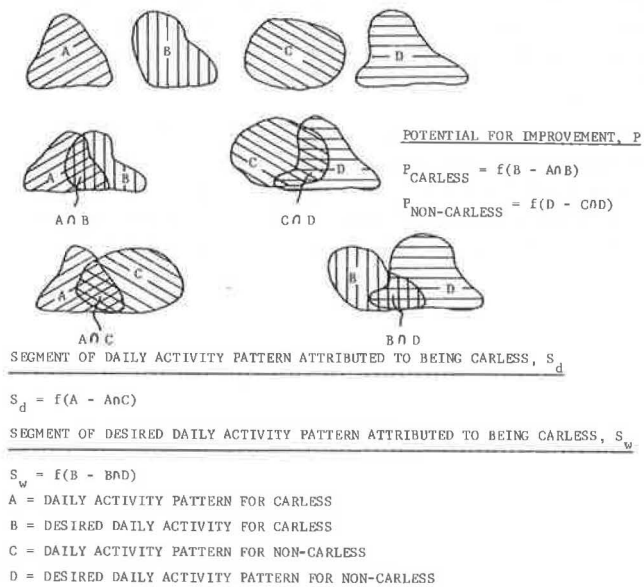


Figure 3. Activity patterns of the carless.



paring the actual daily activity pattern for the carless population with their desired activity pattern, we postulated that the potential for improvement of activity satisfaction among the carless is some function of the portion of the desired activity pattern that lies outside the daily activity pattern. A similar analysis is carried out for the non-carless population. Comparison of the potentials of improvement for the 2 populations can be used to develop a quantitative measure of activity dissatisfaction that is due to being carless. In addition, comparison of daily activity patterns of the 2 groups leads to the postulate that the segment of daily activity pattern attributed to being carless is

measured by the activity set of the carless less that which is also contained in the set for a corresponding group in the noncarless population. These can be directly measured by the survey. The frequencies of travel to 14 activities, together with all the aspects of travel to these activities, have been measured for each respondent.

An intriguing comparison also can be made of the desired activity patterns of carless and noncarless groups. One can postulate that the portion of the desired activity set for the carless that is not contained in the corresponding set for the noncarless is a measure of the segment of desired activity patterns attributed to being carless, that is, the degree to which the perceived activity space of the population has been altered solely because of carlessness. A similar argument, of course, can also be made for the noncarless population. An analysis of actual travel patterns of the carless postulated that the differences in travel between these groups is one of quality (5). Being without access to a car gives a different perception of actual available opportunities. These lead to establishing time and cost travel budgets acceptable to each group. This, in turn, permits the establishment of travel priorities. Unmet priorities of the carless caused by transportation (as opposed to available funds) would be a component of the desired activity set.

The second component of this section of the survey was designed to gather detailed information on any problems associated with performing desired activities (separated according to time-, monetary-, and transportation-related constraints), on the importance of being able to perform the various activities, and on attitudes toward the set of attributes that make up the various activities. The experimental procedure used in this section is based on semantic differential tasks. The resulting information can be interval scaled by using the law of categorical judgment (6). Aggregate models for determining a measure of deprivation can be constructed according to the flow diagram shown in Figure 4. In addition, from information collected on the importances of the various activity attributes, models can be developed to predict changes in activity satisfaction that can be brought about by changes in the characteristics of the activities themselves rather than by improvements to the transportation system, which would make the activities more readily accessible.

Finally, information on attitudes toward existing transportation alternatives was collected in the form of semantic differential judgments in the last section of the questionnaire. From this information, determining the potential, through change, of the existing transportation system to satisfy the needs expressed by the respondents will be possible. This information can then be used to infer any increased activity satisfaction that may be brought about by changes in the transportation system.

## SAMPLE SELECTION

Sample selection for the survey was based on a biased random sampling procedure in selected areas of Buffalo, New York. Five areas were chosen to get a variety of characteristics to ensure that comparisons could be made between

1. Areas with low car ownership and areas with high car ownership,
2. Areas with reportedly low bus use and areas with reportedly high bus use, and
3. Areas with relatively high median income and areas with relatively low median income.

Detailed characteristics of the 5 areas selected are given in Table 1 (7). Because a companion study deals with travel in the Buffalo model neighborhood area (MNA), this area was not included in the survey. The MNA has the highest no-car ownership and lowest median income in the city.

The survey was administered to 401 respondents of whom 105 belonged to households that owned no cars, 115 belonged to households with 1 car and the car was used for the journey to work, and 65 belonged to households with cars available but had no license (25 in household with the car at work). The survey was designed to determine both household car ownership and the respondent's access to a car either within or outside the household.

Figure 4. (a) Aggregate and (b) disaggregate models.

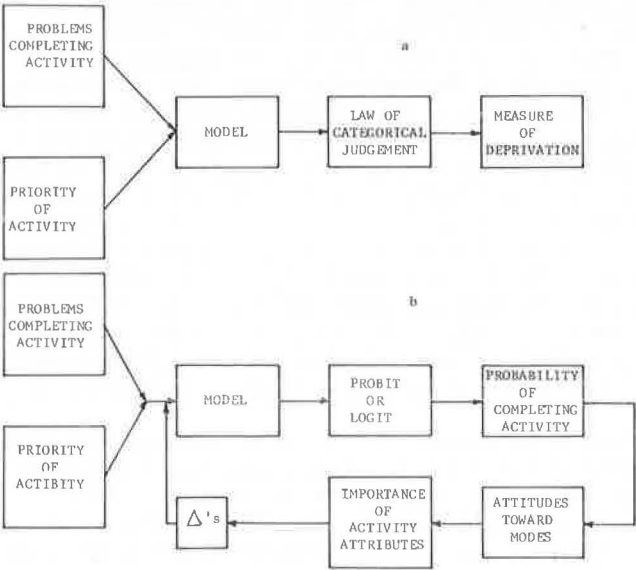


Table 1. Characteristics of study area.

Study Area	Distance to CBD (miles)	Population	Median Income (dollars)	Households With No Car (percent)	Workers Who Journey to Work by Bus (percent)	Workers Who Work in CBD (percent)	Workers Who Work in Rest of City (percent)
1	4,9	20,548	9,297	27	11	8	54
2	4,8	12,698	12,384	15	12	12	57
3	3,3	20,901	8,755	33	24	12	56
4	3,5	22,913	9,458	25	35	14	64
5	1,9	42,029	9,423	40	20	15	59
City		462,768	8,804	34.3	21	12	56

Note: 1 mile = 1,6 km.

Table 2. Characteristics of survey population.

Population	Total Sample (N = 401)		Carless Households (N <sub>0</sub> = 104)		Car-Owning Households (N <sub>1</sub> = 297)	
	Number	Percent	Number	Percent	Number	Percent
Age						
<18	21	5	4	4	17	6
18 to 59	239	61	41	39	198	69
>59	133	34	59	57	74	26
Sex						
Male	154	38	19	18	135	45
Female	247	62	85	82	162	55
Employed	166	41	22	21	144	49
Unemployed	234	69	82	79	152	51

## SOCIOECONOMIC CHARACTERISTICS OF THE CARLESS

For the group that owned no cars within the household, respondents indicated the availability of a car from another source for their use. Only 21 percent of this sample never had a car available for their use. Summary totals of the survey population are given in Table 2. The socioeconomic characteristics of the respondents are given in Table 3. Group A refers to those who never have a car available, and group B refers to those who have access to a car with varying frequencies. The table is set up to look at the age groups within each major category, the employment status of the respondents, and whether the respondents have driver's licenses. The major proportion of the respondent population is female (82 percent) and more than 59 years old (57 percent). Of the total respondents in group A, only 4.5 percent have driver's licenses. This compares with 17 percent in group B. Sixty-one percent of the total number of respondents from the survey had driver's licenses. (This actually becomes 78 percent of those in households with cars who have licenses.) A large proportion of those without licenses are female and elderly. Because of their family roles and lack of driver education courses when they were of high-school age, the necessity of getting a license was not great. This, of course, is changing and more young females are getting licenses. Thus, when they become elderly, they will have licenses and will change greatly the current proportions of those with or without licenses. Twenty-three percent of the respondents in group A are employed, but none have licenses to drive. In group B, 19 percent are employed, but, of these, only 25 percent have driver's licenses. The predominant characteristics, then, of the respondents in carless households (regardless of car availability) are that they are female, elderly, and unemployed and have no driver's licenses.

The data given in Table 4 indicate the total sample and carless household response by study area from the field search for the carless. Comparing the data in Table 4 with the census data in Table 1 confirms that those socioeconomic characteristics used to locate the sample served are good predictors of car access (4). For example, area 2, which has the highest car ownership per person and the highest household income, has the lowest percentage of potentially carless individuals. The general prediction that 65 percent of the population is potentially carless (4) (without direct access even if a car is owned by the household) is also borne out from sample characteristics. Table 4 groups the respondents by carless household, households with a car and with the car at work, and households with cars where the respondent had no driver's license. Again, in the carless households, the majority of the sample did have a car available at some time, and the proportion of car-available to car-unavailable respondents was fairly constant throughout all the areas. Because the great number of respondents were unemployed and female, examining nonwork trips in detail and determining their tie to car availability are possible.

Finally, the characteristics of respondents in sample households without cars are markedly different from the sample population in the aggregate or the car-owning population specifically (Table 2). Sixty-one percent of the entire population was in the 18-to-59 age group; only 39 percent of the carless households were in that group, and the remainder were in the over-59 group. The male-female split of the carless was skewed more to the females, and there were 10 percent more unemployed in the carless household group.

## TRAVEL BEHAVIOR

In the survey, detailed questions were asked concerning the following group of activities:

<u>Code</u>	<u>Activity</u>
0	Employment
1	Grocery shopping
2	Clothes shopping
3	Convenience shopping
4	Doctor, dentist, or clinic
5	Visiting friends in neighborhood
6	Visiting friends out of neighborhood
7	Bank
8	Church or temple
9	Social activities group
10	School
11	Taking children to school, meetings, lessons, or other activities
12	Bar, ice cream parlor, or coffee shop
13	Paid recreation
14	Park or playground

Questions for each activity included frequency, desired frequency, location, travel time, desired locations, and desired times. A set of questions also was asked regarding frequency of use of mode for 6 specified activities. For example, those surveyed were asked how often they used a car, bus, or taxi or walked for

1. Major grocery shopping,
2. Shopping for odds and ends,
3. Shopping for personal goods, and
4. Visiting friends.

Respondents used a scale from 1 to 7 to answer (1 = always, 7 = never).

The activities and modal frequencies are examined based on categories of car availability as discussed in an earlier section of the paper. Two questions from the instrument were keys to establishing these categories. The first established car use, and the second established availability.

1. Do you have use of a car, from any source, either as a driver or rider?
  - a. Yes, as driver and rider
  - b. Yes, as driver only
  - c. Yes, as rider only
  - d. No
  - e. Don't know, no answer
2. Is it available to you?
  - a. Always
  - b. Usually
  - c. Seldom
  - d. Almost never
  - e. Don't know, no answer

In the categorization of the carless, responses a and b to question 2 are grouped together and are considered car generally available; responses c and d are grouped together and are considered car generally unavailable. Figure 5 shows the activities surveyed, the frequencies with which they are performed, and the desire to perform them more or less frequently.

Car availability is also basically independent of the proportion of respondents who participated in the various activities. Shopping of all kinds and visits to bars and coffee shops were done by a larger proportion of the carless than the noncarless. These can be related to personal budget because the noncarless generally had higher incomes than the carless had.

In the question regarding frequency of activity most respondents from the entire

Table 3. Socioeconomic characteristics of carless households.

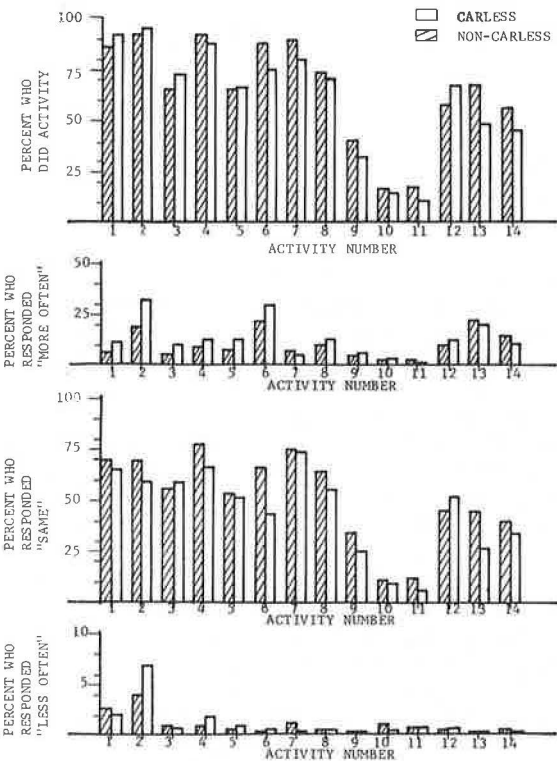
Group	Age	Median Income (dollars)	Employed Males		Unemployed Males		Employed Females		Unemployed Females	
			Total	Licensed Drivers	Total	Licensed Drivers	Total	Licensed Drivers	Total	Licensed Drivers
A	<18	7,800	0	0	1	0	0	0	1	0
	18 to 59	4,985	0	0	1	1	5	0	3	0
	>59	2,988	0	0	4	0	1	0	6	0
B	<18	4,410	1	0	1	1	0	0	0	0
	18 to 59	6,504	3	2	2	1	8	2	19	1
	>59	4,460	1	0	5	2	3	0	39	5

Table 4. Response by sample area.

Area	Total Respondents	Car-Owning Households					
		Carless Households		Car At Work			
		Car Available	Car Unavailable	Total	No Driver's License <sup>a</sup>	No Driver's License	Percentage of Carless
1	77	7	2	25	6	20	63
2	60	3	1	17	3	11	49
3	85	18	4	25	13	21	65
4	67	13	3	29	5	5	67
5	112	42	12	17	2	7	68
	401	83	22	113	29	64	

<sup>a</sup>When the car was used for the work trip, those with no license were tallied and counted again in the next column.

Figure 5. Activity frequencies of respondents.





group were satisfied with their current level of activity frequency. However, more of the carless than the noncarless responded that they would like to travel more frequently than they now do. This set of activities is shown in Figure 5. Shopping of all kinds and visiting friends were noted to be most significant out of the entire activity list.

In a further analysis of the activities, Figure 6 shows actual frequency as a function of car availability. Those who have infrequent or no availability of a car have distinctly different trip frequency patterns than do those who have a car available. Grocery shopping, done slightly more than once a week by those with a car available, is done nearly twice as often by those who do not have a car available. The following analysis of the latter respondent group shows the high frequency of walking to shop:

<u>Direction</u>	<u>Mode</u>				
	<u>Walk</u>	<u>Taxi</u>	<u>Bus</u>	<u>Drive Car</u>	<u>Ride in Car</u>
To store	73	2	4	17	4
From store	70	5	4	17	4

Frequent shopping trips may be made for a variety of reasons that are functions related to both the socioeconomic characteristics of the trip maker and the characteristics of the available system. A large segment of the carless are the elderly and they are members of relatively small households as can be seen in the following tabulation (sample size was small for the over-84 age group):

<u>Age Group</u>	<u>Average Family Size</u>
16 to 54	2.43
55 to 64	2.08
65 to 74	1.72
75 to 84	1.45
> 84	1.6

Shopping for large amounts may be unnecessary for small households, and inadequate or improper storage space may make frequent small trips necessary. Inability to carry packages, frequent availability of store specials, and the pure social aspects of shopping (especially in the neighborhood) would boost this frequency.

Neighborhood visits (activities 5, 12, and 14) also are done with much greater frequency by this group, but paid social activities (activity 14) are done with significantly less frequency. Lack of accessibility to a car obviously limits accessibility to a diverse set of activities, and, from the response, buses do not take up all the slack in travel. Buses are the predominant mode of travel for clothes shopping, visits to the doctor, and visits to friends outside the neighborhood.

Travelers were asked how important improved transportation would be as an incentive to increase the number of trips taken for a series of 6 of the activities. Leisure and recreation and visiting friends were ranked very high, which means that transportation would play an important role in increased trips. Shopping for groceries and necessities also was linked to transportation by this carless group, predominately by the female, 18-to-59 age group. Social visit increases were important primarily to the over-59 age group. Out-of-neighborhood visits became very important to those in the city whose family and friends were in the suburbs.

The same pattern for grocery shopping is indicated in Figure 7, which shows car use. Those with no car use or who could use a car only as a rider shopped for groceries more frequently than those who were able to use a car as a driver. This again occurs

Figure 6. Trip frequencies by car availability.

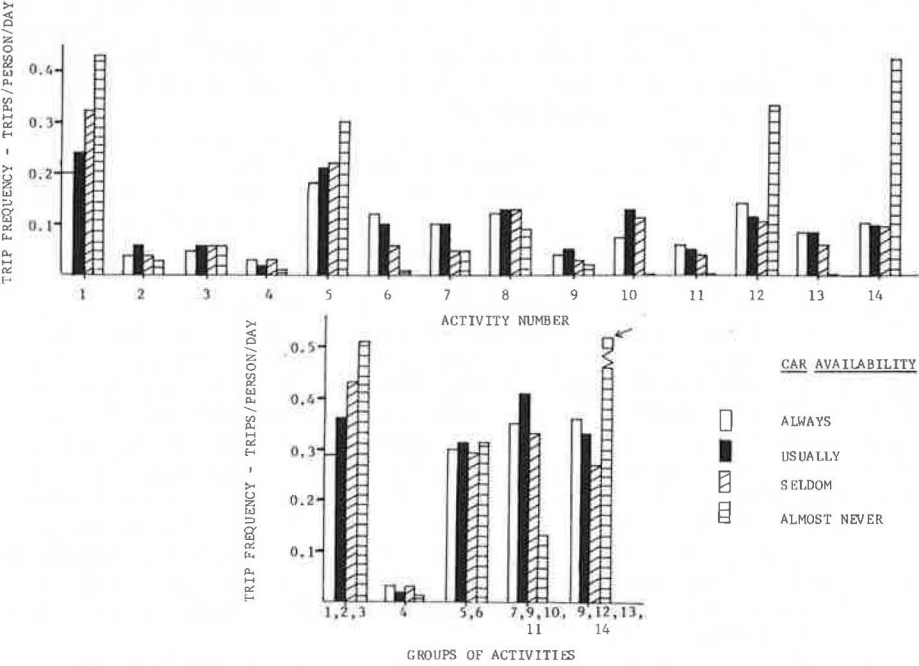
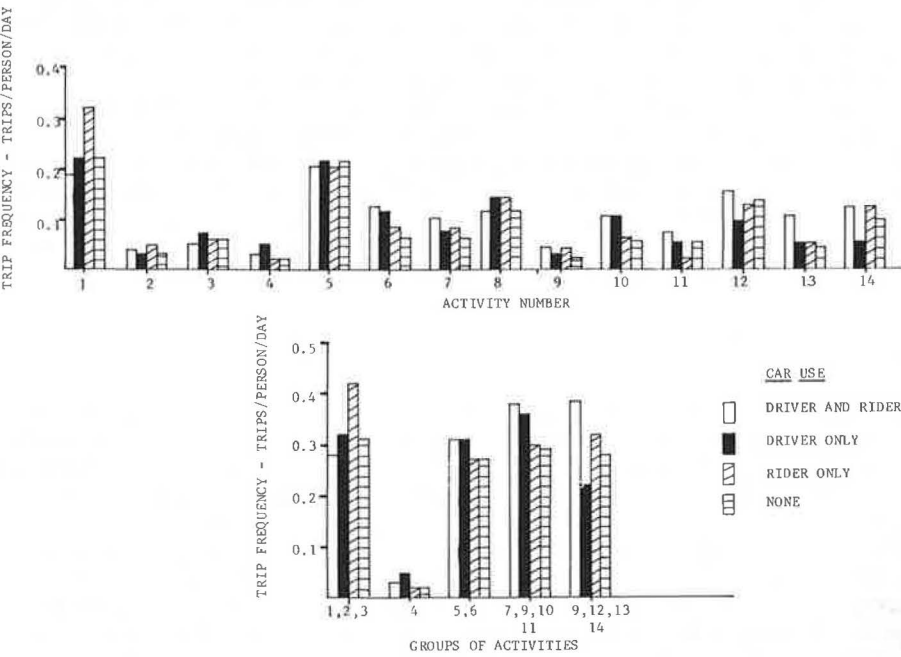


Figure 7. Trip frequencies by car use.



for the reasons previously cited. Activities that can take place within the neighborhood do so at about the same frequency regardless of car use. However, activities specifically cited outside the neighborhood (activities 6 and 12) were done with much less frequency by those who had no car use. Those with no car use can be, perceptually, neighborhood bound. That is, they possess no real sense of the time and distance associated with a variety of opportunities outside their neighborhood.

In a complementary set of questions regarding modal choice, respondents were asked to cite the frequency (on the 7-point scale) with which they used various modes for specific trip purposes. The results of these questions are shown in Figures 8, 9, and 10 for walking, bus, and car. These figures show clearly the effect of car availability on modal choice for the respondents in 2 groups—households that own cars and households that do not own cars.

Walking, as has been noted, is used by most of the carless respondents for grocery shopping; it is used only occasionally by less than 10 percent of the households with cars. Walking for those with cars becomes a more popular mode for other purposes too, especially visiting friends in the neighborhood. The majority of those in carless households find that they can satisfy their other shopping needs (at least sometimes) at places within walking distance. The socioeconomic and travel characteristics of the sample show that most of this group live in the most densely populated area of the city where a large choice of shops exists. The history of Buffalo, like the history of many old urban areas, indicates that the migration of younger people to the suburbs left an older population in the city. Regardless of the reason—tie to neighborhood, accessibility to familiar activities—the elderly are found in large numbers in these areas, and they make up a large proportion of the sample. The results of walking as shown in Figure 8 are consistent with known urban patterns.

The bus is used with little frequency by either group. It is used most frequently by the carless for shopping for odds and ends, visiting friends, and shopping for personal goods. Most of the sample who live in area 5, the largest group of households without cars, are favored also by excellent CBD and crosstown-oriented bus service. This enables buses to be used to shop in the CBD or along the local neighborhood shopping streets, yet bus use is still relatively low. As would be expected, more than 60 percent of those respondents in car-owning households never use a bus for the purposes listed.

The car is used with greater frequency than the bus by the carless for grocery shopping. The importance of this trip seems to create a demand for car availability that is not matched by other activities. The number of carless people who have a car available for the other trip purposes decreases somewhat. The difficulties of grocery shopping without a car become striking when the responses are analyzed. Decentralization of supermarkets, difficulty of carrying packages, and difficulty of using buses in inclement weather make 2 choices necessary for those without cars: (a) get a ride or (b) walk to neighborhood stores, which causes a higher frequency of travel.

## CONCLUSIONS

The survey indicated that delineating not only between car-owning and non-car-owning households but also among the various subcategories of those to whom a car was available with varying frequency was possible. Elderly (more than 59 years old) unemployed females are among the most severely affected of those who responded to the survey. However, the conditions of location within densely populated urban areas somewhat alleviate the problems of shopping and social visits. Bus accessibility appears to be marginally important, but, as noted for grocery shopping, occasional car availability was more important to the carless respondents. The fact that, in carless households, more than 75 percent of the respondents indicated occasional or greater car availability shows that traditional modal-split models calibrated by using car ownership as a criterion might well overestimate demand or potential demand for transit.

The carless have been able to satisfy many of their travel needs locally rather than citywide or regionally. Further studies from the survey will investigate the attitudes of the carless groups toward modal attributes and will develop models of travel priority

Figure 8. Walking frequencies for selected activities.

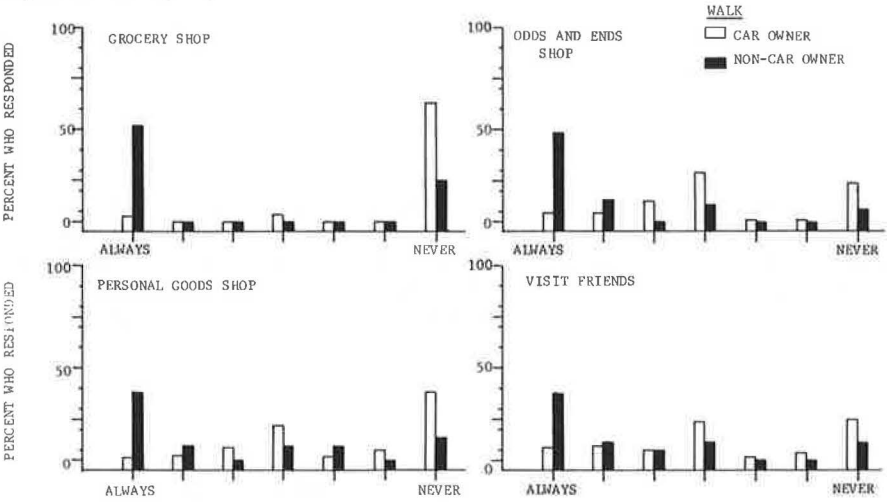


Figure 9. Bus frequencies for selected activities.

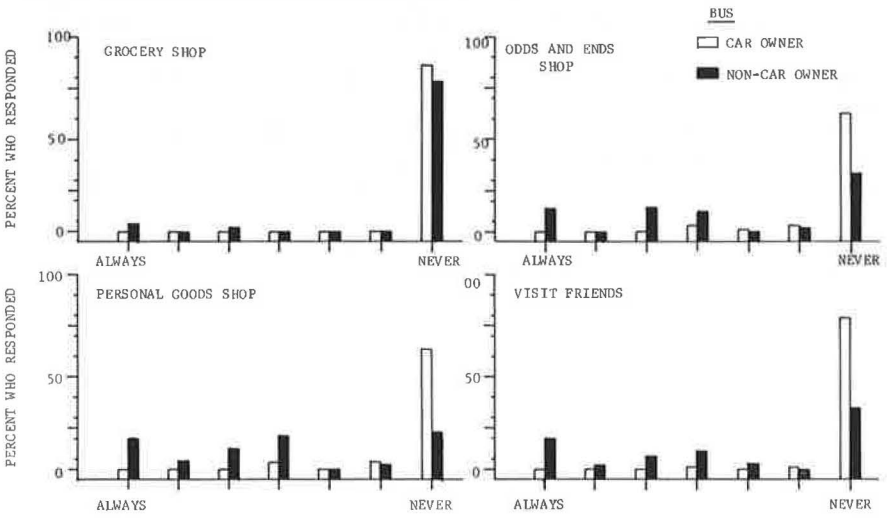
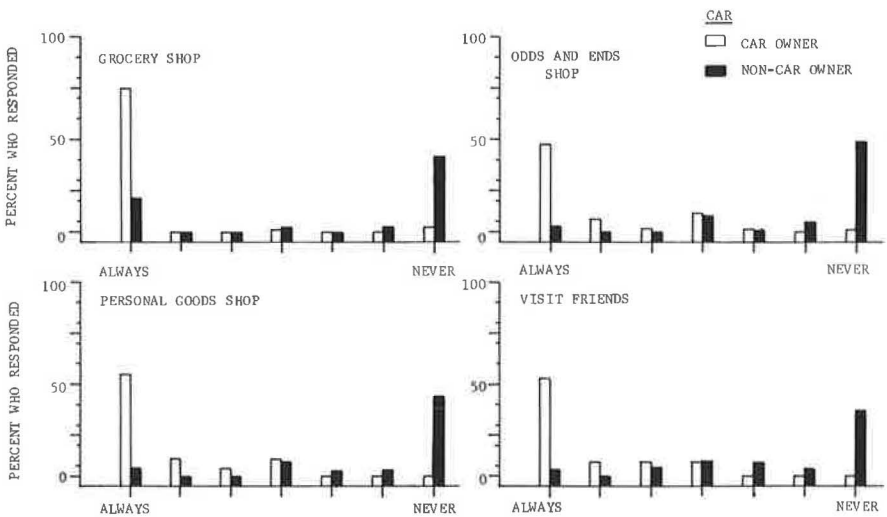


Figure 10. Car frequencies for selected activities.



for these groups.

#### ACKNOWLEDGMENTS

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