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16. Abstract

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FREEWAY DESIGN AND LOCATION: A CASE STUDY OF URBAN RESIDENTS' ATTITUDES

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ABSTRACT

The purpose of this study was to examine the effects of location and design characteristics of urban freeways upon persons with middle and upper incomes living along freeway rights of way. The objectives of the study were: 1) to determine the effects of freeway location on land use characteristics of middle and upper income areas, 2) to determine the opinions of residents living near the freeway regarding its location, 3) to examine some of the effects of different freeway designs on residential satisfaction and 4) to examine some of the social impacts of freeway construction on upper and middle income residential areas. Three residential areas lying along freeways in the Houston, Texas area were chosen for study. Census tract data were used to examine some of the changes in residential patterns that occurred between 1960 and 1970. An "after only" sample survey design was used to obtain data about the opinions and experiences of study area residents. Eighty-six persons in the study areas were interviewed. Major findings were: 1) the study areas underwent considerable change in the period between 1960 and 1970; 2) respondents were generally favorable toward the presence of the freeway; and 3) detremental effects of the freeway on social patterns within the study areas were minimal.

SUMMARY OF FINDINGS

The purpose of this study was to examine the effects of location and design characteristics of urban freeways upon persons with middle and upper incomes living along freeway rights of way. Information was gathered from census tract data for 1960 and 1970 and by personal interviews of residents in study area neighborhoods.

A summary of the findings relative to changes in land use characteristics as a result of the freeway, characteristics of respondents, and opinions of respondents concerning freeway location, design, and impact is presented below:

1. The study is based on interviews with 86 persons residing along elevated, on-grade, and depressed sections of 2 freeways in the Houston, Texas area. The mean age of all respondents is 47.3 years; the mean number of years of education is 13.7 years; and the mean income is $15,902. Ninety-one percent of respondent households in the sample have 1 or more automobiles available to them.

2. Comparison of census tract data for 1960 and 1970 indicates the three study areas underwent substantial changes. These changes were attributed in part to being more accessible as a result of freeway construction. Some of the changes in the study areas were: 1) an increase in the number of housing units; 2) an increase in the percentages of multi-unit structures and rental units; 3) an increase in the percentages of young adults and single persons; and 4) a high mobility rate among area residents.

3. In general, individuals in the sample tended to have a favorable opinion of their place of residence with respect to the freeway. Respondents whose residences abutted the freeway tended to be more unfavorable than those whose residences were further from the freeway. Respondents who moved to their location prior to the construction of the freeway were significantly more favorable than those who moved after the construction of the freeway. Approximately 70 percent of the respondents in the study sample were favorable toward the presence of the freeway in their neighborhood. This was attributed to an orientation on the part of the individual more toward the larger urban community than toward the local neighborhood. This type of person is not affected much by disruptions in neighboring patterns, and enjoys the access afforded by the freeway.

Approximately 79 percent of all respondents were satisfied with the distances of their residences from the freeway. The frequency of those wishing to live further from the freeway increased directly with proximity to the freeway and with the elevation of the freeway design type. Residents who moved to their location prior to the construction of the freeway preferred to live further from the freeway with a significantly higher frequency than did those who moved to their location after the freeway was built.

Thirty-one percent of all respondents report being annoyed in some way by the presence of the freeway. For most respondents, the reported source of annoyance was traffic noise. It was found that "before-construction" respondents reported being annoyed by the freeway with a

significantly greater frequency than did "after-construction" respondents.

4. Twenty-three of the 86 respondents in the sample were living in the study areas prior to freeway construction. Findings regarding the observations and opinions of these "prior resident" respondents are as follows.

Fifty-two percent of the prior respondents experienced some problems during freeway construction. The problems mentioned most often were noise of construction and dust. An inverse relationship was found between distance from the freeway and the incidence of reported problems.

Some positive effects of the freeway were reported by 91 percent of the respondents. The positive effect named most often was a decrease in travel time. Fifty-two percent of the respondents reported negative effects of the freeway. The most frequently reported problems are increased noise levels in the home and increased air pollution.

Approximately 13 percent of the prior resident sample reported an increase in property values, 35 percent reported a decrease, and 22 percent reported no charge. The remaining 30 percent did not know what effect freeway construction had had on property values. The percentage of respondents reporting higher values increases steadily in going from the depressed design subarea to the elevated design subarea.

Travel times of prior resident respondents were not increased to any appreciable extent. Only 13 percent of respondents reported that any travel times were longer. In contrast, a relatively large percentage of respondents reported decreased travel times.

Freeway impact on neighborhood social patterns was minimal. None of the respondents had any friends or relatives who moved from the neighborhood. Almost half of the respondents did not know what had happened to any of the persons displaced by the freeway. It was concluded that the minimal impact of freeway construction on neighborhood social patterns was partially a result of neighborhood residents tending to maintain social ties to the larger urban area rather than to the local neighborhood.

IMPLEMENTATION STATEMENT

This report presents viewpoints of people living near urban freeways. These attitudes and opinions represent a portion of the total informational input needed to evaluate expected impacts. Included in the highway planning process, information such as developed in this report will now fully establish the nature of the trade-offs involved in highway decision-making.

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INTRODUCTION

Construction of an urban freeway affects the lives of almost everyone living in an urban community in some way. A freeway has a major and lasting impact on the physical, economic, and social environments of the entire urban area in which it is built. The direct environmental impact is probably the greatest on those persons who live along the freeway right of way. For them the freeway provides benefits and entails costs that affect their living patterns and the quality of their lives. Some of the potential benefits are an increase in physical mobility, more convenient access to places of employment, shopping facilities, and community services, and an enhancement of property values. Some of the potential costs are higher levels of noise and air pollution, greater traffic congestion, and a disruption of desirable neighborhood social processes.

To the extent that other essential considerations are not compromised, inclusion of design features that maximize the utility of the freeway for those who live along its path should be an integral part of the planning process. To do this, the planner needs to know the physical, economic, and social effects of various design alternatives and which of these effects are considered desirable and undesirable by those in the vicinity of the proposed freeway.

This report presents the results of a survey conducted among a group of urban residents living along freeways. The purpose of the survey was to determine the attitudes of these persons toward freeways

and to relate these attitudes to the major ways each individual had been affected by the freeway in his neighborhood.

Objectives

The purpose of this study was to examine some effects of location and design characteristics of an urban freeway upon persons with middle and upper incomes living along the freeway right of way. In view of the amount of time and other resources available for the study, the following objectives were selected:

1. To determine the effects of freeway location on land-use characteristics of middle and upper-income areas; and
2. To examine the opinions of persons living near the freeway with respect to the following:
   a. amount of satisfaction with location of freeway near residence
   b. effects of different freeway design characteristics
   c. impact of the freeway on residential neighborhoods

Methodology

An "after only" survey design was used to obtain the desired data about the experiences of persons living near the freeway. In this approach, information was obtained from a sample of persons living in selected areas in the near vicinity of IH 610 and Southwest Freeway in Houston during May and June of 1974. Information on the impact of the freeway on neighborhood social patterns was sought from those respondents in the sample who had been living in the neighborhood prior to the construction of the freeway. Information on land-use changes in the

residential areas was obtained from Census reports for 1960 and 1970.

Selection of Study Areas

Several criteria for the selection of study areas had to be met in order to satisfy the objectives of the study. Study areas had to be comprised predominantly of residents with middle incomes or above. Residents living along segments of freeway that were depressed below grade, on grade, and elevated above grade had to be interviewed to examine differential effects of different design characteristics. This requirement necessitated the selection of three separate study areas, since no single suitable residential area could be located that adjoined all three freeway design types. The final criterion was that residential areas had to extend sufficiently far back from the freeway in order to be able to measure differential effects of the freeway due to differences in proximity.

Several sites that met the study criteria were identified by staff members of the Houston Urban Project of the Texas Highway Department. After on-site examination of each area, three areas were selected. The areas chosen were generally representative of Houston area middle and upper income housing units. In addition, each residential area appeared comparable with the other two with respect to those variables that were not controlled in the study.

Selection of the Interview Sample

Because of the limitations in resources, it was necessary to base the

study on information obtained from a sample of those residing in the study areas, rather than attempt to interview all residents.[1]

The individual household was chosen as the appropriate sampling unit, and the head of the household was designated as the primary person to be interviewed. The population was stratified by freeway design type and distance from the freeway so that differential effects of these two variables could be determined. Stratification was achieved by dividing each of the three design type areas into three distance zones. These distance zones are defined as follows:

Zone 1 - Households on properties abutting the freeway right-of-way;

Zone 2 - Households on properties not abutting the freeway and no more than 600 feet (183 m) from the freeway; and

Zone 3 - Households on properties at distances greater than 600 feet (183 m) from the freeway and no more than 1200 feet (366 m) away.

Households at distances greater than 1200 feet (366 m) from the freeway were not included in the population. This stratification scheme produced nine strata, from which independent samples were drawn.

In view of the time available and the estimated costs of interviewing, the sample size was set at 90 households. Since obtaining information from each strata was of importance and the sample size was relatively small, approximately the same number of households were allocated to each strata in order to distribute the possible consequences of sample attrition equally among all strata. The strata varied greatly

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[1]Detailed sampling procedures and confidence intervals for the sample are discussed in Appendices A and B.

in size, so this procedure resulted in a disproportionate stratified sample. Listings from the 1972 Houston City Directory were used to draw a systematic sample from each strata. Table 1 shows the size of each strata, the number of dwelling units sampled from each strata, and the resulting sampling percentages.

In general, cooperation from respondents was very good. Representatives from 86 of the 90 households in the sample or their alternates were interviewed - a very satisfactory result. The refusal rate was low. In those few cases where an interview was denied, alternate interviews were obtained, using the sampling procedure, with little difficulty.

Personal Interviews[2]

An interview schedule was used that included questions designed to elicit the following information:

1) Personal information about respondents and their families;
2) Respondents' opinions concerning the location of their residence with respect to the freeway, design characteristics of the freeway, and its impact on their lives; and
3) Information and opinions regarding driving and riding experiences on the freeway.

Opinions concerning the impact of the freeway on neighborhood social patterns were solicited only from those respondents who had been living in the study areas before construction of the freeway in their residential area had begun. A total of 23 of the 86 respondents, or 26.7 percent of the sample fit into this "before" category.

[2]A copy of the questionnaire is available on request from the authors.

Table 1

Size of Strata, Number of Interviews Obtained from Each Strata, and Sampling Percentages for the Study Sample

Freeway Design Subarea	Zone 1	Zone 2	Zone 3	All Zones
Depressed				
No. of dwelling units in strata	99	647	1260	2006
No. of dwelling units sampled	9	11	12	32
Percent of dwelling units in strata sampled	9.09%	1.70%	0.95%	1.60%
On Grade				
No. of dwelling units in strata	73	934	1154	2161
No. of dwelling units sampled	9	10	10	29
Percent of dwelling units in strata sampled	12.33%	1.07%	0.87%	1.34%
Elevated				
No. of dwelling units in strata	77	454	199	730
No. of dwelling units sampled	7	9	9	25
Percent of dwelling units in strata sampled	9.09%	1.98%	4.52%	3.42%
All Design Subareas				
No. of dwelling units in strata	249	2035	2613	4897
No. of dwelling units sampled	25	30	31	86
Percent of dwelling units in strata sampled	10.04%	1.47%	1.19%	1.76%

Interviewing followed a normal procedure of contacting each respondent in the sample and arranging an appointment at his convenience. The interviewing process was carried out in May and June of 1974.

Description of the Study Area

The locations of the three residential areas chosen for study are shown in Figure 1. The residential area adjacent to the depressed section of freeway is located along Southwest Freeway, in the area between Shepherd and Gravstark Streets. The residential area adjacent to the elevated design section is situated in the northeast quadrant of the intersection of the west loop of IH 610 and Southwest Freeway. The area adjacent to the on-grade section is located along the south loop of IH 610 between Cliffwood and Timberside Streets. For sake of convenience, the study areas are designated by the following names of the respective design sections:

Elevated - "Post Oak Area"

On-grade - "Stella Link Area"

Depressed - "Shepherd Area"

Maps of the study areas are shown in Figures 2-4. General characteristics of each area are discussed below.

Shepherd Area

This residential area is delineated by commercial development along Richmond Avenue to the north, and by Shepherd Street, a major thoroughfare on the west. Southwest Freeway, which traverses the area in an east-to-west direction, divides it into two distinct sections. Overall,

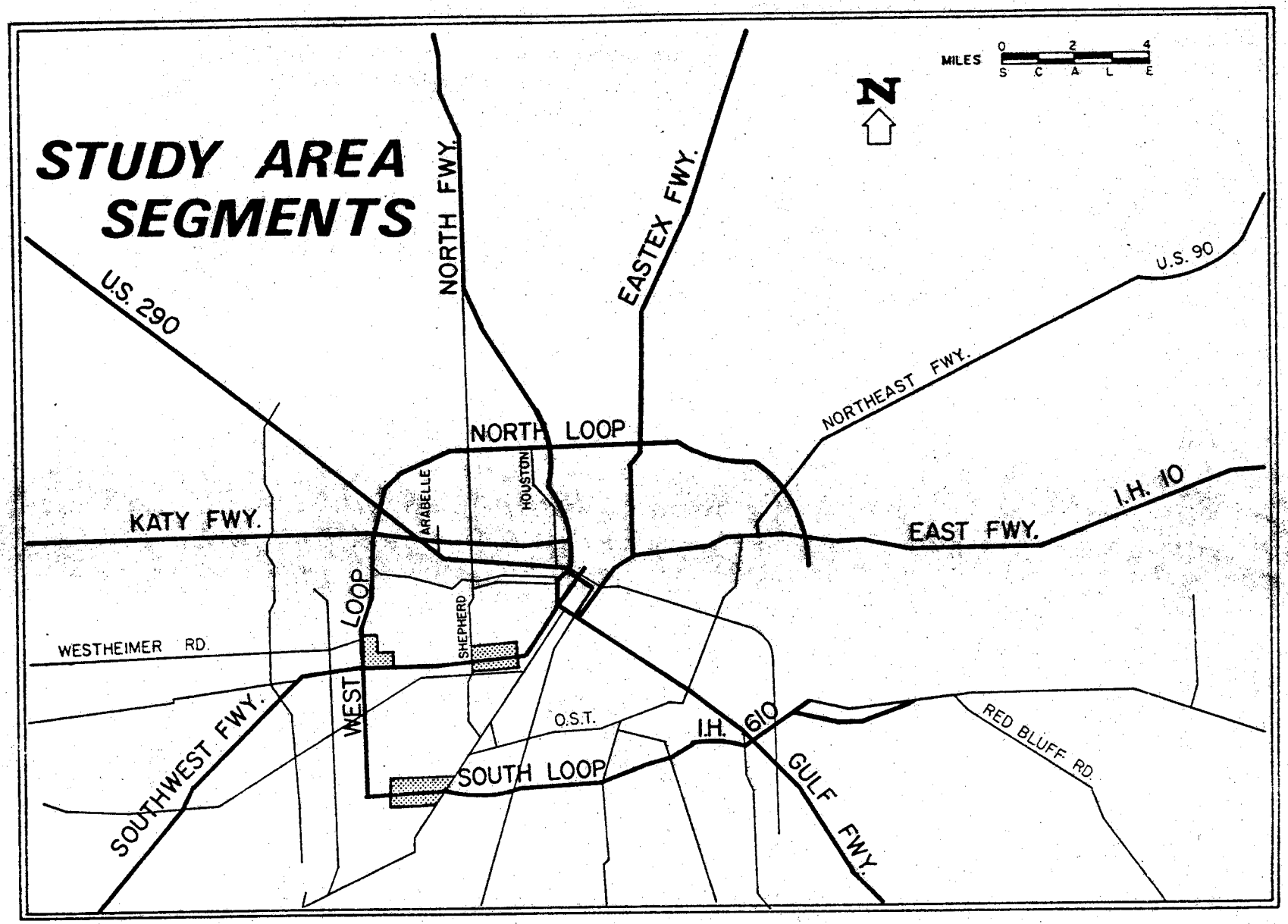

Figure 1. Map of Houston Showing Location of Study Area Neighborhoods.

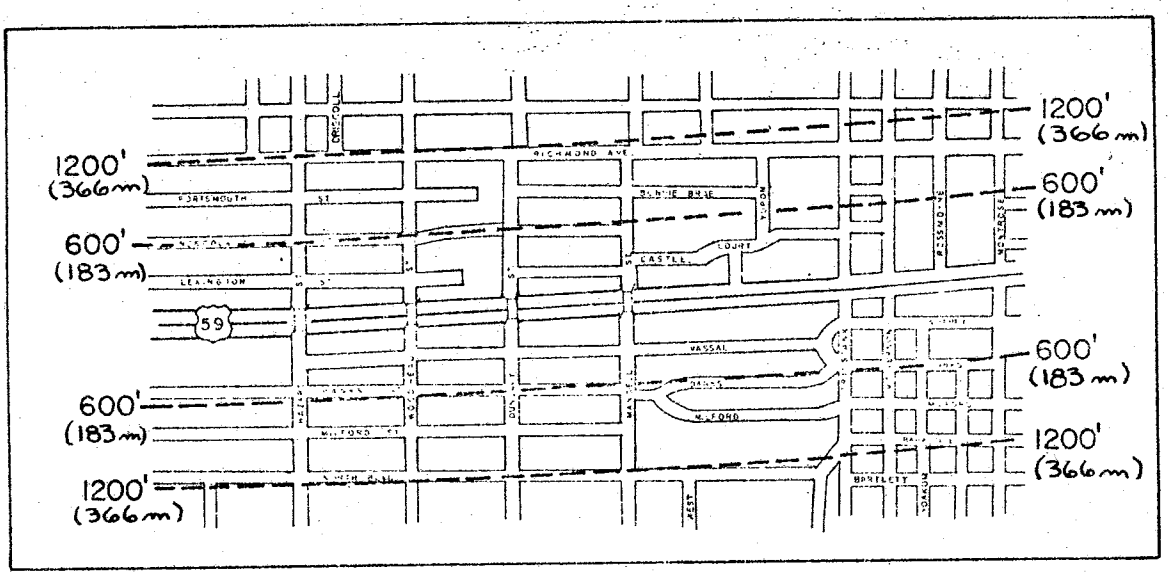

Figure 2. Map of the Shepherd Area showing the boundaries of the study area distance zones.

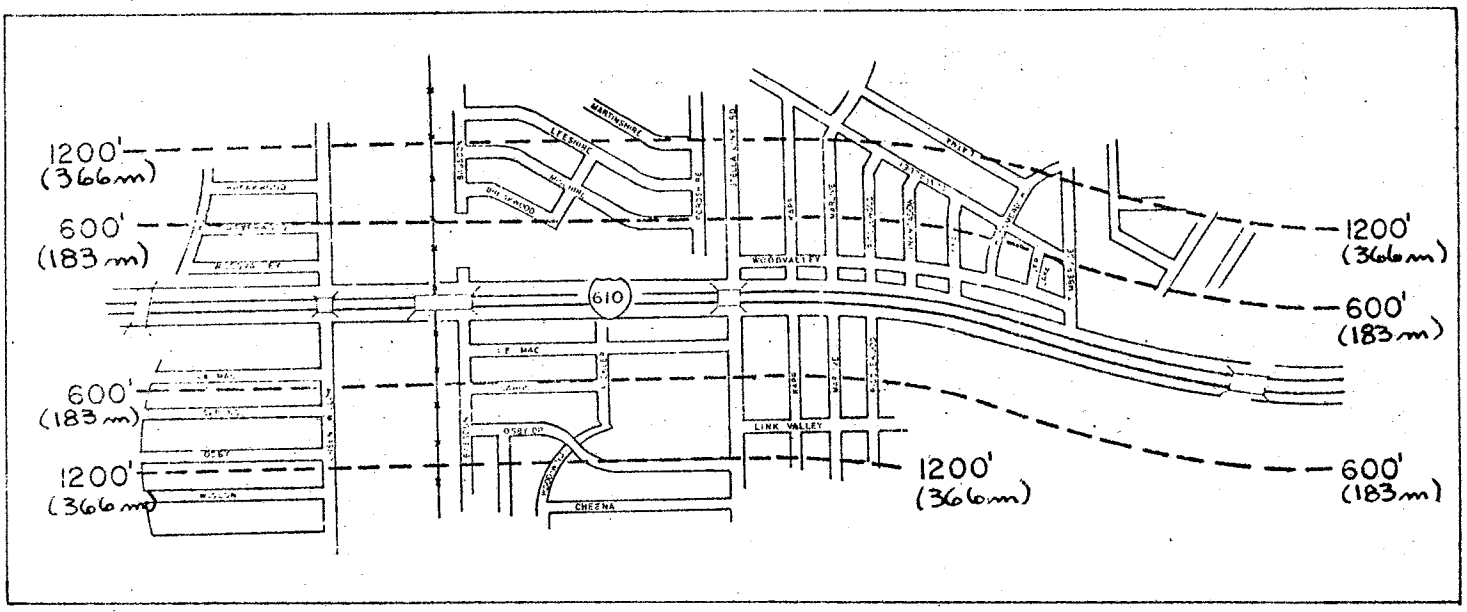

Figure 3. Map of the Stella Link Area showing the boundaries of the study area distance zones.

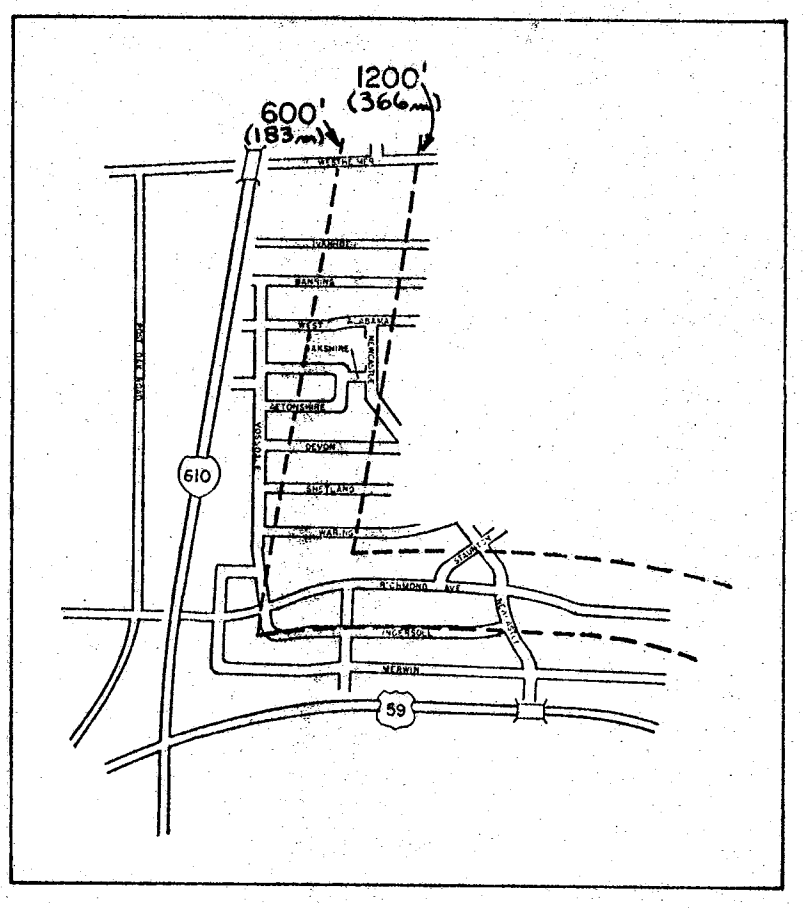

Figure 4. Map of the Post Oak Area showing the boundaries of the study area distance zones.

the area is characterized by older residential dwellings and commercial activity. The majority of the residential buildings appear to be 15-20 years old.

The section north of the freeway shows evidence of a gradual transition from predominantly residential land use toward mixed commercial and residential, or predominantly commercial land use. Commercial development has been relatively heavy along Richmond Avenue, which comprises the northern fringe of this section. Many of the residential structures show some signs of disrepair, especially those near commercial activity. The condition of residential structures tends to improve as one moves away from the commercial zone toward the freeway. Residential structures in the section south of the freeway are generally similar in age and size, but are in much better condition than those north of Southwest Freeway. These structures have been maintained in good repair, and very few display evidence of delapidation.

The section of freeway adjacent to the Shepherd area was opened in July 1961.

Stella Link Area

This area lies along the section of South Loop (IH 610) that extends from Timberside Street westward to Cliffwood Street. It can be described as a densely-settled, suburban subdivision. The area consists of single-family houses, townhouses, and apartment complexes. A majority of the construction appears to be of contemporary or near-contemporary vintage. Most of the commercial activity is situated along Stella Link, a major

north-south traffic artery that bisects the study area.

The section of freeway adjacent to the Stella Link area was opened in May 1969.

Post Oak Area

This residential area is delineated by Westheimer Road to the north, Southwest Freeway to the south, and the West Loop of IH 610 on the west. Richmond Avenue is a major thoroughfare which runs east-west across the lower portion of the area. The study area is an older section of Houston that has changed from predominantly residential land use to mixed commercial and higher-density residential land use. There is extensive commercial development along both Westheimer Road and Richmond Avenue. The Galleria, one of Houston's largest shopping malls, is approximately a block from the study area on Westheimer. A majority of the residential structures here are in very good condition. Much of the residential development appears to have been carried out within the past 10-15 years.

The sections of freeway adjacent to the Post Oak area were opened in June 1964.

PART I

CHANGES IN THE STUDY AREAS CAUSED BY CONSTRUCTION OF THE FREEWAY

One assumption underlying the analysis in this section is that an urban area can be viewed as a vast collection of human activities which are differentiated over space. While activities in different parts of a city tend to be different, they are frequently mutually useful or mutually necessary, and are, therefore, highly interrelated. The transportation system is a means of integrating these interrelated activities. It permits the circulation of men, energy, and goods, thus permitting cooperation over space.

Presently, the major component of the transportation system in most urban areas is the highway system. Activities that take place in one section of an urban area are integrated with activities of other sections by the network of streets and highways that join them. The degree to which the highway system integrates two activity areas is a function of, among other factors, the space-time ratio of the areas. The space-time ratio is defined as the cost in time for traveling between two areas divided by the cost for transversing the space.

An immediate consequence of building a freeway in an urban area is to decrease the space-time rations for many areas. More space can be used for activities which remain just as closely coordinated as before. A greater horizontal area can be included in one network of control at the same cost in time and human energy. Changes in space-time ratios cause circulation patterns within the city to change, which, over time, alters interrelationships between different spatial areas.

The effects of changes in space-time ratios of residential neighborhoods caused by construction of a freeway can have a considerable impact on the structures of these neighborhoods. The type of impact is a result of many factors, including the age of the neighborhood, its location, and its land-use characteristics. For example, the effects of building a freeway through a central city neighborhood may be to make it become relatively more isolated as local places of employment, business establishments, and service delivery organizations leave the congested central business district for more attractive locations in the suburbs. On the other hand, relatively isolated areas may become more centrally located as a result of accessibility created by the freeway and may become major sites of real estate development and commercial activity as a result.

Changes in Study Areas

Census tract data for 1960 and 1970 were compared to determine what changes have occurred in some of the characteristics of the study areas since the construction of the freeway. In using tract statistics in this manner, it is assumed that the characteristics of the study areas are generally the same as those of the larger census tracts. The census tract designations for the study areas are as follows:

Study Area	1960 Tract No.	1970 Tract No.
Shepherd	42	0404
Stella Link	113-G	0415
Post Oak	67-B	0418, 0419

Boundaries for the census tracts that include the Shepherd and Stella Link study areas were the same for both the 1960 and 1970 enumerations. Boundaries of the census tract that included the Post Oak area in 1960 were redrawn in 1970 so that this area comprised the major portions of two census tracts. Data for these two tracts were combined and considered as a single area so that indirect comparisons could be made between characteristics of the Post Oak area in 1960 and 1970. In making these comparisons, some error is introduced into the inferences made about structural changes that have occurred in the area. With this restriction, broad conclusions about the nature, direction, and general magnitude of changes in the Post Oak area are included for comparison purposes.

Changes in Housing Characteristics

Selected characteristics of housing units in the study area census tracts are shown for 1960 and 1970 in Table 2. Two trends that have caused major changes in housing characteristics of the study areas can be seen from an examination of these data.

The first trend is an increase in residential density, as evidenced by the increase in the number of housing units in each area, the decrease in the proportion of single-unit residential structures, and the decrease in the median number of rooms per housing unit. Over the ten-year period, the number of housing units increased 5 percent in the Shepherd area, 42 percent in the Stella Link area, and over 400 percent in the Post Oak area. Over the same period, the proportion of single-unit residential structures decreased 8 percent in the Shepherd area, 22 percent

Table 2

Selected Characteristics of Housing Units in Study Area Census Tracts, 1960 and 1970

Characteristic	Area					
	Post Oak (Elevated)		Stella Link (On Grade)		Shepherd (Depressed)	
	1960	1970	1960	1970	1960	1970
Total Number of Units	1896	(9557)[a]	3486	4940	3768	3961
Type of Occupancy						
Owner Occupied	52.2%	25.8%	90.6%	68.7%	29.4%	26.0%
Renter Occupied	32.9%	60.8%	5.0%	26.5%	56.6%	63.5%
Vacant	14.9%	13.3%	4.4%	4.8%	14.0%	10.4%
Units in Structure						
1	62.5%	36.1%	99.2%	77.2%	43.0%	35.4%
2	1.4%	0.2%	0.1%	0.3%	13.6%	12.3%
3 - 4	5.1%	3.3%	...[b]	...[b]	16.5%	15.5%
5 or more	31.2%	59.8%	0.7%	22.5%	26.8%	36.8%
Rooms Per Unit						
1 room	0.1%	0.1%	...[b]	3.0%	6.6%	6.3%
2 rooms	3.3%	8.5%	0.1%	3.3%	8.0%	13.7%
3 rooms	19.6%	25.9%	0.2%	6.3%	25.5%	22.6%
4 rooms	16.7%	23.4%	2.3%	9.7%	15.2%	16.6%
5 rooms	14.5%	18.6%	13.2%	14.7%	15.2%	15.4%
6 rooms	22.2%	13.4%	38.8%	28.3%	12.4%	11.2%
7 rooms	17.8%	6.6%	29.7%	20.9%	8.3%	6.6%
8 rooms or more	5.9%	2.8%	15.6%	13.8%	8.9%	7.5%
Median number of rooms	5.2	4.1	6.4	6.0	4.2	3.9
Persons Per Occupied Unit						
1 person	17.6%	24.6%	1.9%	12.9%	34.6%	43.9%
2 persons	34.6%	38.7%	18.5%	28.3%	41.5%	37.3%
3 persons	18.7%	18.0%	20.9%	20.3%	12.8%	10.3%
4 persons	15.8%	10.3%	28.5%	20.2%	6.3%	5.0%
5 persons	7.9%	5.3%	18.4%	10.9%	3.0%	2.2%
6 persons or more	5.6%	3.2%	11.7%	7.5%	1.8%	1.3%

Source: U.S. Department of Commerce, Bureau of the Census, Census of Population and Housing, 1960 and 1970.

Table 2 continued

Characteristic	Area					
	Post Oak (Elevated)		Stella Link (On Grade)		Shepherd (Depressed)	
	1960	1970	1960	1970	1960	1970
Median Persons Per Unit						
All occupied units	2.4	2.2	3.8	2.9	1.9	1.7
All owner-occupied units	3.1	2.5	3.9[b]	3.3	2.3	2.1
All renter-occupied units	1.9	2.1	...	2.1	1.7	1.5
Year Structure Built						
1960 - 1969	N.A.[c]	61.9%	N.A.	33.5%	N.A.	10.9%
1950 - 1959	88.2%	25.6%	99.3%	65.9%	2.4%	23.9%
1940 or earlier	11.8%	12.5%	0.7%	0.6%	76.0%	65.0%

[a]Number of housing units for 1970 not directly comparable with 1960 data due to change in census boundaries. See text for full explanation.

[b]Less than 1%.

[c]N.A. - Not Applicable.

in the Stella Link area, and 26 percent in the Post Oak area. The median number of rooms decreased by 7 percent in the Shepherd area, 6 percent in the Stella Link area, and 26 percent in the Post Oak area.

The second trend, which is closely related to the first, is an increase in the proportion of renter-occupied units over owner-occupied units. The proportion of renter-occupied units in 1970 as compared to 1960 was 3 percent greater in the Shepperd area, 28 percent greater in the Stella Link area, and 26 percent greater in the Post Oak area.

Changes in Personal Characteristics of Study Area Residents

The changes that occurred in the housing characteristics of the study areas were accompanied by corresponding changes in the characteristics of the residents of these areas. Previous research has shown that the type of person most attracted to areas of high accessibility and multi-unit rental housing are young, mobile, single adults and married couples with no children.[1] A comparison of the 1960 census statistics with those for 1970 indicates a trend toward an increase in the proportion of these persons as residents of the study areas. Table 3 shows the age distribution and the marital status of study area residents. Each area experienced some increase in the percentage of residents aged 20-24, and some increase in the percentage of single and divorced residents. The increase in the 20-24 age group was 7 percent in the Shepherd area, 5 percent in the Stella Link area, and 9 percent in the Post Oak area. Similarly, the percentage

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[1] See Janet Abu-Lughod and Mary Mix Foley, "The Consumer Votes by Moving," in Robert Guttman and David Popenoe (eds.), Neighborhood, City, and Metropolis, (New York: Random House, 1970), pp. 460-478.

Table 3

Age Distribution of Residents and Marital Status of Individuals 14 Years and Older in Study Area Census Tracts, 1960 and 1970

	AREA					
	Post Oak (Elevated)		Stella Link (On Grade)		Shepherd Ave. (Depressed)	
	1960	1970	1960	1970	1960	1970
No. of Persons	4,676	(20,538)[a]	12,791	14,834	6,915	6,805
Area						
Under 5 years	9.2%	9.0%	14.6%	7.8%	4.8%	4.3%
5 - 9	9.9%	7.1%	15.7%	10.1%	3.6%	3.3%
10 - 14	8.2%	6.3%	10.2%	11.5%	3.9%	3.4%
15 - 19	5.8%	6.9%	5.0%	10.1%	5.0%	6.1%
20 - 24	6.5%	15.7%	2.0%	6.5%	11.5%	18.6%
25 - 44	32.1%	30.5%	37.3%	27.9%	27.1%	28.5%
45 - 64	22.3%	19.4%	13.2%	19.0%	29.0%	20.4%
65 and older	6.1%	6.6%	2.0%	7.1%	15.1%	15.4%
Marital Status						
Single	19.0%	22.1%	13.8%	39.4%	26.5%	33.3%
Married	69.9%	65.0%	81.4%	50.5%	52.2%	47.5%
Widowed	7.3%	5.8%	3.4%	2.3%	12.9%	2.0%
Divorced	3.8%	7.7%	1.4%	7.9%	8.3%	9.7%

[a]Population data for 1970 are not directly comparable with data for 1960 due to changes in the census tract boundaries. See text for explanation.

Source: U.S. Department of Commerce, Bureau of the Census, Census of Population and Housing, 1960 and 1970.

of single and divorced persons increased 9 percent in the Shepherd area, 22 percent in the Stella Link area, and 7 percent in the Post Oak area.

The shift in age composition and marital structure was accompanied by a shift in residential composition. The housing data in Table 2 show a decline in the median number of persons per housing unit in each of the study area census tracts from 1960 and 1970. This is consistent with the increase in the proportion of younger adults, and in single and divorced persons residing in the study areas. This shift was such that the population of the Shepherd area decreased by 5 percent, while the number of housing units increased by 5 percent, and the vacancy rate in the area fell from 14 percent to 10 percent.

Each of the study areas was characterized by high residential mobility over the intercensual period. From Table 4, it can be seen that 53 percent of Shepherd area residents had moved to their residential location within three years prior to the 1970 Census survey. Thirty-four percent of Stella Link residents and 63 percent of Post Oak residents had moved to their residence during this period. In the ten-year period from 1960 to 1970, 79 percent of Shepherd residents, 69 percent of Stella Link, and 85 percent of Post Oak residents had moved to their residential location.

Financial Characteristics of Study Area Residents in 1970

Some financial characteristics of the residents of study area census tracts for 1970 are shown in Tables 4 and 5. In general, income levels in all three areas are high. The median income is almost $10,000 for the Shepherd area, $14,000 for the Stella Link area, and $12,000 for the Post

Table 4

Personal and Financial Characteristics by Housing Units in Study Area Census Tracts, 1970

Characteristic	Area		
	Post Oak (Elevated)	Stella Link (On Grade)	Shepherd (Depressed)
Income of Families and Unrelated Individuals			
Less than $1,000	1.2%	0.4%	1.6%
$1,000 - $1,999	1.0%	0.5%	3.5%
$2,000 - $2,999	0.9%	0.8%	6.9%
$3,000 - $4,999	4.1%	2.7%	9.2%
$5,000 - $6,999	8.6%	4.6%	10.7%
$7,000 - $9,999	18.7%	13.4%	19.5%
$10,000 - $14,999	34.4%	33.5%	21.4%
$15,000 - $24,999	23.7%	31.8%	12.9%
$25,000 or more	6.4%	12.1%	14.4%
Median Income	$11,987	$13,994	$ 9,806
Mean Income	$14,037	$16,028	$15,160
Automobiles Available			
None	3.8%	2.6%	15.3%
1	51.3%	35.9%	54.4%
2	38.6%	49.7%	26.3%
3 or more	6.2%	11.7%	4.0%
Year Moved Into Unit			
1968 to March 1970	63.4%	34.3%	53.3%
1965 to 1967	12.6%	20.4%	13.6%
1960 to 1964	8.9%	13.9%	11.8%
1950 to 1959	11.5%	31.1%	11.5%
1949 to earlier	3.7%	0.2%	9.7%

Source: U.S. Department of Commerce, Bureau of the Census, Census of Population and Housing, PHC(1) - 89, 1970

Table 5

Value of Owner Occupied Units and Gross Rent of Renter Occupied Units in Study Area Census Tracts, 1970

Characteristic	Area		
	Post Oak (Elevated)	Stella Link (On Grade)	Shepherd (Depressed)
Value of Owner Occupied Units			
Less than $20,000	65.6%	42.7%	38.3%
Less than $5,000	0.3%	0.1%	1.1%
$5,000 - $7,499	1.0%	0.1%	0.3%
$7,500 - $9,999	2.7%	0.4%	2.0%
$10,000 - $14,999	30.9%	8.1%	10.8%
$15,000 - $19,999	30.7%	34.0%	24.1%
$20,000 - $24,999	11.9%	26.6%	15.8%
$25,000 - $39,999	12.3%	27.2%	17.5%
$35,000 - $49,999	5.7%	5.5%	11.0%
$50,000 or more	4.5%	0.8%	17.5%
Median Value	$18,733	$21,600	$23,700
Gross Rent			
Less than $100	2.3%	1.2%	47.5%
Less than $40	....	...	0.2%
$40 - $59	0.4%	...	1.4%
$60 - $79	0.4%	0.8%	7.3%
$80 - $99	1.5%	0.4%	19.4%
$100 - $149	43.3%	26.4%	47.7%
$150 - $199	42.0%	44.4%	13.1%
$200 or more	11.0%	25.6%	7.5%
No cash rent	1.4%	2.4%	3.3%
Median	$154	$174	$118

Source: U.S. Department of Commerce, Bureau of the Census, Census of Population and Housing, PHC(1) - 89, 1970

Oak area. This level of income is reflected in the financial characteristics of housing in each area. The median value of owner-occupied units ranges from $18,733 in the Post Oak area to $23,700 in the Shepherd area. It is interesting to note that over 17 percent of the owner-occupied units in the Shepherd area are valued at $50,000 or more.

Automobiles Available to Study Area Residents in 1970

The number of automobiles available in each study area by housing unit is shown in Table 4. Approximately 85 percent of the housing units in the Shepherd area have one or more automobiles available. Approximately 97 percent of the housing units in the Stella Link area and 96 percent of those in the Post Oak area have at least one automobile available. The proportion of housing units with two or more automobiles available is approximately 30 percent for the Shepherd area, 61 percent for the Stella Link area, and 45 percent for the Post Oak area. These statistics reflect the high economic status and physical mobility of the study area residents. The high rate of availability of automobiles is consistant with the hypothesis that study area residents are oriented to the automobile as a major means of transportion and with the assumption that the freeway has impacted upon the study areas by increasing their accessibility.

Summary

The construction of a freeway can have a major impact on an urban residential neighborhood by altering its space-time ratios with other areas within the city. If space-time ratios are lowered substantially, the

residential area becomes more accessible and its value for residential and/or commercial purposes increases. Comparison of census data for 1960 and 1970 indicates the three study areas underwent substantial change that may have been a result of being more accessible after the construction of Southwest Freeway and IH 610. Some of the changes that took place in study area census tracts were: 1) an increase in the number of housing units; 2) an increase in the percentages of multi-unit structures and rental units; 3) an increase in the percentages of young adults and single persons; and 4) a high mobility rate among area residents.

The socioeconomic level of study area residents is generally high. Each of the study areas is characterized by a high incidence of automobile availability, which suggests a dependency on automobile transportation.

PART II

CHARACTERISTICS OF SURVEY RESPONDENTS

Personal Characteristics

The distribution of respondents by age, sex, years of education, and ethnic background are shown in Table 6. These statistics are summarized as follows. The mean age of all respondents is 47.3 years. Approximately 52 percent of the respondents interviewed are female. Approximately 58 percent of the respondents are the head of the household, 40 percent are the spouse of the head, and the remaining 2 percent of the sample are comprised of other household members. The mean number of years of education for all respondents is 13.7 years. Only a very small proportion of the respondents, approximately 2 percent of the sample, are from ethnic backgrounds other than Anglo.

Household Composition

The composition of respondents' households is shown in Table 7. Overall, approximately 68 percent of the households in the sample consist of persons living alone, and married couples without children or other persons in the household. This percentage is almost evenly divided between single persons and married couples, with 31 percent and 37 percent of all households respectively belonging to each group. Within design subareas, the household compositions show considerable variation. In the elevated and on-grade design subareas, 20 percent and 17 percent, respectively, of the households sampled consist of single persons living alone, while in the depressed design subarea, 53 percent of the households

Table 6

Percent Distribution of Respondents by Age, Sex, Years of Education, Ethnic Background, and Relation to Head of Household by Design Subarea

Characteristic	Design Subarea			
	Elevated (N=29)	On Grade (N=25)	Depressed (N=32)	All Subareas (N=86)
Age				
20 - 29	20%	14%	25%	20%
30 - 39	12%	21%	22%	19%
40 - 49	16%	21%	12%	16%
50 - 59	16%	14%	16%	15%
60 - 69	32%	24%	16%	23%
70 and above	4%	7%	9%	7%
Mean Age	50.9 yrs.	46.7 yrs.	45.4 yrs.	47.3 yrs.
Sex				
Male	40%	34%	66%	48%
Female	60%	66%	34%	52%
Years of Education				
8	0%	3%	0%	1%
9 - 12	52%	41%	25%	38%
13 - 15	12%	24%	28%	22%
16 - 20	20%	28%	41%	30%
No Response	16%	3%	6%	8%
Mean Years of Education	13.5 yrs.	13.2 yrs.	13.9 yrs.	13.7 yrs.
Ethnic Background				
Anglo	96%	97%	100%	98%
Black	0%	3%	0%	1%
Other	4%	0%	0%	1%
Relationship of Respondent to Head of Household				
Head of Household	40%	59%	72%	58%
Spouse	52%	41%	28%	40%
Child	4%	0%	0%	1%
Other Household Member	4%	0%	0%	1%

Table 7

Household Composition of Respondents by Design Subarea

Characteristic	Design Subarea			
	Elevated (N=25)	On Grade (N=29)	Depressed (N=32)	All Subareas (N=86)
Number of Persons in Household				
1	20%	17%	53%	31%
2	48%	55%	25%	42%
3 - 4	28%	24%	16%	22%
5 or more	4%	3%	6%	5%
Mean Persons per Household	2.2	2.2	2.0	2.1
Household Composition				
Head of Household with no Spouse:				
Living Alone	20%	17%	53%	31%
Living with Children	0%	21%	3%	8%
Living with Persons Other Than Children	0%	0%	9%	3%
Head of Household with Spouse:				
Living with Spouse Alone	48%	45%	22%	37%
Living with Children	20%	10%	12%	14%
Living with Persons Other Than Children	12%	7%	0%	6%

consist of single persons. Conversely, only 22 percent of the households in the depressed design subarea consist of married couples without children, while 45 percent of the households in the elevated subarea and 45 percent of the households in the on-grade subarea have this composition. The largest variation in the subarea samples is among households comprised of heads of households without spouses who live with children. These households comprise none of the elevated subarea, 21 percent of the on-grade, and 3 percent of the depressed design subareas.

Income

The distribution of respondents by total family income for 1973 is shown in Table 8. In general, the study sample can be characterized as comprised of respondents in the middle and upper income ranges. The mean family income of all respondents is $15,902. Approximately 80 percent of all respondents had annual family incomes of $10,000 or more. The per-capita income for all households in the study sample is $7,572.

Housing Characteristics

Physical Characteristics of Housing

The physical characteristics of respondents' dwelling units are shown in Table 9. Overall, dwelling units of respondents in the study sample can be generally characterized as moderately old to old, fairly large, most likely to be a single family dwelling, and in excellent condition. The average age for all dwelling units is 17.6 years, and the mean number of rooms is 5.27 per unit. Approximately 63 percent of all

Table 8

Percent Distribution of Respondents by Family Income and Design Subarea

Characteristic	Design Subarea			
	Elevated (N=25)	On Grade (N=29)	Depressed (N=32)	All Subareas (N=86)
Income				
$3,000 - $4,999	8%	3%	6%	6%
$5,000 - $6,999	4%	7%	0%	3%
$7,000 - $9,999	4%	10%	12%	9%
$10,000 - $14,999	8%	3%	22%	12%
$15,000 - $24,999	24%	6%	6%	11%
$25,000 or more	12%	17%	6%	12%
Income not reported	40%	52%	47%	46%
Mean Income of Those Reporting	$18,643	$15,800	$13,735	$15,902

Table 9

Physical Characteristics of Respondents' Dwelling Units by Design Subarea

Characteristic	Design Subarea			
	Elevated (N=29)	On Grade (N=25)	Depressed (N=32)	All Subareas (N=86)
Type of Dwelling				
Single Family	72%	79%	41%	63%
Duplex	0%	0%	6%	2%
Apartment House	28%	21%	53%	35%
Age of Dwelling				
Less than 5 Years	0%	0%	3%	1%
5 - 9	16%	0%	6%	7%
10 - 14	16%	3%	9%	9%
15 - 19	44%	45%	19%	35%
20 - 29	24%	52%	53%	44%
30 Years or more	0%	0%	9%	3%
Mean Age of Dwellings	14.9 yrs.	18.5 yrs.	18.9 yrs.	17.6 yrs.
Heated Area				
499 sq. ft. or less	8%	3%	25%	13%
500 - 999	8%	10%	19%	13%
1,000 - 14,999	8%	7%	3%	6%
15,000 - 19,999	8%	21%	12%	14%
20,000 or more	40%	28%	3%	22%
Don't Know	28%	31%	38%	33%
Number of Rooms				
2 - 3	16%	7%	47%	24%
4 - 5	4%	14%	22%	14%
6 - 7	52%	45%	12%	35%
8 or more	12%	3%	6%	7%
No Response	16%	31%	12%	20%
Mean Number of Rooms	6.00	5.75	4.39	5.27

dwelling units are single-family type, and 37 percent are multi-unit apartments of duplexes.

The characteristics of dwelling units vary considerably between design subareas. The elevated and on-grade areas are comprised predominantly of single family dwellings, while the depressed design subarea is comprised largely of apartment dwellings and duplexes. Approximately 76 percent of the units in the elevated area were built after 1954, while 52 percent of the dwellings in the on-grade area and 62 percent of the dwellings in the depressed area were built before 1954.

Financial Characteristics of Housing

Some financial characteristics of dwelling units in the sample are shown in Table 10. Each design subarea exhibits a high percentage of respondents who rent compared to respondents who own their dwelling. The proportion of renters ranges from 34 percent in the depressed subarea to 45 percent in the on-grade subarea. The estimated values of owner-occupied dwellings and the estimated monthly rent paid reflect the high economic status of the respondents. The mean value for owner-occupied dwellings for all respondents who reported this information is $28,846. The mean monthly rent paid by reporting respondents is $152.

Length of Residency

Information regarding the length of respondent residency is shown in Table 11. The information regarding length of respondent residency in their neighborhood indicates that each of the study sections is very stable with respect to resident movement. Respondents show a tendency

Table 10

Financial Characteristics of Respondents' Dwelling Units by Design Subarea

Characteristic	Design Subarea			
	Elevated (N=25)	On Grade (N=29)	Depressed (N=32)	All Subareas (N=86)
Household Tenure				
Owner	60%	55%	66%	55%
Renter	40%	45%	34%	45%
Estimated Value of Owner-Occupied Dwelling Units				
Less than $20,000	0%	0%	10%	3%
$20,000 - $29,999	47%	21%	50%	38%
$30,000 - $39,999	13%	57%	0%	26%
$40,000 - $49,999	33%	14%	0%	18%
$50,000 - $59,999	7%	7%	0%	5%
$60,000 or more	0%	0%	40%	10%
Gross Monthly Rent				
Less than $100	0%	0%	5%	3%
$100 - $149	12%	11%	14%	13%
$150 - $199	0%	11%	23%	15%
$200 or more	0%	11%	0%	3%
No Response	88%	67%	59%	67%

Table 11

Percent Distribution Length of Respondent Residency by Design Subarea

Characteristic	Design Subarea			
	Elevated (N=29)	On Grade (N=25)	Depressed (N=32)	All Subareas (N=86)
Length of Residency In Neighborhood				
1 - 5 years	32%	41%	41%	38%
1 year	4%	7%	16%	8%
2 years	8%	17%	16%	14%
3 years	0%	7%	3%	3%
4 years	12%	3%	6%	7%
5 years	8%	7%	0%	6%
6 - 9 years	16%	14%	28%	20%
10 - 14 years	20%	17%	16%	17%
15 - 19 years	28%	4%	3%	10%
20 years or more	4%	25%	12%	14%
Mean Years of Residency in Neighborhood	9.96 yrs.	10.10 yrs.	7.40 yrs.	9.37 yrs.
Length of Residency at Address				
1 year	4%	3%	16%	9%
2 years	8%	17%	16%	14%
3 years	0%	7%	3%	2%
4 years	12%	3%	6%	7%
5 years	8%	7%	0%	7%
6 - 9 years	16%	14%	28%	19%
10 - 14 years	20%	17%	16%	16%
15 - 19 years	28%	4%	3%	10%
20 years or more	4%	25%	12%	14%
Mean Years of Residency at Address	9.59 yrs.	9.96 yrs.	7.40 yrs.	9.37 yrs.

both to remain in their neighborhood and to remain at the same address. For all respondents, the mean length of residency in the neighborhood is 9.37 years, and the mean length of residency at the address is 9.17 years. Only 4 of the 86 respondents (5 percent of the sample) had resided at addresses in the neighborhood other than the one at which they were residing at the time of their interview.

Respondents were classified by type of tenure and length of residency in the neighborhood in order to see if differences in length of residency existed between respondents who were owners and respondents who were renters. This information is shown in Table 12. There are major differences between owners and renters with respect to length of residency. Sixty-two percent of the renters had resided in the neighborhood for 5 years or less, while 68 percent of the owners had been residents for 10 years or longer. The mean length of residency is 12.61 years for owners as opposed to 4.59 years for renters.

Travel Characteristics

As discussed earlier, one of the benefits of a freeway for those who live in its vicinity is the physical mobility that it provides. A freeway has the greatest potential utility for those individuals and families who can take full advantage of the access afforded by the automobile. Financial and social characteristics of the study area residents demonstrate an orientation toward the automobile as a primary mode of transportation. For example, incomes of respondents are high enough so that the cost of owning and operating an automobile can be met with little difficulty. At the same time, age and family structures are such that access to other areas is both necessary and highly desirable.

Table 12

Percentage Distribution of Respondents by Length of Residency in Neighborhood and Type of Tenure

	Tenure		
	Owner (N=47)	Renter (N=39)	Total (N=86)
Length of Residency in Neighborhood			
1 - 5 years	16%	62%	38%
1 year	0%	18%	8%
2 years	6%	23%	14%
3 years	4%	3%	3%
4 years	2%	13%	7%
5 years	6%	5%	6%
6 - 9 years	13%	28%	20%
10 - 14 years	23%	10%	17%
15 - 19 years	19%	0%	10%
20 years or more	26%	0%	14%
Mean Length of Residency	12.61 yrs.	4.59 yrs.	9.37 yrs.

Chi-square with 4 d.f. = 9.60. $p < .05$, significant.

In the analysis of the characteristics of residents of study area census tracts, a high level of automobile ownership was found. Given the financial characteristics of respondents, a high level of automobile ownership should also be present among this group, and the automobile should be the primary mode of transportation utilized by this group.

Number of Automobiles Owned by Members of Respondent Households

The distribution of respondents by the number of automobiles owned is shown in Table 13. As indicated by the number of automobiles owned, there seems to a strong orientation toward the automobile as a means of transportation among study respondents. Approximately 91 percent of respondent households have at least 1 automobile, and 50 percent of the households have 2 or more automobiles. Furthermore, those households without automobiles are predominantly those headed by elderly persons. Six of the 8 households without automobiles are headed by persons 60 years of age or older. Thus, the households without automobiles are those headed by the group of persons who would be expected to be the least mobile.

No statistical significance was found in the degree of automobile ownership by either design subareas or distance zones.

Modes of Transportation Utilized by Respondents

The percentage of respondents who report the use of various modes of transportation is shown in Table 14. Approximately 93 percnet of the resondents report utilizing the automobile to meet some or all of

Table 13

Percent Distribution of Number of Automobiles Owned by Members of Respondent Households by Design Subarea and by Distance Zone

Characteristic	Design Subarea[a]			
	Elevated (N=25)	On Grade (N=29)	Depressed (N=32)	All Subareas (N=86)
Number of Automobiles Owned				
0	12%	3%	12%	9%
1	36%	41%	44%	41%
2	40%	52%	44%	45%
3	12%	3%	0%	5%

	Distance Zone[b]			
	1 (N=25)	2 (N=30)	3 (N=31)	All Zones (N=86)
Number of Automobiles Owned				
0	8%	10%	10%	9%
1	52%	33%	39%	41%
2	36%	57%	42%	45%
3	4%	0%	10%	5%

[a]Chi-square with 6 degrees of freedom = 6.74. $p > .05$, not significant.

[b]Chi-square with 6 degrees of freedom = 5.79. $p > .05$, not significant.

Table 14

Percentage of Respondents who Use Various Modes of Transportation, by Design Subarea and by Distance Zone

	Design Subarea[a]			
	Elevated	On Grade	Depressed	All Subareas
Mode of Transportation				
Automobile	92%	97%	91%	93%
Bus	12%	17%	12%	14%
Taxi	4%	14%	6%	8%
Walking	0%	0%	0%	0%
Bicycle	0%	0%	6%	2%
Total Number of Responses	(27)	(37)	(37)	(101)

	Distance Zone[a]			
	1	2	3	All Zones
Mode of Transportation				
Automobile	92%	93%	94%	93%
Bus	8%	20%	13%	14%
Taxi	8%	13%	3%	8%
Walking	0%	0%	0%	0%
Bicycle	0%	3%	3%	2%
Total Number of Responses	(27)	(39)	(35)	(101)

[a]Percentages for each column do not total 100 because of multiple responses.

their transportation needs. This figure is consonant with the high level of automobile ownership reported by respondents. In addition, the eight respondents who reported that they did not utilize the automobile as a means of transportation are the same respondents who reported that they did not own an automobile. All of these persons reported using taxis, buses, or both as an alternative to automobile transportation.

The differences in response rates between the different design subareas and between the different distance zones are well within the limits of sampling variation. Thus, the responses in Table 14 represent a high degree of utilization of automobile transportation by respondents regardless of the design of the freeway in their vicinity, or the distance respondents live from the freeway.

These data are consistent with a picture of a group of persons who are physically mobile and have the financial resources to take advantage of the access afforded by the freeway. Furthermore, since only two of the respondents report utilizing walking or bicycles as major modes of transportation, it can be inferred that the orientation of respondents is toward activities outside their neighborhood which could not be reached by foot or bicycle.

PART III

OPINIONS OF STUDY RESIDENTS CONCERNING FREEWAY LOCATION, DESIGN, AND IMPACT

One of the major objectives of the study was to determine the opinions of persons living near the freeway concerning the preferred locations of residences with respect to the freeway, and to determine if one type of freeway design was considered more desirable than others. To satisfy these objectives, respondents were interviewed extensively to determine their opinions concerning various aspects of the freeway.

Analysis of Data

The major focus of the analysis of data in this section was on relating respondents' opinions toward the freeway to some of the variables that could be controlled in the design and construction of future freeways. In this regard, one of the major concerns was whether opinions varied significantly by type of freeway design and by the distance of residences from the freeway. For this reason, hypotheses of significant differences in respondent opinions by design subarea, and hypotheses of significant differences in respondent opinions by distance zone were subjected to statistical tests whenever appropriate.

Opinions of Respondents Regarding Location of Residences

The degree to which an individual is favorable to the presence of the freeway can be viewed as a function of the amount of satisfaction he feels toward his place of residence, and whether he sees the freeway as enhancing this satisfaction or detracting from it. This section

examines the responses to a series of questions asked of each respondent to determine (1) the reasons for locating at his place of residence, (2) whether or not the respondent liked living at his residential location, and (3) whether or not the respondent was satisfied with the location of the freeway relative to his neighborhood and residence.

Reasons for Locating at Present Address

Each respondent was asked to list the major reasons for choosing his present residential location. The distribution of coded responses is shown in Table 15. The most frequent reason given by all respondents was that the residence was chosen because it was "located in a good neighborhood." "Being close to work" and "being the best for the money" were the next most frequent reasons given. Only 2 respondents (2 percent of the sample) indicated that their residence was the only one available to them.

Respondents were classified according to whether they had moved to their present residence before or after the freeway had been constructed in order to determine if there were significant differences in the reasons given for moving into the study neighborhoods that could be attributed to the construction of the freeway. The resultant distribution is shown in Table 16. The major difference in the two groups is that those who moved to their address after the freeway was built gave "best for the money" with greater frequency and "good neighborhood" with lesser frequency than did those who moved to their address before the freeway was built. However, differences in the frequency distributions of the responses of the two groups are not statistically significant.

Table 15

Distribution of Responses to the Question "What was the Main Reason For Locating at this Address," by Design Subarea and by Distance Zone

Response	Design Subarea[a]			
	Elevated	On Grade	Depressed	All Subareas
Best for Money	17%	20%	16%	17%
Good Neighborhood	59%	68%	50%	58%
Only Available	3%	0%	3%	2%
Close to Work	21%	20%	22%	21%
Other Responses	21%	12%	12%	15%
Total Number of Responses	(35)	(30)	(33)	(98)

Response	Distance Zone[a]			
	1	2	3	All Zones
Best for Money	16%	7%	29%	17%
Good Neighborhood	64%	57%	45%	58%
Only Available	0%	3%	3%	2%
Close to Work	4%	23%	32%	21%
Other Responses	20%	17%	4%	15%
Total Number of Responses	(26)	(35)	(37)	(98)

[a]Percentages in each column do not total 100 because of multiple responses.

Table 16

Percent Distribution of Responses to the Question "What was the Main Reason for Locating at This Address," by Respondents Moving to Location Before or After Construction of Freeway

Response	Respondent Moved to Location[a]		All Respondents
	Prior to Construction of Freeway	After Construction of Freeway	
Best for Money	4%	22%	17%
Good Neighborhood	74%	52%	58%
Only Available	4%	2%	2%
Close to Work	17%	22%	21%
Other Responses	22%	13%	15%
Total Number of Responses	(28)	(71)	(99)

[a]Percentages for each column do not total 100 because of multiple responses.

Chi-square with 4 d.f. = 5.68. $p > .05$, not significant.

Satisfaction with Residential Location

Respondents were asked to express a general opinion of their residential location. Responses were coded according to whether the opinion was generally favorable, unfavorable, or one of indifference toward the residential location. Tabulated results are shown in Tables 17 and 18. In general, respondents tended to express satisfaction with their place of residence. In the total sample, 86 percent of the respondents gave a favorable opinion of their residential location, 7 percent gave an unfavorable opinion, and 7 percent were indifferent toward their residential location.

Differences in Opinion of Residential Location by Design Subarea

When respondents are classified according to design subarea, the proportion of favorable opinions varies from 76 percent of those in the on-grade subarea to 100 percent of those in the elevated subarea, as shown in Table 18. The Chi-square statistic for this contingency table is not significant at the 95 percent confidence level.

Differences in Opinion of Residential Location by Distance Zones

When respondents are classified according to distance zone, the proportion of favorable opinions ranged from 76 percent of those respondents in zone 1 to 96 percent of those in zone 2, as shown in Table 18. The Chi-square statistic for this contingency table is significant at the 95 percent confidence interval. An examination of the table indicates that a significantly greater percentage of the respondents who live in zone 1 expressed opinions unfavorable toward their residential

Table 17

Distribution of Responses to the Question "How Do You Like Living at this Location," by Design Subarea and by Distance Zone

Type of Response	Design Subarea[a]			
	Elevated (N=25)	On Grade (N=29)	Depressed (N-32)	All Subareas (N-86)
Favorable	100%	76%	81%	86%
Indifferent	0%	20%	3%	7%
Unfavorable	0%	4%	16%	7%

Type of Response	Distance Zone[b]			
	1 (N=25)	2 (N=30)	3 (N=31)	All Zones (N=86)
Favorable	76%	96%	88%	86%
Indifferent	10%	4%	6%	7%
Unfavorable	14%	0%	6%	7%

[a]Chi-square with 2 d.f. = 5.15. $p > .05$, not significant.

[b]Chi-square with 2 d.f. = 16.01. $p < .001$, significant.

Table 18

Distribution of Responses to the Question "How Do You Like Living in this Location," by Respondent Moving to Location Before or After Construction of Freeway

Type of Response	Respondent Moved to Location		
	Prior to Construction of Freeway (N=23)	After Construction of Freeway (N=53)	All Respondents (N=86)
Favorable	83%	87%	86%
Indifferent	0%	10%	7%
Unfavorable	17%	3%	7%

Chi-square with 2 d.f. = 7.11. $p < .05$, significant.

location with respect to those who live in zones 2 and 3. Zone 1 contains those residences which abut the freeway. Therefore, it can be concluded that those respondents whose residences abut the freeway tend to be somewhat more unfavorable toward their residential location than do those residents who live at greater distances.

Differences in Opinion of Residential Location by Respondent Moving to Residential Location Before or After Construction of the Freeway

Those respondents who moved to their residential location after the construction of the freeway had an advantage over those respondents who moved to their residential location before construction of the freeway in that the post-construction respondents could take the presence of the freeway into account when choosing their residential location. The post-construction residents could weigh the assets and liabilities of living in the proximity of the freeway in the process of choosing their residential location, an option that was denied the pre-construction residents. This factor could affect the amount of satisfaction with the residential location, and hence the type of opinion expressed by the respondent.

To examine this hypothesis, the sample responses were classified according to whether the respondent had moved to his residential location before or after the construction of the freeway in his own area. The resulting distribution is shown in Table 18. The proportion of the pre-construction and post-construction residents who expressed favorable opinion toward their residential locations is approximately the same, consisting of 83 percent and 87 percent of each group, respectively. However, a noticeably greater proportion of pre-construction respondents

tended to be unfavorable toward their residential location, in contrast to post-construction respondents who tended to be indifferent to their location. In the pre-construction group, 17 percent, of all those respondents who did not express favorable opinions expressed unfavorable opinions. On the other hand, in the post-construction group, 10 percent of the respondents expressed opinions of indifference, and only 3 percent expressed unfavorable opinions toward their residential location. The Chi-square statistic for this contingency table is significant at the 95 percent confidence level.

Satisfaction with Freeway Location

Respondents' satisfaction with the location of the freeway can be analyzed as a function of two separate factors. These are: (1) the degree to which the presence of the freeway interferes with neighboring relationships and neighborhood activities that the individual feels are an important part of his social structure, and (2) the degree to which the individual's quality of life is affected by such freeway-related problems as noise pollution, air pollution, and traffic congestion. This section examines respondent opinions regarding the location of the freeway with respect to each of these two factors.

Location of the Freeway with Respect to the Neighborhood

The impacts of freeway construction on the social structure of an urban neighborhood depend to a large extent on the ways that neighborhood residents orient their social patterns. In this regard, a distribution between local and urban orientations toward life is useful.[1]

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[1] See Suzanne Keller, The Urban Neighborhood (New York: Random House, 1968), p. 160.

Locally-oriented residents concentrate on the immediate area for the satisfaction of basic social, personal, and material needs. Urban-oriented individuals use local facilities, services, and social contacts in a much more limited and less exclusive way and look to the wider society for these things. Local types reside in the city but live in the neighborhood; the urban types reside in the neighborhood but live in the city.

Social patterns of locally-oriented residents will be disrupted to some extent by the construction of a freeway through their neighborhood. Consequently, locally-oriented individuals should tend to have negative opinions regarding the presence of the freeway in their neighborhood. Conversely, social patterns of urban-oriented residents will be minimally disrupted by freeway construction through their neighborhood, and their lifestyles will be enhanced by the access afforded by the freeway. Consequently, urban-oriented residents should tend to be positively oriented or indifferent to the presence of a freeway in their neighborhood.

The findings discussed in previous sections suggest that, in general, the study sample is urban oriented rather than local oriented. Respondents tend to be physically mobile, do little walking, make considerable use of automobile transportation, and are of relatively high socioeconomic status. All these characteristics are consistent with an urban-oriented life style.[2] If this hypothesis of a general urban orientation is valid, then there should be a high degree of acceptance of the presence of the

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[2]For a discussion of research regarding the relationships between individual and group characteristics and neighboring patterns, see Suzanne Keller, op.cit., pp. 72-74.

freeway in study neighborhoods. Also, if the individual's orientation toward the neighborhood is the major factor in determining his attitude toward the presence of the freeway, then little relationship should be found between individual opinion and variables such as freeway design type, distance from the freeway, and whether the individual moved to the neighborhood before or after construction of the freeway.

Two questions on the interview schedule deal with the respondent's opinion toward the presence of the freeway in the neighborhood. The first question is "Are you glad to have the freeway in this neighborhood?" The second question is "Do you think the freeway is properly located with respect to your neighborhood?" The distributions of coded responses to these two questions are shown in tables 19-20.

Findings from these data support the hypothesis of generally favorable opinions toward the freeway due to an urban orientation on the part of respondents. The overall response was generally favorable to both the presence of the freeway in the neighborhood and the location of the freeway with respect to the neighborhood. Approximately 70 percent of the respondents were glad to have the freeway in their neighborhood, and approximately 72 percent thought that the freeway was properly located with respect to the neighborhood. An examination of the data did not reveal any patterns in the responses that could be attributed to either the design of the freeway, the distance of the respondent's residence from the freeway, or when the respondent moved to the neighborhood. None of the Chi-square tests conducted on the various contingency tables were significant at the 95 percent level of confidence.

Table 19

Distribution of Responses to the Question "Are You Glad to Have the Freeway in this Neighborhood?" by Design Subarea, by Distance Zone, and by Respondent Moving to Location Before or After Construction of Freeway

Response	Design Subarea[a]			
	Elevated (N=25)	On Grade (N=29)	Depressed (N=32)	All Subareas (N=86)
Yes	80%	55%	75%	70%
No	12%	31%	6%	16%
Don't Know	8%	14%	19%	14%

Response	Distance Zone[b]			
	1 (N=25)	2 (N=30)	3 (N=31)	All Zones (N=86)
Yes	64%	80%	65%	70%
No	24%	10%	16%	16%
Don't Know	12%	10%	19%	13%

Response	Respondent Moved to Location[c]		
	Prior to Construction of Freeway (N=23)	After Construction of Freeway (N=63)	All Respondents (N=86)
Yes	70%	70%	70%
No	21%	14%	16%
Don't Know	9%	16%	14%

[a]Chi-square with 4 d.f. = 8.69. $p > .05$, not significant.

[b]Chi-square with 4 d.f. = 3.39. $p > .05$, not significant.

[c]Chi-square with 2 d.f. = 1.20. $p > .05$, not significant.

Table 20

Distribution of Responses to the Question "Do You Think the Freeway is Properly Located with Respect to Your Neighborhood?" by Design Subarea, by Distance Zone, and by Respondent Moving to Location Before or After Construction of Freeway

Response	Design Subarea[a]			
	Elevated (N=23)	On Grade (N=29)	Depressed (N=32)	All Subareas (N=86)
Yes	88%	56%	75%	72%
No	4%	10%	3%	6%
Don't Know	8%	34%	22%	22%

Response	Distance Zone[b]			
	1 (N=25)	2 (N=30)	3 (N=31)	All Zones (N=86)
Yes	80%	80%	58%	72%
No	8%	6%	3%	6%
Don't Know	12%	14%	39%	22%

Response	Respondent Moved to Location[c]		
	Prior to Construction to Freeway (N=23)	After Construction of Freeway (N=63)	All Respondents (N=86)
Yes	83%	68%	72%
No	9%	5%	6%
Don't Know	9%	27%	22%

[a]Chi-square with 4 d.f. = 7.89. $p > .05$, not significant.

[b]Chi-square with 4 d.f. = 7.99. $p > .05$, not significant.

[c]Chi-square with 2 d.f. = 3.48. $p > .05$, not significant.

Location of the Freeway with Respect to Respondent Residences

Two related questions on the interview schedule were designed to measure respondent satisfaction with the location of residences in respect to the freeway. The first question is "Where do you prefer to live with respect to the freeway?" The second question is "Does the presence of the freeway annoy you in any way?" The distributions of responses to these questions are shown in Tables 21-22.

In the total sample, response was generally that respondents tended to prefer to live about where they were with respect to the freeway. Approximately 79 percent of all respondents said that they were satisfied with the distance of their residence from the freeway; 20 percent of all respondents stated that they preferred to live further from the freeway; and 1 respondent, or slightly over 1 percent of the sample, preferred to live closer to the freeway.

The data indicate a possible relationship between respondent satisfaction with his residential distance from the freeway and the elevation of the freeway section in the proximity of his residence. As shown in Table 21, the percentage of respondents who prefer to live further from the freeway increases as the elevation of the freeway increases. Twenty-eight percent of those in the elevated design subarea prefer to live further from the freeway, while only 9 percent of those in the depressed design subarea have this preference. The Chi-square statistic is not significant at the 95 percent level of confidence, so a conclusion that this relationship is due solely to sampling effects cannot be rejected.

The data show a definite relationship between proximity to the freeway and where respondents prefer to live with respect to the freeway.

Table 21

Distribution of Responses to the Question "Where do You Prefer to Live with Respect to the Freeway?" By Design Subarea and Distance Zone and by Respondent Moving to Location Before or After Construction of Freeway.

Response	Design Subarea[a]			
	Elevated (N=25)	On Grade (N=29)	Depressed (N=32)	All Subareas (N=86)
Closer	0%	0%	3%	1%
Further Away	28%	24%	9%	20%
About Where You Are	72%	76%	88%	79%

Response	Distance Zone[b]			
	1 (N=25)	2 (N=30)	3 (N=31)	All Zones (N=86)
Closer	0%	3%	0%	1%
Further Away	40%	13%	10%	20%
About Where You Are	60%	84%	90%	79%

Response	Respondent Moved to Location[c]		
	Prior to Construction of Freeway (N=23)	After Construction of Freeway (N=63)	All Respondents (N=86)
Closer	0%	2%	1%
Further Away	43%	11%	20%
About Where You Are	57%	87%	79%

[a]Chi-square with 4 d.f. = 5.06. $p > .05$, not significant.

[b]Chi-square with 4 d.f. = 10.98. $p < .05$, significant.

[c]Chi-square with 2 d.f. = 11.31. $p < .001$, significant.

The data in Table 21 show that the greater the distance from the freeway, the greater the satisfaction with the residential location relative to the freeway. Sixty percent of the respondents living in zone 1 (abutting the freeway) prefer to live about where they are, while 90 percent of those in zone 3 (600-1200 feet from the freeway) express satisfaction with their residential location. The Chi-square statistic is significant beyond the 95 percent confidence interval, so it can be concluded that this relationship is probably not due to chance variation alone.

The data also show a relationship between the respondent's satisfaction with his residential location and whether he moved to the location before or after the freeway was built. As shown in Table 21, respondents who moved to their residential location after the freeway was built prefer to live about where they are with a much greater frequency than do respondents who were living at their residential location before the freeway was built. Eighty-seven percent of the "after-construction" residents preferred to live about where they are, compared to 57 percent of the "before construction" residents who have this preference. The greater degree of satisfaction of the "after-construction" respondents may be explained by their being able to take the presence of the freeway into account when choosing their residential location. These persons could actively consider the trade-offs between the costs and benefits of living a particular distance from the freeway and had more opportunity to choose a location that was satisfactory.

Whether the individual is a "before construction" or "after-construction" resident also seems to be one of the major factors determining whether or not he is annoyed in some way be the freeway. Sixty-one percent of the "before-construction" respondents reported being annoyed in some way by the freeway, while only 21 percent of the "after-construction" respondents reported any annoyance, as shown in Table 22. The Chi-square statistic for this distribution is significant beyond the 99.9 percent level of confidence. No readily recognizable patterned relationship could be found between the frequency of annoyance and either design subarea or distance zone.

The major type of annoyance reported by respondents is traffic noise. Twenty-four of the 27 respondents who reported being annoyed in some way listed noise pollution as the source of their irritation. Predictably, those respondents whose residences are nearest the freeway tended to report being disturbed more by noise than were respondents whose residences were further from the freeway. In addition, respondents who lived in single family residences tended to be disturbed more by noise than were those living in apartment buildings and other multi-family dwellings.

Opinions of Respondents Regarding Design of Freeway

A series of questions regarding certain aspects of freeway design were included on the interview schedule. The results, reported in Table 23, show that 69 percent of all respondents approved of the appearance of the freeway in their neighborhood. By design subarea, the proportion of respondents who approved of the appearance ranged from a

Table 22

Distribution of Responses to the Question "Does the Presence of the Freeway Annoy You in Any Way?" By Design Subarea and by Distance Zone and by Respondent Moving to Location Before or After Construction of Freeway.

Response	Design Subarea[a]			
	Elevated (N=25)	On Grade (N=29)	Depressed (N=32)	All Subareas (N=86)
Yes	40%	28%	28%	31%
No	60%	72%	72%	69%

Response	Distance Zone[b]			
	1 (N=25)	2 (N=30)	3 (N=31)	All Zones (N=86)
Yes	32%	40%	23%	31%
No	68%	60%	77%	69%

Response	Respondent Moved to Location		
	Prior to Construction of Freeway (N=23)	After Construction of Freeway (N=63)	All Respondents (N=86)
Yes	61%	21%	31%
No	39%	79%	69%

[a]Chi-square with 2 d.f. = 1.21. $p > .05$, not significant.

[b]Chi-square with 2 d.f. = 2.15. $p > .05$, not significant.

[c]Chi-square with 1 d.f. = 10.86. $p < .001$, significant.

Table 23

Responses of Respondents to Questions Regarding
Design of the Freeway

Responses to Questions	All Respondents
Do You Like the Appearance of the Freeway in Your Neighborhood?	
Yes	59%
No	24%
Don't Know	7%
Are There Enough On and Off Ramps?	
Yes	50%
No	29%
Don't Know	21%
Are There Enough Overpasses and Underpasses?	
Yes	76%
No	16%
Don't Know	8%
Would You Rather Live Near a Depressed, On-Grade, or Elevated Section of the Freeway?	
Depressed	6%
On-Grade	5%
Elevated	2%
No Preference or Don't Know	87%

low of 55 percent of those living in the on-grade design subarea, to a high of 80 percent of those living in the elevated subarea. Very few respondents could give any specific reason for not liking the appearance of the freeway; nor could they offer any suggestion for improving the freeway's appearance.

Approximately 50 percent of all respondents felt that there were enough off-on ramps in their neighborhood. Two major reasons were given for preferring more ramps. The most frequent reason given was that more ramps and more feeder streets would help relieve traffic congestion in the neighborhood and/or near the individual's home.

Most respondents had no definite preference for one type of freeway design over any other design. Overall, 87 percent of the respondents expressed no preference for a particular freeway design type or did not know which design type they preferred. Of those who expressed a preference, the majority preferred the type of freeway design they were living near. These responses are not surprising, since nearly all of the respondents had had experience with only one type of freeway design, the one they were currently living near, and thus had no means of realistically comparing freeway designs.

Summary

The degree to which an individual is favorable toward the freeway can be explained largely in terms of the degree to which he is satisfied with his place of residence, and how he sees the freeway affecting this satisfaction. In general, individuals in the sample tended to have a favorable opinion of their place of residence, with 86 percent of the

respondents expressing satisfaction with their location. Respondents whose residences abutted the freeway tended to be more unfavorable than those whose residences were further from the freeway. Respondents who moved to their location prior to the construction of the freeway were significantly more unfavorable than those who moved after the construction of the freeway.

Individual satisfaction with the location of the freeway was analyzed in terms of the degree to which the freeway interferes with the individual's neighboring relationships and the degree to which the individual's quality of life is enhanced or degraded by the freeway. Approximately 70 percent of the respondents in the study sample were favorable toward the presence of the freeway in their neighborhood. This is attributed to an orientation on the part of the individual more toward the larger urban community than toward the local neighborhood. This type of person is not affected much by disruptions in neighboring patterns and enjoys the access afforded by the freeway.

Respondents were asked where they preferred to live with respect to the freeway. Approximately 79 percent of all respondents were satisfied with the distances of their residences from the freeway. The frequency of those wishing to live further from the freeway increased directly with proximity to the freeway and with the elevation of the freeway design type. Residents who moved to their location prior to the construction of the freeway preferred to live further from the freeway with a significantly higher frequency than did those who moved to their location after the freeway was built.

Thirty-one percent of all respondents reported being annoyed in some way by the presence of the freeway. For most respondents, the reported source of annoyance was traffic noise. It was found that "before-construction" respondents reported being annoyed by the freeway with a significantly greater frequency than did "after-construction" respondents.

Sixty-nine percent of the sample liked the appearance of the freeway in their neighborhood. Approximately 60 percent of respondents thought there were enough off-on ramps, and 87 percent had no preference for living near a particular type of freeway design.

PART IV

NATURE AND EXTENT OF CHANGES IN STUDY NEIGHBORHOODS[1] ATTRIBUTABLE TO CONSTRUCTION OF THE FREEWAY

Twenty-three of the 86 respondents in the study sample were living in the study areas prior to freeway construction. These respondents were asked to evaluate the nature and extent of various changes in their neighborhood that they could attribute to the construction and presence of the freeway. The observations and opinions of these residents regarding neighborhood and individual changes are analyzed in this section.

Problems Encountered During Freeway Construction

The prior resident respondents were asked if they had experienced any problems during the period the freeway was being constructed in their neighborhoods. As shown in Table 24, the respondents were almost equally divided between those who had experienced some problem (52 percent) and those who had not experienced any problems (48 percent). The problems mentioned most often were noise of construction and dust.

There is very little difference in the reported incidence of construction problems in the different design subareas. As could be expected, there is an inverse relationship between the distance from the freeway and the incidence of reported problems. Examination of Table 24 reveals that the proportion of respondents who encountered each type of problem during freeway construction increases sharply from zone 3 to zone 1, and conversely, the proportion of respondents who did not encounter any problems decreases sharply from zone 3 to zone 1.

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[1] It should be noted that some of the tables in this section contain multiple responses from the 23 "prior" residents.

Table 24

Responses of Prior Residents Regarding Problems Encountered During Freeway Construction, By Design Subarea and Distance Zone

Type of Problem	Design Subarea[a]			
	Elevated	On Grade	Depressed	All Subareas
Did The Construction of the Freeway Cause You Any Problems?				
Noise of Construction	50%	44%	50%	48%
Dust	50%	33%	50%	43%
Other Problems	12%	22%	0%	13%
No Problems	50%	44%	50%	48%
Number of Responses	(13)	(13)	(9)	(35)

Type of Problem	Distance Zone[a]			
	Zone 1	Zone 2	Zone 3	All Zones
Did The Construction Of The Freeway Cause You Any Problems?				
Noise of Construction	75%	42%	0%	48%
Dust	62%	42%	0%	43%
Other Problems	25%	8%	0%	13%
No Problems	25%	50%	100%	48%
Number of Responses	(15)	(17)	(3)	(35)

[a]Percentages in each column do not total 100 because of multiple responses.

Positive and Negative Effects of the Freeway

The distribution of coded responses regarding the positive effects of the freeway for prior residents is shown in Table 25. The most often reported positive effects relate to the access the freeway provides. All of the respondents either reported that the freeway saves them time in traveling to places they went before its construction, or that they use the freeway to travel to places to which they did not go before its construction, or both. Approximately 78 percent of all respondents reported that the freeway saves them time, and 48 percent of all respondent reported using the freeway for travel. Only two of the 23 respondents (9 percent of the sample) did not see any benefit from the presence of the freeway. These respondents were in the on-grade design subarea, with residences abutting the freeway.

The distribution of coded responses regarding the negative effects of the freeway is shown in Table 26. The most frequently reported problems are increased noise levels in the home (52 percent) and increased air pollution (26 percent). Three respondents in the elevated design subarea whose residences abutted the freeway reported that the access to their property was limited by the presence of the freeway. Approximately 35 percent of all respondents felt there were no negative effects from the freeway.

The degree to which noise is viewed negatively seems to be directly related to the elevation of the freeway and inversely related to the distance the respondent lives from the freeway. The proportion of respondents who report noise as a problem increases with the elevation of the freeway and decreases as the distance of respondents' residences

Table 25

Responses of Prior Residents Regarding Positive Effects of the Freeway by Design Subarea and Distance Zone

Type of Positive Effect	Design Subarea[a]			
	Elevated	On Grade	Depressed	All Subareas
Saves Time in Traveling	100%	56%	83%	78%
Use the Freeway for Travel	38%	22%	100%	48%
Increased Property Values	12%	0%	0%	4%
Other Positive Effects	0%	11%	0%	4%
No Positive Effects	0%	22%	0%	9%
Number of Responses	(12)	(10)	(11)	(33)

Type of Positive Response	Distance Zone[a]			
	Zone 1	Zone 2	Zone 3	All Zones
Saves Time in Traveling	62%	83%	100%	78%
Use the Freeway for Travel	50%	50%	33%	48%
Increased Property Values	12%	0%	0%	4%
Other Positive Effects	0%	8%	0%	4%
No Positive Effects	25%	0%	0%	9%
Number of Responses	(12)	(17)	(4)	(33)

[a]Percentages in each column do not total 100 due to multiple responses.

Table 26

Responses of Prior Residents Regarding Negative Effects of the Freeway, by Design Subarea and Distance Zone

Type of Negative Effect	Design Subarea[a]			
	Elevated	On Grade	Depressed	All Subareas
Increased Noise in Home	75%	56%	17%	52%
Limited Access to Property	0%	33%	0%	13%
Increased Dust and Fumes (air pollution)	12%	33%	33%	26%
Other Negative Effects	0%	0%	17%	4%
No Negative Effects	25%	33%	50%	35%
Number of Responses	(9)	(14)	(7)	(30)

Type of Negative Effect	Distance Zone[a]			
	Zone 1	Zone 2	Zone 3	All Zones
Increased Noise in Home	75%	42%	33%	52%
Limited Access to Property	25%	8%	0%	13%
Increased Dust and Fumes (air pollution)	25%	33%	0%	26%
Other Negative Effects	0	8%	0%	4%
No Negative Effects	25%	33%	67%	35%
Number of Responses	(12)	(15)	(3)	(30)

[a]Percentage in each column do not total 100 percent because of multiple responses.

from the freeway increase. Conversely, the proportion of respondents who report no negative effects from the freeway decreases with freeway elevation and increases with residence distance from the freeway. Also, in this sample, a small percentage of the respondents living near the elevated freeway section report air pollution as a problem.

Effects of the Freeway on Residential Property Values

Respondents were asked what effect the construction of the freeway had had on the value of their residences. The distribution of responses in Table 27 shows that approximately 13 percent of all respondents reported that their residential values had increased since the construction of the freeway; 35 percent reported that residential values had decreased; 22 percent reported no change in values; and 30 percent did not know what effect the construction of the freeway had been on property values. Examination of the frequency distributions in Table 27 reveals that there is a possible relationship between the elevation of the freeway and increased property values. The percentage of respondents reporting higher values increases steadily in going from the depressed-design subsample to the elevated-design subsample.

A possible relationship between the distance of residence from the freeway and changes in residential values also is indicated by the data. The percentage of respondents who report an increase in property values is smallest in zone 1 (abutting the freeway) and greatest in zone 3 (600-1200 feet or 183-366 m from the freeway). Conversely, the percentage of respondents who report a decrease in property values is greatest in zone 1 and smallest in zone 3. The Chi-square statistics for the

Table 27

Responses of Prior Residents Regarding Effects of the Freeway on Residential Property Values, by Design Subarea and Distance Zone

Effects on Value of Residence	Design Subarea[a]			
	Elevated (N=8)	On Grade (N=9)	Depressed (N=6)	All Subareas (N=23)
Increased Value	25%	11%	0%	13%
Decreased Value	25%	44%	33%	35%
No Effect	25%	22%	33%	22%
Don't Know	25%	22%	33%	30%

Effects on Value of Residence	Distance Zone[b]			
	Zone 1 (N=8)	Zone 2 (N=12)	Zone 3 (N=3)	All Zones (N=23)
Increased Value	0%	17%	33%	13%
Decreased Value	50%	33%	0%	35%
No Effect	12%	33%	0%	22%
Don't Know	38%	17%	67%	30%

[a]Chi-square with 6 d.f. = 3.18. $p > .05$, not significant.

[b]Chi-square with 6 d.f. = 7.57. $p > .05$, not significant.

Table 28

Responses of Prior Residents Regarding Effects of the Freeway on Travel Habits, by Design Subarea and Distance Zone

Effects on Travel Habits	Design Subarea[a]			
	Elevated	On Grade	Depressed	All Subareas
Freeway Used Often	100%	33%	17%	57%
Changed Travel Patterns	25%	44%	33%	39%
Freeway Caused Round-about Travel to Certain Places	0%	33%	50%	22%
Other Effects	0%	11%	33%	4%
No Effects	0%	11%	0%	4%
Don't Know	0%	0%	17%	9%
Number of Responses	(10)	(12)	(9)	(31)

Effects on Travel Habits	Distance Zone[a]			
	Zone 1	Zone 2	Zone 3	All Zones
Freeway Used Often	38%	58%	100%	57%
Changed Travel Patterns	25%	50%	33%	39%
Freeway Caused Round-about Travel to Certain Places	38%	17%	0%	22%
Other Effects	12%	0%	0%	4%
No Effects	12%	0%	0%	4%
Don't Know	12%	8%	0%	9%
Number of Responses	(11)	(16)	(4)	(31)

[a]Percentages in each column do not total 100 due to multiple responses.

relationships in Table 27 are not significant at the 95 percent confidence level, so it is possible that the relationships found are spurious.

Effects of the Freeway on Travel Habits

Prior respondents were asked what changes had occurred in their travel habits as a result of the construction of the freeway. Most of the responses fell into one of three general categories (see Table 28). In order of frequency of response, these categories are: (1) the freeway is used often for travel (57 percent); (2) the freeway changed customary travel patterns (39 percent); and (3) the freeway caused roundabout travel to certain destinations (22 percent). Only 3 of the 23 respondents reported no effects on travel habits or did not know what the effects of the freeway were.

A possible relationship between freeway design type and change in the use of the freeway is indicated by the data in Table 28. The proportion of respondents who report that their travel habits changed towards more frequent use of the highway is greater in the on-grade subsample as compared to the depressed subsample, and greater for the elevated subsample as compared to the on-grade subsample.

As could be expected, there is an apparent relationship between freeway design type and the degree to which respondents report having to use roundabout routes to some destinations. None of the elevated design subsample reported any roundabout travel; while 33 percent of the on-grade design and 50 percent of the depressed design reported such travel.

Some relationships between the distance the respondent lives from the freeway and some of the changes in travel habits are also indicated by the data in Table 28. The percentage of respondents who report frequent use of the freeway increases as distance from the freeway increases. On the other hand, the percentage of respondents who reported having to use roundabout routes to certain destinations increases with proximity to the freeway. Interestingly, all of the respondents who did not know what the effects of the freeway were resided in the depressed design subarea, and the percentage of "don't know" responses increases with the proximity to the freeway. However, only 3 respondents gave this answer, a response rate much too small to serve as the basis for any serious inferences of a relationship.

Effects of the Freeway on Travel Times

Each respondent was presented a list of typical travel destinations and asked how his travel time to these places had been affected by the construction of the freeway. The tabulated responses are shown in Table 29. Examination of this table reveals that construction of the freeway did not increase travel times for any appreciable number of prior residents. Only 4 respondents (13 percent of the sample) reported that any travel times were longer. Three respondents (9 percent of the sample) reported that it took them longer to get to some shopping facilities, and 1 respondent (4 percent of the sample) reported an increased travel time to his doctor's office. The residences of each of these respondents abut the freeway and 3 of the 4 respondents were in the depressed design subarea.

Table 29

Responses of Prior Residents Regarding Effects of Freeway on Travel Time to Various Places[a]

Destination	Reported Effect on Travel Time			
	Increased Travel Time	No Effect on Travel Time	Decreased Travel Time	Not Applicable
Place of Employment	0%	17%	61%	22%
Schools	0%	17%	4%	78%
Grocery Stores	0%	65%	22%	13%
Other Shopping Facilities	9%	48%	30%	13%
Churches	0%	61%	17%	22%
Doctors and Dentists	4%	65%	9%	22%
Parks	0%	17%	0%	83%
Other Recreational Facilities	0%	17%	13%	80%
Homes of Relatives and Friends	0%	48%	39%	13%
Downtown Houston	0%	13%	70%	17%
Out of Town	0%	9%	74%	17%

[a]Responses in each row of the table include all 23 prior residents.

In contrast to the small percentage of respondents who reported increased travel times, a relatively large percentage of respondents reported decreased travel times to certain destinations. Destinations with the highest percentage of respondents reporting a decrease in travel times are: (1) out of town (74 percent of the sample), (2) downtown Houston (70 percent of the sample), and (3) place of employment (61 percent of the sample).

Impact of the Freeway on Study Area Neighborhoods

Respondents who had been living in the study area neighborhoods prior to the construction of the freeway were asked a series of questions in an effort to determine if the construction of the freeway had seriously disrupted neighborhood social patterns, and to determine the impact of the freeway on transportation-dependent services to the study neighborhood. The questions asked and the distribution of responses given are shown in Table 30.

Freeway Impact on Neighboring Patterns

The degree to which the construction of a freeway affects the social relationships in an urban neighborhood is a function of two factors. The first factor is the extent to which a neighborhood is physically disrupted by the displacement of residents, the removal of social institutions such as churches and schools, and the blockage of lines of interaction and communication. The second factor is the extent to which neighborhood residents depend on the local neighborhood for social interaction. If neighborhood residents are local-oriented, any physical disruption by the freeway will seriously disturb the network of social relationships in the

neighborhood. On the other hand, if the residents are urban-oriented, massive physical disruption can occur without seriously disrupting the social relationships of neighborhood residents, since these individuals tend to look to the larger urban community rather than the local neighborhood. In the previous section, it was concluded that respondents in the study areas tend to be urban-oriented. If this hypothesis is correct, respondents should have few close ties with their fellow neighborhood residents, and the construction of the freeway will have had a minimal effect on social ties in the study neighborhoods.

The data in Table 30 seem to indicate that respondents did not maintain very many close social relationships with the residents who were displaced as a result of the freeway. Forty-eight percent of the respondents did not know whether or not people displaced by the freeway had remained in the neighborhood. None of the respondents had any close friends or relatives who moved from the neighborhood. These responses lend support to the hypothesis that the study respondents tend to be urban-oriented rather than local-oriented and do not engage in neighboring activities to any appreciable extent.

The lack of close social ties to the neighborhood could also explain the lack of concensus on the part of respondents regarding the question of whether the neighborhood is better off or worse off because of the freeway. It seems reasonable to expect that if the respondents were closely tied to their neighborhood, there would be a large amount of agreement concerning the overall impact of the freeway on study neighborhoods. Only 13 percent of the respondents reported their neighborhoods as worse off because of the freeway, 17 percent did not know, 35 percent

Table 30

Responses of Prior Residents Regarding the Impact of the Freeway On Study Neighborhoods[a]

Question and Response	Percent Responding
Did many of the people who were displaced by the freeway remain in this neighborhood?	
Yes	17%
No	35%
Don't Know	48%
Did any of your close friends or relatives move from the neighborhood because of the freeway?	
Yes	0%
No	100%
In general, do you think that the people who had to move because of the freeway are better off or worse off?	
Better	0%
Worse	13%
Same	17%
Don't Know	68%
Did the freeway remove any neighborhood meeting places such as cafes, etc?	
Yes	0%
No	100%
Does the freeway help or hinder your fire and police protection?	
Help	52%
Hinder	4%
No Effect	44%
Does the freeway help or hinder the hospital and ambulance services you might need?	
Help	61%
Hinder	4%
No Effect	35%
Did the freeway reduce traffic congestion in the streets in your neighborhood?	
Yes	52%
No	22%
Don't Know	26%

Table 30 Continued

Question and Response	Percent Responding
Did the freeway reduce congestion on major streets leading from your neighborhood?	
Yes	57%
No	17%
Don't Know	26%
Considering all the changes brought about by the freeway, were you benefited more than harmed by it?	
Yes	39%
No	26%
Don't Know	35%
Is your neighborhood better off or worse off because of the freeway?	
Better	35%
Worse	13%
Same	35%
Don't Know	17%

[a]Each question includes responses from all 23 prior respondents.

reported the neighborhood was the same, and 35 percent of respondents reported their neighborhood better off as a result of the freeway. An alternate explanation for this lack of consensus is that the freeway had differential impacts on each of the three study neighborhoods which, in turn, caused differential responses; but this was not found to be the case when responses were tabulated by either design subarea or distance zone.

Impact of the Freeway on Transportation-Dependent Services

The tabulated responses of prior residents to question regarding the impact of the freeway on neighborhood services which are primarily transportation related are shown in Table 30. In general, the majority of respondents either see the freeway as enhancing such services as police and fire protection and ambulance services or do not know what the effects of the freeway are on such services. The biggest negative response in this group of questions is that 22 percent of the respondents felt that neighborhood traffic congestion was not reduced by the construction of the freeway.

Summary

Twenty-three of the 86 respondents were living in the study areas prior to freeway construction. Observation and opinions of these "prior resident" respondents are analyzed in this section.

Fifty-two percent of the prior respondents experienced some problems during freeway construction. The problems mentioned most often were noise of construction and dust. An inverse relationship was found between distance from the freeway and the incidence of reported problems.

Some positive effects of the freeway were reported by 91 percent of the respondents. The positive effect named most often was a decrease in travel time. Fifty-two percent of the respondents reported negative effects of the freeway. The most frequently reported problems are increased noise levels in the home and increased air pollution.

Approximately 13 percent of the prior resident sample reported an increase in property values, 35 percent reported a decrease, and 22 percent reported no charge. The remaining 30 percent did not know what effect freeway construction had had on property values. The percentage of respondents reporting higher values increases steadily in going from the depressed design subarea to the elevated design subarea.

Travel times of prior resident respondents were not increased to any appreciable extent. Only 13 percent of respondents reported that any travel times were longer. In contrast, a relatively large percentage of respondents reported decreased travel times.

Negative freeway impact on neighborhood social patterns was minimal. None of the respondents had any friends or relatives who moved from the

neighborhood. Almost half of the respondents did not know what had happened to any of the persons displaced by the freeway. It was concluded that the minimal negative impact of freeway construction on neighborhood social patterns was partially a result of neighborhood residents tending to maintain social ties to the larger urban area rather than to the local neighborhood.

APPENDIX A
SAMPLING PROCEDURES

The population for this study consisted of all the households in the three selected residential areas in the Houston area. The sample was stratified by study area and by distance zone within each study area. This stratification scheme produced nine subpopulations, or strata, from which independent, systematic samples were drawn.

The sample for each stratum was drawn in the following manner:

1. The number of residences was counted in each stratum and a sampling rate was determined that would produce the number of observations which had been allocated to that stratum.
2. A procedure for systematically selecting sample residences was determined before sampling began. The procedure is as follows:
   a. Sample the streets parallel to the freeway first, proceeding from south to north, with the starting point being the most southerly street on the east end.
   b. Next, sample the cross streets, proceeding from east to west, with the starting point being the most easterly street on the south end.
   c. Sample first the even numbered residences on a street; then sample the odd numbered residences before proceeding to another street.
   d. The actual starting point on the first parallel street for the first sampling interval, e.g. between the first and 10th residence, was determined by using a table of random numbers.

3. Alternates were selected in the following manner:
   a. First alternate - first residence or apartment to the right of the original sample residence or apartment.
   b. Second alternate - first residence or apartment to the left of the original sample residence or apartment.
   c. For other alternate - proceed to the next closest house or apartment until interview can be made.
4. Alternates were chosen to replace the original sample members only under the following circumstances:
   a. If the sample residence was vacated.
   b. If no adult occupant could be interviewed after repeated attempts (at least four) had been made between 9:00 a.m. and 9:00 p.m.
5. Several attempts were made to interview the head of household before another adult, usually the wife, was interviewed.

APPENDIX B

CONFIDENCE INTERVALS

From sample data, it is possible to infer something about the magnitude of P, the percentage of a population who exhibit a certain characteristic or express a certain opinion. This is an inductive process where one reasons from a part to the whole. Since p, the estimate of the population percentage obtained from a sample, varies from one sample to another, it is difficult to say that P, the population percentage, is exactly equal to p, the sample estimate. It is often more accurate to give an interval, perhaps with p as the center, and say with reasonable confidence that P was in the interval. This is known as the confidence or fiducial inference. The interval estimates of P are known as confidence intervals.

Confidence intervals can be calculated for each of the percentage estimates in this study, which were calculated from sample data. The mathematical formula is:

$$P = \left(p \pm \left[t\sqrt{i - n/N}\ \sqrt{pq/(n-1)} + \frac{1}{2n}\right] \times 100\%\right.$$

where P = Population percentage

t = value of the standard normal deviate for a given degree of confidence. (For confidence that P is within the interval 95 percent of the time, t = 1.95).

n = the number of observations in the sample.

N = the number of persons in the population.

p = the sample estimate of the population proportion (population proportion = population percentage ÷ 100 percent)

q = (1-p)

The values of $\underline{n}$ and $\underline{N}$ can be obtained from Table 1 on page 6 of the main body of the study.

The following example will illustrate the use of this formula to calculate confidence intervals for population percentages. From Table 7 on page 27 it can be seen that 20 percent of the households sampled in the elevated design subarea are comprised of only one person. To calculate the 95 percent confidence intervals for the percentage of one-person households in the elevated design subarea, the following figures are substituted into the mathematical formula:

$t = 1.95$

$n = 25$ (From Table 1, page 6)

$N = 730$ (From Table 1, page 6)

$p = .20$

$q = (1.00-.20) = .80$

Then

$$P = \left(.20 \pm \left[1.95 \sqrt{1- 25/230} \sqrt{(.2)(.8)/(25-1) + \frac{1}{(2)(25)}}\right]\right) \times 100\%$$

$$P = 20\% \pm 17.4\%$$

Thus, in 95 out of 100 times, the percentage of one-person households will lie between 2.6 percent and 37.4 percent of all households in the population. Confidence intervals for any of the sample percentages reported in this study can be calculated in the same manner.