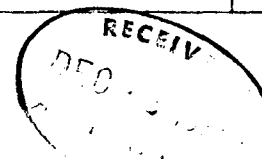
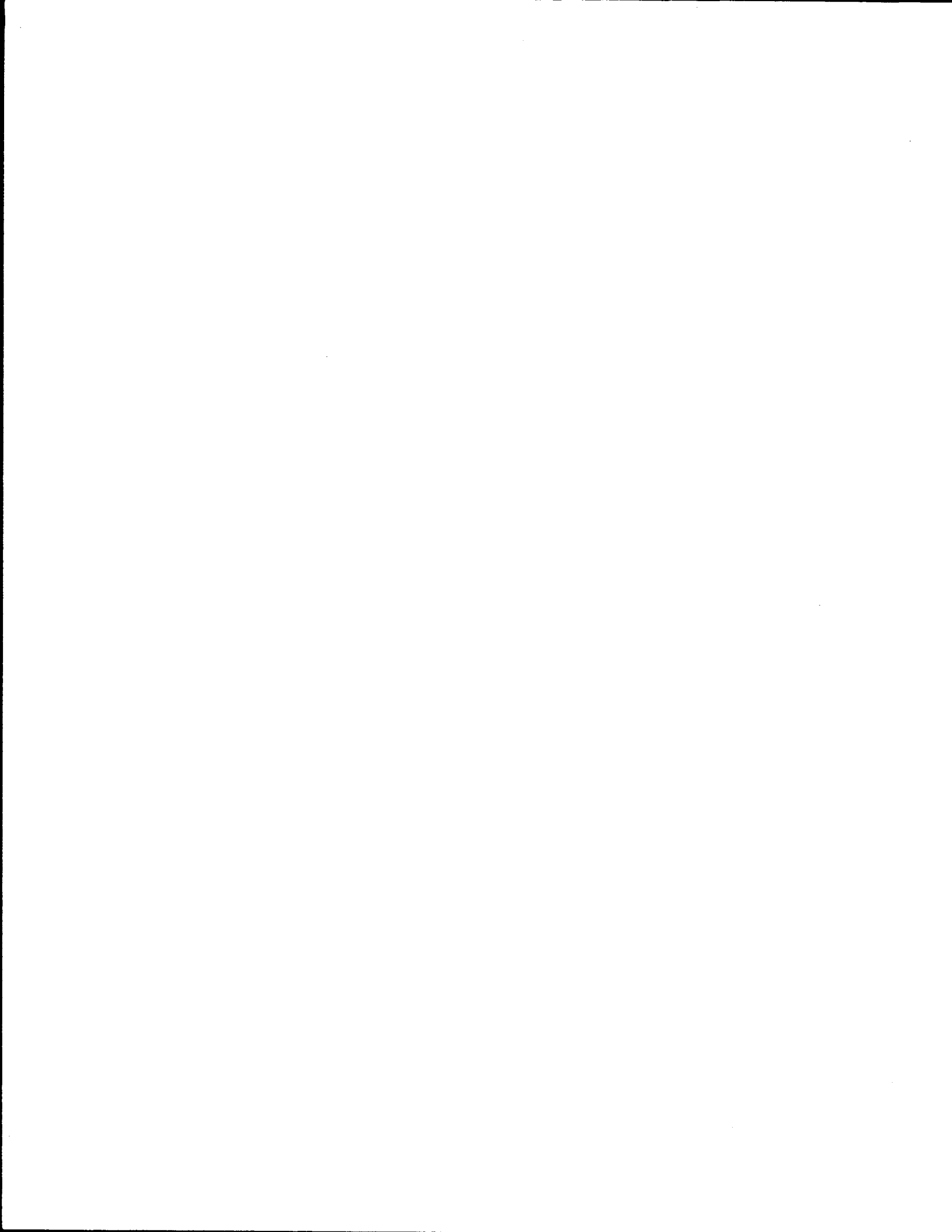


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SOCIAL IMPACTS:  
EVALUATION OF HIGHWAY PROJECT DEVELOPMENT  
IN URBAN RESIDENTIAL AREAS

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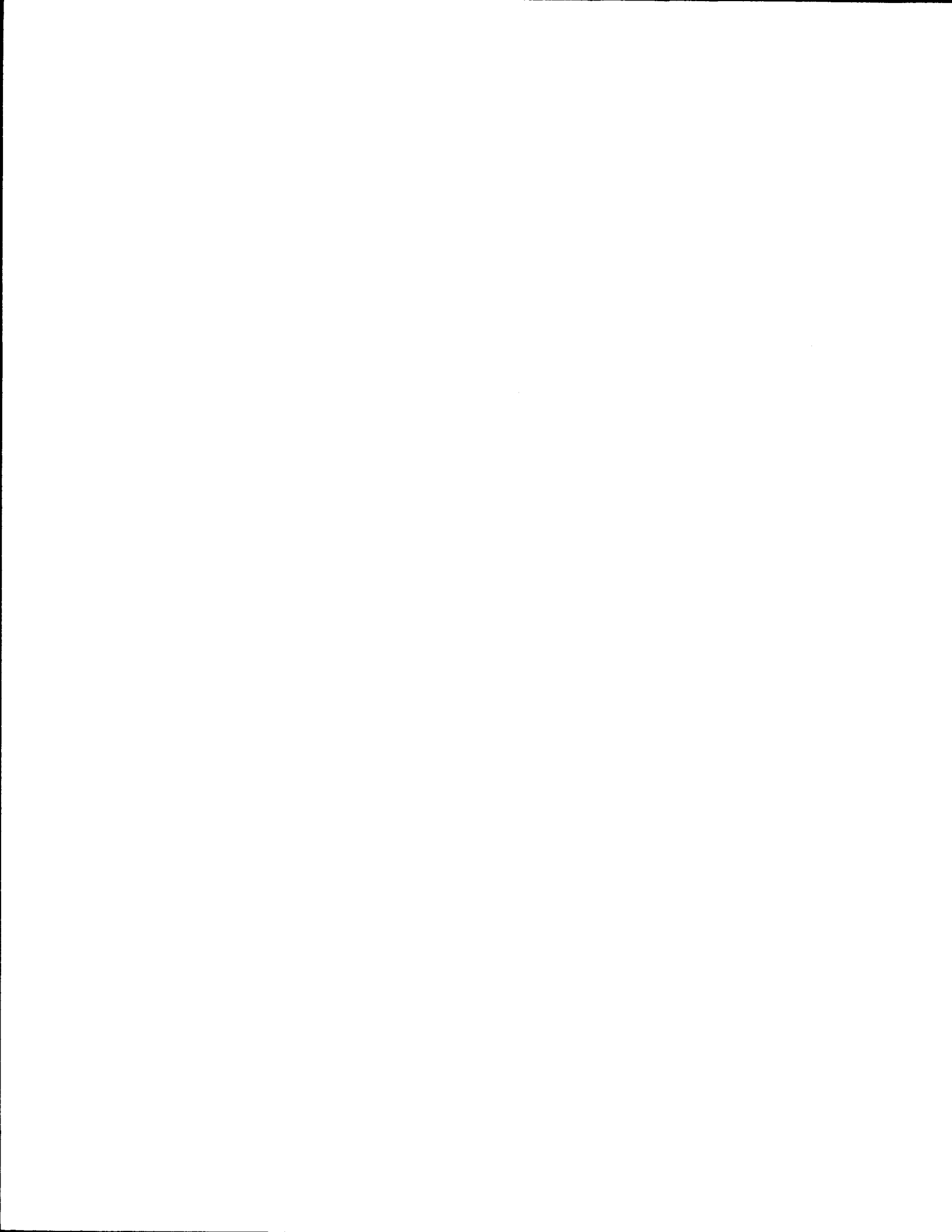
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The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration. This report does not constitute a standard, a specification, or a regulation.

## ABSTRACT

Many prior impact studies which define the consequences of major environmental change, such as that imposed by the introduction of a major urban transportation facility, have indicated the operation of certain factors which influence the degree to which such change affects project area residents. This report attempts to delineate key variables which may be utilized by highway planners prior to project implementation to predict potential effects of a proposed route on non-users. Techniques for measuring these predictive variables, which may be generalized to all major project evaluations, are also provided. Factors and measurement techniques outlined in the report were obtained through a survey of the existing sociological and transportation impact literature, reviewing previously used techniques as well as other sociological indicators not utilized in earlier social impact evaluations. The predictive factors and measurement procedures were organized into a comprehensive and quantified framework, consisting of three broad dimensions of prediction: land usages and community/neighborhood form; demographic characteristics of area residents; and socio-psychological attributes of residents. In the use of these three dimensions, highway planners should be able to accurately predict the social impact of transportation improvements in the project area. Specific short-term social consequences of urban freeway construction are discussed, as well as long-term multi-disciplinary forecasting techniques.

## SUMMARY OF FINDINGS

The key factor that differentiates social impact assessments from other forms of freeway project evaluation is the very localized character of pronounced social effects --- that is, on residents living within the immediate project area. In planning for urban highway improvements, projections of transportation need for these facilities are determined. Nevertheless, plans that would clearly benefit the public-at-large, and that are feasible engineering designs, may change the entire structure of existing urban residential areas. The questions concerning the means by which "need" should be weighed, and the measurement of trade-offs between the public need and localized need, are not easily resolved. In the majority of cases, freeway planners should have several design options, with a specific site then determined according to engineering, economic, environmental, and sociological assessments.

The degree of social impact evidenced with any large-scale public works project is primarily dependent on three factors:

1. land use attributes;
2. human ecological factors relating to characteristics of area residents; and
3. socio-psychological attributes of residents.

### Land Use Characteristics as Predictors of Social Impact

Field observation was suggested as the most appropriate technique for analyzing land use and community/neighborhood forms. Observational procedures can be supplemented by city planning or land use maps. Further, field observation can be used as the sole approach to social impacts assessment or can be used in conjunction with demographic and survey data (to be discussed in the two following sections).

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Land use which maintains residential or social institutional activity comprises approximately 40 percent of the space in metropolitan environments. While urban freeway introduction is often advantageous for existing commercial and industrial activities, the impact on dwelling units and many social institutions is often detrimental.

The types of land use characteristics evidenced prior to highway project development provide data which can be used to accurately assess alternative routing plans. The characteristics of existing social uses of urban space to be evaluated through field observation are summarized in Table 1.

Table 1. Land Use Characteristics Predictive of Social Impact

---

1. Residential Concentrations

- (1) *Proximity to city center*
- (2) *Proportion of mixed land usage*
- (3) *Density of population*
- (4) *Proportion of undeveloped land*
- (5) *Age of dwellings in area*

2. Locational Factors

- (1) *Location of social institutions*
  - (2) *Location of neighborhood boundaries*
-



Characteristics of Area Residents  
As Predictors of Social Impact

The evaluation of potential impacts of freeway introduction in urban areas must, in many cases, make use of existing, readily available data sources. One very useful approach is the prediction of beneficial and adverse social impacts within specific areas that are primarily residential through the analysis of published census tract data. Because personal characteristics of area residents, that is, specific demographic variables, have been found to be predictive of neighborhood patterns and of receptiveness to a freeway facility, measures for the use of these data are outlined in the report and summarized in Table 2.

Table 2. Summary of Demographic Data Descriptors  
for Characteristics of Area Residents

---

<p>1. <u>Residential Stability</u></p> <ul style="list-style-type: none"><li>(1) <i>Mobility Index</i></li><li>(2) <i>% 5-Year residents</i></li><li>(3) <i>Median year moved to dwellings</i></li><li>(4) <i>% Owned dwellings</i></li></ul>	<p>4. <u>Age Distribution</u></p> <ul style="list-style-type: none"><li>(1) <i>% Residents &lt; 16</i></li><li>(2) <i>% Residents 65+</i></li><li>(3) <i>Dependency Ratio</i></li></ul>
<p>2. <u>Ethnic Characteristics</u></p> <ul style="list-style-type: none"><li>(1) <i>% Anglo</i></li><li>(2) <i>% Negroes</i></li><li>(3) <i>% Spanish-Americans</i></li><li>(4) <i>Index of Qualitative Variation for Ethnicity (I.Q.V.E.)</i></li></ul>	<p>5. <u>Transportation Characteristics</u></p> <ul style="list-style-type: none"><li>(1) <i>% Workers driving private vehicles</i></li><li>(2) <i>% Workers as passengers in private vehicles</i></li><li>(3) <i>% Workers dependent on buses</i></li><li>(4) <i>% Workers walking to place of employment</i></li><li>(5) <i>Location of work relative to place of residence</i></li><li>(6) <i>General Pedestrian Dependency Index (G.P.D.I.)</i></li></ul>
<p>3. <u>Socioeconomic Status of Residents</u></p> <ul style="list-style-type: none"><li>(1) <i>Median owner value</i></li><li>(2) <i>Median gross rent</i></li><li>(3) <i>Median family income</i></li><li>(4) <i>Median years of school completed</i></li><li>(5) <i>% White collar workers</i></li><li>(6) <i>Coefficient of Variation (C.V.) for owner values, rent, family income, and education</i></li></ul>	

---

The demographic approach to social impact analysis thus provides one set of procedures for measuring the social costs and benefits of highway routing within urban residential areas. The indicators can be obtained with little difficulty or cost. In most cases, these data descriptors can be viewed as "social capacity indicators" -- pointing to the types of changes that can be sustained. In smaller scale, new highway projects or improvements of existing facilities, demographic data can prove a sufficient measure of potential social impacts. In larger urban highway projects, the demographic measures can be tied to field observation and survey information (to be discussed) to obtain a more comprehensive evaluation.

Socio-Psychological Attributes of Area Residents  
As Predictors of Social Impact

The attitudes and behavioral patterns of residents in the planned corridor, as obtained through a survey, may provide the most useful method for estimating individual-level effects of highway improvements. With the use of a representative survey, the highway planner has: (1) objective information about the personal consequences, both beneficial and adverse, to area residents; and (2) an understanding of existing residential linkages or interaction patterns that aids in designing the actual freeway route. If the field observation and census tract tabulations have already been undertaken, the survey should further validate what highway planners have concluded from the use of these previous approaches. On the other hand, the personal attitudinal and behavioral characteristics of residents, obtained through an area survey, may suffice as the sole data source on potential social impacts. A summary of questionnaire responses which should aid in the project assessment are summarized in Table 3.

Table 3. Summary of Socio-Psychological Characteristics of Area Residents

- 
- |   |   |
|---|---|
| <p>1. <u>Use of Local Facilities</u></p> <p>(1) <i>Distance to 8 "commonly used" facilities</i></p> <p>(2) <i>Frequency of usage of 8 area facilities</i></p> <p>2. <u>Neighboring</u></p> <p>(1) <i>Location of close friends</i></p> <p>(2) <i>Location of close relatives</i></p> <p>(3) <i>Frequency of visiting with neighborhood friends</i></p> <p>(4) <i>Frequency of visiting with relatives in neighborhood</i></p> <p>3. <u>Participation in Area Associations</u></p> <p>(1) <i>Number of memberships in area voluntary organizations</i></p> <p><i>Area Activity Index (A.A.I.) - a combination of the three sets of factors outlined above.</i></p> | <p>4. <u>Identification/Evaluation of Area</u></p> <p>(1) <i>Degree to which area is a "neighborhood"</i></p> <p>(2) <i>Evaluation of social intimacy of area</i></p> <p>(3) <i>Plans for moving out of area</i></p> <p>(4) <i>General evaluation of area</i></p> <p>5. <u>Community Values of Residents</u></p> <p>(1) <i>Desirability-weighted-by-Importance Index</i></p> <p>6. <u>Highway Project Involvement</u></p> <p>(1) <i>Number of actions <u>for</u> or <u>against</u> proposal</i></p> <p>(2) <i>Respondents' belief that personal interests are considered</i></p> <p>(3) <i>Respondents' knowledge of other groups <u>for</u> and <u>against</u> proposed facility</i></p> <p>(4) <i>Respondents' knowledge of relocation assistance</i></p> |
|---|---|
- 

The survey will normally contain information that provides not only sociological data, but also economic, environmental, and political evaluation criteria, so that a comprehensive understanding of trade-offs among these substantive assessment bases can be gained. The interview survey, however, can be more costly than either field observation or the use of demographic data. A plausible alternative is a mail-out questionnaire of 150 questions or less, which should be less costly while providing the same detailed data base.

"Knowledgeables" within the project study area can also be interviewed as a

substitute for the larger, resident sample survey.

### Ex Post Facto Social Impacts and Forecasting Techniques

In the use of the three dimensions described above, concerning existing land usages, characteristics of area residents, and their individual attitudes and activities, highway representatives should be able to accurately predict the social consequences of project implementation. The three chapters dealing with these three dimensions--and the techniques which can be applied in each case--are thus a tool to be used prior to and during the project planning and project design process.

In some instances, impact analysis may be undertaken at more than one point in time. The primary purpose of this report, Social Impacts: Evaluation of Highway Project Development in Urban Residential Areas, is to provide procedures for predicting positive and negative impacts before the freeway facility is introduced. Nevertheless, two chapters have been provided to present methods for the assessment of both short-term impacts (during and immediately following highway construction) and long-term forecasting techniques (with a ten- to twenty-year predictive capability).

By providing specific methods for delineating social impacts in sequential stages of project planning and implementation, a charting of impacts for any one urban community or neighborhood over an allotted time period can be undertaken. More importantly, the immediate and long-term changes should be predicted and analyzed before construction of the facility, so that short-term adjustments in the impacted area will be specified in advance.

The examination of short-term social impacts provides for the highway planner a substantive guide by which he can more adequately predict the

consequences of freeway construction in an urban area. Two sociological groups need be considered in freeway project planning: those residents displaced by the right-of-way and those residents who remain in the area. Both groups must make many adjustments to the physical and social changes which result from the introduction of the freeway and, for each group, successful adjustment is influenced by the availability and adequacy of personal resources.

Three specific approaches for forecasting the long-term social and economic effects of a new transportation facility were outlined in the report:

1. Scenario construction, combined with model building;
2. Delphi sequence analysis; and
3. Cross impact matrix analysis.

These forecasting methods have much potential utility for the transportation planning process, and are particularly applicable to transportation decision-making. The methods extend the ability of the planner to obtain valuable long-range estimates of the social, economic, and environmental impacts of proposed transportation facilities, and to make decisions that will maximize their benefits at a minimal cost to the social system and to the physical environment. Forecasting methods also can be applied to the needs of the decision-maker who must make decisions regarding the more engineering-oriented or technological aspects of transportation decision-making.

### Conclusions

Many previous studies have included social assessment techniques as a part of environmental impact statements. The purpose of this report is the presentation of a more comprehensive, quantitative approach to social

impacts evaluation than has heretofore been attempted. The inclusion of previously used techniques, with the addition of several sociological techniques not utilized in earlier social impact assessments, provide an aid to state and district highway officials for project-level decision-making. It is anticipated that this presentation of social indicators and techniques will not precipitate a more costly evaluation for highway agencies, but rather a more organized and quantified framework for social assessment than has been used in the past.

## IMPLEMENTATION STATEMENT

Any major urban highway project must be considered in terms of expected changes in the quality of life for both the facility's users and the impacted residents in the project corridor. The resulting alteration of the physical and social environments which provide the bases for social interaction and activity has a differential impact on varying social groups in the urban environment. Characteristics of the immediate residential areas and of the residents themselves help to define potential social impact. An analysis of these characteristics, as well as methods for measuring them, are presented in the report in light of their predictive value for the highway planning process. As has been illustrated in earlier economic and socioeconomic impact studies, the net effects of freeway introduction tend to be beneficial both for the project area and for the public at-large. The focus of social impact studies, on the other hand, is often negative. Nevertheless, the assessment of these short-term consequences in alternative route locations is essential to the highway planner to minimize disruptive effects which may accompany the facility's construction. By avoiding areas in which maximum adverse impact is incurred and by traversing areas in which the positive benefits of highway construction may be maximized, route selection and design can more adequately suit the needs and characteristics of urban residents.

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## CHAPTER I

### INTRODUCTION

Public service systems, such as urban highways, are designed to accommodate public interests and needs. A broad conception of public welfare, however, is often incompatible with more localized, neighborhood-level concerns about a freeway project's impact. This dilemma points to a growing recognition that transportation improvements within cities have a great potential for beneficial, as well as disruptive, impacts. Any major highway project thus must be considered in terms of expected changes in the quality of urban life for both the users and the impacted residents.

Social impacts of transportation improvements should be analyzed for at least four different reasons:

- (1) It is worthwhile to predict, and to account for, any beneficial and/or adverse impacts on urban sub-areas.
- (2) Objective information concerning such impacts can be of aid in highway planning, as well as in public meetings and public hearings.
- (3) Highway funds could be spent in a more expeditious manner if social impacts for alternative sites were strictly clarified.
- (4) Long-run benefits should accrue to the urban area as a whole from transportation improvements which advantageously shape the social structure of cities.

A brief summarization of several crucial issues confronting highway representatives can perhaps point to a justification for the preparation

of Social Impacts: Evaluation of Highway Project Development in Urban Residential Areas. First, urban systems continue to increase in scale and complexity (Hudson, et al., 1974). Because of the many, intense metropolitan problems existent, neighborhoods have become a more salient unit of personal concern. It is both the white middle class, as well as lower income minorities who feel that any intervention within their neighborhood is a special threat. Additionally, Burkhardt and Shaffer (1974:207) have suggested:

Public decision-makers have begun to realize that programs are judged by the public not only in terms of the intended results but also in terms of the other consequences or indirect effects. The planners of urban highways, airports, and transit facilities are now facing substantial opposition to transportation improvements, opposition which is based on the premise that the improved traffic flow (which is seldom questioned) is not worth the community disruption necessary to create the transportation improvement. It is relatively easy to predict and understand the changes in traffic flow that a new transportation facility can generate, but our ability to predict non-transportation changes in the city and in the lives of its people due to transportation improvements is much less refined.

At present, the vast majority of freeway locations and designs have been chosen according to two criteria: (1) physical or topological characteristics; and (2) costs of alternative sites. Very often the less tangible, indirect costs of the construction have not been fully considered. Because of the energy crisis, current inflation problems, and ecological concerns, which all have a "target" in terms of further urban freeway construction, the disadvantages of such construction are brought to the forefront by news media and special interest groups.

Manheim (1973:16) has attempted to summarize this problematic situation:

Our primary observation is that, although many states have responded to the challenges posed by the increased concerns for



community and environmental considerations, significant problems still exist. The problem is manifested by the public concerns expressed in various ways that social and environmental factors should be considered more centrally in highway planning than has traditionally been done. Some segments of the public feel these sentiments so strongly that there is a substantial base of anti-highway opinion within almost every state. Those who hold that opinion are found in many state legislatures and in politically active citizen groups, and their goal is to block most if not all major highway improvements. These actions suggest a "crisis of confidence." Many segments of the public no longer have confidence in highway engineering professionals, and rightly or wrongly, highway engineers are perceived as being opposed to many of the things that these citizens think are important.

### SOCIAL IMPACT AS A CONCEPT

Impacts reflect the effect of one factor or event on other factors or events. Very often, the decision to construct a highway has been based on an input-output evaluative approach. The inputs for evaluation have been derived from approximately four fields: (1) an overall planning approach; (2) traffic engineering criteria; (3) engineering design factors; and (4) construction costs criteria. The output, of course, is the decision to build or not build, and the determination of the actual highway site. Input-output analyses, thus, tend to deal with those factors which are directly related to the freeway project. Impacts easily can be included in an input-output analytic model, but they are nevertheless by-products of the improvement process and of the improvement itself (Burkhardt and Shaffer, 1974).

While both inputs and impacts must certainly be considered in any highway project plan or design, the focus of this report is on impacts--those indirect effects of highway improvements which are primarily non-user

oriented.<sup>1</sup> These forms of impacts often cannot be delineated in terms of their dollar value, and in some instances cannot be entirely quantified, which has limited their inclusion in previous project evaluations.

According to Riedesel et al. (1968:150):

Because property has to be acquired to be able to construct a highway, it is sometimes erroneously thought that the social impact of a highway can in one way or another be measured by the value or state of the dwelling units. On sociological grounds such an evaluation and subsequent decisions are incorrect and any conclusions drawn on the basis of similar evaluations suffer from such a large degree of error that their discussion serves no real purpose.

#### TYPES OF SOCIAL IMPACT

Any large-scale public works project--whether it be urban renewal, public housing construction, or railway and freeway construction--precipitates the same forms of impact on highly dense urban areas (Burkhardt and Shaffer, 1974). The evaluation of each of these improvements entails an analysis of different input and output variables, while social impact factors are similar in all four instances.

In each case, the degree of social impact evidenced is primarily dependent on six factors (see Table I-1):

- (1) socio-psychological attributes of residents
- (2) human ecological factors relating to characteristics of area residents
- (3) land use attributes
- (4) political factors

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<sup>1</sup>As can be envisioned, in some instances a person who can be an adversely affected non-user also can potentially benefit from the greater accessibility provided by the transportation project. An evaluation of these types of trade-offs is included in a later chapter.

Table I-1. Social Attributes to be Considered in  
Urban Highway Location Decisions

A. Attributes Directly Measured for the Assessment of Social Impact

Land Use -- Community/Neighborhood Form

Proximity to city center  
Proportion of mixed land usage  
Proportion of undeveloped land area  
Density of population  
Age of dwellings in area  
Location of social institutions  
Location of neighborhood boundaries

Human Ecological-- Modal Characteristics of Area Residents

Stability of area and housing tenure  
Ethnicity of residents  
Socioeconomic status of residents  
Age distribution of residents  
Transportation characteristics of residents

Socio-Psychological -- Individual Level Attributes

Use of local facilities  
Neighboring - ties to friends and relatives in area  
Participation in area associations  
Identification/evaluation of area  
Individual values in regard to residential area  
Highway issue involvement

B. Attributes Indirectly Related to Social Assessment

Political -- Decision-Making and Service Provision

Political decision-making in regard to project  
Neighborhood tax base  
Public service availability - police and fire protection,  
refuse disposal, educational and medical facilities

Economic -- Cost-Benefit Analysis

Property values  
Employment impact  
Industrial distribution  
Commercial distribution  
Travel costs  
Potential relocation costs

Environmental -- Human Physiology Impact

Air quality  
Noise levels

- (5) economic or cost-benefit factors
- (6) environmental conditions

This listing of social attributes to be evaluated for freeway location and design provide a very lengthy, and almost unlimited, set of parameters for assessment. The political, economic, and environmental factors relate to people within delimited urban sub-areas and affect their living patterns. However, these three dimensions are defined as peripheral to the first three social attribute categories--socio-psychological, human ecological, and land use factors--and will not be discussed in this report. The existing land use of the particular area and the characteristics of people within the area can be considered as extra-personal factors, and as predictors of inter-personal behavior, whereas the actual attitudes and behavior of residents provide an inter-personal focus.

#### SCOPE OF PROJECT EVALUATION AND SOCIAL IMPACT ASSESSMENTS

To be practical, the evaluation process for different transportation improvements must reflect the uniqueness of individual projects, as well as the scale of potential impacts for each project. Thus, the costs in time, manpower, and monetary investment for particular social impacts assessments should be highly variable. The suggested modes of evaluation presented in this report are usable for different levels of project evaluation. They are intended to be comprehensive and generalizable to all project situations. The goal has been to provide worthwhile and accurate techniques, but methods which are not directed for use in particular cities or specific projects. In small-scale freeway improvements, comprehensive considerations should be of less importance than one or two operational measures which evaluate the social benefits to the urban sub-area involved.

In the use of the three dimensions described above--concerning existing land usages, characteristics of area residents--and their individual attitudes and activities --highway representatives should be able to accurately predict the social consequences of project implementation. The three chapters dealing with these three dimensions, and the techniques which can be applied in each case, are thus a tool to be used prior to and during the project design process.<sup>2</sup>

In some instances, impact analysis may not be undertaken at only one point in time. The primary purpose of this report, Social Impacts: Evaluation of Highway Project Development in Urban Residential Areas, is to provide procedures for predicting positive and negative impacts before the freeway facility is introduced. Nevertheless, two chapters have been provided to present methods for the assessment of both short-term impacts (during and immediately following highway construction) and long-term social forecasting techniques (with a ten to twenty year predictive capability).

By providing specific methods for delineating social impacts in sequential stages of project planning and implementation, a charting of impacts for any one urban community or neighborhood over an allotted time period can be undertaken. More importantly, the immediate and long-term changes should be predicted and analyzed before construction of the facility, so that short-term and long-term adjustments in the impacted area will be specified in advance.

It should be recognized, for example, that individual residents will experience many strains before and during the construction phases, so that

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<sup>2</sup>After the acquisition of property for right-of-way and relocation has begun, it is normally too late to consider any but the ex post facto forms of impact.

the socio-psychological analysis is of special importance in predicting specific social adjustments at these stages of project implementation. On the other hand, the social impacts of land use changes may not be observable immediately, so that procedures used to predict these impacts must take into account the appropriate time frame.

Many previous studies have included social assessment techniques as a part of environmental impact statements. A primary goal for this report is the presentation of a more comprehensive, quantitative approach to social impacts evaluation than has heretofore been attempted. The inclusion of previously used techniques, with the addition of several sociological techniques not utilized in earlier social impact assessments, should provide an aid to state and district highway officials for project-level decision-making.

## CHAPTER II

### DEMARCATIION OF URBAN NEIGHBORHOODS

The basic perspective presented in this Chapter for determining the existence, and boundaries, of viable residential areas represents a consolidation of three operational techniques. Before delineating these three approaches, it should be noted that the area designated as a "study area" by highway planners may not be comparable to a "community" or a "neighborhood". A study area may represent only a portion of a residential area, may encompass numerous neighborhoods, or may contain no viable residential neighborhoods.

The term "community" usually depicts a broader geographical area than a neighborhood, with the full constellation of social institutions and services represented (Boskoff, 1970:4,8-10; Warren, 1963:9-10). Thus, a community may be an incorporated urban area or some sub-area of a city. A neighborhood connotes a narrower definition, usually described in terms of the following (Keller, 1968:87):

1. Geographical boundaries,
2. Ethnic, socioeconomic, or cultural characteristics of the inhabitants,
3. Psychological unity among people who feel that they belong together, or
4. Concentrated use of an area's facilities for shopping and leisure pursuits, and dependency on an area's social institutions (such as schools and churches).

Neighborhoods combining all four characteristics are rarely observed in contemporary urban settings, but normally at least two of the above criteria are evidenced.

The means for identifying the existence and boundaries of urban neighborhoods depends on three approaches: (1) observational methods of demarcation; (2) a demographic delineation; and (3) a survey approach. Each of these three perspectives are discussed in detail in Chapters III, IV and V, respectively, as well as in appendices at the conclusion of this report. In the use of any one of the three methodological approaches for neighborhood demarcation, the researcher will normally be simultaneously conducting a portion of the actual social impacts assessment. For example, in surveying residents as to the distinctiveness of their area as a neighborhood and obtaining neighborhood perimeters, the researcher most often will use these questions as an addendum of a larger social impacts evaluation, with the survey as the key assessment device.

#### SOCIAL INTERACTION AREAS

The pattern of residential linkages is inherently personal and must be determined at an individual level rather than on an areal basis. As a part of a larger environmental or social impacts survey, social interaction areas and neighborhood identification can be obtained.

The criteria for determining neighborhood boundaries and/or neighborhood cohesiveness should be based on survey questions revolving around the following components:



1. Congruency in identification of neighborhood boundaries;
2. Extent of residents' positive evaluation or identification with an area, i.e. a locality consciousness;
3. Extent of ties to friends and relatives within an area;
4. Use of localized facilities; and
5. Participation in area associations.

The last four factors are discussed in depth in Chapter V, "Socio-Psychological Attributes of Area Residents As Predictors of Social Impact." In this later chapter, each of these four components is operationalized; for example, the types of local facility usage is specified. Additionally, a means for measuring the scope, as well as the depth or intensity, of each of these four dimensions is defined in Chapter V.

The first factor, "congruency in identification of neighborhood boundaries," is a key component in the demarcation of urban neighborhoods. Examples of previous approaches to obtain a subjective delineation of neighborhood boundaries are outlined below, followed by a suggested procedure for delineation:

1. Community "knowledgeables," such as city planners or city officials, ministers, ethnic leaders, businessmen, local newsmen, or other informed persons, can be asked to plot residential neighborhoods. Peripheral or nebulous areas may be excluded so that all residential land use need not be included in the knowledgeables' assessment.
2. Highway project study area residents can be asked to provide information concerning the existence of neighborhoods and neighborhood boundaries by one of several methods:

- a. the specification of two "sides" to a sub-area, where two clear ecological boundaries are present, and the demarcation of remaining boundaries by the sub-area respondents and community "knowledgeables" (Vedlitz, 1975);
- b. the listing of residential area subdivision names or a complete listing of boundaries in terms of subdivision choices from which the sub-area respondents and community "knowledgeables" may select only one (Burke, et al., 1975);
- c. the listing of well-recognized historical or slang names of residential clusters, including those with ethnic or status connotations, which may have been well established and accepted by custom, as well as the arbitrary delineation of boundaries associated with each such name (Warren, 1955:341; Ross, 1970:562); and
- d. the collation of a survey question concerning "What is the name of the area within five blocks from your home," and then asking for specific boundaries (Ross, 1970:559).

The approach preferred by the authors of this report, because of its successful usage by sociologists, is:

- e. the collation of responses to "What is the name of this part of [the city]," followed by a request to state the boundaries of the area so named (Ross, 1970:559).

Using an evaluation based on (2.e.) above, it can be anticipated that a majority of residents within the same residential "core" will provide agreement concerning a neighborhood name, if one exists, and that a majority will identify identical neighborhood boundaries for three out of four boundaries (Ross, 1970:559).

#### DEMOGRAPHIC APPROACH TO NEIGHBORHOOD DEMARCATION

The information concerning neighborhood boundaries which can be gained

as a part of a larger social impacts study may not necessarily be correlated with the homogeneous residential area, i.e., census tracts delineated for decennial censuses. Nevertheless, in choosing neighborhood boundaries, it is often a good practice to consider the areas which have been demarcated in former studies by other research groups (Warren, 1955:341). This is especially the case for census tracts in tracted cities, which are normally Standard Metropolitan Statistical Areas (SMSAs). Without the use of subjective evaluations by residents or "knowledgeables" concerning neighborhood boundaries, the census tract demarcation becomes an appropriate alternative. According to Shryock and Siegel (1971:132):

Wards, election precincts, and other types of political areas within cities are not usually the most appropriate areas for statistical analysis of variation by locality within cities. Many of these areas are frequently changed so that variations over time cannot be studied. To meet this need, most large cities and their metropolitan areas have been divided into small areas called "census tracts". Most tracts have a population between 3,000 and 6,000. They are designed to include an area fairly homogeneous with respect to ethnic origin, economic status, and living conditions. Although tract boundaries are intended to be permanent, changes are sometimes made, particularly in the case of tracts that have had such a large population growth that they need to be subdivided.

In many instances, one census tract may encompass two or more neighborhoods which have been delineated by study area survey respondents. In some cases, the neighborhood delimited through such subjective estimates may consist of several tracts.<sup>3</sup>

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<sup>3</sup>Census block data are also helpful when census tracts are inappropriate, either because of the area covered by the project study site or because of the need for more in-depth analysis. The block data can be combined into fairly homogeneous socioeconomic units which may be representative of viable neighborhoods. Nevertheless, block level data are more limited as to indicators available and much of the existing data are suppressed when the anonymity of block residents could be violated.

Table II-1. Demographic Variables Used to Measure Residential Homogeneity

- 
1. Homogeneity of Housing
    - a. Coefficient of variation for owner values (CVO)<sup>a</sup>
    - b. Coefficient of variation for rental values (CVR)
    - c. Percent of rental units
    - d. Percent of single-family detached dwellings
    - e. Median age of dwellings in area
    - f. Median year residents moved to dwellings
  2. Homogeneity of Social Status
    - a. Coefficient of variation for family income (CVI)
    - b. Coefficient of variation for educational level (CVE)
    - c. Index of qualitative variation for occupational mixing (IQVO)<sup>b</sup>
  3. Ethnic Homogeneity
    - a. Index of qualitative variation for ethnicity (IQVE)
- 

<sup>a</sup>The actual method for computing a coefficient of variation from census tract data is shown in Chapter IV, page 54.

<sup>b</sup>The formula for computing the index of qualitative variation based on census tract data is found on page 47 of Chapter IV.



*Neighborhood boundaries can be delineated according to the identification of perimeters by residents, with the use of census tract boundaries, or, as shown above, by observable features. Railroads, creeks, or major streets can provide visible boundaries for neighborhood identification.*



Existing land use and zoning maps can supplement on-site observations to aid in the identification of residential areas which are distinct or separable from other land areas. In addition, the observer should identify mixed land use patterns. Large areas of mixed land use should not be included within the first experimental neighborhood boundaries.

Neighborhoods are often characterized by small service or activity centers. The localized trade area of stores and other local service

institutions may aid in delineating residential concentrations. According to Warren (1955:341): "Both in urban and rural settings, the neighborhood is sometimes thought of as the area served by the elementary school and the larger community or district by the high school". If the researcher can determine, through field observation or land use and city planning maps, the catchment areas for localized institutions and facilities, the recognition of these territorial boundaries can aid in neighborhood delineation.<sup>4</sup>

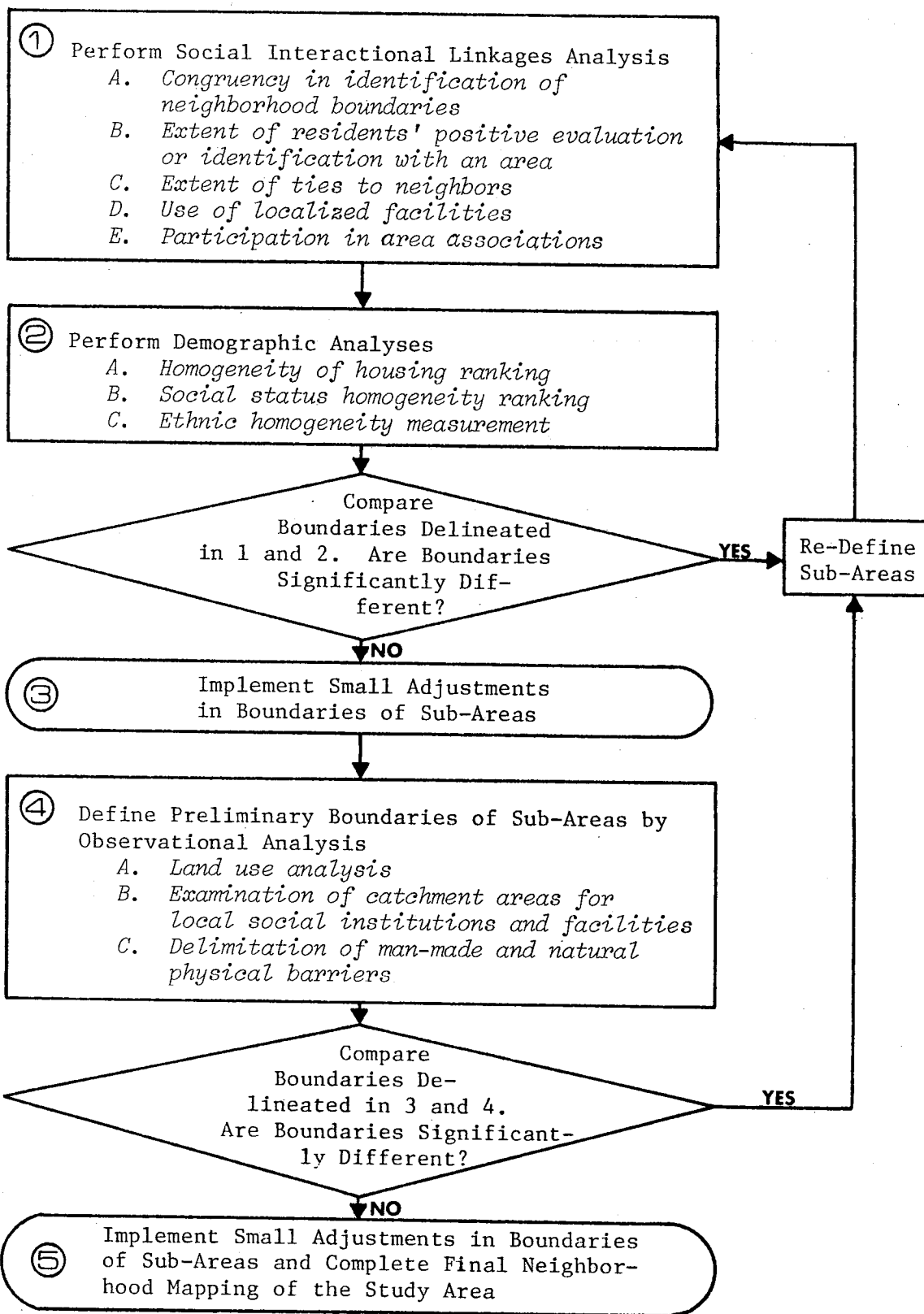
#### SUMMARY

The study area under consideration for urban highway improvements may have no such easily defined neighborhoods as have been indicated in the three approaches described in this chapter. If more than one of these approaches is utilized, there may be overlapping neighborhood boundaries. Depending on whether the researcher is adept at weighting or ranking alternative boundaries, a compromise may be obtained. "Nebulous" areas (which tend to surround easily identifiable "core" residential areas) may not be a part of any viable neighborhood and may thus signify an appropriate location for highway routing. A simplified flowchart which can be used in neighborhood demarcation is suggested in Figure II-1, showing a sequential process of perimeter selection. Previous attempts at urban neighborhood demarcation have made extensive use of overlays (see Marshall Kaplan, Gans, and Kahn, 1972; U. S. Department of Transportation, 1974b; Form and Smith,

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<sup>4</sup> Often area businesses, service organizations, and neighborhood associations have fairly clear conceptions as to where the perimeters of the area they serve are located.

Figure II-1. Profile of Sequential Steps in Neighborhood Delineation



1974). Nevertheless, the subjective, qualitative understanding of a study area, which can be gained by carrying out the observational, demographic, and survey analyses, should be a primary factor in making sequential adjustments of neighborhood boundaries.

The three methods described for urban neighborhood delineation play a dual role: (1) the demarcation of viable and "real" neighborhoods as opposed to heterogeneous areas or areas with mixed land usage; and (2) the first step in predicting the extent of social impact that freeway development within the study area would precipitate.



CHAPTER III  
LAND USE CHARACTERISTICS AS PREDICTORS  
OF SOCIAL IMPACT

The land form or land usage of residential areas under consideration for highway project implementation can be useful in evaluating the most appropriate route. Examination of existing residential patterns and neighborhood boundaries may point to specific alternate locations in regard to social impacts. After the social feasibility of alternative routes has been assessed, other analyses from engineering and cost-benefit perspectives can then be compared with the social impact evaluation.

Field observation is suggested as the most appropriate technique for analyzing land use and neighborhood forms. However, residential patterns and area characteristics also can be determined through census tract analyses (such as defining the median age of dwellings, or the proportion of dwellings that are multiple-family units) or through representative resident surveys (for example, determining the socioeconomic characteristics of area residents or actual residential linkages to neighbors and local facilities). Field observation can be used as the sole means of social impacts analysis or can be used in conjunction with these other two approaches. With extensive and controlled observation, the behavioral milieu and life styles of an area can be obtained, so that observation records have a potential for depicting more complex neighborhood characteristics than merely area land uses. While this Chapter emphasizes varied techniques for the analysis of specific land use characteristics, it also represents an attempt to discuss the usefulness of field observation in formulating impact statements.

The concept of land use denotes the particular function or activity which occurs in a specific area (Riedesel, et al., 1968:81). Such functions are described as being either residential, institutional, commercial, or industrial. Commercial and industrial districts form the "economic base" of the urban area, and generally generate heavy traffic and intense land usage. Institutional areas also may support a large amount of activity, especially organized centers of activities such as medical, educational, and cultural institutions. Residential areas are made up of a high percentage of housing units, and comprise some 40 percent of the land use in the metropolitan area (Riedesel, et al., 1968:81). These residential districts vary in the densities of population from six persons per acre in single-family dwellings to potentially over 300 per acre living in high-rise apartment buildings. While each of the types of land use described above has different intensities and patterns of usage, only the residential and social institutional districts will be emphasized in this chapter.

Where the relationships among residents, or their use of local facilities and social institutions, are altered, social adjustments also must be made. The types of land use characteristics evidenced prior to highway project development provide data which can be used to accurately assess alternative routes. These characteristics of existing uses of urban space can be summarized as:

- A. Residential Concentrations
  1. Proximity to city center
  2. Proportion of mixed land usage
  3. Density of population

4. Proportion of undeveloped land
  5. Age of dwellings in area
- B. Locational Factors
1. Location of social institutions
  2. Location of neighborhood boundaries

## RESIDENTIAL CONCENTRATIONS

### Proximity to City Center

The location of the planned project corridor relative to the central business district is an important predictor of potential freeway usage and of intensity of land development. Employment, along with commercial and service activities, is becoming more dispersed throughout the city. Further, cities are continually expanding outward. Residential areas near the city's core are in need of improved access to outlying areas. On the other hand, suburban residential areas tend to be "commuter's zones", so that improved freeway access is of importance to these districts.

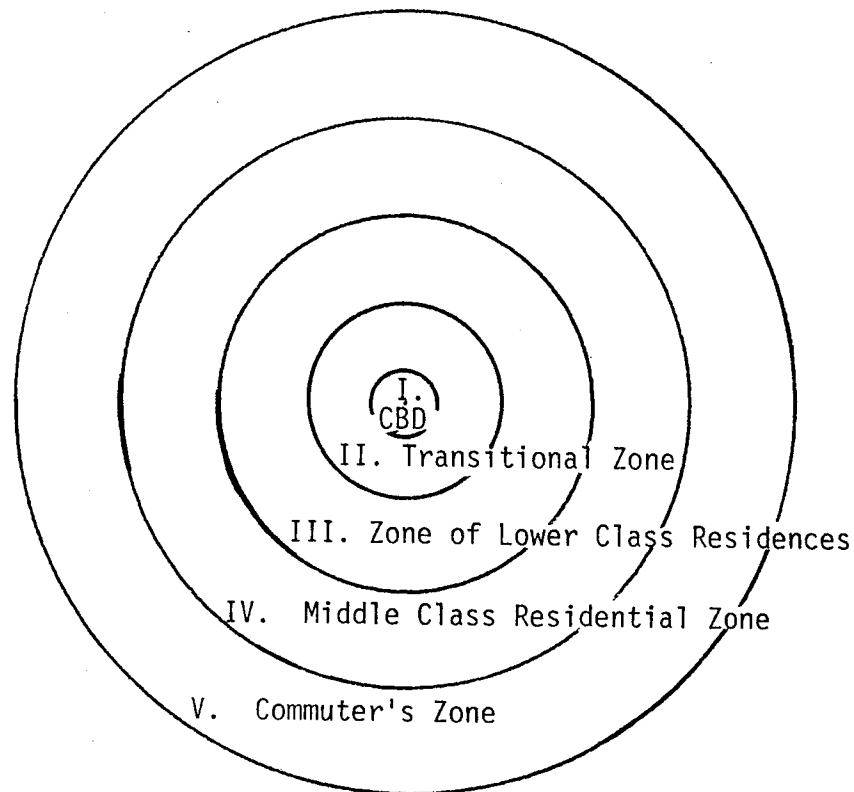
Location of residence in close proximity to the downtown area implies dense residential development, often mixed land usage, and older dwelling units. "Residential concentration" is the most prominent feature of these dwellings as emphasized by Phalan, et al., (1961:15):

The degree of development in an area is also related to its geographical position in relation to a dominant center. The area of land around a city increases as the square of the radius from the center. Areas located near the center of a city are almost wholly developed, vacant land is scarce, and the price of land is high. Such land is used more intensively and there is a considerable degree of obsolescence and mixture of uses.

A concentric zone analysis of project location, using the central business district as a hub, is often helpful. Many cities conform to several specific categories of zones, such as those shown in Figure III-1. Although commercial and industrial centers, as well as other social

institutions, are dispersed throughout the zones, these concentric zones are often representative of typical residential development in American cities.

Figure III-1. Concentric Zone Presentation of City Land Use Forms



Abridged Source: Ernest W. Burgess "The Growth of the City: An Introduction to a Research Paper," Pp. 37-44 in George A. Theodorsen (ed.), Studies in Human Ecology, 1961, Evanston, Ill.: Harper and Row. (Redrawn from the original)

Need for improved access in (1) residential areas close to the city center or (2) those areas in the commuting zone or rural-urban fringe suggests that a highway project in either of these two types of residential areas would be beneficial. However, central city neighborhoods are more densely settled, often containing a high proportion of residents with a

variety of social problems, so that the impact of freeways which are designed to segment these residential areas can be great. Thus, central city residential areas must be closely analyzed to determine neighborhood boundaries.

#### Proportion of Mixed Land Usage

From a sociological view, those areas with a high proportion of residences or prominent social institutions would be the least advantageous route locations, unless the freeway could border these areas and facilitate mobility for residents within such milieus. Mixed land usage normally points to districts in a transition stage, so that the construction of a large transportation artery would serve to facilitate the processes for change. If the area contains dwelling units which are interspersed between commercial or industrial facilities, such districts may not be viable neighborhoods. Expansion of commercial and industrial land use in these areas will be further facilitated with freeway introduction, but such changes were in the process of occurring without the highway as a catalyst.

The homogeneous, single-use residential sector is much less amenable to large scale intervention or change (Phalan, et al., 1961). Determination of mixed use of land versus the uniform residential area can be adequately measured through field observation, as shown in a following section.

#### Density of Population

Residential areas with either a high dwelling unit density or a high population concentration in relation to land space are areas where the social



*High residential density in urban areas may be associated with such demographic characteristics as lower socioeconomic status and a higher proportion of minority residents. Such characteristics may intensify adverse impacts of freeway construction.*

impacts of highway construction can be pervasive. High dwelling unit density can be estimated by field observers; over 1.5 persons per room indicates crowded conditions (U.S. Bureau of Census, 1972). Persons per acre for very dense areas can be as high as 250 or sometimes even higher (Riedesel, et al., 1968:99). High residential density is associated with more extensive neighboring and residential linkages to the area. In addition, densely settled urban milieus are also those which usually contain a greater proportion of lower socioeconomic and ethnic groupings. These factors point to areas which should not be transversed with a highway facility.<sup>5</sup>

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<sup>5</sup>Cost-benefit approaches to appropriate freeway route location also point to less densely developed land uses as more economically efficient site choices.

On the other hand, high density can be associated with mixed land use rather than strictly residential development. Thus, the degree of land use mixing must be compared with the extent to which the area is assessed as a viable, socially interactive milieu to determine the importance of population density as a predictive variable (Boskoff, 1970).

Low density residential areas contain an average of 8 to 12 persons per acre. Residents of low density developments may be more receptive to freeway construction because (1) the number of residents displaced is smaller, (2) more effective bordering of residential developments with the route location can be undertaken, and (3) low density areas tend to contain more undeveloped space amenable to site location.

#### Proportion of Undeveloped Land Area

Except in unusual instances, large tracts of undeveloped land tend to be found on the city's periphery, so that this variable is closely associated with distance from the central business district discussed earlier. Undeveloped, or sparsely settled land, such as evidenced for a city's rural-urban fringe, shows less social impact simply because fewer residents are affected by the facility. Further, residents located in sparsely settled subdivisions normally need improved transportation facilities and increased access to activity centers. Empirical data on social effects of different types of neighborhoods adjacent to freeways in Massachusetts and California suggested that "low-density, suburban type neighborhoods can



*A high proportion of vacant land in the project area often reduces adverse social impact. With lower density, for example, transportation facilities potentially displace fewer residents.*

tolerate freeways.<sup>6</sup> These neighborhoods ordinarily depend on walking very little, have many automobiles, and have most of the activity locations of the residents outside the neighborhoods" (Department of Transportation, 1974b:43).

The upsurge in residential development surrounding new freeway construction in relatively undeveloped land areas has been well documented. The development of vacant land, given the increased accessibility to the city provided by the facility, has been recorded in a number of locations (see Stover, et al., 1970:68). In a Michigan study, for example, 74 percent of new non-farm dwelling units were constructed within a two-to-three mile web around the highway (Philbrick, 1961:123).

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<sup>6</sup>The percent or portion of developed residential space can be measured with population density indicators or can be based on current measures of residential construction. In Texas, a large proportion of land which has been developed with multiple-family units can contain from 25 to 30 dwellings per acre and, in some cases, up to 40 such dwelling units. Single-family detached dwellings, on the other hand, reach a maximum of approximately 3.5 units per acre, so that a large proportion of sparsely settled one-unit structures points to areas which would sustain freeway introduction with less disruption.



### Age of Dwellings in Area

The average or median year that dwellings were constructed within a residential area points to several factors which are predictive of social impacts. Older residential areas, those with dwellings built before 1940, normally evidence (1) a greater diversity of socioeconomic groups or social classes, and (2) more mixing of land uses (Gans, 1968).

The first factor--homogeneity of residential areas--points to viable neighborhoods where large-scale changes, such as freeway construction, would be disruptive. For example, Gans (1968:156) has suggested:

In the new suburbs, current building and market practices combine to bring together people of relatively similar age and income, thus creating sufficient homogeneity to enable strangers to live together peaceably. In the communities which I have studied, many people say that they have never had such friendly neighbors. Where chance assembles a group of heterogeneous neighbors, unwritten and often unrecognized pacts are developed which bring standards of house and yard maintenance into alignment and eliminate from the conversation topics that might result in conflict.

While it is difficult to generalize, older residential areas tend to evidence a greater degree of diversity and are often less viable as neighborhoods, except in those instances where residents represent a highly homogeneous segment of the population.

### Measurement of Residential Concentrations

Potential social impact, as measured by land use characteristics, should point to both beneficial and detrimental adjustments that will accrue to non-users of a freeway facility. Unlike long-term social changes, these social adjustments occur simultaneously with highway construction and diminish in importance after two to three years.

The analysis of residential concentrations subsumes at least five key variables: (1) proximity to city center; (2) proportion of mixed land usage; (3) population density; (4) proportion of vacant land; and (5) the age of dwellings in the area. A sixth category and a seventh category of general importance are: the population size of the broad corridor in which alternative sites are being examined, and the potential residential displacement which will be incurred.

Field observation is suggested as the best approach for the examination of these variables. However, field work is one of the most difficult techniques in social science research because it cannot be reduced to mechanical procedures or formulas. A check-off list is an effective tool for field observation, as shown in Table III-1.<sup>7</sup> Figure III-2 provides a graphic summarization of the variables associated with the analysis of residential concentrations. The field observations by an analyst representing the highway department are qualitative and, therefore, more subjective than other research techniques. Not all project plans need include all the variables suggested in this section of the report. Appropriate variables, which are relevant to the alternative sites under consideration, should be selected from among those presented. The five variables presented in Table III-1 are highly interdependent. For example, densely populated areas normally have very little vacant land, are closer to the city's center, contain older dwellings, and often have a greater mixture of land usage.

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<sup>7</sup>More detailed information about field observation as a research approach can be found in Appendix B.

Table III-1. Partial Schedule for Field Observation:  
Evaluation of Residential Concentrations

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1. Proximity to city center of project site
    - a. Inner city transitional area (Social impact = low)
    - b. Lower class residential area in close proximity to city center (Social impact = high)
    - c. Middle class residential areas (Social impact = low)
    - d. Commuter's area (Social impact = high)
  2. Proportion of mixed land usage
    - a. Homogeneous, uniformly residential land use (Social impact = high)
    - b. Mixed land use (Social impact = medium)
  3. Density of population
    - a. High dwelling unit density, i.e., more than 1.5 persons per room (Social impact = high)
    - b. High population concentration in relation to land space, i.e., more than 50 persons per acre (Social impact = high)
  4. Proportion of undeveloped land area
    - a. Residential areas with greater than 90% land area developed (Social impact = high)
    - b. Residential areas with less than 2.0 dwelling units per acre (Social impact = low to medium)
  5. Age of dwellings in area
    - a. Dwellings units constructed before 1940, in mixed land usage situation, heterogeneous residents (Social impact = low)
-

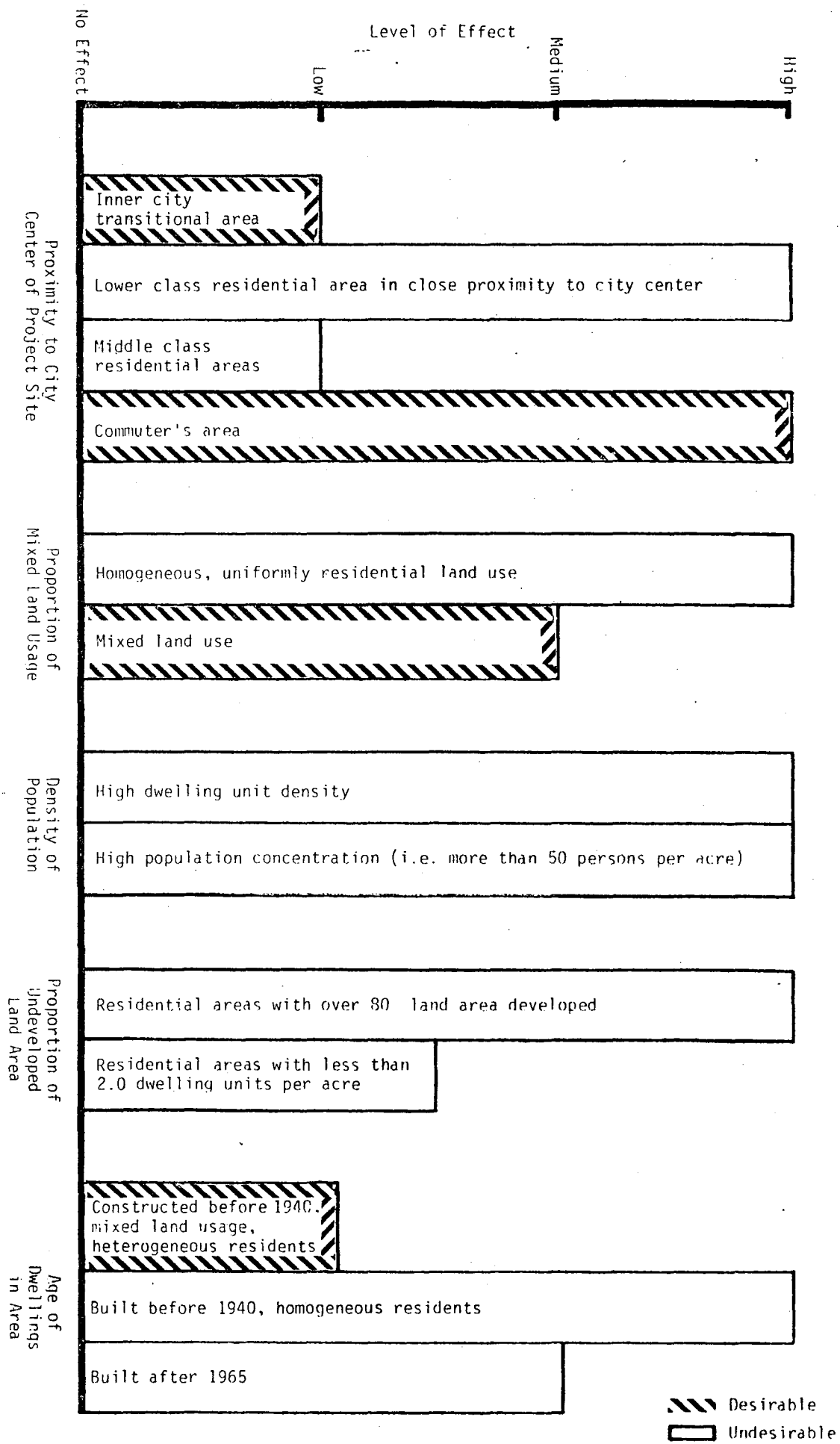


Figure III-2. Evaluations of Residential Concentrations

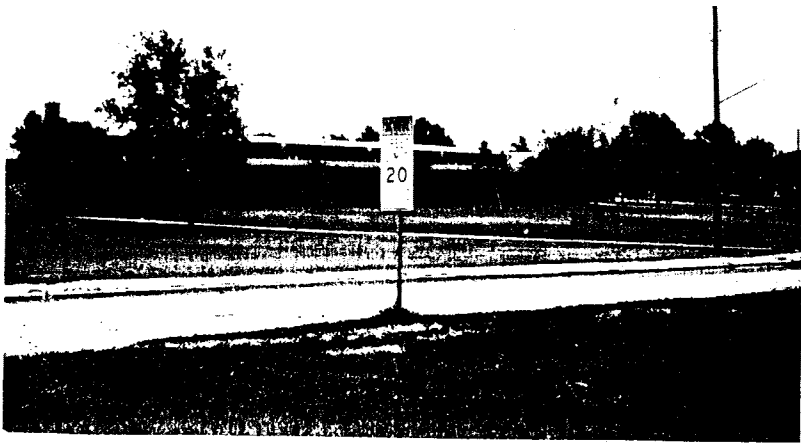
## LOCATIONAL FACTORS

### Location of Social Institutions

Highway impact on social institutions and activity centers, such as schools, hospitals, churches, and commercial facilities, has received considerable attention in recent years (Department of Transportation, 1974b:11-27). Because effects of urban freeways on businesses and industry are not considered a key means of predicting social impacts, they have been omitted from this report. Nevertheless, the location of localized businesses, services, and social institutions which are used by area residents aids in delineating information about residential linkages. An accurate assessment of such linkages thus provides a means for determining the social impacts of alternative routes.

The added accessibility and visibility provided by a new freeway facility may benefit institutions which cater to the entire city's population. Thiel (1961:23) has suggested, "Perhaps the most important effect of improved highway transportation on public services is the influence which highways exert in making public service facilities available more generally and for providing these services more economically." Traditionally, churches, hospitals, and schools have been located so as to maximize low noise levels and pedestrian accessibility, implying an avoidance of highway locations. Churches and medical centers, however, appear to be constructed more recently on property abutting limited access facilities, usually near interchanges (Department of Transportation, 1974b:23).

The key criterion in locating a freeway in close proximity to such institutions is the degree to which these facilities are utilized by residents within the immediate area. Schools are particularly vulnerable



*Community facilities for which use is localized are often vulnerable to the adverse effects of freeway construction. Freeways may, as an example, isolate the local facilities from their users.*

to such negative effects of freeways as decreased pedestrian safety and possible segmentation of residential areas being served by the school. Proximity effects vary, depending on:

- (1) the age of students attending the school;
- (2) the size and boundaries of the school service area; and
- (3) the use of the facility for non-school-related purposes, such as civic meetings.

Any localized facility usage, where a large proportion of the clientele are residing within the immediate area, should not be isolated from these users (Department of Transportation, 1974b).

#### Measurement of Locations of Social Institutions

A tentative procedure for delineating the neighborhood service areas is the delimitation of social institutions serving area residents. Neighborhood service areas are cohesive "pockets" which can be determined by field observation of the types and locations of social institutions. Field observation is, as has been noted, a subjective evaluation. The guidelines for determining the locality-centered character of social institutions are as follows:

- (1) Determination on a land use map, of existing area institutions, such as:<sup>8</sup>
  - a. churches
  - b. public schools (by grades served)
  - c. technical schools
  - d. church schools (by grades served)
  - e. labor unions
  - f. fraternal and masonic lodges
  - g. cemeteries
  - h. city parks
  - i. public services (fire stations, police stations, public housing authorities, libraries, etc.)
  - j. medical services

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<sup>8</sup>Although the use of localized commercial facilities and services is discussed in Chapter V, local businesses could also be included in the above list, if field observation is the only method utilized for a social impacts assessment.

- (2) Determination, by observation or informal discussion, of the extent to which each of the above facilities is locality-centered. (Ranking: Serves no residents in immediate area = 0; Serves few area residents = 1; Serves area residents and city population about equally = 2; Serves primarily area residents = 3).
- (3) Subjective evaluation of the service area boundaries provided by each of the facilities getting a rank of "2" or "3", as measured in (2) above.
- (4) Subjective weighting of neighborhood or area dependency on the facility compared to other facilities ascertained on the land use map (a comparative evaluation).

Each of the four guidelines depict sequential steps in the determination of the neighborhood-centered orientation of existing social institutions. Mapping of these observational steps can be undertaken, either by sequential maps, map overlays, or a simpler combined-stage map (as shown in Figure III-3, where the first two guidelines are mapped).

#### Location and Measurement of Neighborhood Boundaries

The delineation of neighborhood perimeters has been discussed previously in Chapter II. Any one (or a combination) of the three methods discussed for boundary demarcation can be adapted to the land use analysis.<sup>9</sup>

#### SUMMARY

Field observation has been suggested in this Chapter as the most appropriate technique for analyzing land use and neighborhood forms. Observational

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<sup>9</sup>These boundaries thus could be determined by aggregating the subjective perimeters of survey respondents, by demographic (census tract) accounts, or through subjective land use evaluation.



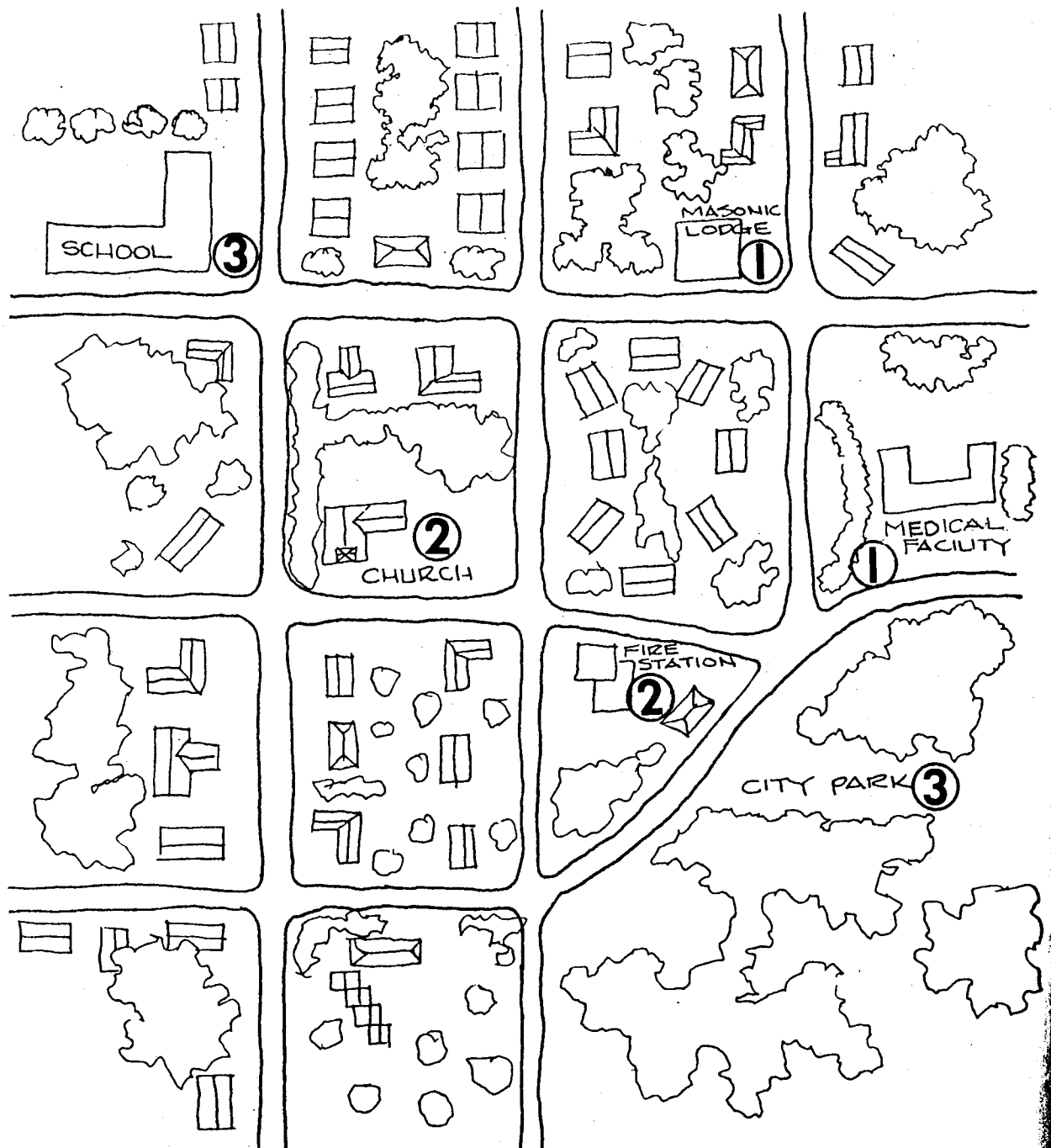


Figure III-3. Examples of Measures of Neighborhood Dependency on Specific Services<sup>a</sup>

<sup>a</sup>This figure is based on guideline (1)--demarkation of existing facilities or area institutions--and guideline (2)--ranking of the locality-centered character of each facility--where a 0 would suggest that the facility serves no area residents and a 3 denotes that the facility serves area residents primarily.

procedures can be supplemented by city planning or land use maps. Further, field observation can be used as the sole approach to social impacts assessment or can be used in conjunction with demographic and survey data.

Land use which maintains residential or institutional activity makes up a high percentage of space in the metropolitan environment. While urban freeway introduction is often advantageous for existing commercial and industrial activities, the impact upon dwelling units and many social institutions is often detrimental.

The types of land use characteristics evidenced prior to highway project development provide data which can be used to accurately assess alternative routes. The characteristics of existing social uses of urban space are summarized in Table III-2. The need for improved access in residential areas close to the city's center or in commuting zones on the

Table III-2. Land Use Characteristics Predictive of Social Impact

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1. Residential Concentrations

- (1) *Proximity to city center*
- (2) *Proportion of mixed land usage*
- (3) *Density of population*
- (4) *Proportion of undeveloped land*
- (5) *Age of dwellings in area*

2. Locational Factors

- (1) *Location of social institutions*
- (2) *Location of neighborhood boundaries*

city's fringe suggests that highway improvement in either of these two types of residential areas would be beneficial. Nevertheless, the social impact of construction is much more pronounced for central city residential areas.

The proportion of undeveloped land area is closely associated with proximity to city center, as is population density. With a sizeable portion of the freeway route constructed on undeveloped land or in areas that are sparsely settled, the social impact of the facility is greatly lessened, as might be expected.

Mixed land use along a proposed freeway site normally points to more transitory areas which are already undergoing large-scale changes. Thus, the residents in such areas may often be less intensely affected by freeway introduction. Older residential areas -- areas with a median age of dwellings prior to 1940--also tend to point to lowered social impacts in that these areas normally have more mixed populations and the dwellings themselves are highly varied.

Each of the variables summarized above has depicted the importance of observing particular population concentrations. Locational factors, especially the delineation of viable neighborhood boundaries -- where they do in fact exist -- also are important components of a valid social impacts assessment. In addition, the feasibility of segmenting "service areas" of localized social institutions and facilities needs to be examined. The boundaries surrounding institutions, such as schools and churches, which are dependent on area residents for adequate service provision should be delineated. As noted in this Chapter, neighborhood patterns and residents' utilization of local facilities and social institutions are altered with freeway project development. Thus, the extent of land use change and the concomitant social adjustments which are made should be predicted prior to project implementation.

## CHAPTER IV

### CHARACTERISTICS OF AREA RESIDENTS AS PREDICTORS OF SOCIAL IMPACT

The evaluation of potential impacts of freeway introduction in urban areas must, in many cases, make use of existing, readily available data sources. One very useful approach is the prediction of beneficial and adverse social impacts within specific residential areas through the analysis of published census tract data. While surveys of attitudes and interaction patterns normally provide the most meaningful approach (see Chapter V), this task is often costly and time consuming. Because personal characteristics of area residents have been found by sociologists to be predictive of interaction patterns and of receptiveness to a freeway facility, techniques for the use of these data are outlined in the following pages.

The characteristics of area residents which have a proven effectiveness for prediction of social impacts are:

1. Stability of households and housing tenure
2. Ethnic composition of area
3. Socioeconomic status of residents
4. Age distribution of residents
5. Transportation characteristics of residents

Each of these dimensions will be assessed for its usefulness as a guide in explaining the effects of large-scale highway project development in urban residential areas. The measures suggested to evaluate social impact, based on the dimensions described, are dependent on decennial census data.

## RESIDENTIAL STABILITY AS A PREDICTOR OF IMPACT

For some urbanites, residential areas are devoid of sentimental value. Many urban residents use neighborhoods as stepping stones--they continually move in the hope of achieving a higher social status or greater residential satisfaction. This pattern is not typical, however. The average urban resident moves once every five years, and overwhelmingly portrays a sentimental attitude to the area in which he resides.

The degree of neighboring in an area is usually associated with length of residence. Social bonds take time to build, so that the longer people reside in an area, the more likely friendships are to develop (Spear, 1974). Burkhardt (1971:89-90) utilized 22 demographic and physical characteristics of census tracts to determine which of these descriptors correlated most highly with a "social interaction index." He discovered that the "percentage of families who have been living at their current address less than two years" was the most important predictor, in a negative sense, of social interaction. The degree of interaction, in turn, is a crucial indicator of the social impact on an area which is divided by a freeway. However, the bordering of a highly stable area by an urban freeway should strengthen the cohesion of the area. In addition, dependency on local facilities and services tends to increase with length of residence, so that adjustments in everyday activity patterns must change if the structure of the area is altered.

Stability of residence is thus associated with neighborhood satisfaction and housing satisfaction, and also relates to home ownership. Renters, especially those in multiple-family dwellings, more often express

a willingness to move. Further, one national study (Speare, 1970:457) suggested that renters were four to five times more likely to move than home owners.

Residential mobility also has been used to measure, ex post facto, the social impact of a transportation facility. McLean and Adkins (1971:99) used city directory data on a city block basis for Houston, Dallas, and Austin sites where a freeway had been constructed. With a "mobility index" they found that residential mobility actually declined slightly in study neighborhoods bordering and not bordering (several blocks away from) the freeway. However, residential mobility increased in study neighborhoods segmented by the freeway, as shown in the table below.

Table IV-1. Statistical Means for Mobility Index by Neighborhood Category

Neighborhood Category	Mobility Index	
	Before Construction	After Construction
Control neighborhoods	123	113
All study neighborhoods	124	117
Study neighborhoods not bordering freeway	116	111
Study neighborhoods bordering freeway	120	112
Study neighborhoods segmented by freeway	111	122

Source: Edward L. McLean and William G. Adkins, "Freeway Effects on Residential Mobility in Metropolitan Neighborhoods," Highway Research Record 356 (1971:95-104). (Abridged from the original).

In the majority of urban highway projects, several potential sites are originally delineated and a choice among these alternatives is necessary. In many instances, commercial and industrial interests and land usages must be weighed against residential interests. For these cases, the stability of households should be an important factor in measuring such trade-offs, since stable residential areas tend to provide superior urban environments for their inhabitants.

## Stability Indicators

To measure the residential mobility levels of residents, a Mobility Index can be used, based on published census tract data. The Mobility Index has been tested for both California and Texas study sites; it is formulated as follows:

$$\text{Mobility Index} = 200 - 2X,$$

where  $X$  = the proportion of residents in the same dwelling for a five-year period. The Index ranges from 0 to 200, where 200 implies that every person in a census tract had moved within the five-year period, that is, the least stable of neighborhoods.<sup>10</sup>

If a more simplified approach is needed, three data descriptors from the census tract publication for the Standard Metropolitan Statistical Area (SMSA) can be utilized:

- (1) percent of residents living in their dwellings for five years or more;
- (2) median year residents moved to dwelling units; and
- (3) percent of dwellings that are owned,

for the census tracts subsumed in each of the possible project corridors.<sup>11</sup>

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<sup>10</sup>A tract could have a score of 200 if, for example, the area was newly developed. One important consideration is that the Mobility Index can also be used at a block level if more specific information is needed. In addition, decennial census information may not be sufficiently current for many purposes, so that city directory data can be compiled at a base year for households and compared with directory data for the same residences five years past.

<sup>11</sup>These three data descriptors and the Mobility Index are continuous or interval-level variables which could easily be placed in a comparative analysis with variables representing environmental, economic, and other impact considerations for any specific urban sub-area.

ETHNIC CHARACTERISTICS OF AREA RESIDENTS AS  
PREDICTIVE OF SOCIAL IMPACT

While the majority of city residents benefit from intra-urban highway improvements, the application of majority rule may not be an entirely feasible approach. As ethnic minorities are becoming continually more concentrated within central cities, they may be exposed to more social costs than benefits of transportation development (Ylvisaker, 1969:49).

Basic community values of ethnic minorities are not noticeably different from those values for Anglos--ability to be involved in local affairs, ability to socially interact and to use localized facilities (Feldt, 1969: 66). On the other hand, Blacks especially emphasize the need for more control and influence in decision-making, accessibility to employment, and stability and security in their neighborhood as being of special importance. It may be anticipated that greater opposition to transportation improvements will be evidenced in residential areas that are predominantly Black or Mexican-American. Ethnic minorities tend to feel that urban freeways within their community limit, rather than expand, accessibility. Ethnic minorities place an emphasis on stability within their immediate environments, perhaps because these groups are less "future-oriented." According to Riedesel, et al., (1968:159):

While many ethnic communities have disappeared in the melting pot, others have resisted changes. Those that remain separate often have difficulties in adjustment; or, for their members, access to communities other than their own has been denied. Thus, their social intimacy might be different from that of other metropolitan communities, and particularly oriented to specific "other" attributes. The impact of the highway will either be complete dissolution or rapid reconstitution elsewhere.

A dilemma occurs, however, in that many ethnic groups stress their opposition to urban freeway construction because of the displacement of residents and neighborhood segmentation. On the other hand, representatives



exposure, there would be a greater understanding of each other's problems and that a common base could be established wherein these problems could be solved.

The dilemma is pronounced and further efforts need to consider appropriate strategies in this regard.

According to at least two studies (Davis, 1974; Grier, 1970) dealing with potential highway impact, Blacks (and to some extent other ethnic minorities, such as Mexican-Americans in Texas cities) have special problems in obtaining replacement housing. Davis (1974:587) found that: "As compared with displaced white families (in a St. Paul freeway project), a significantly larger proportion of nonwhites had difficulty when they tried to leave the nonwhite area." Since clearance for highway construction was undertaken in the most nonwhite portion of St. Paul, the displaced Blacks have a particularly difficult problem in obtaining replacement housing.

Since 1970 the financial assistance provided to all relocatees has been greatly improved, especially for those who are renters (Buffington, 1974:32). Since a greater proportion of ethnic minorities are renters than are Anglos, this financial remuneration should provide many with an opportunity for improved housing conditions, and encourage home ownership. The relocation assistance, if applied liberally, should enhance the stability of place of residence once the relocatees have found suitable replacement dwellings.

The discussion above points to several strategies for future transportation project development:

- (1) If the alternative freeway locations point to one site which effectively borders two Anglo residential areas, so that neither is adversely affected by internal displacement and segmentation, this site should be more appropriate.

- (2) In attempting to border both an Anglo neighborhood and a Black (or Mexican-American) residential area, the attitudes of residents should be assessed to determine if this physical and social barrier is acceptable.
- (3) The project described in (2), however, also could be used to further or encourage ethnic mixing, thereby reducing residential polarization, and stimulating social, economic, and political integration in the impacted area.
- (4) Finally, the proposed project should provide improved accessibility for the residents surrounding the freeway site. Ethnic residents are more tied to their immediate residential area; public transportation improvements may be needed to encourage use of the new facility by area residents. Service roads and on/off ramps should adequately serve these areas.

#### Measures of Ethnic Composition

As with the analysis of area stability described earlier, techniques will be described in an attempt to provide an evaluation of ethnic concentration and of ethnic mixing in an area. The term "ethnic" is used loosely to encompass racial, nationality, cultural, or linguistic groups. Racial distinctions alone are not adequate in most Southwestern states, for example, where a sizable number of residents are Mexican-American.

The concentration of Blacks or Mexican-Americans can be ascertained by obtaining, through census tract publications:

- (1) the percent of Anglos per tract,
- (2) the percent of Negroes, and
- (3) the percent of Mexican-Americans (Spanish-Americans).

Where the proportion of Blacks or Mexican-Americans is high (such as more than 75 percent of the tract's population), project planners should attempt to border rather than to divide viable residential neighborhoods.

Because of the interest in maintaining ethnically mixed neighborhoods, rather than segmenting them with freeway project implementation, a measure of ethnic mixing is also provided, entitled the Index of Qualitative Variation,

Index of Qualitative Variation for Ethnicity (IQVE) =

$$\frac{\sum n_i n_j}{\frac{k(k-1)}{2} \left(\frac{N}{2}\right)^2}$$

where the summation is over all values  $i > j$ ,  $n$  = number in each ethnic category,  $k = 3$  or the number of ethnic categories being used, and  $N$  = the total population for the census tract. For example, among 1,500 residents of any one tract, suppose that 1,000 are Anglo, 400 Mexican-American, and 100 Negro according to published 1970 census tract reports. The observed mix is actually fairly high for this residential area, considering that the majority of tracts will evidence a more homogeneous ethnic composition. The IQVE for this tract is  $\frac{(1,000 \times 400) + (1,000 \times 100) + (400 \times 100)}{\frac{3(3-1)}{2} \left(\frac{1,500}{3}\right)^2} = .72$ .

The Index will always range between 0 and 1.0, with 1.0 indicating totally balanced mixing among the three ethnic groups.<sup>13</sup>

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<sup>13</sup>The number of categories ( $k$ ) can be altered to accommodate the appropriate number of ethnic groups that could potentially occupy any one area. The Index is based on the number of differences between categories divided by the maximum number of possible differences. For further information on the Index of Qualitative Variation, see John H. Mueller, *et al.* (1970) Statistical Reasoning in Sociology, 2nd ed., Boston: Houghton Mifflin.

SOCIOECONOMIC STATUS OF AREA RESIDENTS  
AS A PREDICTOR OF IMPACT

Attitudinal studies of residents in or near proposed freeway corridors tend to point to lower class residents as being more opposed to construction of the facility (see, for example, Department of Transportation, 1974b). Thus, low educational and income levels, as well as other characteristics of low socioeconomic status of residents in study sites, should aid in predicting acceptance of the facility and the amount of maladjustment likely to occur.

In Fielding's (1971:7) study of the social impacts of a highway in Cambridge, Massachusetts, he noted that lower class residents tend to "live for the day" and to fear broad scale changes:

People who are 'present oriented' and who are socially or psychologically incapable of comprehending future change pose a special problem for urban policy. Banfield (1970:265-8) suggests that this 'lower culture' group may constitute one-fifth of the population and need not be exclusively low-income. Affluent individuals, as well as the poor, are incapable of providing for the future or correcting alcohol and drug addiction. However, because of nutritional deficiencies among their children and the inadequacy of schools in the central cities and rural areas, poor families are prone to a 'present oriented,' lower culture status.

Informal friendships and ties to local services and facilities are normally strong in urban working class and lower class neighborhoods. In the vast majority of sociological studies of neighboring, it has been found that the majority of "friends," as listed by lower class respondents, reside in close proximity to the respondents. Lower-income residents are not necessarily oriented to their residence per se, but often are tied to the residential area because of (1) extended family relationships there, or (2) the importance to these individuals of visiting within the neighborhood

As consumers, residents of lower socioeconomic status are often more "personalizing;" without access to either formal or informal channels of social participation, lower income consumers tend to establish friendship relationships with the personnel of neighborhood retail institutions. Foley (1961:614) correlated educational level with the extent of neighborhood facility usage (see Table IV-2), and found that those with less formal education were more tied to localized facilities.

Table IV-2. Use of Local Facilities and User's Formal Education

Education of Users 18 Years of Age and Over	Median Mileage, Home to Facility
3 Years of high school or more	2.05
2 Years of high school or less	1.23

Source: Donald L. Foley, "The Use of Local Facilities in a Metropolis," pp. 220-234 in Jack P. Gibbs (1961) Urban Research Methods, Princeton, N.J.: Van Nostrand.

The conclusion to be drawn from these findings, then, is that persons in lower class neighborhoods are more likely to require shops and services close to their homes. In part, this reflects their inadequate economic and transportation resources, but it also reflects cultural and ethnic preferences (see Keller, 1968:103). In residential areas for middle and upper socioeconomic groups, friendship relations are more spatially diffuse. Urbanites in these categories have more alternatives in terms of social participation and use of service and retail establishments.

While the discussion in this section has simplified and aggregated the behavior of residents by socioeconomic status alone and has not emphasized

individual variation, a broad presentation of socioeconomic status as a predictor of social impacts has been undertaken. Apprehension about freeway project implementation within a lower class residential area, while more pervasive, does not cause these residents to move to another residential area. As noted above, lower status groups are, on the whole, more tied to particular neighborhoods than are higher class urbanites. The Texas study (McLean and Adkins, 1971) of socioeconomic impacts of freeway construction in Dallas, Houston, and Austin pointed to the fact that, if a higher socioeconomic area was traversed by the transportation facility, residents moved out of the area in greater numbers than was the case in lower status areas (see Table IV-3).<sup>14</sup> This table shows that, while the base or original mobility levels were the greatest predictors of mobility after the freeway was constructed, higher status residential areas segmented by the freeway also had a greater propensity for outward mobility.

Elliot (1971:34) suggests that "there would often be less actual community disruption if the highway went through the high-priced property rather than the low. Bought out and turned loose, those people have the means to fend for themselves far better than the people within the poor neighborhoods."<sup>15</sup>

<sup>14</sup> In most residential areas where urban highways have either been constructed or planned, the socioeconomic levels have been low to intermediate, indicating that the choice of a freeway right-of-way is very much tied to economic considerations. Also, central city residential areas tend to be lower to middle class, and many freeway sites traversed these areas.

<sup>15</sup> Elliot further notes that this approach is not taken, not only because of higher property values, but because these residents know to whom to complain to stop such a plan.

Table IV-3. Final Multiple Regression Analysis of Variables Which Were the Greatest Predictors of Mobility After Freeway Introduction

Independent Variable	"t"-value	Probability of a Type I Error
Mobility Index for 1955	-3.26	0.0002
Higher Socioeconomic Index for 1950 (Segmented)	2.05	0.043

Change in M.I.\* = 43.80 ( $\beta$ -constant) - 0.36 (M.I. 55)  
+ 16.51 (High S.I. 50 Segmented)

Root Mean Square Residual (R.M.S.R.) = 22.04; F-value = 9.82

Critical value of  $F_{.05} = 3.11$

\*This equation represents the final step-down regression equation which shows the significant predictiveness of the remaining independent variables.

Source: Patricia K. Guseman and Edward L. McLean, "The Impact of Freeways on Urban Neighborhoods," paper presented at the American Sociological Association meetings in Denver, August, 1970.

Transportation improvements can play a large part in increasing property values in all neighborhoods and can stimulate renovation in deteriorated neighborhoods. In attitudinal studies, the majority of residents in all socioeconomic groups appear to favor freeway construction, although lower status groups are the least receptive. Realistic involvement of low status residents in highway planning may be impossible (see Fielding, 1971). Therefore, accurate assessments of the potential social and economic impacts on this group should be undertaken.

Judgment concerning the degree of disruption by economic status should not omit the criterion of socioeconomic homogeneity. Although propinquity stimulates social interaction, the homogeneity of a residential area in



*The socioeconomic status of residents may influence their receptivity to freeway introduction. Lower-class residents are often more closely tied to their residential area due, in part, to limited personal transportation.*

terms of these status characteristics is also of primary importance. Just as mixed land use tends to point to areas where neighboring is of less importance to those people residing in them, so does mixed class or status levels create a less intensive "feeling of community".

Homogeneity of social values, community goals, and customs tends to be a function of neighborhoods which are closely homogeneous in regard to class. In these areas, any large scale changes are likely to meet with greater, and more organized, opposition, unless the change can be of proven benefit to the area. Diverse or socioeconomically mixed areas, on the other hand, are often less cohesive and residents may evidence a greater concern about improved property values with the freeway's introduction than with a concern for community disruption.



## Measurement of Socioeconomic Status

Two approaches to the measurement of socioeconomic status are described below, one pointing to a measurement of the "modal" or average economic status of the residents and a second indicating the degree of class mixing within the planned corridor. Socioeconomic status can be measured through the use of five census tract descriptors:

- (1) median owner value,
- (2) median gross rent,
- (3) median family income,
- (4) median years of school completed (for those 25 years of age and over), and
- (5) percent of white collar workers (where white collar workers = professional, managerial, clerical, and sales occupational categories).

Each of these descriptors is more meaningful when compared to the city as a whole, so that the socioeconomic status of any residential area is a relative characteristic. These five measures normally evidence a high degree of statistical correlation (above .90) so that knowledge of one descriptor indicates to a large extent the values of the remaining four data variables. It has been emphasized that residential areas containing residents with low income or educational levels tend to be more affected by any large-scale changes. Thus, those areas with very low socioeconomic scores should be evaluated carefully.

Second, homogeneity of socioeconomic traits stimulates social interaction and neighborhood cohesion. Areas containing residents with disparate

socioeconomic statuses normally reflect lower rates of interaction and evidence a lowered "sense of community", as described earlier. For these reasons, the Coefficient of Variation (C.V.) was suggested for the purposes of depicting area homogeneity, and can be used to point to homogeneity in owner values, rental values, income, or educational levels within a tract. The C.V. is formulated as,

$$C.V. = \frac{\sum f_i (X_i - \bar{X})^2 / N - 1}{\bar{X}}$$

where  $\bar{X}$  = the mean or average owner value, for example,  $X_i$  = the midpoint for each category of owner values,  $f_i$  = the number of owner values in each category, and  $N$  = the total number of owner units per tract.<sup>16</sup> The C.V. can range from 0 to  $\infty$ , but normally does not exceed 1.00 or 1.15. A very homogeneous area is one which has a C.V. (whether for owner or rental values, educational levels, or income) of less than .30.

#### AGE DISTRIBUTION OF AREA RESIDENTS AS PREDICTIVE OF SOCIAL IMPACT

The family status and age distribution of an area can provide an important predictor of the degree of identification and ties to a residential area.

<sup>16</sup>The C.V. is the standard deviation relative to the mean value, and is more appropriate than the standard deviation used alone when census data are the information source. A Wichita Falls census tract (the first tract listed in the 1970 tract publication for the Wichita Falls SMSA) contained 133 owned dwellings in 1970. To obtain the C.V. for the tract, which had a mean owner value of \$9,793, the actual calculation was the square root of

$$[12(3333 - 9393)^2 + 37(6249 - 9393)^2 + 36(8749 - 9793)^2 + 14(11,249 - 9793)^2 + 20(13,749 - 9793)^2 + 7(16,249 - 9793)^2 + 0(18,749 - 9793)^2 + 8(22,499 - 9793)^2 + 0(29,999 - 9793)^2 + 0(42,499 - 9793)^2 + 0(62,499 - 9793)^2] / 133 = \sqrt{2,930,711,392/133} = \$4,694/9,793 = .48.$$

A large proportion of older persons or a large percent of children residing within the area can provide insight into the effects of highway project implementation. While a positive relationship between economic status and social isolation from neighbors has been observed, those who are between the ages of 20 and 50 may also be considered to be more isolated from their neighborhoods than the very young or very old. In addition, it is generally thought that young housewives with children are more involved with neighbors than are those females who are in the labor force.

Keller, in The Urban Neighborhood (1968:72-73, 105), has suggested:

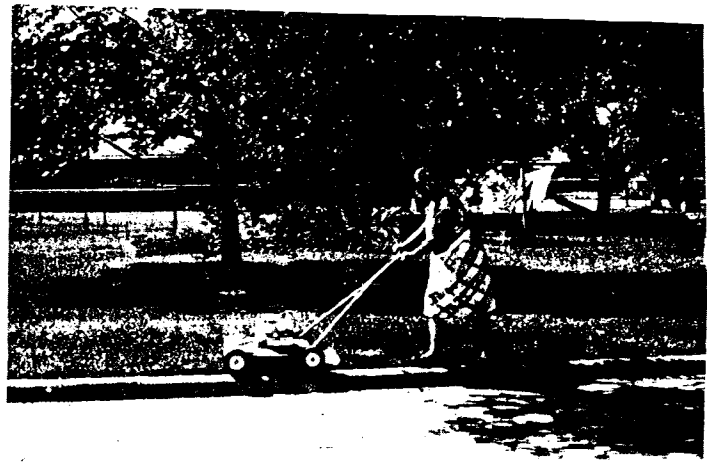
Those immobilized by old age, family responsibilities, ill health, ignorance, or isolation need the neighborhood most, not only for the satisfaction of their tangible wants for goods and services but also for intangibles such as gossip and information....

For example, both children and older citizens, more than other age groups, have been found to draw their social contacts from among neighbors...The propensity among the elderly to select their friends from among neighbors may be due either to age as such or the length of residence in an area, the two often going hand in hand.

The immediate neighborhood is of great importance to many older persons--as important as their own dwelling unit (Carp, 1971:107). Retired persons, especially, form personal relationships with age cohorts within their neighborhood for mutual assistance.

Older age is highly correlated with length of residence and with a desire to remain in current place of residence (Speare, 1974:176):

Although more young than old people consider moving, we cannot adequately explain this by saying that growing older causes immobility. A fuller explanation starts with the assumption that age affects some of the elements of residential satisfaction....The importance of a familiar environment is likely to increase with age, providing another element of relative satisfaction with the current location.



*The age distribution of residents is indicative of their abilities to adjust to the transportation facility. Residents under 16 and over 60 years of age often exhibit closer ties to their immediate area, and generally benefit less from freeway introduction.*

Because of the importance of the residential area as a milieu for social interaction and facility usage, freeway introduction is problematic for older persons if these ties are impeded. Appleyard (1971:73-77) found that the old and the young were especially affected by heavy traffic volumes on arterial streets. Pedestrianism was decreased for these age groups, residential linkages were impaired, and noise was suggested as a problem by the older persons interviewed.

## Measurement of Age Distribution

The data source emphasized in this chapter is census tract information. This form of data can be very useful in analyses of the age distribution of area residents, particularly when alternative highway project sites are being evaluated. The data descriptors to be obtained for each census tract are:

- (1) the percent of residents under 16 years of age, and
- (2) the percent of residents 60 and over.

These two descriptors can be used alone or can be readily combined in a formula entitled a Dependency Ratio,<sup>17</sup>

$$\text{Dependency Ratio} = \frac{\text{Percent of Children (Residents < 16)} + \text{Percent Aged (Residents 60+)}}{\text{Active Population (16 - 59)}} \times 100$$

As can be anticipated, the greater the number of "dependent" residents, the more adverse tend to be the consequences of freeway intervention. If the proportion of children is greater than 35 percent, or the proportion of older persons is larger than 15 percent, higher Dependency Ratios will result. The weighting of this measure with other indicators described earlier will be undertaken in Chapter VI. When the area or census tracts under consideration consist primarily of multiple-family dwellings, it is often helpful to obtain an additional variable, the percentage of unmarried adults, as this age group is particularly amenable to relocation and to large-scale neighborhood alterations.

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<sup>17</sup>For further information in regard to the Dependency Ratio, see William Peterson (1969) Population. New York: MacMillan.

TRANSPORTATION CHARACTERISTICS OF AREA RESIDENTS  
AS PREDICTIVE OF SOCIAL IMPACTS

A basic approach to measuring the social impact of urban highway introduction on a neighborhood is the examination of automobile dependency. Especially in Texas cities, public transportation does not receive more than minimal usage. Households which are dependent on easy accessibility and which possess one or more automobiles, such as suburban households, are more receptive to freeway construction. Location of place of residence within the urban environment is a crucial indicator of transportation needs and of modes of transportation employed. Carp (1971:110), in a study of transportation needs of older persons, found that:

The strongest correlate of the frequency of walking was location of the person's home in the urban complex. Residents of the centermost zone walked most, and the incidence of walking as a means of transportation diminished zone by zone, to be least among residents of the new suburbs at the periphery of the city.

Because a greater proportion of lower class individuals, ethnic groups, and older persons have no automobile, as compared to the population as a whole, these groups often perceive the freeway as of little benefit to them.<sup>18</sup> Some of these individuals may profit by highway construction in terms of increased property values, but those of lower socioeconomic status and/or of ethnic minority backgrounds are primarily renters.

The employment status of these problematic groups may not be enhanced by improved freeway facilities because of the lack of automobile availability. A summary of a Syracuse-Onondago County Planning Agency study for 1969 states:

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<sup>18</sup> In addition, when the one-automobile household uses the family car for the head of the household to get to work, the rest of the family members are essentially carless 8 to 10 hours a day. Members of these families must use other means of transportation for any non-home-based activities during this period (Paaswell and Recker, 1974:16).

The relationship of job opportunities to transportation was analyzed in the model cities neighborhood of Syracuse, N.Y. with family income serving as the criterion of focus. About 1200 interviews were held in the neighborhood to discover views toward unemployment. An interesting finding was that about 1400 healthy males of working age had been effectively barred from joining the work force. It was estimated that 18,000 jobs are not served by public transit--and this system is only about one-third as efficient as the auto in providing inner-city residents access to job opportunities. The unemployment rate is almost 10 times higher among those dependent on bus for work trips than among auto users.

For specific groups--especially the inner city poor, the old, and minority groups--public transportation improvements are often more important (in terms of public expenditure preferences) than is further urban highway construction (Burke, et al., 1975; Ryan, et al., 1972:17).

Benefits from freeway project improvements within residential areas will be evidenced when the vast majority of households have at least two automobiles, and are provided ease of accessibility with crossovers, service roads, and on/off ramps. These forms of improvements can stimulate local, as well as extra-neighborhood, access by which residents can travel to needed facilities and institutions. Thus, the obstruction may be relatively unimportant at worst, and highly advantageous at best, in residential areas where individuals and families rely solely on private vehicles (Marshall Kaplan, Gans, and Kahn, 1972).

#### Measures of Transportation Dependencies

Census data on neighborhood-level transportation and related characteristics can be used to determine the social impact of freeway project development in terms of, first, increased accessibility and, second, maintenance of existing residential linkages within the impacted area.

At a census tract level, from published decennial reports, the following data descriptors can be obtained on transportation to work:

- (1) percent of workers per tract who drive a private vehicle to work,
- (2) percent of workers per tract who are passengers in a private vehicle,
- (3) percent of workers per tract who use buses,
- (4) percent of workers per tract who walk to work, and
- (5) location of work relative to census tract under consideration (place of work = (a) inside central city, (b) inside county, but not in central city, (c) inside SMSA but in outlying counties, or (d) outside SMSA).

These data can then be compared to the city or SMSA as a whole to determine the extent of private vehicle dependency.<sup>19</sup>

An additional formula, based on available census tract data, has been used and recommended by other researchers concerned with socio-economic impacts (Marshall Kaplan, Gans, and Kahn, 1972; Department of Transportation, 1974b) entitled a General Pedestrian Dependency Index. The title of the indicator is somewhat confusing when compared to the actual data descriptors used as components, in that the formula is basically an aggregated social feasibility model, to be used as a "proxy" for pedestrianism. The General Pedestrian Dependency formula depends on such neighborhood characteristics as the proportion of households without cars (h%), the average number of persons per

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<sup>19</sup> If a survey is additionally undertaken within the project corridor, the percent of households with one, two or more automobiles can be obtained, as well as further information about modes of transport to specific activities and the existing framework of residential linkages.



household (p), the median family income for the city (I), and the median family income for the census tract (i). The General Pedestrian Dependency formula is calculated as follows:

$$\text{General Pedestrian Dependency Index (G.P.D.I.)} = \frac{(h\%) \times (p) \times (I)}{i} \cdot 20$$

#### SUMMARY

Demographic data can be used as a substitute for specific attitudinal and behavioral characteristics of residents within corridors of planned highway improvements. These data, representing socioeconomic, ethnic, and age characteristics of residents, as well as stability and transportation characteristics of an area, are high predictors of the social impacts of freeway introduction and of receptiveness to the facility. Such attributes measure "style of life" within specific residential areas.

Stability of residence has been described as a measure of an area's vitality and of the satisfaction of residents with their place of residence. The measures of residential stability are summarized in Table IV-4.

Ethnic composition of urban sub-areas aids in predicting the degree of dependency or ties to a residential area. The implications of planning highway routes to optimize ethnic mixing or ethnic homogeneity were discussed. Indicators of ethnic composition are shown in Table IV-4.

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<sup>20</sup> For example, residents in areas scoring over 100 on the G.P.D. index may be characterized as containing a relatively large proportion of pedestrians who may be generally dependent on the local area. In these areas where scores are less than 20, on the other hand, residents may be viewed as being relatively mobile throughout the metropolis.

Table IV-4. Summary of Demographic Data Descriptors for Characteristics of Area Residents

<p><u>1. Residential Stability</u></p> <ul style="list-style-type: none"> <li>(1) <i>Mobility Index</i></li> <li>(2) <i>% 5-Year residents</i></li> <li>(3) <i>Median year moved to dwellings</i></li> <li>(4) <i>% Owned dwellings</i></li> </ul> <p><u>2. Ethnic Characteristics</u></p> <ul style="list-style-type: none"> <li>(1) <i>% Anglo</i></li> <li>(2) <i>% Negroes</i></li> <li>(3) <i>% Spanish-Americans</i></li> <li>(4) <i>Index of Qualitative Variation for Ethnicity (I.Q.V.E.)</i></li> </ul> <p><u>3. Socioeconomic Status of Residents</u></p> <ul style="list-style-type: none"> <li>(1) <i>Median owner value</i></li> <li>(2) <i>Median gross rent</i></li> <li>(3) <i>Median family income</i></li> <li>(4) <i>Median years of school completed</i></li> <li>(5) <i>% White collar workers</i></li> <li>(6) <i>Coefficient of Variation (C.V.) for owner values, rent, income, or education</i></li> </ul>	<p><u>4. Age Distribution</u></p> <ul style="list-style-type: none"> <li>(1) <i>% Residents &lt;16</i></li> <li>(2) <i>% Residents 60+</i></li> <li>(3) <i>Dependency Ratio</i></li> </ul> <p><u>5. Transportation Characteristics</u></p> <ul style="list-style-type: none"> <li>(1) <i>% Workers driving private vehicles</i></li> <li>(2) <i>% Workers as passengers in private vehicles</i></li> <li>(3) <i>% Workers dependent on buses</i></li> <li>(4) <i>% Workers walking to place of employment</i></li> <li>(5) <i>Location of work relative to place of residence</i></li> <li>(6) <i>General Pedestrian Dependency Index (G.P.D.I.)</i></li> </ul>
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Socioeconomic status of residents, similar to analyses of ethnicity, points to types of residential linkages and attitudinal characteristics which may be affected by freeway introduction. In addition, the homogeneity of the area along social class lines points to viable, cohesive areas which cannot be readily traversed. Areas which are fairly economically diverse were suggested as more appropriate project sites.

Age distribution of residential areas also predicts the degree to which highway improvements affect the immediate population. Especially

in neighborhoods with high Dependency Ratios (that is, a large proportion of older persons and/or children) possible resistance to residential alterations was suggested.

Location of an urban highway is intended to provide greater access to those in close proximity to the facility as well as those desiring rapid intra-urban travel. Residents of urban sub-areas which depend solely on personal vehicles for transportation and those households which are not tied to the immediate neighborhood for daily activities accrue more benefits from freeway project implementation within their residential area. Table IV-4 includes a presentation of transportation-dependency indicators.

The demographic approach to social impact analysis provides one set of procedures for measuring the social costs and benefits of highway routing within urban residential areas. The indicators summarized in Table IV-4 can be obtained with little difficulty or cost. In most cases, these data descriptors can be viewed as "social capacity indicators" -- pointing to the types of changes that can be sustained. In smaller scale highway projects or improvements of existing facilities, demographic data can prove a sufficient measure of potential social impacts. In larger urban highway projects, the demographic measures can be tied to survey information and field observations to obtain a more comprehensive evaluation.

## CHAPTER V

### SOCIO-PSYCHOLOGICAL ATTRIBUTES OF AREA RESIDENTS AS PREDICTORS OF SOCIAL IMPACT

In large urban highway projects, more specific information than demographic or field observation data may be necessary. The attitudes and behavioral patterns of residents in the planned corridor, as obtained through a survey, may provide the most useful method for estimating the effects of highway improvements. With the use of a representative survey,<sup>20</sup> the highway planner has: (1) objectifiable information about the personal consequences, both beneficial and adverse, to area residents; and (2) an understanding of existing residential linkages or interaction patterns that aids in designing the actual freeway route. If the field observation (Chapter III) and census tract tabulations (Chapter IV) have already been undertaken, the survey should further validate what highway planners have concluded from the use of these previous approaches. On the other hand, the personal attitudinal and behavioral characteristics of residents, obtained through an area survey, may suffice as the sole data source on potential social impacts.

The survey should provide an information base prior to the development of a specific route location. The primary objective of such a survey is to obtain a "social diagnosis" or determine the feasibility of alternative sites within a broad corridor. The survey will normally contain information that provides additional economic, environmental, and political data bases, so that a comprehensive understanding of trade-offs among these substantive fields can be gained.

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<sup>20</sup>A second, or additional, possibility is the interviewing of "knowledgeables" -- those individuals considered informed about neighborhood residential linkages and attitudes of area residents, and those who can provide a representative presentation of these attitudes and behavioral characteristics.

This chapter seeks to provide a clearer explanation of the socio-psychological attributes of urbanites which aid in predicting social impacts. Techniques are provided, based on survey questions, which provide an objective basis for evaluation. The attributes to be considered in the chapter are:

1. Use of local (neighborhood) facilities;
2. Ties to friends and relatives in the area -- neighboring;
3. Participation in localized associations;
4. Identification and evaluation of the area;
5. Community values of residents; and
6. Highway issue involvement.

#### USE OF LOCAL FACILITIES

Though residents of an area make use of a wide range of facilities throughout the metropolitan region, the majority of facility use is locally based. Local uses of facilities generally fall into different levels or patterns of activity than those involved in nonlocal use (Foley, 1961:226). These patterns of facility use may, independent of any other factors, provide the basis for social integration or cohesion among the area's residents: "This [localized use of facilities] may not result in . . . greater neighborliness or emotional attachments to the area, but it may serve to link the inhabitants to one another and to the area indirectly through a sharing of local facilities" (Keller, 1968:103). The greater the use of an area's facilities by different groups, then the greater the integrative function of these facilities.



*The use of such local facilities as neighborhood shops and area stores often serves to integrate residents to the residential area. Frequent usage of the area's facilities may be indicative of a relatively viable neighborhood.*

According to a St. Louis study, over one-half of residents' uses of facilities took place within or near the local area (Foley, 1961:226). Three general functions emerge as a part of the neighborhood activities: (1) food shopping; (2) church attendance; and (3) school attendance. In a West Philadelphia study, for example, grocery shopping was more locally based than any other activity (Keller, 1968:105). Non-local activities, those occurring outside of the residential district, are most often: (1) miscellaneous indoor activities, such as association meetings and sporting events; (2) clothing, household equipment, or furniture shopping; (3) employment; and (4) miscellaneous outdoor activities, such as recreational outings and outdoor sports (Foley, 1961:230). Similarly, the Harrisburg survey in Houston indicated that the facilities used locally were grocery stores and

and churches; those used adjacent to the Harrisburg area were banks, movie theaters, and public parks; and the non-local facilities used were medical care facilities and work places (Burke, et al., 1975).

The degree of use of facilities in the local area, however, is influenced by the resident's personal resources. Lack of such resources necessarily implies a dependence on local facilities for one's needs. For example, the use of local facilities is most concentrated among families who do not own an automobile, and whose freedom of access to non-local facilities is limited: "The possession of an automobile may alter the perception of distance so that people who are within easy driving distance of certain facilities may consider them conveniently located" (Keller, 1968:104). Similarly, young persons (especially under 16 years of age) and elderly individuals (over 65 years) evidence limited resources for mobility and hence make greater use of facilities in the local area.

Persons in low income neighborhoods are also more likely to require services close to their homes, illustrating a lack of economic resources as well as a lack of personal transportation. Associated with these factors is the amount of education; greater use of neighborhood facilities is found among residents with less education. Ethnic preferences may also determine the locale of facility use; immigrant and ethnic minorities patronize local shops, churches, and clubs that reflect their distinctive ways of life. In addition, females show more use of local facilities than males, due in part to a greater amount of unemployment, need for extensive shopping, and participation in neighborhood leisure activities (Foley, 1961: 232, Keller, 1968:103-104). Significantly, according to the Harrisburg study in Houston, women were less receptive to the freeway proposal due to concern for the safety of their children (Burke, et al., 1975).

Generally, in areas in which more than 50 percent of facility use is locally-based, freeway routing may be undesirable, because of the relative dependence on the area. Where less than 20 percent of facility use occurs in the local area, neighborhood dependency is also greatly reduced.<sup>21</sup>

In a study analyzing individual preferences for accessibility to certain facilities, Peterson and Worrall (1970) found that residents emphasize the location of such facilities as public transportation stops, children's parks, churches, and local shopping centers within walking distance of their homes. This emphasis on the desirability of facility locations, as well as the resident's perception of the probable changes on these locations by the freeway, affects his interpretation of the freeway proposal.

The Harrisburg survey revealed that, of those residents who felt that the proposed freeway would worsen local traffic to neighborhood facilities, over one-half were opposed to its construction. Conversely, those who felt that the freeway would aid localized travel (80 percent) approved of the facility (Burke, et al., 1975:62). In some cases, then, accessibility to other parts of the city can be overshadowed by the need to maintain or improve accessibility to facilities within the neighborhood.

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<sup>21</sup>See Donald Foley (1961), "The Use of Local Facilities in a Metropolis." Pp. 220-234 in Jack P. Gibbs (ed.), Urban Research Methods. Princeton, N.J.: D. van Nostrand.



Measurement of Neighborhood Facility Usage

The primary indicator to be suggested dealing with facility usage is entitled an Area Activity Index. The Index includes survey questions on the intensity of (1) visiting with neighbors, (2) participation in area associations, as well as (3) use of area facilities. Since the Index is an aggregate of these three factors, it will be presented in a later section.

The two questions which are an aid in evaluation of the extent of local facility usage are outlined, as follows:

(1) *Where do members of your household go to perform the following activities? How far is each from your home? The question is consolidated into a matrix (see hypothetical example in Table V-1) after respondents have been interviewed.*

Activity	Name & Address of Facility	Distance in Miles					Not Applicable	Don't Know
		0-1/2	1/2-1	1-3	3-5	5+		
Grocery shopping (most used)	_____	5	4	3	2	1	0	X
Banking	_____	5	4	3	2	1	0	X
Church service (most used)	_____	5	4	3	2	1	0	X
Doctor care (family)	_____	5	4	3	2	1	0	X
Employment (head of household)	_____	5	4	3	2	1	0	X
Movie going (most used)	_____	5	4	3	2	1	0	X
Public parks (most used)	_____	5	4	3	2	1	0	X
Other activity	_____	5	4	3	2	1	0	X

Table V-1. Area Facility Usage

Activity	Distance from Residence (in miles)						Total
	0-1/2	1/2-1	1-3	3-5	5+	Not Applicable	
Grocery shopping	<u>.65</u> <sup>b</sup>	.25	.05	.03	.02	--	
Banking	.06	.12	<u>.38</u>	.32	.08	.04	
Church services	<u>.52</u>	.24	.08	.04	.01	.11	
Doctor care	.09	.14	.18	<u>.32</u>	.26	.01	
Employment	.07	.09	.15	<u>.32</u>	.31	.06	
Movie going	.17	.29	<u>.32</u>	.06	.08	.08	
Public parks	.10	<u>.38</u>	.31	.06	.03	.12	
Other activity	.25	<u>.26</u>	.24	.12	.06	.07	

<sup>a</sup>Although this is a hypothetical example, those responding "don't know" in actual survey responses should be deleted.

<sup>b</sup>These cells represent percentages.

(2) How often do members of your family go to these places? (See Table V-2 for a hypothetical example of responses to this question.)

	At Least Once Every					Don't Know
	Day	Week	Month	Year	Not Applicable	
1. Grocery store	4	3	2	1	0	X
2. Bank	4	3	2	1	0	X
3. Church	4	3	2	1	0	X
4. Doctor	4	3	2	1	0	X
5. Employment (Hdqtrs. of head of house)	4	3	2	1	0	X
6. Movie theater	4	3	2	1	0	X
7. Public park	4	3	2	1	0	X
8. Other activity (service, institutional commercial establishment)	4	3	2	1	0	X
9. Other activity	4	3	2	1	0	X

Table V-2. Frequency of Area Facility Usage

Activity	Frequency of Facility Usage					Total
	Daily	Weekly	Monthly	Yearly	Not Ap- plicable	
Grocery shopping	.27 <sup>a</sup>	<u>.72</u>	.01	.00	-	1.00
Banking	.02	.33	<u>.53</u>	.08	.04	1.00
Church services	.07	<u>.43</u>	.29	.10	.11	1.00
Doctor care	.01	.12	.39	<u>.47</u>	.01	1.00
Employment	<u>.72</u>	.19	.03	.00	.06	1.00
Movie going	.03	.26	<u>.33</u>	.30	.08	1.00
Public parks	.14	<u>.29</u>	.23	.13	.12	1.00
Other activity (service, institutional, commercial establishments)	.09	.32	<u>.38</u>	.14	.07	1.00
Other activity	.07	.28	<u>.49</u>	.11	.05	1.00

<sup>a</sup>Each cell represents hypothetical percentages.

#### TIES TO FRIENDS AND RELATIVES IN THE AREA -- NEIGHBORING

Neighboring involves the exchange of services, information, and material aid between physically close residents. Neighbors meet needs which are not met by the existing formal institutions. The expectations associated with the role of neighbor varies with the importance of services rendered; where need of services is greatest, the role is most rigidly defined. In this way, neighboring activities serve to tie residents of an area to each other (Keller, 1968:33-34):

The activities and occasions for neighboring give rise to a number of more or less strong bonds or links among neighbors. These links among variously connected individuals lend an area a characteristic web of social relationships.

In the Harrisburg survey, the majority (58 percent) of residents' friends lived within walking distance of the respondents (Burke, et al., 1975), forming a pattern of interpersonal relationships around place of residence. The construction of the proposed freeway could potentially have an adverse effect on the main source of personal relationships of the residents.

Needs prompting the neighboring exchanges fall into four categories (1) daily, unexpected yet recurrent events, such as running out of milk or bread; (2) large emergencies, such as fire, illness, or death; (3) large collective events, such as marriages and holidays; and (4) cyclical collective needs, such as layoffs (Keller, 1968:44). Such collective occurrences bestow special meaning to neighbors (Keller, 1968:28):

Their lives were vaguely bound up with yours because they shared the same scene, the same kind of houses, the same political representatives, and the same shortages. They were part of a familiar environment . . . Personal relationships among neighbors . . . are indirect by-products of larger impersonal forces shaped by tradition, current styles of life, and common destiny.

This "sense of community" engendered by mutual dependency is especially important where personal resources are limited for coping with problems. In this way, the amount and extent of neighboring reflects social class. In working class areas of skilled and semi-skilled workers physical isolation, economic need, and limited opportunity combine to make neighboring an essential part of the web of social relationships. Bott remarks (1957:112):

It is only in the working class that one is likely to find a combination of factors all operating together to produce a high degree of connectedness; concentration of people of the same or similar occupations in the same local area; jobs and homes in the same local area; low population turnover and continuity of relationships; . . . little demand for physical mobility, little opportunity for social mobility.

In middle-class residential areas, on the other hand, neighboring is still geared to crises, but the number of crises has decreased with greater economic security and self-sufficiency. The more self-reliant an individual or group, the smaller the reliance on neighboring activities. The self-sufficiency of middle-class areas is due to:

- (1) Availability of multiple sources of information through mass media, travel, voluntary associations, and employment outside of the local area;
- (2) Greater mobility beyond local boundaries;
- (3) Greater diversification of interests, desires, and work patterns; and
- (4) Better social service and greater economic security (Keller, 1968:58).

Neighboring in middle-class areas is more selective and less bound to other aspects of life; emphasis is placed on personal compatibility or based on common occupational and cultural interests.

Neighboring is also affected by the levels of traffic on local streets. Where there is heavy traffic, there is correspondingly a decrease in social interaction between neighbors. On the other hand, in areas where streets have light traffic levels, residents indicated three times as many localized friends and acquaintances (Appleyard and Lintell, 1971:76). The illustration in Figure V-1 shows this effect.

In conclusion, the impact of freeway introduction varies according to the amount of neighboring in the local area. For example, where there is an absence of close relatives or where a small percent of close friends reside within walking distance of each other, freeway impact will be less adverse (see Ross, 1970).

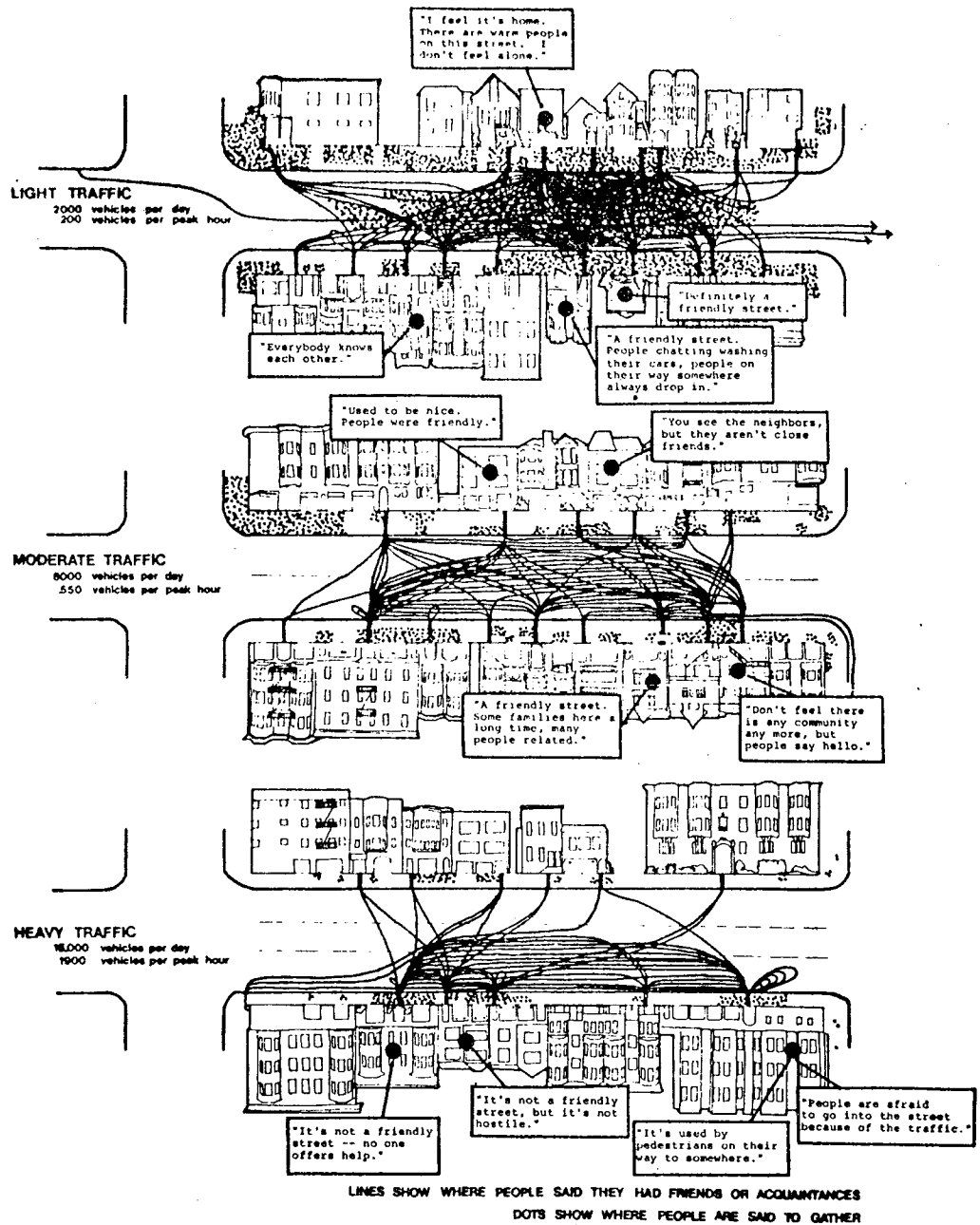


Figure V-1. Neighboring or Visiting on Three Selected Streets in San Francisco

Source: Donald Appleyard and Mark Lintell (1971) "Environmental Quality of City Streets," Highway Research Record 356:76.

Measurement of Neighboring

As a part of a more comprehensive survey, the following questions can be addressed to respondents:

(1) *How often do you or members of your household visit a close relative living in this area? A close friend? (7 = Daily; 6 = 2 or 3 Days a week; 5 = Weekly; 4 = 2 Times a month; 3 = Monthly; 2 = Several times a year; 1 = Less often; and 0 = Not applicable)*

The reply to this two-part question provides a neighboring score for each respondent which can range from 0 to 14, as shown in a hypothetical example in Table V-3. A frequency table pointing to the "average" response or to the distribution of responses can then be obtained. In addition, the percentage replying positively to (a) or (b) in the following question should be ascertained:

(2) *Where do the close relatives of your household live? Close friends?*

- a. *In walking distance*
- b. *Elsewhere in neighborhood*
- c. *In this general area*
- d. *Other parts of city*
- e. *Out of city*
- f. *Have none in city*

Table V-3. Intensity of Neighboring in Immediate Area

Neighbor Category	Intensity of Visiting								Total
	Daily	2 or 3 Days	Weekly	2 times a Month	Monthly	Several times a Year	Less Often	Not Applicable	
Close Relatives Neighborhood	.22	.17	.14	.02	.02	.00	.00	.43	1.00
Close Friends Neighborhood	.27	.25	.20	.06	.03	.00	.00	.18	1.00

The replies to the two questions concerning the degree of neighboring are not only useful when used alone, but also can be consolidated into an Area Activity Index, as shown in a later section.

#### PARTICIPATION IN AREA ASSOCIATIONS

The extent of participation in organizations within a neighborhood roughly indicates the degree of integration among residents. Participation in voluntary associations often arises out of a community's collective need which can be met only within the framework of an organization. In addition to this instrumental function, voluntary associations also afford satisfaction to participants in the informal gathering of like-minded individuals (Gist and Fava, 1974:356-358).

In several studies, the greatest amount of participation was found to be in association with the area's churches. High degrees of participation in church organizations is often important to the area as a whole. According to Riedesel, et al., (1968:158), churches, in addition to their religious function, have an important impact on individuals in the formation and guidance of attitudes not directly related to religious concerns. This aspect of local church affiliation tends to bind together church participants.

Significantly, the organization of different groups with competing or similar interests, that is, the "political culture" of the local area, affects the receptiveness of residents to the freeway proposal. Locally there are overlapping centers of power in neighborhood organizations--in civic groups, professional organizations, unions, and homeowner associations. However, the ability of the organization to influence opinion



concerning the proposal depends on the cohesion, the resources (time and money), and the skill (bargaining and gaining allies) of existing groups (Fielding, 1971: 3-5). Where more than 50 percent of neighborhood residents participate in local organizations, social consequences of freeway introduction in the area will likely be more adverse.<sup>22</sup>

Measurement of Involvement in Area Associations

A general inventory of participation in voluntary organizations or informal neighborhood groups can be obtained through the following questions:

(1) *Are you or someone in your household an active member of any organization, club or church?*

- a. Church*
- b. PTA or other school-related association*
- c. Social club(s)*

\_\_\_\_\_

\_\_\_\_\_

*d. Service club(s)*

\_\_\_\_\_

\_\_\_\_\_

The number of area organizations is six, so that an aggregate score for neighborhood organizational participation can be determined.<sup>23</sup>

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<sup>22</sup>In some urban sub-areas, other specific organizations might be included, such as the American Association of Mexican-Americans or L.U.L.A.C.

<sup>23</sup>See Eugene Litwak (1970), "Voluntary Associations and Neighborhood Cohesion." Pp. 583-600 in Robert Gutman and David Popenoe (eds.), *Neighborhood, City, and Metropolis*. New York: Random House.

## DEVELOPMENT OF THE "AREA ACTIVITY INDEX"

The three attributes previously discussed in this chapter have revolved around neighborhood activities:

- (1) use of area facilities;
- (2) friends and relatives in area; and
- (3) participation in area associations.

An Area Activity Index (A.A.I) has been developed to consolidate these data with the following components:

- (A) *Visiting with close friends in area:*  
Daily = 4; Weekly = 3; Monthly = 2; Yearly or Less = 1;  
Never = 0.
- (b) *Visiting with close relatives in area:*  
Daily = 4; Weekly = 3; Monthly = 2; Yearly or Less = 1;  
Never = 0.
- (C) *Grocery shopping in immediate area:*  
Daily = 4; Weekly = 3; Monthly = 2; Yearly or Less = 1;  
Never = 0.
- (D) *Banking in immediate area:*  
Daily = 4; Weekly = 3; Monthly = 2; Yearly or Less = 1;  
Never = 0.
- (E) *Church activities in immediate area:*  
Daily = 4; Weekly = 3; Monthly = 2; Yearly or Less = 1;  
Never = 0.
- (F) *Medical facility usage in immediate area:*  
Daily = 4; Weekly = 3; Monthly = 2; Yearly or Less = 1;  
Never = 0.
- (G) *Employment (of head of household) in immediate area:*  
Daily = 4; Weekly = 3; Monthly = 2; Yearly or Less = 1;  
Never = 0.
- (H) *Movie going in immediate area:*  
Daily = 4; Weekly = 3; Monthly = 2; Yearly or Less = 1;  
Never = 0.
- (I) *Use of public parks in immediate area:*  
Daily = 4; Weekly = 3; Monthly = 2; Yearly or Less = 1;  
Never = 0.
- (J) *Other facility usage in immediate area:*  
Daily = 4; Weekly = 3; Monthly = 2; Yearly or Less = 1;  
Never = 0.

(K) *Member of area voluntary association (Where 4 = member of four or more such organizations; 3 = member of three organizations; 2 = member of two associations; 1 = member of one association; and 0 = none).*

The highest possible score on the Area Activity Index is 44. After undertaking preliminary tests from a freeway project survey data file at the Texas Transportation Institute, it has been determined that a high Area Activity Index is any score (whether for an individual or a respondent average) of 20 or more. A low score for the A.A.I. should be considered as any value below 7 - 10. The Area Activity Index should prove beneficial in the evaluation of interaction patterns with the residential area(s) under study.

#### IDENTIFICATION/EVALUATION OF THE AREA

##### Identification with Area

Individuals may derive from their area of residence a special feeling or attachment which constitutes for them a sense of belonging, that is to say, an identification of the area as "home". One identifies with the familiar. Indeed, the area in which one carries on day-to-day activities and interpersonal relationships takes on special meaning as a result of these routine activities. This attachment is acquired through:

- (1) Childhood experiences or family involvement in the area for long periods of time;
- (2) An emphasis on the significance of historical objects or events in the area;
- (3) The presence of friends and relatives in the area who possess particular importance for the individual; and,
- (4) The use of the area as a symbol for certain cultural values. (Keller, 1968:108; Firey, 1974:270).

The effect, then, of a proposed freeway on the residential area is the alteration of the inhabitant's sense of "place" by introducing change to his meaningful environment.

The organization of the external environment which defines the framework of daily activities varies among differing socioeconomic groups. Among middle and upper-income groups, the environment is viewed primarily as pathways or channels between individually important locations; accessibility to nonlocal places is of greater concern.

The working class, on the other hand, defines physical space not in terms of pathways to other areas but rather as bounded regions in which one has freedom or limitations of access; further, the boundary between the residential unit and the street is quite permeable: "Social life has an almost uninterrupted flow between apartment and street." (Fried and Gleicher, 1961: 312). Because of this interaction with the surrounding physical environment, the resident's living space is extended to include outdoor as well as indoor space. This expansion of personal living space invests the local area with highly positive emotions and a personal significance of "home". Fried points to the sense of belonging offered by the working class West End of Boston. In analyzing their reactions of grief to forced relocation, Fried concludes that West End provided the external bases for interpersonal contacts which, in turn, provided residents with a group identity, a feeling of being part of "larger human and social entities"; this "membership" in social groups represents an integrated sense of commonality or continuity (Fried, 1963:157). In the North End of Boston, Fried found that the area held particular significance for older Italians

as a symbol of Italian ethnic solidarity. Residence in the area pointed to an integration of Italian values while emigration from it indicated an assimilation of American culture.

In a low-income black Detroit slum, however, there was no evidence of "attachment to place"; in fact, one-third felt they were unsafe and another one-third were uneasy about the great amount of violent and delinquent behavior which characterized the area. For these Detroit blacks, living in the slum was less a preference than the result of limited alternatives (Wolf and Lebeaux, 1974: 446-7). Further, in another low-income black slum in Syracuse, New York, there was little attachment to the neighborhood despite the existence of family contacts there. As in Detroit, commitment to the area was the result of "no place else to go" (Cagle and Deutscher, 1970: 243).

Traffic levels also have been associated with residents' identification with the area. Areas with heavy traffic levels evidenced little feeling of community; homes served merely as sanctuaries from the outside world. In areas with light traffic levels, residents made full use of the external environment, and a "lively, close-knit community" was found to exist, as shown in Figure V-2 (Appleyard and Lintell, 1971:77).

#### Evaluation of Area

In determining residential satisfaction, the inhabitant's evaluation of the quality of the neighborhood environment appears to be the primary factor. Whether an area is "well kept up" defines the resident's general contentment (Lansing, et al., 1970). Furthermore, when seeking a new home, most potential

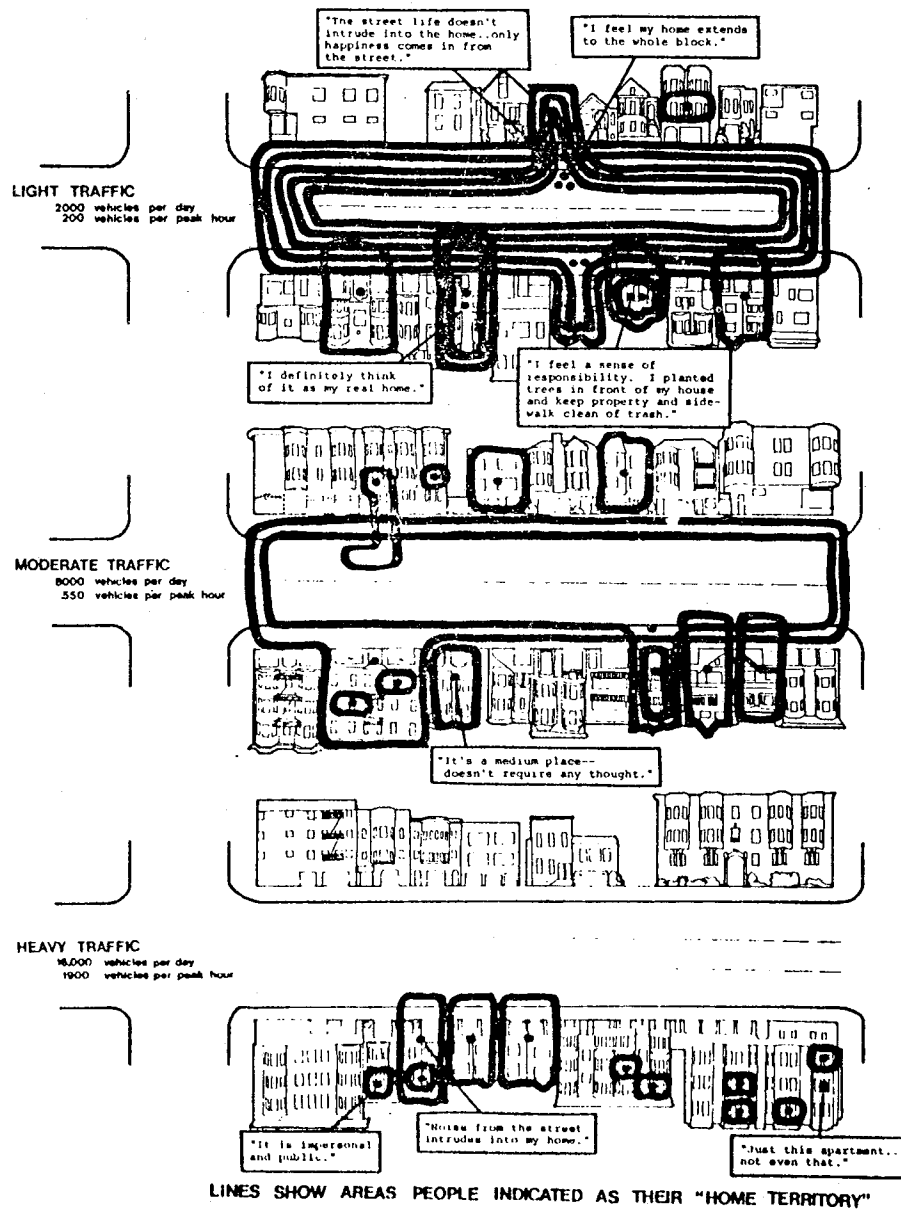


Figure V-2. Home Territory as Defined by Residents on Three Selected Streets in San Francisco

Source: Donald Appleyard and Mark Lintell (1971) "Environmental Quality of City Streets," Highway Research Record 356:78.

buyers require that the home be located in a "good" neighborhood (Paxton, 1955:15):

Yet by itself the term "good" neighborhood depends on what the homeseeker regards as "good". In some instances, it appeared the buyer was trying to say he wanted a neighborhood that was old and solidly established. In other cases, he meant that exact opposite; it developed he had been looking for a new and modern neighborhood. In fact, if we substitute for the word "good" the word "congenial" the result is a single and reasonably significant indication of what the buyers sought. What each was trying to find was a neighborhood he thought would prove congenial to his family and himself.

The Detroit study revealed that even though social ties were strong within the neighborhood, residents held their area in low esteem and many considered it dangerous. Sixty-five percent of survey respondents indicated they would not advise a friend to move into their neighborhood, due clearly to its physical and social deterioration:

It may be noted that the modal reason, physical deterioration, was often by implication a criticism of behavior: 'People don't take care of their houses'; 'property is not kept up'; 'It's a slum.' (Wolf and Lebeaux, 1969:219).

In the Harrisburg study, the acceptance of the proposed facility was tied to the expected effect on the general appearance of the area. Of those who felt the freeway would worsen the neighborhood's appearance, 64 percent were against it. Similarly, of those who felt that the complexion of the area would be enhanced, 80 percent approved the facility's construction. Clearly, the importance of a resident's evaluation of the area significantly influences their reaction to the construction of a freeway through it (Burke, et al., 1975:67). When a large percent of the residents have a high evaluation of their neighborhood, freeway impact will likely be greater (see Wolf and Lebeaux, 1969).

## Measurement of Area Identification or Evaluation

A set of questions for measuring the extent of positive area evaluation and attachment to the area has been derived (see Riedesel, et al., 1968:153-154):

- (1) *Do you feel this area in which you live is a "neighborhood"?*  
(2 = Yes; 1 = Uncertain; 0 = No)
- (2) *How well do you think people in the neighborhood [area] know each other?* (4 = Very well; 3 = Well; 2 = Average; 1 = Not very well; and 0 = Not at all)
- (3) *If you had your choice, would you continue living in this neighborhood [area]?* (2 = Yes; 1 = Uncertain; 0 = No)
- (4) *Would you evaluate this neighborhood [area] highly?*  
(4 = Very highly; 3 = Highly; 2 = Uncertain; 1 = Low ranking; 0 = Very low ranking)<sup>24</sup>

A matrix of identification/ evaluation criteria can be developed from the aggregation of all survey responses (as shown in the hypothetical example of Table V-5). A positive evaluation of one's neighborhood and a

Table V-4. Identification/Evaluation of Residential Area

Question Asked of Respondent	Degree of Attachment to Area			Totals
	Positive	Medium	Negative	
1. Area = a "neighborhood"	<u>.72</u> <sup>a</sup>	.18	.10	1.00
2. Extent of social intimacy	.27	<u>.54</u>	.19	1.00
3. Stability ex- pectations	<u>.67</u>	.21	.12	1.00
4. Evaluation of area	<u>.49</u>	.28	.23	1.00

<sup>a</sup>Cells represent percentages; categories in (2) and (4) were collapsed from four categories to two categories.

<sup>24</sup>The actual terms of the evaluation is a function of the respondent's own idea as to what constitutes a "good area"; for example, the respondent may think of congenial neighbors, high property values, a well-maintained neighborhood, or a lack of vandalism.



statement of attachment to an area can be an important indication of the extent of impact of large scale changes, such as freeway construction.

### COMMUNITY VALUES OF RESIDENTS

To a large extent, community values reflect both the needs and interests of various groups. Not only do different groups possess divergent values, but they also have more intense attitudes and goal priorities in regard to various issues (Feldt, 1969:65). Community values become important in enabling the highway planner to estimate the extent of stress a proposed facility will precipitate in a residential area. According to one study (Bleiker, 1971:14):

Increasing attention has been drawn to the disruption they [highways] cause to the physical and much less understood nonphysical elements of the city. The urban setting is entirely different from the rural setting, is more complex, and requires a range of complex and interrelated urban problems. Urban highways must be responsive to criteria that were either possible to ignore or less critical on inter-city roadways. These criteria, for lack of a specific definition, have been labeled community and environmental values.

There is some correspondence between values, attitudes, and opinions, so that values can be roughly gauged by the latter; however, the correspondence is not one-to-one. Values are formed as a part of the learning process, reflecting an individual's accumulation of experiences through time. As individuals communicate with each other, values converge into a "common value system" so that interacting groups tend to share similar value patterns (Boulding, 1969:33-34). These value patterns are expressed

through attitudes: "By scaling or ranking an individual's attitudes towards given objects, one can depict their relationship to his values" (Mason and Moore, 1971:47). However, attitudes do not mirror actual behavior; rather, they represent an individual's tendency to act (Park, 1967:65). Though inexact, opinions "are currently the most reliable guide a researcher has for establishing goal priorities in lieu of a prolonged period of empirical observation of behavior" (Mason and Moore, 1971:47).

Furthermore, in a Connecticut study, it was established that individuals surveyed are both articulate and aware enough of their values to be able to describe them such that they can be applied to route-location decisions (Weiner and Deak, 1971:57). Various researchers point out these values, including the:

1. Integrity of the neighborhoods;
2. High aesthetic quality of the visual environment;
3. Preservation of community heritage;
4. Stability of residence;
5. Protection of property investments;
6. Preservation or enhancement of community's cohesion.
7. Maintenance of community services;
8. Preservation of community safety;
9. Provision of adequate housing; and
10. Availability of employment

(Schofer, 1969:67; Colcord, 1971:34; Weiner and Deak, 1971:60; Ylevisaker, 1969:49).

In a comparison of values emphasized by private citizens and public officials, Mason and Moore found that the preservation of neighborhood integrity and associated esthetic enhancement were more highly valued by residents than public officials. For this latter group, industrial expansion and economy in highway construction were ranked higher in priority:

"They perceived that, given additional jobs and an expanded and diversified economic base, matters related to esthetics, beautification, pollution, and the like would develop as a natural by-product of more jobs and higher per capita income." While the officials viewed the possibility of using highways for urban renovation, private citizens strongly opposed this intention (Mason and Moore, 1971:52-53).

#### Measurement of Community Values

In using the survey approach, preferences in regard to community or neighborhood objectives can be ascertained. Adequate knowledge of these area goals aids in assessing the consequences of a proposed freeway route, or in comparison of alternate routes. This approach further enables area residents to express their opinions about the effects of highway improvement proposals.

Different residential areas may evidence a variation in their evaluation of community values. The crucial factor, then, is that the goals are ranked by survey respondents so that an assessment of residents' preferences can be obtained. Criteria (or goals to be ranked) should be itemized. The relative importance of goals, i.e., the weighting, can be multiplied by the rank to yield a product for each item (Fielding, 1971:30).

Mason and Moore (1971) attempted this form of community values analysis, with public officials and knowledgeable community citizens as the respondents. They collapsed and narrowed goals to obtain the final listing shown in Table V-5. In this example, the preservation of neighborhood integrity was rated most highly in terms of desirability and importance. In some cases, a

Table V-5. Computation of a Desirability-Weighted-By-Importance Index

Goal	Desirability Ranking (10 to 1)	Relative Importance Ranking (10 to 1)	Desirability-Weighted-by-Importance Index
Attractively landscape areas	8	3	11
Reduce air and water pollution	6	9	15
Preserve historic sites and buildings	2	6	8
Expand system of parks	5	1	6
Preserve and maintain open spaces	9	4	13
Reduce accident rate	4	8	12
Reduce noise levels	3	7	10
Preserve and enhance natural features of the land	7	5	12
Protect and accommodate wildlife	1	2	3
Preserve neighborhood integrity (i.e., highways do not split neighborhoods)	10	10	20

Source: Joseph B. Mason and Charles T. Moore (1971) "Development of Guides for Community Acceptance of Highway Location, Development, and Construction," Highway Research Record 356:43-54.

goal listed as highly desirable, such as "attractively landscape areas", was nevertheless not considered as important or as having a high priority as the majority of other goals when "trade-offs" were being considered.

Those goals receiving the five highest values in the third column, that is, "Desirability-Weighted-by-Importance Index", should be included as an important criterion in project planning, especially when a high degree of consistency among respondents is reached.

## HIGHWAY PROJECT INVOLVEMENT

Issue involvement is an attribute which estimates the amount of participation in the highway proposal. Protests over highway location, design, and construction have pointed to the increasing participation of new groups largely unheard in the past. Observes Manheim, et al., (1971:14-15): "The planning and design of a highway and transportation system is as much a socio-political problem as a technical one. The choices must balance the conflicting interests of many groups."

Through the involvement of citizens in the highway proposal, a relative evaluation of its effect can be inferred. The active participation of affected residents is generally viewed as an essential method for identifying these socio-economic impacts. Citizen participation may affect several desirable results in that it can:

- (1) bring residents into the public policy and planning process;
- (2) stimulate public discussion to reflect the community's values;
- (3) identify the pros and cons of alternative plans;
- (4) increase the public's understanding of planning options;
- (5) uncover alternative options; and
- (6) encourage resolution of public opposition (Department of Transportation, 1974:49).

Group participation, however, should not be selective. Fielding (1971:25) notes:

It is important...that the transportation committee does not become captive to persons already viewed as capable of influencing local decisions. Opportunity for groups to participate, such as homeowners, who are usually passive, is essential. Otherwise, opposition groups will develop who will be excluded from information needed if they are to make a beneficial contribution.

The goal of issue involvement is to clarify interests, to eliminate confusion, and to agree on a specific course of action which satisfies as many interests as possible. Conflict in route location is to be expected. When conflict arises, three alternatives emerge for the highway planner: deadlock, coercion, or resolution through negotiation. Ideally, coercion should be minimized. However, some groups will pose special problems for planners in resolving conflict: (1) community agitators, those who oppose any plans made by governmental bodies and are more concerned with gathering a following than reaching a negotiated solution; (2) those who are unable to comprehend the future changes, beneficial and detrimental, of highway improvement; and (3) those who are the most directly impacted by the proposed facility, such as those residents to be relocated.

The degree of citizen participation and involvement in the issue varies considerably. For example, Harrisburg residents in Houston exemplified little community involvement in the proposed highway. Over one-fourth of the residents had never heard of the facility, while another one-fifth had known less than one year. Sources of information were most often from friends and relatives in the area. In addition, knowledge of the proposed highway did not imply involvement; only 14.7 percent of all residents who knew of the highway attended any public hearing or citizen meetings on the proposal (Burke, et al., 1975). In most proposed projects, only a slight interest is evidenced by the majority of residents, with a small minority becoming highly involved in the issue. Nevertheless, it is important to (1) identify the degree of apathy or involvement and (2) the reasons behind any intense involvement concerning the proposed facility.

## Measurement of Issue Involvement

Questions such as those which follow can aid in analyzing issue involvement:

- (1) *What actions have you or other members of your household taken due to the proposed facility? (A sum of actions is needed: Attended meetings with Highway Department officials present = 1; Attended other community meetings = 1; Wrote letters to elected officials = 1; Made telephone calls = 1; Helped organize a group = 1; Others (specify) = 1; Have taken no actions = 0; Also record those replying, not applicable, if never heard of proposal = X)*
- (2) *Do you feel that your interests concerning the proposed freeway are being properly considered by your elected officials? By Highway Department officials? (For both questions: Yes = 2; Don't know = 1; No = 0; and Not applicable = X)*
- (3) *Do you know any of your elected officials or community leaders who have taken a position for or against the proposed freeway? (Record for both "for" and "against": Yes = 1; No = 0; Not applicable, if never heard = X)*
- (4) *Do you know of any organization that is in favor or against the proposed freeway? (Record for both "for" and "against": Yes = 1; No = 0; Not applicable, if never heard = X)*
- (5) *Do you know any of your neighbors who are in favor or against the proposed freeway? (Record for both "for" and "against": Yes = 1; No = 0; Not applicable, if never heard = X)*
- (6) *Do you know that the Highway Department gives relocation assistance to residents who are displaced by the freeway? (Yes = 1; No = 0)*

A hypothetical chart or matrix of involvement is depicted in Table V-6.

Influences on respondents, such as neighbors' involvement or concern about the proposed facility, can precipitate involvement. It is necessary to determine these influences, or bases of opinion formation, which aid in explaining issue involvement. This knowledge can aid highway representatives in attempting to formulate project plans acceptable to the area residents.

Table V-6. Highway Project (Issue) Involvement

Basis of Involvement	Intensity of Issue Involvement (Number of Actions)			Totals
	0	1	2+	
Respondent's Interests Considered by Public Officials (Positively)	.96 <sup>a</sup>	.04	.00	1.00
Respondent's Interests Considered by Public Officials (Negatively)	.73	.23	.03	1.00
Respondent's Interests Considered by Highway Representatives (Positively)	.94	.04	.02	1.00
Respondent's Interests Considered by Highway Representatives (Negatively)	.76	.20	.04	1.00
Respondent's Knowledge of Community Leaders <u>For</u> Freeway Proposal	.97	.02	.01	1.00
Respondent's Knowledge of Community Leaders <u>Against</u> Freeway Proposal	.93	.04	.03	1.00
Respondent's Knowledge of Any Organization <u>For</u> Freeway Proposal	.83	.13	.03	1.00
Respondent's Knowledge of Any Organization <u>Against</u> Freeway Proposal	.81	.17	.02	1.00
Respondent's Knowledge of Neighbors <u>For</u> Proposal	.91	.07	.02	1.00
Respondent's Knowledge of Neighbors <u>Against</u> Proposal	.71	.24	.05	1.00
Respondent's Knowledge of Relocation Assistance	.92	.08	.00	1.00

<sup>a</sup>Cells represent percentages.

#### SUMMARY

With survey data, actual attitudes and behavioral characteristics of area residents can be obtained. The survey also provides a means of obtaining economic and environmental data useful in analyzing trade-offs between many factors. This type of information depicts the opinions of residents who, while analyzed as non-users of the proposed facility, also may benefit from increased accessibility.



Use of area or neighborhood facilities, especially intensity of usage, points to a functional dependence on place of residence. The linkages to such activities can be analyzed (as summarized in Table V-7) so that an optimum highway route through residential areas can be determined.

The social ties to a neighborhood can be determined through an examination of frequencies of visiting with friends and relatives in an area. Residents of ethnic residential areas, especially, tend to have close relatives living nearby. These social ties represent another criterion to be considered in a social impacts assessment (see Table V-7).

Table V-7. Summary of Socio-Psychological Characteristics of Area Residents

<p>1. <u>Use of Local Facilities</u></p> <ul style="list-style-type: none"> <li>(1) Distance to 8 "commonly used" facilities</li> <li>(2) Frequency of usage of 8 area facilities</li> </ul> <p>2. <u>Neighboring</u></p> <ul style="list-style-type: none"> <li>(1) Location of close friends</li> <li>(2) Location of close relatives</li> <li>(3) Frequency of visiting with neighborhood friends</li> <li>(4) Frequency of visiting with relatives in neighborhood</li> </ul> <p>3. <u>Participation in Area Associations</u></p> <ul style="list-style-type: none"> <li>(1) Number of memberships in area voluntary organizations</li> </ul> <p>Area Activity Index (A.A.I.) - a combination of the three sets of factors outlined above.</p>	<p>4. <u>Identification/Evaluation of Area</u></p> <ul style="list-style-type: none"> <li>(1) Degree to which area is a "neighborhood"</li> <li>(2) Evaluation of social intimacy of area</li> <li>(3) Plans for moving out of area</li> <li>(4) General evaluation of area</li> </ul> <p>5. <u>Community Values of Residents</u></p> <ul style="list-style-type: none"> <li>(1) Desirability-weighted-by-Importance Index</li> </ul> <p>6. <u>Highway Project Involvement</u></p> <ul style="list-style-type: none"> <li>(1) Number of actions <u>for</u> or <u>against</u> proposal</li> <li>(2) Respondents' belief that personal interests are considered</li> <li>(3) Respondents' knowledge of other groups <u>for</u> and <u>against</u> proposed facility</li> <li>(4) Respondents' knowledge of relocation assistance</li> </ul>
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A high degree of participation in area associations, rather than in organizations dispersed throughout the city, points to a third type of social tie to the area. Measures to determine the intensity of area association participation, along with frequency of area facility usage and degree of neighboring were combined into an "Area Activity Index" (see Table V-8) which acts as a summary indicator of behavioral links to the respondents' residential area.

Close identification with, and a positive evaluation of, a residential setting aids in predicting the amount of large scale changes that will be acceptable to residents. Measurement of (1) plans for remaining in an area, (2) the general evaluation of the area, and (3) evaluation of social intimacy as well as (4) assessment of the area as a "neighborhood" point to the type of areawide commitment which exists.

The ranking of community values facilitates an accurate evaluation of the effects of a proposed route or of each alternative route. Community or neighborhood goals can be effectively measured with opinion surveys of a representative sample of residents.

The degree of involvement in the highway project as a citizen's issue also can be indicated by knowledge of project-related actions in which residents have participated. As summarized in Table V-7, knowledge of involvement by residents is of no substantial benefit, without related information dealing with the basis of, or reasons for, such involvement.

The survey approach provides one set of criteria for measuring social impacts of large scale changes to a residential area. The interview survey can be more costly than field observation or the use of demographic data. A plausible alternative is a mail-out questionnaire of 150 questions or

less, which is less expensive, but which can provide the same amount of data. As mentioned earlier, "knowledgeables" within the residential area can also be interviewed as a substitute for the larger, resident-sample survey. Whether the planned facility is a small-scale highway improvement or a comprehensive, new freeway project, the survey is a device for providing detailed information about impacts on area residents.

## CHAPTER VI

### THE SHORT-TERM IMPACTS OF FREEWAY INTRODUCTION

Because experience is a large part of the prediction process, examination of the effects of a freeway on an urban residential area is a vital component in predicting its impact. Attention is directed toward the short-term impacts of freeway routing, construction and operation. A review of these impacts of freeway introduction provides for the highway planner a substantive foundation, that is, an "information base", from which he can more adequately assess future urban freeway projects. As a result, techniques as such are not emphasized; rather, the discussion focuses on "after-the-fact" phenomena, both social and physical, as aids in determining the proper location of freeways within cities.

The two concepts of social and physical impacts are not unrelated. Physical changes in the environment may be viewed as observable, tangible indicators of less tangible social changes; they may either precede (cause) or follow (result in) alterations in the patterns of social activity and interaction. Physical changes are essentially structural alterations: the increased construction of apartment houses or business establishments among residential units; the segmentation of a neighborhood by an on-grade freeway. Social changes may be manifested in such physical alterations; that is, different patterns of neighboring or other daily activities may emerge as a result of the restructured environment. An examination of both these phenomena enables the highway planner to calculate more comprehensively the total impact of a proposed freeway in light of past occurrences.

The total social impact of freeway construction can be viewed as the alteration of existing residential areas:

- (1) by displacing those residents who reside in the path of the right-of-way; and
- (2) by altering the physical and social environments of those who remain.

Those displaced face special problems in securing and maintaining replacement housing as well as in their separation from a more familiar environment. Those who remain are affected by the physical intrusion of the freeway, the displacement of others, resulting in, for both of the affected parties, a disruption of ties with individuals, businesses, and institutions (for example, schools and churches). The degree to which these groups rebuild their social ties is the primary consideration in their subsequent adjustment (Riedesel, et al., 1968).

#### DISPLACED RESIDENTS: SOCIAL IMPACTS OF RELOCATION

The acquisition of property for the right-of-way dictates that those residents in the path of the freeway site be removed. The success of relocating those displaced depends largely on two factors:

- (1) the availability and location of replacement housing which will meet the needs of the relocatees;
- (2) characteristics of the relocatees which may create special problems in their relocation.



*The construction of a transportation facility necessitates the removal of all structures within its path. Occupants of such dwelling units must find comparable replacement housing elsewhere.*

Characteristics of the replacement area, availability of local facilities (including schools, churches, parks, health centers, transportation facilities) and the proximity to employment opportunities determine how well replacement housing meets the needs of relocatees (Aschman, 1970). By considering these factors, disruption can be minimized. Williams (1968:20) comments on this social aspect of relocation:

In looking back over our four-year program in relocation work, it seems that an unususally high percentage of houses purchased for right-of-way presented social, rather than economic, problems. By this, I mean that a lot of people were more concerned about where they were going to relocate than the price we were paying [emphasis added].

However, impacts of relocation do not fall with equal force on all groups displaced. For some, the consequences of displacement are more severe. Generally, this occurs among individuals and households who are most vulnerable before relocation, including, for example, the elderly, the poor, and ethnic

groups. Among these individuals and families, informal systems of mutual aid may develop to account for their vulnerability; relocation, in turn, may create greater hardships by dispelling these adaptive systems.

#### Availability of Replacement Housing

As was indicated earlier, the success of relocation initially depends on the ability of displacees to find adequate replacement housing. Most studies conclude that the housing situation in areas adjacent or close to the clearance site determines the degree of relocation success.

Operation of the Housing Market. The large-scale removal of residential units by such major displacing activities as urban renewal and highway construction aggravates the shortage of adequate housing in the United States. By 1967, Federal programs had taken over one million units, with 330,000 of these acquired through highway right-of-way programs (Downs, 1970b). As of 1972, another 356,000 housing units were scheduled for removal by urban renewal projects. At the same time, highway programs planned to displace 50,000 households yearly without constructing replacement dwellings (Hartman, 1972). While the magnitude of removal is considerable, the number of units started annually has declined in recent years. This drop does not reflect a reduction in demand, but rather an increase in rates of interest and construction cost. The result of the increasing demand and limited supply is an upward pressure on occupancy levels and monthly housing payments in the market as a whole (Downs, 1970b).

However, the housing market does not function in the same way for all socioeconomic groups. New housing is seldom added for lower income groups; in fact, most of the newly constructed residential units are priced at \$30,000 and up. Because of this limitation on a new supply, the low-income "submarket" functions apart from other submarkets (Sly, 1972). The supply of

housing for this market comes through a process of "filtering down". This process entails a gradual decline in the price of an aging dwelling unit until it is within the financial range of low-income households. Filtering down is seriously inadequate as a source of supply in "tight" housing market conditions, and often those units which do filter down may fail to meet housing codes. Smart (1970:30-32) points to the implications of housing supply shortages for low-income groups:

Any shortage of housing in any locality may tend to limit the broad choices available to middle-and upper-income families; it produces severe crises and traumatic situations for low-income families . . . Choices available to the poor are often nonexistent.

Concentration. In addition to the inefficient supply of residential units among the lower-income submarket, the effects of relocation are magnified due to the relocatees' tendency to remain close to the clearance area after relocation. Competition for housing sharpens in this immediate area. Because of this concentration, the removal of a small number of dwelling units has a greater effect than may be anticipated. This tendency to concentrate around the clearance area has been documented in numerous studies. In a Milwaukee study, for example, the mean distance of movement was only 1.45 miles. Forty-six percent of the relocatees' households moved within one mile of their original location; 78 percent, within two miles (House, 1970). In an Austin study, Hartman (1972) reports that two out of three displaced residents relocated within one mile of their original homes.

Competition for housing in the clearance area may become acute because highway displaces may:

- (1) desire to remain physically close to an area, due to a sentimental attachment to the neighborhood;
- (2) attempt to remain near friends and relatives in the area;



- (3) be required or may desire to remain near community facilities or place of employment;
- (4) lack information on housing alternatives in other areas of the metropolis;
- (5) lack sufficient income to re-enter the market for standard housing;
- (6) meet with racial or ethnic discrimination; and,
- (7) compete with individuals displaced by other local and federal displacing agencies.

For any large-scale relocation project, these factors should be considered to determine the relative ability of relocatees to secure replacement housing. Success of a project will be enhanced when replacement housing exists near the clearance area.

#### Financial Disbenefits

Adjustments are consistently necessitated in the budgets of relocated households. In view of the change in the supply-demand relationship, higher monthly costs may be anticipated by the relocatees. This increases but one of several costs incurred as a result of the relocation activities. The additional costs may be taken on with relative ease or with substantial difficulty, depending upon the resources of the individual household. Also, various groups may allot differing amounts of their income to different activities, and changes in the budgets may result in varying changes in their ways of life (Riedesel, et al., 1968:151):

The allocation of income to different items in the budget is dissimilar for different congeries. Thus the mere dislocation of specific congeries of the population not only implies a change in budgetary allocations for the dwelling unit but also a change in style of life per se. This change in budget as a result of changing rent and mortgage payments permanently influences other budgetary items and might decrease the probability to participate in a specific style of life.

Expenses taken on by relocatees as a result of their forced move include:

- (1) increased monthly housing costs;
- (2) costs in locating the replacement dwelling;
- (3) operating and maintenance costs;
- (4) losses resulting from uncertainties and delays in the relocation program.

#### Physical Alterations

Replacement housing inevitably differs from the original dwelling in certain physical features and in the specific location. For the relocatee, these differences generally result in changes in:

- (1) housing quality;
- (2) travel distances to employment and important facilities; and
- (3) neighborhood conditions.

Reasons given by Texas relocatees for obtaining these particular replacement housing showed the importance of the above features. Relocatees most often sought (Buffington, 1973):

- (1) the best dwelling for the price;
- (2) a dwelling in a good neighborhood;
- (3) the best dwelling of those available;
- (4) a dwelling convenient to work; and
- (5) a dwelling convenient to relatives and friends.

Thus, quality of the dwelling (within a certain price range and housing selection), location, and neighborhood quality were important variables in the selection of replacement housing for most Texas relocatees.

In addition to these alterations, many relocatees also change their tenancy status. A large proportion of tenants become homeowners after relocation. In Texas, for example, 59 percent of those originally renting purchased their replacement dwelling. Eleven percent of the owners elected to rent (Buffington, et al., 1974). In an Ohio study, one of every two tenants became homeowners after relocation (Colony, 1972). Similar findings are documented in other studies (House, 1970; Hartman, 1972; Hartman, 1964).

#### Personal Adjustments to Relocation

For some displaced individuals, the relocation experience can present considerable emotional or psychological hardships. There are many disruptions in daily routines inherent in the process of displacement. One sociologist described individual reactions to this process as expressions of grief similar to that expressed in mourning for a lost person. This grief was evidenced by the relocatees' feelings of loss, their continued longing for the original home, generally depressed tones, symptoms of psychological and somatic distress, and tendencies to idealize the original home (Fried, 1966). The reactions of grief were attributed to the relocation experience because it physically separates members of a neighborhood, thereby disrupting:

- (1) ties to individuals, such as neighbors, friends, or relatives who had resided in or close to the original neighborhood;
- (2) ties to commercial and educational establishments;

- (3) an individual's identification with, or sense of "belonging" to, the physical features of an area.

Adjustments to these disruptions are necessary for the satisfactory functioning of the individual in his new location. He may make these adjustments by reestablishing his previous linkages or by cultivating new ties. The relocatee's success in establishing new ties depends on several factors, including the traditions of neighboring in the old neighborhood, the individual's response to the move, and the new conditions of the replacement neighborhood (Keller, 1968).

Relocation appears to most severely affect those groups who lack the personal resources (for example, time, energy, or money) to make the necessary adjustments. Success in relocation is related to the:

- (1) age of the head of household;
- (2) length of residence in the original location; ;
- (3) socioeconomic status of the household;
- (4) sex of head of household; and
- (5) ethnicity of household.

Figure VI-1 depicts a model which includes these personal characteristics predictive of relocation success, as well as summarizing the relocation process.

In a statewide Texas study (Buffington, et al., 1974) one out of every four relocatees interviewed were mildly or very upset by the relocation experience. These individuals, according to the study: (1) were elderly, with the head of household over 60 years of age and retired; (2) had lower incomes, usually less than \$6,000 annually; (3) were more likely to have occupied their original dwelling over twenty years; (4) were more likely

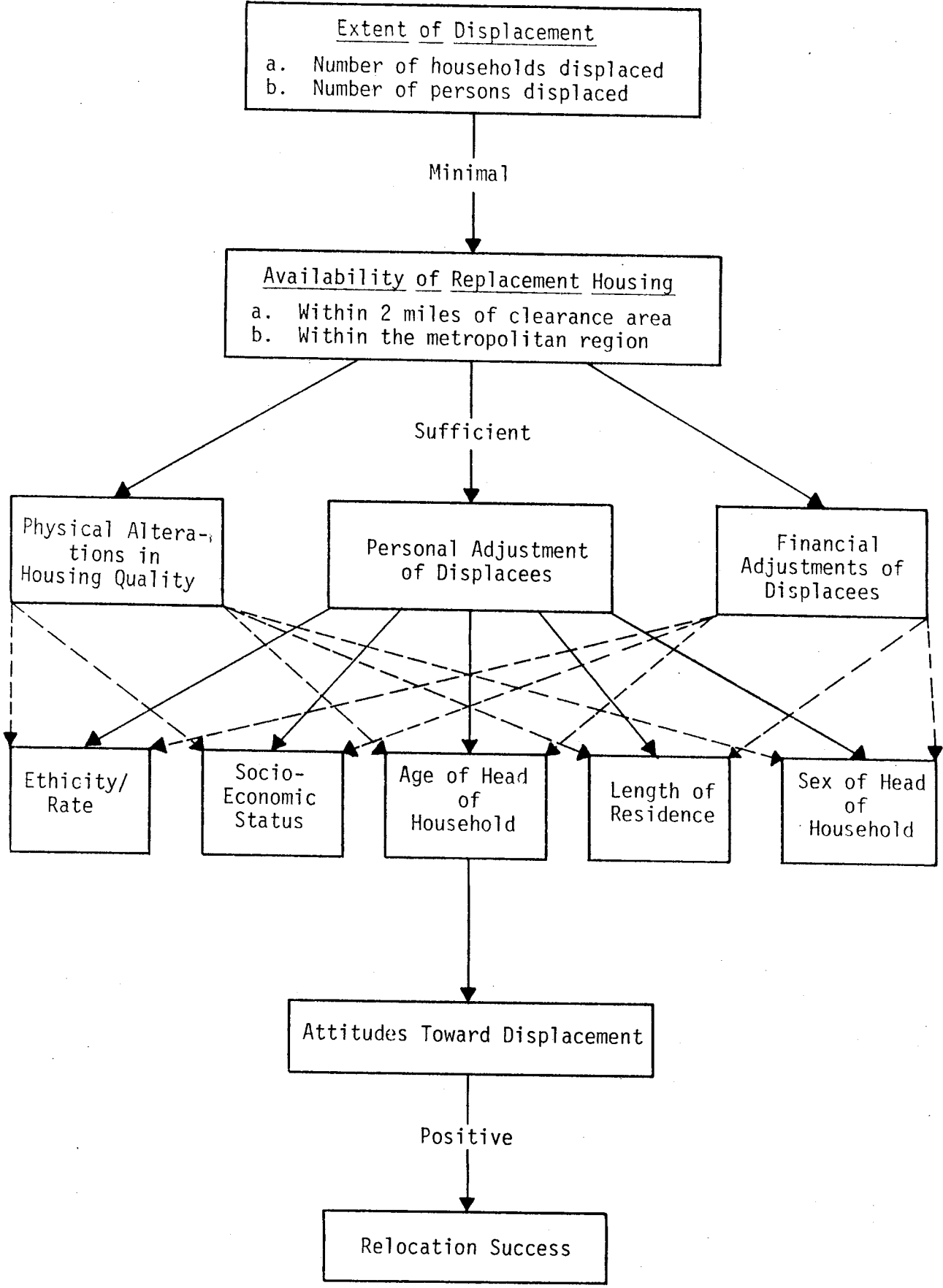


Figure VI-1. Short-term Social Impacts on Displaced Residents: A Model of Successful Relocation

to have downgraded their housing; and (5) exhibited a general dissatisfaction with the payments and personnel of the program. For many relocatees, however, this dissatisfaction with compensation did not appear to be the causative factor for their negative feelings towards the relocation program. In fact, 20 percent of the relocatees who felt that the payments were adequate and had fewer financial problems in relocating were also upset by the entire experience (Buffington, et al., 1974). To understand an individual's ability to relocate successfully, then, more than the adequacy of financial compensation should be considered.

#### Re-relocation

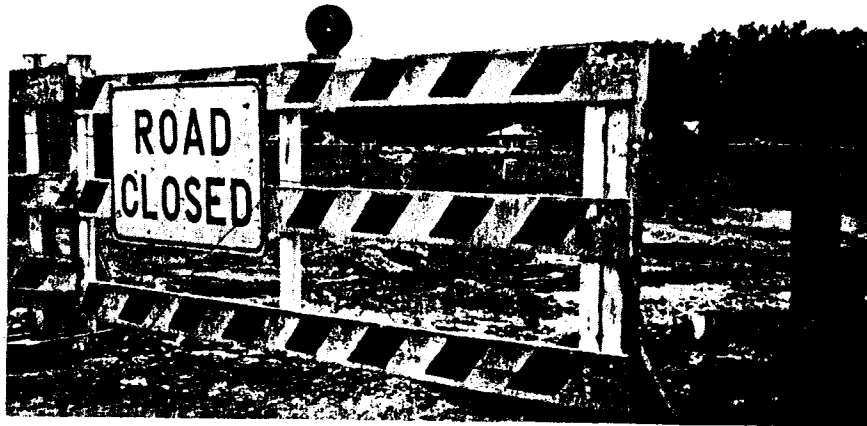
One important indication of satisfaction with replacement housing is the degree of permanency at the post-relocation address. In Texas, 76 percent of the relocatees remained in their original replacement dwelling. Owners had a greater tendency to feel satisfied, while tenants were more apt to feel that their replacement housing was unsuitable. Two years after being displaced, 88 percent of the respondents felt they were living in permanent housing. Thus, Buffington, et al., (1974) concludes that a two-year period is necessary for some relocatees to settle into a permanent dwelling. The Virginia study revealed that 12.5 percent of relocatees moved from their original relocation dwellings within a two-year period, usually as a result of a dislike for the replacement home or an inability to meet the additional costs (Perfater, 1972). Adjustments to the relocation process, it can be seen, usually occur within two years of relocation.

## RESIDENTS WHO REMAIN: LIVING WITH THE FREEWAY

While residents displaced from a neighborhood must make adjustments to an environment wholly new to them, residents who remain must adjust to an old environment made less familiar by the construction of a freeway. The facility itself significantly alters the physical appearance of the local area. Its mere size, for example, may dwarf the residences and the individuals around it; also, its location may divorce a community facility from its clientele. The high volume of freeway traffic further affects the surrounding area, often mitigating residential amenity. Moreover, because the quality of the residential environment is abated, changes in the usage of adjacent land may also accompany the facility's construction.

In an environmental sense, physical changes in overall appearance will inevitably occur in all regions traversed by the freeway. Social effects, however, occur only to the extent that these physical changes alter the functioning of residents, that is, their patterns of social interaction within the neighborhood (Burkhardt, 1971). The social impact of the freeway on area residents occurs as those patterns of interaction, which provide meaning and support, are disrupted.

In this context, Keller (1968) distinguishes between local- and urban-oriented individuals. Locally-oriented residents utilize the local neighborhood to fulfill their basic needs. They patronize local shops, maintain friends in the neighborhood, and make use of local services as a large part of their social activities. Urban-oriented residents, on the other hand, employ the facilities, contacts, and services of the local neighborhood



*Residents not displaced by freeway introduction must adapt to an altered environment, both during and after construction. Such large-scale physical changes may also necessitate social adjustments on the part of residents.*

to a much more limited extent, rather seeking the entire metropolis to satisfy their needs (Keller, 1968:160): "The local type resides in the city but lives in the neighborhood; the urban type resides in the neighborhood but lives in the city."

The effect of the freeway on these two types will also differ. Because significant social patterns are disrupted, locally-oriented residents tend to view negatively the presence of the freeway in their neighborhood. Social patterns of urban-oriented individuals, on the other hand, are only minimally altered by the freeway, while their lifestyles are augmented by the increased access to other parts of the metropolis. As a result, these residents tend to hold positive or indifferent opinions of the freeway's presence in their neighborhoods.

A recent Houston study (Fuller, et al., 1975) of three separate residential areas generally supported these contentions. Favorable opinions



toward the freeway were found among residents with an urban orientation. Respondents in the survey were physically mobile, rarely walked in the neighborhood, and were of relatively high socioeconomic status, characteristics which support an urban-oriented lifestyle. About 70 percent of these respondents were pleased to have the freeway in their neighborhood; seventy-two percent felt it was located properly in relation to the neighborhood.

In light of these differing orientations of area residents, it is apparent that the social impacts of the freeway may vary with the neighborhood under consideration (Burkhardt, 1971:85-86):

It is, therefore, possible that in some areas the social changes produced by the highways will be negligible. This is not true for individual and environmental impacts, which will be incurred by all neighborhoods. The social impacts are restricted to an area defined as a neighborhood, but there is no reason for the individual or environmental effects to end at the neighborhood boundary and, in fact, they do not.

The patterns of social interaction which are important to the functioning of an area as a neighborhood (see Chapter V) can be measured in terms of the:

- (1) extent to which local facilities are employed by area residents;
- (2) amount and importance of neighboring in the area;
- (3) degree of participation in local organizations;
- (4) individual's identification with and evaluation of the local area;
- (5) values held by community members;
- (6) extent of involvement in the highway issue.

Social changes, then, occur to the extent that physical changes produced by the freeway are perceived by residents to significantly block or alter some or all of these neighborhood characteristics. These environmental changes affect the appearance and quality of the residential area by creating:

- (1) changes in the use of land near and adjacent to the facility;
- (2) barriers through the local neighborhood;
- (3) adverse sound and air pollutant levels;
- (4) changes in residential mobility levels.

#### Land Use Changes

The label applied to a particular use of land primarily describes a characteristic set of human activities or functions which occurs in that area. A residential use of land, for example, indicates the presence of those structures associated with daily habitation: single- and multiple-family dwelling units, grocery stores, elementary and secondary schools, and neighborhood churches (see Chapter III).

While activities in different parts of the city tend to be different, they also tend to be mutually beneficial and necessary. Commercial districts provide employment for an area's residents. Because of these interdependent systems, it is essential that activity areas be integrated or linked. In most urban areas, this task is accomplished through the systems of streets and highways which provide networks of access and communication between these areas.

Studies in Dallas, Houston, Monroesville, Atlanta, Minneapolis-St. Paul, and Flint, Michigan document the rise of commercial activity in residential

areas as a result of the highway's introduction (Phalan, et al., 1961; Larson and Schenker, 1961). The resulting mixture of residential and commercial land uses may adversely affect the character of the residential area. For example, commercial development interrupts the continuity of residential structures, causing then a reduction in neighborhood solidarity.

In addition to the increase in the extent of industrial and commercial development, multiple-family dwellings also appear to be attracted to freeway locations. In three design subareas (elevated, on-grade, and depressed) in Houston, for example, the proportion of renter-occupied over owner-occupied units after the completion of two portions of I.H. 610 and one section of U.S. 59 increased 26, 28, and 3 percent respectively (Fuller, et al., 1975). Similarly, the Capital Beltway in Virginia became a focal point for intensive multi-family development soon after its completion (Department of Transportation, 1974b). In San Antonio, land used for apartments increased 52 to 109 percent in property value after the construction of the expressway (Phalan, et al., 1961).

Associated with this rise in multi-family dwelling units is a corresponding increase in residential density. The Houston study just described found increases in number of housing units in the residential area, decreases in the proportion of single-family dwelling units, and decreases in the median number of rooms per dwelling unit (Fuller, et al., 1975). This increase in density in the residential area creates for the original inhabitants rather unsatisfactory private or communal space. Often, any open space in the area for recreation (parks, for example) is too distant and is somewhat inadequate

as a resource. With the increase in residential density, there is frequently a shortage of parking space, resulting in a high level of on-street parking. This, together with an increase in area traffic levels, may make the area unsafe for pedestrians and children (Riedesel, et al., 1968).

As changes in the structures and residential densities in the areas occur, corresponding changes in the characteristics of residents also are evidenced. While single-family residents seek the "amenity"<sup>25</sup> of local neighborhoods, multiple-family dwellers are more often attracted to areas of high accessibility. The types of persons most attracted to areas of high accessibility and multiple-family units are usually young, mobile, single adults, and married couples with no children. In the Houston study of impacted residential areas along I.H. 610 and U.S. 59, there was a proportional increase in residents aged 20 to 24 years and in the percentage of single and divorced residents (Fuller, et al., 1975). A study of apartment dwellers along the Capital Beltway in Virginia indicated that accessibility to the Beltway had been a major factor in the selection of one's residence (Department of Transportation, 1974b).

While seeking areas of high accessibility, multi-family dwellers pay less attention to the "amenity" of single-family areas. In the earlier

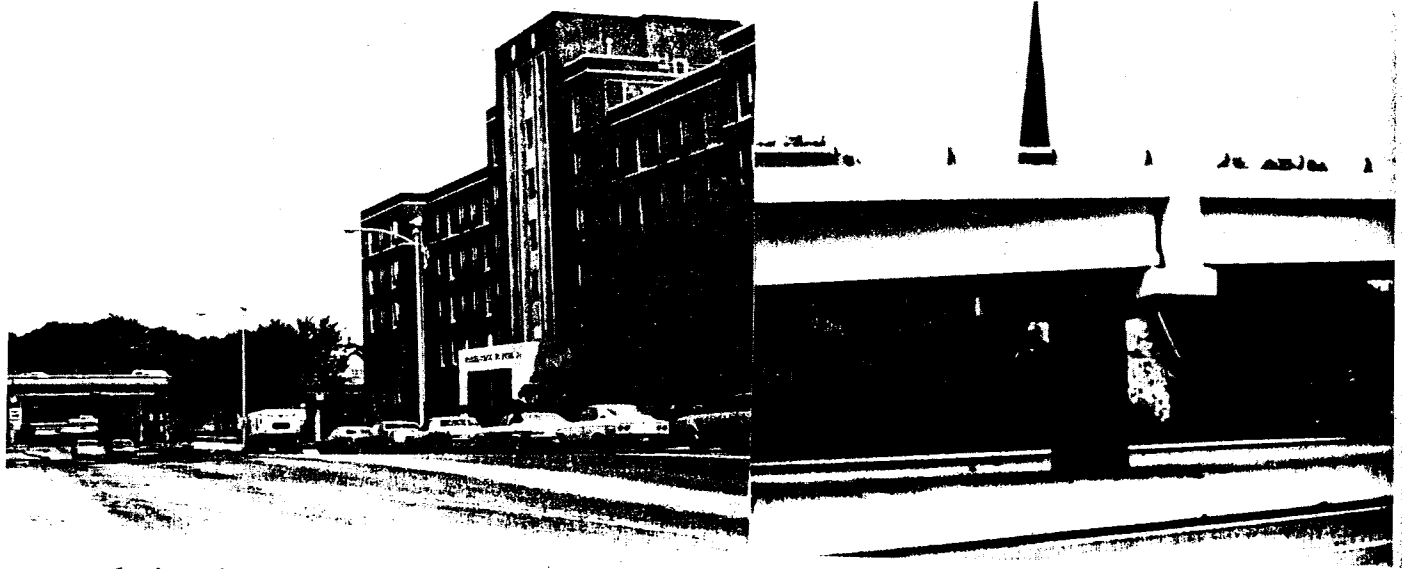
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<sup>25</sup> "Amenity", while a subjectively defined concept, normally refers to the safety, seclusion, and quiet of residential sites. Residences located on minor streets enjoy a great deal of "amenity", as long as they are not isolated from other residences which together form a neighborhood with integrity and self-sustaining services. At this level, residents may be more concerned with accessibility to such local neighborhood facilities as schools and shopping centers which requires purely local travel than with accessibility to other metropolitan areas. In California, for example, only ten percent of the residents who lived adjacent to the freeway considered its accessibility to other areas in buying a home, while 38 percent considered it irrelevant (Phalan, et al., 1961).

Houston study of the Katy Freeway, the mixture of commercial establishments in the residential area was listed by survey respondents as a major disadvantage; however, in areas containing a large percentage of multi-family apartments, the land use changes were not perceived as a problem (Buffington, et al., 1971). Other studies have found that no appreciable damage was incurred by apartment buildings after the construction of the freeway; most damage appeared to occur in areas of single-family dwellings. It was concluded that apartment dwellers are less concerned with amenity factors than are residents in single-unit structures (Phalan, et al., 1961).

Institutions may also locate along major thoroughfares to take advantage of the benefits which accrue from increased accessibility and visibility. Large churches, for example, appear to seek property abutting limited access facilities, usually near interchanges; and some pay fairly high prices for the locational advantages thereby gained. A survey of the spokesmen for 35 churches along the Capital Beltway in Virginia denied any negative effects of proximity to the facility. Of the 35, twenty-one spokesmen felt their church location was favorable, while twelve saw no effect. For churches serving an entire community, accessibility and visibility may be essential for the institution's viability.

Major hospitals also benefit from an alignment with the freeway. In a study of 13 hospitals situated next to freeways, hospital spokesmen cited such advantages from the increased accessibility and visibility as greater public awareness and use of the hospital, improved neighborhood quality, and improved access for patients and emergency vehicles. In addition, they agreed that the noise generated by the freeway was usually less than that generated within the hospital walls (Department of Transportation, 1974b).



*Such institutions as hospitals and churches often seek the locational advantages afforded by the freeway. Most institutions view as major benefits the increased accessibility resulting from freeway proximity.*

Design Features and Land Use Changes. The following characteristics of the freeway may affect the direction and rate of land use change:

(1) Proximity to the freeway: Changes in land usages occur with greater force and speed as a function of distance from the facility. The closer land is to the freeway, the greater is the likelihood of land use change. Freeway-abutting land showed significantly higher land value increases in most urban areas after construction of the expressway, including Dallas, Houston, Atlanta, Seattle, and Boston (Phalan, et al., 1961). The relationship of land use changes is illustrated in Figure VI-2. General effects impact the entire community, perhaps raising the value of land throughout the city or county; neighborhood effects refer to the changes incurred by a definite area by virtue of its proximity to the facility, and special effects impact only a particular parcel of land due to its direct relationship with the facility.

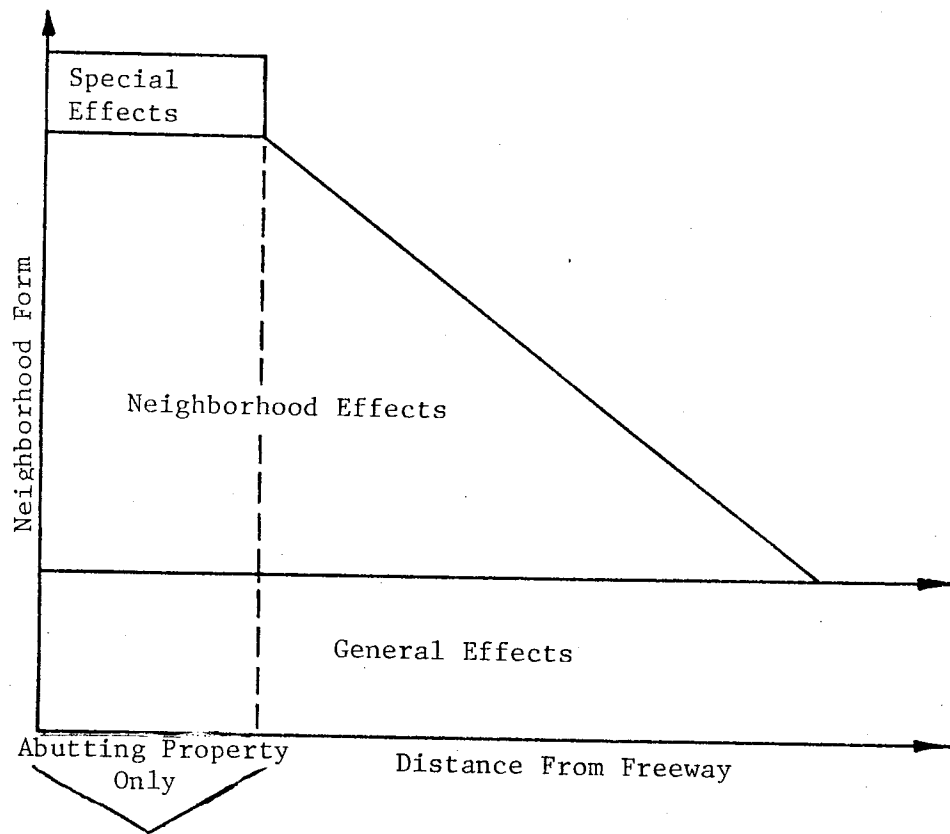


Figure VI-2. Relationship of Proximity of Residences to Freeway and Changes in Land Use

Source: Adapted from Vergil G. Stover, William G. Adkins, and John C. Goodnight (1970). Guidelines for Medial and Marginal Access Control on Major Roadways. National Cooperative Highway Research Program Report 93: 54.

It may be surprising that land values increase relative to the entire facility since they are limited access facilities. However, increases may also result from:

- (a) advertising or visibility value;
- (b) psychological stimulation of speculation and expectation (which is often a major factor in the valuation process); and



*Low-cost, deteriorating dwellings are vulnerable to changes in land use because of the reduced cost of acquiring such property. Frequently, dwellings such as these are superseded by commercial activity.*

(c) availability of frontage roads (Phalan, et al., 1961).

This increase in property valuation in low-valued residential areas can have adverse consequences for the lower-income residents who must bear the resulting increases in property taxes. These areas are also most likely to be superseded by commercial and industrial interests because of the relatively low cost necessary for property acquisition and removal of existing structures. In Houston, lower-income residential areas most frequently underwent a mixture of land usages; higher-income areas, restricted in use by zoning regulations, failed to evidence a change in use, although there was a reported decline in property values (Phalan, et al., 1961)

(2) Proximity to interchanges: Multiple-family dwelling units and commercial and industrial establishments first tend to develop in nodes at major intersections, and in time, fill the spaces between the nodes. In one study, land located at highway intersections required only two-thirds to one-half of the amount of time necessary for full development of the



abutting strip to develop (Phalan, et al., 1961). By increasing the factors of accessibility and visibility of the land, nodes at major intersections hold definite advantages for business interests (Stover, et al., 1970).

(3) Access to the freeway: The number of on/off ramps and the availability of frontage roads also affects the changes in land usage by providing greater access to the facility from the abutting territory. In a San Antonio study, for example, the greatest changes occurred to property along frontage roads or otherwise having access to the freeway (Phalan, et al., 1961). On and off ramps also control access to the facility as well as affect the levels of traffic on area streets. In one Houston study, those respondents who desired more on/off ramps felt the additional ramps would enhance the accessibility provided by the freeway; they also felt the ramps would reduce the amount of traffic within their area (Fuller, et al., 1975).

#### Creation of a Neighborhood Barrier

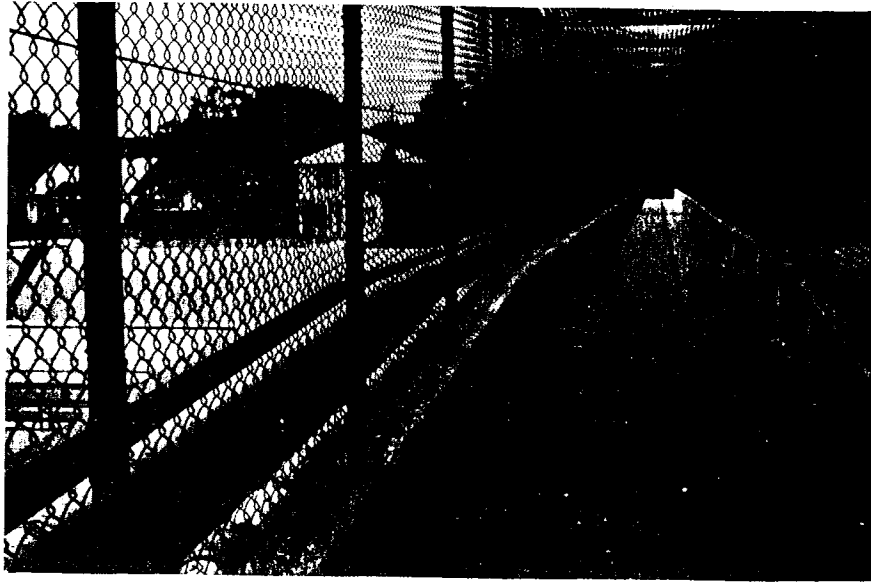
By locating the freeway through a residential area, the through circulation of minor streets in the immediate area is often blocked. Accessibility within a neighborhood directly influences neighborhood patterns of social interaction; interaction patterns tend to occur within and not across major barriers. As a result, any decrease in intra-neighborhood accessibility will cause reductions in overall levels of social interaction. The presence of the freeway directly affects intra-neighborhood accessibility by:

- (1) changing local travel patterns; and
- (2) serving as a psychological limit on the boundaries of the neighborhood (Burkhardt, 1971:92).

While commercial, industrial, multi-family units, and institutional land uses develop where accessibility to all parts of the metropolitan region is enhanced, residential sites are chosen, to a large extent, where accessibility to local facilities is easiest. Hence, while other usages may benefit from highway introduction, residential areas are often disadvantaged. In a study undertaken by Buffington, et al. (1971:52), for example, those who felt the new freeway negatively affected residential areas cited the division of the neighborhood as a major disadvantage. The implication of neighborhood partitioning can be quite severe; the poor, for example, frequently feel that they are deliberately being sealed off from others (Schorr, 1966). Segregation may thus occur (Fellman, et al., 1970:43):

Frequently, as in Washington, D.C., highways are built on the informal boundary line between wealthier areas and poor--often black--neighborhoods, thereby turning what was formerly a potentially passable social barrier into an impassable concrete wall.

Inevitably, the construction of the freeway will cause increased travel distances for residents to many neighborhood facilities. For some residents, particularly those in abutting zones, more of their social life will have to be carried on by car (Thiel, 1961). As a result, individuals whose means of mobility are restricted (elderly and carless households, for example) will be most severely impacted.



*Depressed freeways may isolate residential areas from each other. The provision of crosswalks is often the only means of preventing the formation of an impermeable pedestrian barrier.*

Design Features and the Freeway As a Barrier. Highway characteristics which influence the extent to which intra-neighborhood accessibility may occur after its introduction into the local neighborhood are:

(1) Number of crossovers: Crossovers, either pedestrian or automobile, provide points at which the highway barrier can be passed. The provision of crossovers, then, has the effect of making the highway somewhat more permeable to residents on either side.

(2) Number of frontage roads and on/off ramps: The number of frontage roads and on/off ramps also affect the degree to which the freeway is considered a barrier. Without frontage roads, local streets often dead-end at the freeway, and accessibility to the facility itself is hampered. With frontage roads, however, most local streets meet with service roads and can eventually connect with other roads in the area, increasing the

amount of circulation in the immediate vicinity of the freeway. Frontage roads also provide accessibility to automobile crossovers for area residents. In the same way, the number of on/off ramps affects the ability of residents to make use of the freeway while also opening the area to freeway traffic. Without such ramps, the area effectively becomes isolated.

(3) Elevation of the freeway: The elevation of freeway design may form a psychological or physical barrier to reduce the level of intra-neighborhood accessibility. As it increases travel time to selected local facilities, the facility forms a physical barrier within the neighborhood. One Houston study indicated that a higher percentage of residents living near an elevated facility were forced to use circuitous travel routes to get across the freeway. Travel habits were more often affected for residents living closest to the freeway (Buffington, et al., 1971).

In another sense, freeways may form psychological barriers by blocking visual perceptions of the other side; as a result, the freeway may become a neighborhood boundary (see Figure VI-3). An embanked freeway (Example A of Figure VI-3) blocks all vision between the neighborhoods, effectively isolating the two from each other. Likewise, the at-grade freeway (Example B) is as much a visual barrier as is the embanked; in addition, any crossing must normally be above or below ground level, making the transition difficult to accomplish gracefully. The elevated freeway (Example C), though dominating in scale, enables residents to pass rather freely beneath it, and it allows residents to see through it to the other side. Depressed freeways (Example D) also permit visual perception of the other side. They are, in addition, relatively easy to cross, provided that pedestrian and automobile crossovers are constructed (Riedesel, et al., 1968).

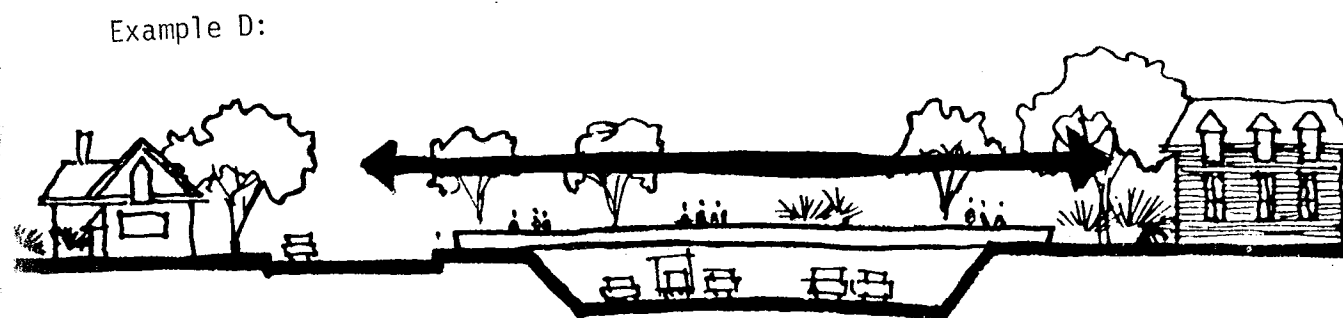
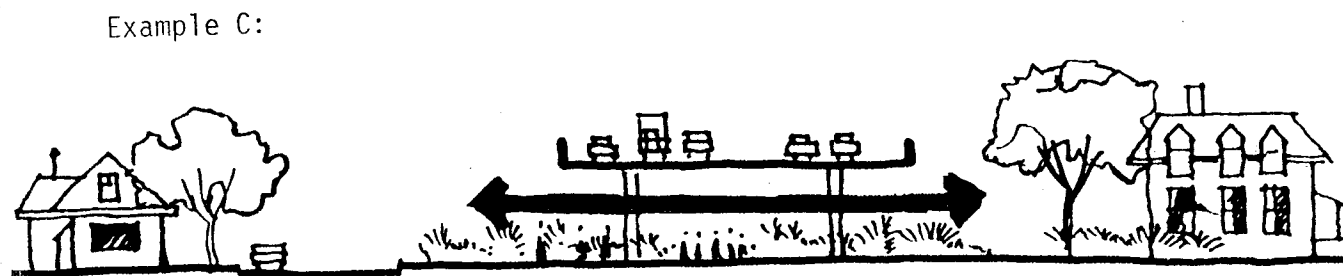
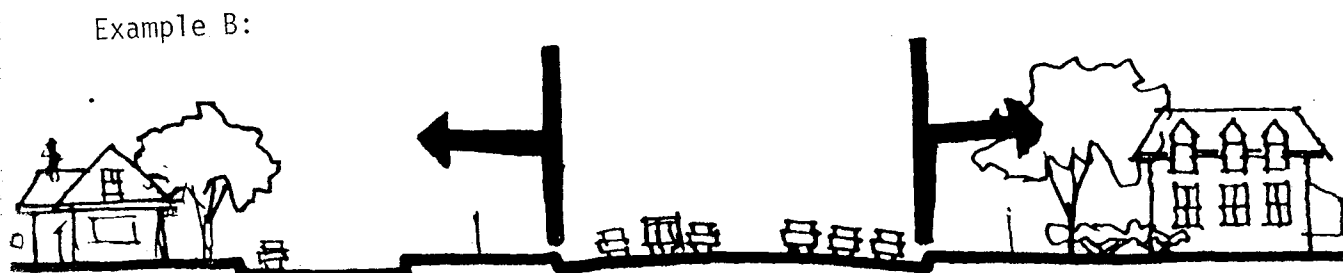
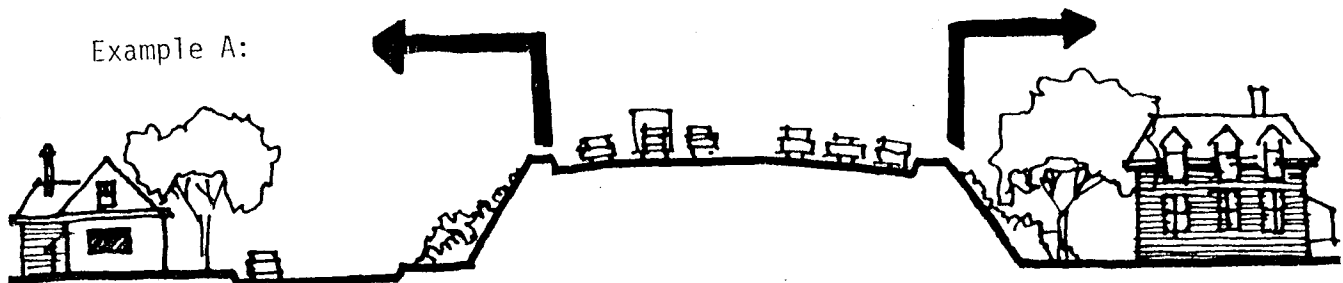


Figure VI-3. The Effect of Visual Perception as Psychological Barriers

Source: G. A. Riedesel, et al., (1968). A Study of the Social, Economic, and Environmental Impact of Highway Transportation Facilities. Pullman, Washington: Washington State University, p. 63.

## Sound and Air Pollution

In addition to the freeway's effect on intra-neighborhood accessibility residential satisfaction with the location of the freeway can be analyzed in relation to the degree to which the resident's quality of life is affected (Fuller, et al., 1975). Most residents cite as a major disadvantage to living near the freeway the increased levels of noise and fumes associated with freeway traffic. As a result, property values of the residential area may decline, as long as commercial and multi-unit structures do not develop. In a San Antonio study, for example, the single-family residential area was the sole property use evidencing value damage. Neighborhoods undergoing such property value decline are generally older and more stable, have a stronger degree of neighborhood cohesion, and are more reluctant to willingly respond to change (Phalan, et al., 1961; Stover, et al., 1970).

In two Houston studies, noise and air pollution were specifically listed as negative effects of the freeway (Fuller, et al., 1975; Buffington et al., 1971). Fifty-two percent of all respondents in the former survey reported increased noise levels in the home, and 26 percent pointed to increased levels of air pollutants (Fuller, et al., 1975). Noise levels were particularly bothersome for older persons; a higher percentage of those 60 years and older felt that the freeway noticeably raised the level of noise than did those under 60 years (Buffington, et al., 1971).

Increased levels of noise and air pollution may both physically and mentally disadvantage those residents who must tolerate them. Doctors and

psychologists generally agree that these increased levels induce greater physiological and psychological stress on the individual (Riedesel, et al., 1968). The use of noise abatement techniques may reduce the problem somewhat. Building setbacks, buffer planting, fences, walls, and embankments where possible, may reduce noise (Stover, et al., 1970), yet at the same time, they reinforce the freeway's barrier effect.

Design Features and Pollution of Residential Areas. Those characteristics associated with the freeway which effect the impact of freeway traffic noise and fumes are:

(1) Elevation of the freeway: Respondents in the Houston study more frequently reported the increased levels of pollutants in the elevated and on-grade design sub-areas than those in the depressed sub-area (Buffington, et al., 1971). Similarly, Fuller, et al., 1975), concludes that the degree to which noise is negatively viewed is related directly to the elevation of the freeway.

(2) Proximity: Residents nearest the freeway tend to be more annoyed by noise and fumes than residents whose homes are farther from the facility. In other words, positive attitudes toward the facility lower as one approaches it (Thiel, 1961). In one study, it was found that convenience is least and nuisance greatest when one is closest to the facility. This relationship is illustrated in Figure VI-4.

In the recent Houston survey of residents along I.H. 610 and U.S. 59, it was found that the greater distance from the freeway, the greater was the resident's satisfaction with his residential location relative to the freeway. While 90 percent of those residents farthest from the freeway

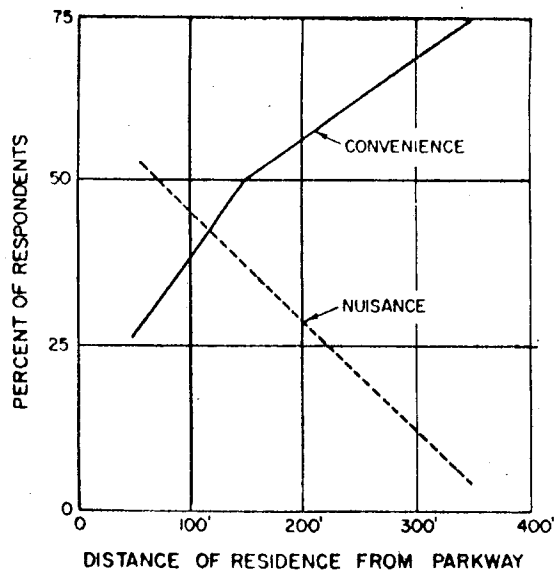


Figure VI-4. Relationship of Residential Attitude Towards Freeway Based on Proximity

Source: Vergil G. Stover, William G. Adkins, and John C. Goodknight (1970). Guidelines for Medial and Marginal Access Control on Major Roadways. National Cooperative Highway Research Program Report 93:83.

preferred to live where they were, only 60 percent of those residents whose homes abutted the freeway desired to stay (Fuller, *et al.*, 1975). The primary reason for seeking the move was a desire to escape the noise of freeway traffic.

In distinguishing between pre-construction respondents (those residing in the area before the introduction of the freeway) and post-construction



respondents (those moving into the neighborhood after the freeway was completed), Fuller, et al. (1975), found that a considerably greater proportion of pre-construction individuals tended to negatively view their residential location than post-construction individuals. The latter respondents, he concluded, could weigh the assets and liabilities of living near the freeway, including the disadvantages of noise and air pollution. Pre-construction respondents lacked that option.

### The Effect of Freeways on Residential Mobility

As noted in an earlier section, the effects of metropolitan freeways on residential neighborhoods were initially explored in a 1967 California Study (Hill, 1967) and were further examined in a Texas A&M study (McLean and Adkins, 1971) of 152 study neighborhoods and 47 control neighborhoods in Dallas, Houston, and Austin. Neighborhoods were delineated on the basis of a Neighborhood Index which identified residential areas with similar social and economic characteristics and measured their socioeconomic levels. In addition, a Mobility Index was formulated to calculate residents' rates of movement from their dwelling units during a five-year time period. It was felt that residential mobility was essential in studying freeway effects on urban neighborhoods, and that it could aid in the process of route selection.

Four freeway-neighborhood relationships were identified: control neighborhoods, study neighborhoods not bordering the freeway, study neighborhoods bordering the freeway, and study neighborhoods segmented by the freeway. The effect of freeways on each of these neighborhoods relative to residential mobility was examined, using correlation and multiple regression analyses.



*Some residents elect not to live in residences abutting the freeway. Impact studies reveal an increase in residential mobility in areas traversed by the facility.*

It was established that the rate at which individuals and families move from their residences declines after the introduction of the freeway in bordered and not bordered neighborhoods. In neighborhoods segmented or divided by the freeway, however, residential mobility increased significantly as shown in Figure VI-5. In addition, the socioeconomic level and behavior which results in residential mobility was most likely to change in these segmented neighborhoods. This change, for example, included a decline in socioeconomic levels in segmented areas, a net loss of total dwelling units (excluding displaced units), and an increase in the proportion of multiple-family dwelling units (either by a conversion of existing single-family units or by the addition of new apartment houses).

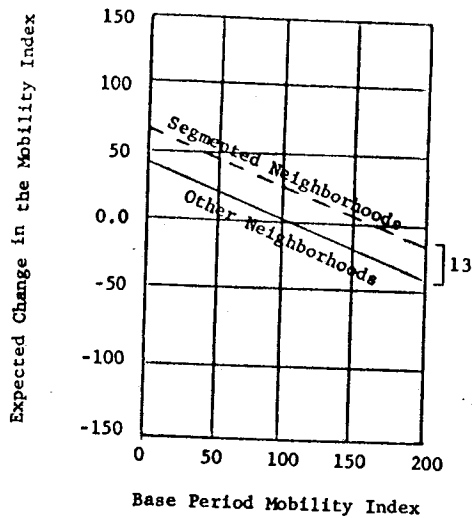


Figure VI-5. Expected change in residential mobility from 1950 to 1965. (Root mean square residual = 23; two-thirds of the estimates made should be within 23 of the actual change experienced. The regression is significant beyond the 0.001 level.  $F_{2,104} = 16.3$ .)

Source: Edward McLean and William G. Adkins (1971) Freeway Effects on Residential Mobility in Metropolitan Neighborhoods: Highway Research Record 356:101.

Most study and control neighborhoods registered increases in socioeconomic levels. Neighborhoods not bordered by the freeway evidenced the greatest amount of growth while segmented neighborhoods experienced slight increases. This trend most likely was due, it was felt, to the construction of modern apartment complexes in the segmented neighborhoods. However, the study also suggested that residential socioeconomic levels were more likely to decline in these areas.

In addition, neighborhoods with initially low socioeconomic levels tended to experience increases in these levels. Areas with intermediate or high levels, on the other hand, were most likely to note downward trends. Deterioration was found to occur more when there was a combination of old or intermediate single-family units and intermediate or new multiple-family units.

This evidence points to the need for research prior to route selection as essential in urban highway decision-making and planning. The primary conclusion from the above study is that freeway routes in metropolitan areas should not intersect residential areas. For a graphic summarization on the social impacts of those residents who remain in an area after freeway construction (see Figure VI-6).

#### SUMMARY

The examination of short-term social impacts provides for the highway planner a substantive guide by which he can more adequately predict the consequences of freeway construction in an urban area. Two groups need be considered in freeway planning: those residents displaced by the right-of-way and those residents who remain in the area. Both groups must make many adjustments to the physical and social changes which result from the introduction of the freeway and, for each group, successful adjustment is influenced by the availability and adequacy of personal resources.

The success of relocating in a new environment initially depends on the amount, location, and characteristics of replacement housing, as was shown in Figure VI-1. Replacement housing which is physically close to the clearance area and which meets the needs of the relocatees is often necessary for their subsequent adjustment. The availability of housing for low-income homeowners is a special problem, due to the nature of the housing market in which they operate. Relocatees also face problems in the added monthly costs of replacement housing. The resulting adjustment in financial allocations in the household budget may necessitate changes in their individual styles of life and social activity. Physical alterations

621  
Level of Social Effect

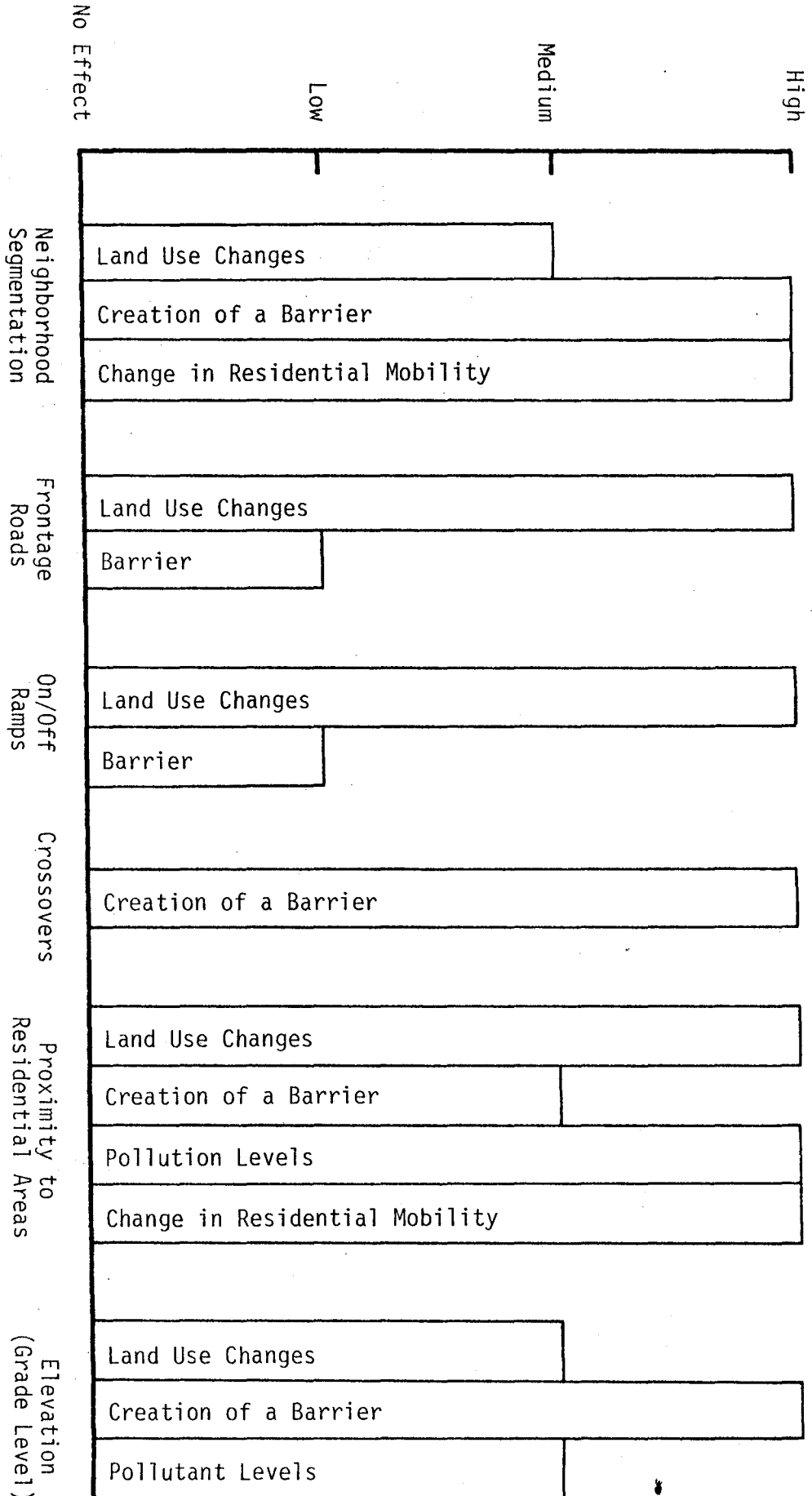


Figure VI-6. Overview of Short-term Social Impacts on Residents in Close Proximity to Urban Freeways (Based on Highway Design Features)

in housing quality, in travel distances to employment and important facilities, and in neighborhood conditions also affect the social activities of relocatees. In addition, the physical separation of neighborhood members disrupts their ties to each other, to facilities in the area, and to the area as a whole. Personal adjustments to this disruption is related to the age and sex of the head of household, to the length of residence in the original location, and to the socioeconomic status and ethnicity of the household members.

Residents who remain in the area must also adjust to a new environment. The way residents view the freeway is related to their orientation toward the neighborhood, which is a function of the extent of social interaction in the area. Social changes occur to the extent that physical changes are perceived as blocking or altering these patterns of social interaction. Physical alterations include land use changes, the creation of barriers, increased pollutant levels, and changes in residential mobility. Each of these physical changes can be modified by significant highway characteristics.

Land use changes include changes in the functions or activities of a specific area. The alterations are evidenced by an increased proportion of multi-family dwelling units, by an increased density of the population, by a rise in commercial and industrial establishments in residential areas, and by an increase of institutions (such as churches and hospitals) near the freeway.

This focus on the short-term impacts of freeway introduction is intended to aid the freeway planner in predicting future impacts. By realizing

what has occurred in past projects, the planner has greater insight into what is likely to occur in future project sites.

## CHAPTER VII

### FORECASTING LONG-TERM IMPACTS

This chapter presents several methods that can be used to forecast the long-term economic and social effects of a new transportation facility upon a social area. The methods and techniques presented here are drawn from the areas of social forecasting, technological forecasting, and long-range planning. Each method has been selected on the basis of its practicality, its utility to the planning process, and its applicability to the needs of transportation decision-making. Although the emphasis of the discussion here focuses on the use of these techniques to forecast the social, economic and environmental consequences of a proposed project, their usefulness is not limited to these particular considerations. They can also be used to analyze future needs in the areas of transportation design, engineering technology, and construction. Indeed, many of the methods discussed in this section had their origin in the practical need for information in R&D planning, engineering, and business decisions. For this reason, they can be applied to the technological aspects of the highway planning process with a high payoff relative to their difficulty of application.

#### THE USE OF FORECASTS

In order to understand the role of forecasting in the process of decision making, it is useful to view the future as composed of a large set of alternatives (de Jouvenal, 1967). Forecasting is a means of delineating and articulating the more important of the probable outcomes and estimating how the more desirable of these are likely to be produced in the implementation of a proposed program (Gordon, 1972:165). In this app



forecasts serve as an input to the planning and decision-making process of an organization. The role of the forecast in planning is described by Martino (1972:15) as follows:

- a. The forecast identifies limits beyond which it is not possible to go.
- b. It establishes feasible rates of progress, so that the plan can be made to take full advantage of such rates; it does not demand an impossible rate of progress.
- c. It describes the alternatives which are open and can be chosen from.
- d. It indicates possibilities which might be achieved, if desired.
- e. It provides a reference standard for the plan. The plan can thus be compared with the forecast at any point in time, to determine whether it can still be fulfilled, or whether, because of changes in the forecast, it has to be changed.
- f. It furnishes warning signals, which can alert the decision-maker that it will not be possible to continue present activities.

Martino also develops a framework for integrating forecasting into the cycle of organizational activity. The cyclical process is shown in Figure VII-1.

Martino (1972:15-16) describes this process:

The first step in logical sequence is forecasting, and this is shown at the top of the cycle. The forecast provides a statement of future possibilities or likelihoods. On the basis of this forecast, a plan is developed. This plan prescribes a sequence of activities which is intended to achieve some goal. Once the plan is developed, a program can be devised, it being a statement of the resources which will be committed to carrying out the plan. The program allocates specified resources to particular activities, assigns specific people to particular tasks, etc. Once the resources are available, the program can be implemented. This involves the expenditure of resources, the carrying out of activities by people, and so on. After the implementation of the program, it is necessary to evaluate the results. Was the plan successfully carried out? Did the expenditure of the resources achieve the desired results? Was the performance of the activity satisfactory? The evaluation amounts to a determination of the present status, and its comparison with the status which was expected on the basis of the plan. To the extent that the actual status differs from the expected status at this point in time, unexpected conditions have arisen. This may mean the forecast on which the plan was based is to that extent no longer valid. By taking the findings of the evaluation as a new starting point, a new forecast can be prepared and the cycle begun again.

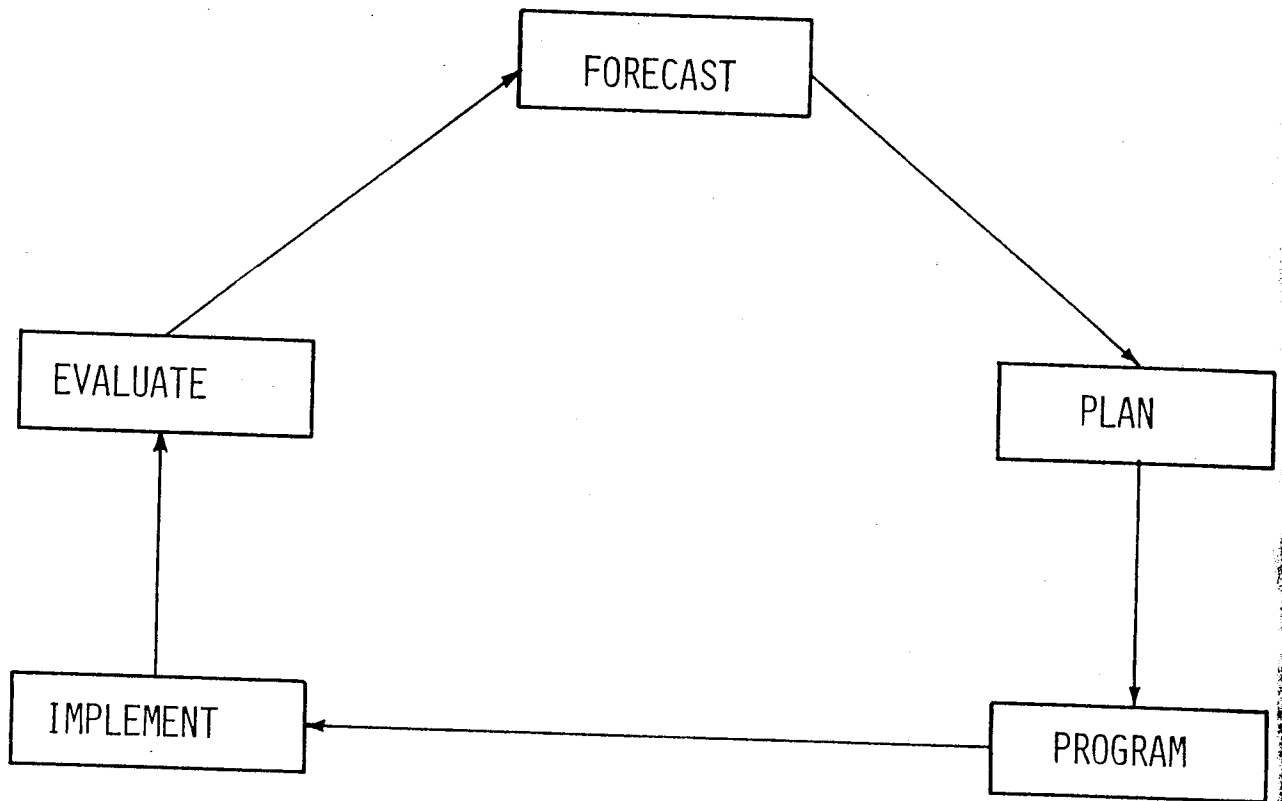


Figure VII-1. Cycle of Organizational Activity

Source: Joseph P. Martino, Technological Forecasting for Decisionmaking (New York: Elsevier, 1972) p. 15.

It is important to note that forecasts do not state what the future will be if a certain course of action is followed. All information available to the planner is of the past, regardless of the methods used to obtain it. A forecast tells only of the implications of available information about the past. These implications are connected with the future through a logical framework (Martino, 1972:14). As Schoeffler (1955) states:

The operation of predicting is a logical operation. A prediction is the assertion of information about the future. Inasmuch as we do not and cannot have direct knowledge of the future, any information about the future must inevitably be a logical consequence of information available in the present. In other words, we can assert about the future only those bits of information that are entailed, according to an accepted body of postulates of logic, in the body of information about the 'present' and the 'past' that we have available at the time we wish to make a prediction.

Thus, forecasting, like all other planning methods regardless of type, relies on judgment, not facts of the future.

#### TYPES OF FORECASTING TECHNIQUES

A useful way of categorizing forecasting techniques is that developed by Jantsch (1967). He classifies techniques into two categories: (1) exploratory and (2) normative. These categories represent two basically different approaches to decision-making. In the exploratory approach, the forecast begins with some present state of affairs and proceeds forward in time to establish the most likely pattern of future events. In the normative approach, goals, needs, objectives, or desires are specified, and the forecast works backward to the present to see what capabilities now exist or could be extrapolated to meet future goals. The two types of forecasts

are illustrated in Figure VII-2. Since the main focus of this chapter concerns prediction of the long-term impacts of proposed transportation facilities, methods considered here are exploratory in nature. The forecasting methods presented in this chapter are as follows:

- (1) Scenarios and Model Building
- (2) The Delphi Sequence; and
- (3) Cross Impact Analysis

Each method will be discussed in a separate section of this chapter.

#### SCENARIOS AND MODEL BUILDING

A scenario is a narrative description of a potential course of developments which might lead to some future state of affairs (Gordon, 1972:185). The term scenario is taken from the field of literature where a scenario is defined as the outline of the plot of a play. In forecasting, scenario refers to the plot of a drama dealing with certain aspects of some future time. This plot depicts potential actions and events in some likely order of development. A scenario can be either: (1) a direct extrapolation of present conditions; or (2) an extrapolation formed by adding new conditions to the present environment. In the process of constructing a scenario, the forecaster may rely solely on information about the past, or he may combine information about the past with sets of discrete forecasts to form a broader composite forecast. The major utility of a scenario is in providing a context in which the various options open to the decision-maker can be placed so that he can determine which is the most satisfactory on an overall basis.

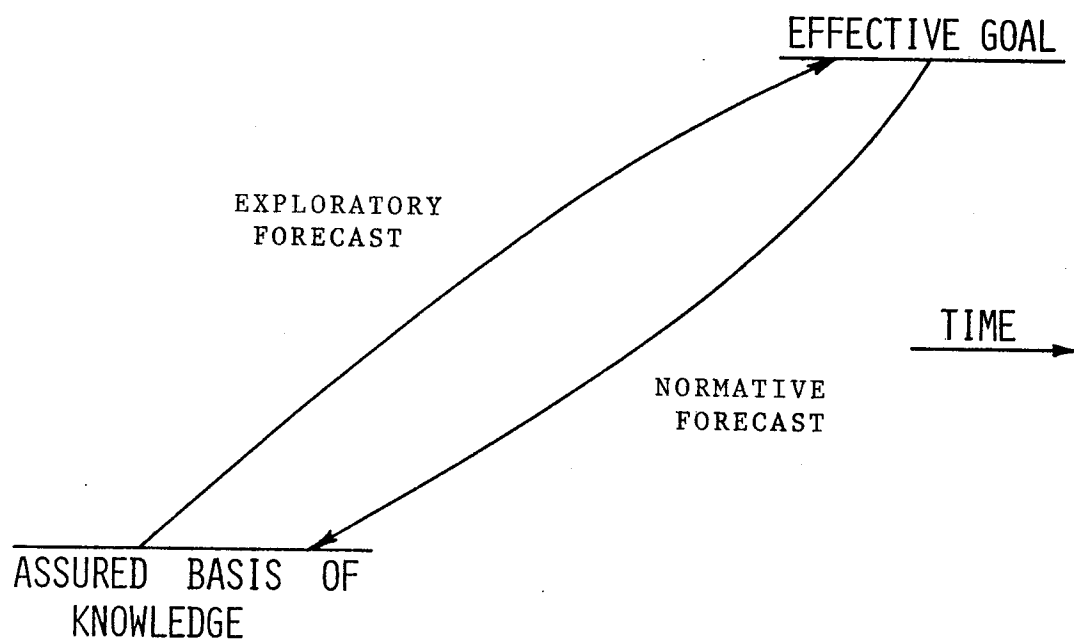


Figure VII-2. Illustration of Exploratory and Normative Forecasts

Source: Erick Jantsch, Technological Forecasting in Perspective (Paris: Organization for Economic Cooperation and Development, 1967).

There is no general agreement in the literature as to the precise elements that constitute a scenario. The only element that is accepted either implicitly or explicitly as basic to a scenario is consistency. A scenario is more than just a set of discrete forecasts juxtaposed in a narrative. "A scenario is...a picture of an internally consistent situation which, in turn, is the plausible outcome of a sequence of events" (Martino, 1972:267). The transportation planner faces the problem of integrating the separate forecasts of the long-range economic, environmental, and social impacts of a proposed transportation facility into a consistent forecast. A major source of difficulty in this respect is taking into account all the possible interactions and feedback relationships that might occur among the various factors under consideration.

One means of achieving consistency is to base the scenario on a causal model of the system of interest. Causal models represent the effects on some variables caused by changes in the others. A well-constructed causal model enables the planner to define the consequences of various impacts and, thus, to evaluate large-scale alternative configurations of a system with assurance. Moreover, the development of a causal model requires the planner to specify a deliberate causal structure, based upon either a formal theory, or at least some strong arguments of plausibility. A scenario constructed on the basis of a well-constructed model is more likely to be internally consistent and to take interactions into account. The procedures to be followed in constructing a causal model are discussed below.

Steps in Model Specification. The first step in the creation of a causal model is the definition of the domain of the model. This entails specification of the parameters of time, space, or a range of values of variables for which the model is desired to be valid. For the transportation impact model, the domain is a time period of 10-20 years after the completion of the proposed facility, and the spatial area which will experience social, economic and environmental impacts as a result of the presence of the facility. In the second step, the decision-maker must determine which variables should, according to the selected domain of the model, be part of the model. In the transportation model, these are the social, economic and environmental variables that are most clearly related to the system and which will change in the time period covered by the forecast as a direct result of the presence of the proposed transportation facility.

The third step is to proceed from theory or other arguments to specify the way in which the variables might interact. If there is no formal theory about these interactions, plausible hypotheses should be advanced. If there is more than one hypothesis as to what the most appropriate relationship should be, alternative specifications of causal linkages should be tested against each other through the use of the best empirical data available.

Graphical Techniques of Representing Causal Models. Since causal models are difficult to convey in words, a useful graphical technique has been developed.

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<sup>26</sup> Discussion in this section is taken from Richard de Neufville and Joseph H. Stafford (1971). Systems Analysis for Engineers and Managers. New York: McGraw-Hill: Chapter 12.

Arrow diagrams are used to indicate the direction of causation between variables. Thus, if X causes Y, the relationship is shown as

$$X \rightarrow Y .$$

Feedback loops are shown by the use of dual arrows

$$X \rightleftarrows Y .$$

The type of relationship is designated by plus (+) and minus (-) signs. A plus sign assigned to a causal arrow represents a direct relationship between variables. By direct relationship is meant that an increase or decrease in the magnitude of variable X causes a corresponding increase or decrease in Y. A minus sign assigned to an arrow represents an inverse relationship. By inverse relationship is meant that an increase in the magnitude of X causes a decrease in the magnitude of Y, and a decrease in X causes an increase in Y.

An example of a causal diagram is shown in Figure VII-3. In this example, it is hypothesized that the construction of a proposed highway will increase the mobility of the residents of a particular area. This is shown by the (+) sign on the arrow joining the two variables. In turn, it is hypothesized that an increase in resident mobility will result in decreased commercial activity as residents shop more in the larger urban area and less in the neighborhood. The inverse nature of the relationship is shown by the (-) sign of the causal arrow. It can also be seen from the diagram that there is an inverse relationship between construction of the highway and the amount of commercial activity that results from the relationship each has with resident mobility. This is an advantage of graphic representation of causal structures. Complex relationships can be visualized with relative ease. Most transportation impact models needed for scenario construction can be represented by simple arrow diagrams similar to the one illustrated here.



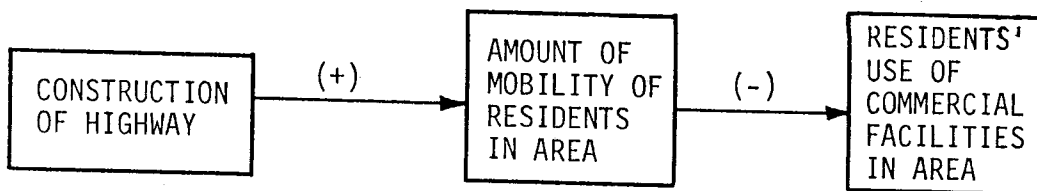


Figure VII-3. Hypothetical Causal Diagram

## Construction of a Scenario: A Transportation Example

An example of scenario construction applied to a transportation impact situation is presented here to illustrate the forecasting process. The hypothetical situation for the forecast is as follows:

*A limited-access, four-lane highway is proposed that will provide an access from the suburbs of a major metropolitan area to the central business district. The study area for which the forecast is to be made is a middle-income residential neighborhood consisting predominantly of single unit residences. A small shopping complex consisting of a service station, a grocery store, a discount store, and two fast-food restaurants is located on the edge of the neighborhood and is economically dependent on trade from the residents of the study area. The proposed right-of-way of the highway is located on the periphery of the neighborhood so that little relocation will be necessary and physical disruption will be minimal. The proposed opening date of the highway is 1979.*

The first step in the process of constructing the scenario is to develop a causal model of the neighborhood system according to the procedures discussed earlier. The model constructed for this example is shown in Figure VII-4. This model is based upon the best theoretical explanations of the operation of the system, findings from previous transportation impact studies of similar situations, and sets of plausible alternate hypotheses in those cases where theory and data are lacking or present conflicting conclusions. Alternate hypotheses are shown by the (+ or -) symbol assigned to the causal arrow in the diagram. The variables in the model are those in the system considered to be most likely to undergo change in the time period from 1979 to 1989.

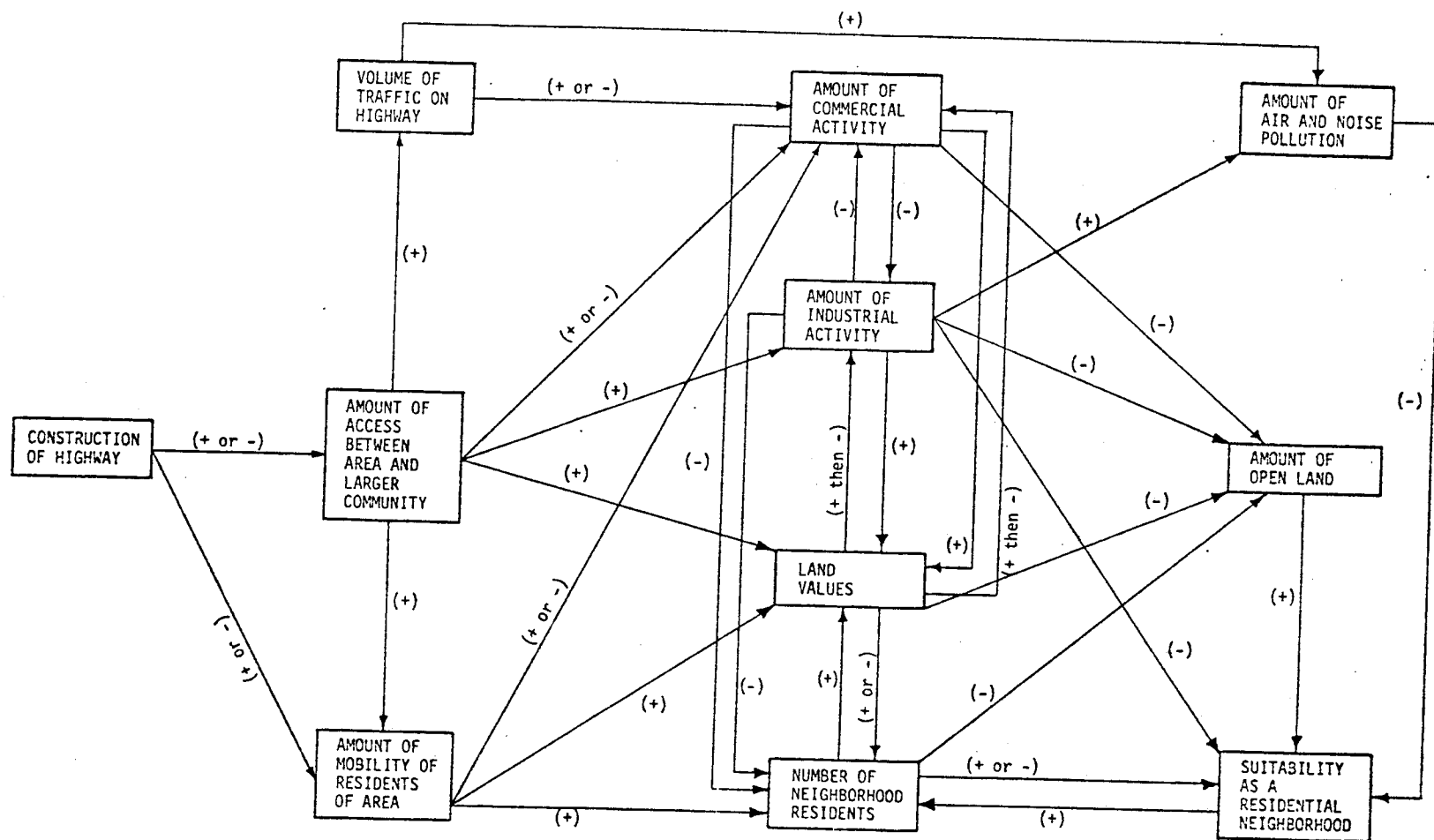


Figure VII-4. Preliminary Causal Diagram of the Impact of a Proposed Highway

The next step in the process is to determine what relationships exist among the various factors in the system to determine which of the alternative hypotheses should be chosen for inclusion in the model and to determine the trends that will serve as the information for the forecast extrapolations. This information is gathered by means of the methods delineated in previous chapters of this report. For the example, the following hypothetical trends were found or are predicted:

1. *The proposed highway will greatly increase the access of the study neighborhood to the central business district, to major suburban shopping centers, and to places of employment in other parts of the city.*

2. *The physical mobility of residents of the neighborhood will be enhanced by the construction of the highway.*

3. *Land values have been increasing steadily for the past five years. It is estimated that land values will increase by an additional 20 percent in the first year after the highway is opened.*

4. *Census data shows that the neighborhood has shown a 23 percent population increase over the past 10 years. A continued population increase is predicted for the next 10 years. The study area will continue to be comprised predominantly of young married couples with young children and middle-aged couples with teenage children.*

5. *Expansion of commercial activity in the shopping center is planned as a result of population growth in the study area.*

These data are used to choose the causal linkages that are most plausible from the set of alternative hypotheses developed in the preliminary model. The final form of the causal model for this example is shown in Figure VII-5. This model and the trend data are now utilized to devise a scenario of the

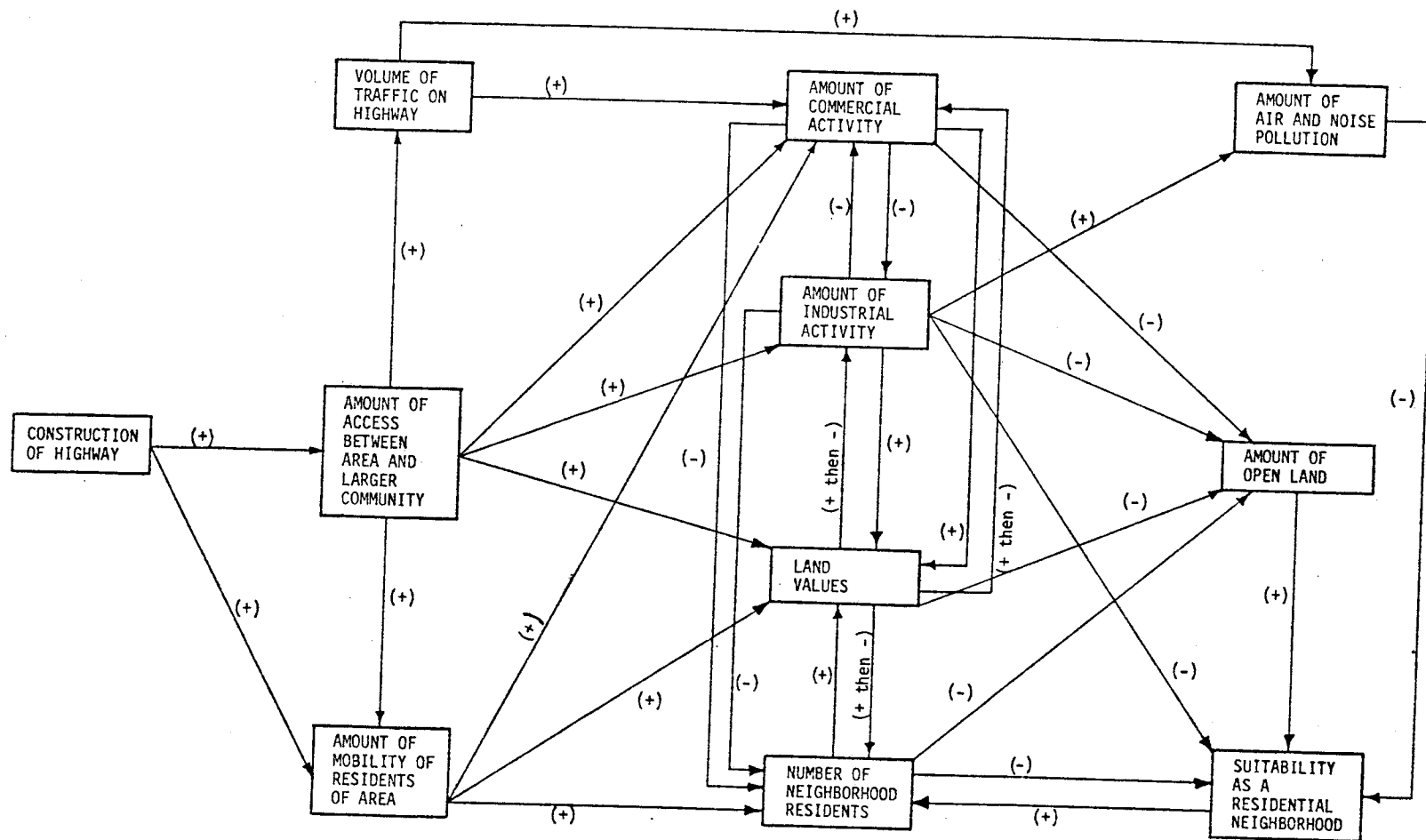


Figure VII-5. Final Causal Diagram of the Impact of a Proposed Highway

outcome of the construction of the highway on the study neighborhood. One such scenario is the following:

Social Impacts. The highway opens to traffic in 1979. This will immediately make the study neighborhood more accessible to the larger urban area and increase the physical mobility of area residents. The construction of high-density housing such as apartment complexes, condominiums, and duplexes will precipitate a population increase. By 1986 the area will change from 80 percent of the residents living in single-unit residences to 60 percent living in multi-unit residences. The composition of the population will change from predominantly families with children to unmarried persons and couples without children. By 1986 the mean length of residency will decline from approximately six years to approximately three years.

Economic Impacts. The influx of residents into the neighborhood combined with a high volume of traffic on the periphery of the neighborhood will stimulate commercial development in the area. A major shopping center will replace the present shopping complex by 1983. Initially, the relatively low cost of land along the highway will encourage extensive commercial development adjacent to the new highway. Rising land costs will cause this trend to end by 1986. The commercial and high-density residential development will cause land values within 500 feet (152 meters) to increase by 50 percent by 1983. No industrial development is anticipated in the foreseeable future.

Environmental Impacts. The anticipated volume of traffic on the highway combined with an increase in traffic within the neighborhood due to the increase in population density and the increase in commercial activity will cause present Environmental Protection Agency standards for noise pollution to be exceeded by 1982 for the area extending 1,000 feet (304 meters) on either side of the highway. Air pollution will increase, but not beyond present EPA standards in the foreseeable future. All available open land in

*the area will be under some type of development by 1985 unless positive measures are taken earlier by the city to develop parks and playgrounds in the area. The loss of open land, increase in noise pollution, and increased population density and traffic congestion will result in a decrease in the aesthetic qualities that the neighborhood presently exhibits.*

The final step in the process is to study the scenario just generated to see if there are contingencies within the system that could cause outcomes considerably different from those predicted by this scenario. If such contingencies are found, a new scenario should be generated that presents the alternative outcomes. All such alternative scenarios should be included in the forecaster's report, along with an explanation for their inclusion. In order to limit the number of scenarios to a reasonable number, only those contingencies which might result in significantly different situations should merit alternative scenarios.

### Strengths and Weaknesses of Scenarios

Strengths of Scenarios. A scenario can be a very powerful narrative description of a potential course of developments when constructed under the guidance of an experienced expert. Scenario construction is one of the easiest forecasting methods to apply to transportation problems, since the minimum requirements are one expert in the field with an access to a good data base. Forecasts that are plausible, interesting, distinctive, and understandable are relatively easy to make by means of a properly constructed scenario. By including the causal model that served as the basis for the scenario in the forecaster's report, those using the forecast can evaluate the logic behind the scenario. In addition, the adequacy of the scenario can be evaluated as events unfold and adjustments are made in the scenario by inserting revised extrapolations into the causal model.

Weaknesses of Scenarios. There are two main types of weaknesses with the method of scenario construction. These are: (1) weaknesses in causal models and (2) weaknesses in the writing and presentation of scenarios. The major weakness with causal models is that they are difficult to devise and are, consequently, fairly rare. Sufficient theory and/or good empirical data are often not available with which to formulate the causal structure of the model. The transportation planner, thus, cannot count on having causal models for his problems or on being able to create empirically-based models with the resources available to him. In the absence of good theory and empirical data, the causal model degenerates into an intuitive and subjective picture of reality without objective support.

The weakness of the writing and presentation of the scenario is that it is extremely dependent on the capability of the expert who writes it. If not skillfully presented, the scenario is susceptible to being dismissed as politically biased since, in the final analysis, it represents the point of view of a single expert or decision-maker. In addition, the scenario may well represent a major professional risk for the expert, especially if it seems to differ radically from the commonly accepted beliefs of his peers. If the forecaster must differ radically from most of the other professionals in his field, he faces a considerable degree of risk to his professional standing. Likewise, if he must make a forecast that he judges will be unfavorably received by those who hired him to make the forecast, he is presented with a risk to his credibility with his employers and to his future employment. These pressures on the expert tend to make scenarios more conservative in nature and to contain strong organizational and/or professional biases.



Some of the more serious weaknesses of scenario construction and model building can be overcome by the use of methods such as Delphi that utilize groups of experts. The Delphi method will be discussed in the next section.

## DELPHI

The Delphi method was developed to overcome a number of the problems associated with the use of experts to provide forecasts. The method is designed to make effective use of informed intuitive judgment. It derives its importance from the realization that there are areas in which planning decisions must be largely based on the personal expectations of individuals rather than on predictions derived from well-established theory. In particular, these may be: (1) new areas where adequate historical information is not available, (2) areas that involve judgment about the impact of many converging factors, or (3) areas where technological progress is more dependent upon the decisions of others than on technological potential alone. In areas such as these, a forecast must be obtained from expert opinion and judgment (Martino, 1972:18; Helmer, 1968:118).

The Delphi method is a means of seeking group consensus which avoids some of the problems of face-to-face confrontations that sometimes characterize a group decision-making process. Delphi makes it possible to obtain many of the advantages of groups while eliminating most of the disadvantages. The Delphi procedure is characterized by three features that distinguish it from the more traditional methods of group interaction. These are: (1) anonymity; (2) iteration and controlled feedback; and (3) statistical group responses.

(1) Anonymity. Anonymity exists at two levels. During a Delphi sequence, the identities of group members are not made known to each other. In addition, interaction is carried out by an intermediary in completely anonymous fashion by means of questionnaires. Individual responses are never attributed to particular group members. As a result of these measures an idea can be considered on its merits, without regard to whether the originator is held in high or low esteem by other members of the group, and the originator of an opinion can change his mind without publicly admitting that he has done so and possibly losing face.

Iteration and Controlled Feedback. The Delphi process is carried out in a series of rounds. The individual or agency conducting the sequence extracts from the questionnaires only those pieces of information that are relevant to the issue and presents these to the group in the next round. The primary effect of this controlled feedback is to permit the group to concentrate on its original objectives without being distracted by self-chosen goals such as winning an argument or reaching agreement for the sake of agreement.

Statistical Group Response. The Delphi procedure presents a statistical response which summarizes the opinions of the entire group. On a single question, for example, the group response may be presented in terms of a median and two quartiles. In this way, each opinion within the group is taken into account in the median, and the spread of opinion is shown by the size of the interquartile range (Martino, 1972:20-21).

### Establishing the Panel of Experts

Establishing the panel of experts and making the most constructive and systematic use of their opinions are major considerations for the person in charge of the Delphi sequence. Helmer (1968:118-119) states two rules that should be followed in setting the proper framework for a successful sequence: (1) the experts on the panel must be selected wisely; and (2) the proper conditions under which they can perform must be created. The panel of experts for a Delphi sequence to forecast the economic, environmental, and social impacts of a proposed transportation facility should, obviously,

be comprised of persons who have specialized knowledge in these three fields. In addition, at least one member of the panel should have specialized knowledge of the transportation agency's plans and of the technological aspects of the proposed facility. Experts might be selected from some or all of the following fields:

1. Transportation Engineering
2. Urban Planning
3. Urban Sociology
4. Economics
5. Transportation Economics
6. Political Science
7. Environmental Design and Environmental Engineering
8. Business Management and Finance
9. Real Estate Development
10. State and Local Government
11. Wildlife Science

This list is intended to be representative of the type of expertise needed, and is not intended to be exhaustive of the possibilities for panel members.

The Delphi sequence director should begin the selection process by considering those specialists in the desired fields who are members of the transportation agency staff. These persons can be asked to nominate outside experts, and these outside experts can themselves be asked to nominate others. A rule of thumb is to select the individual who has been nominated by two other persons. Other selection criteria are a knowledge of the quality of the individual's professional work, honors by professional societies, number of papers published, and citation rates of published papers (Sher and Garfield, 1966).

The second rule that the expert be placed in the right conditions in which he can perform well imposes two tasks on the director of a transportation Delphi sequence. The first task is seeing that the experts

chosen for the panel have adequate time to participate in the full Delphi sequence. The most suitable individuals to serve on the panel are also most likely to be the busiest persons. The director should stress to each person he contacts that an agreement to serve on the Delphi panel is a commitment to devote adequate time to the forecast. Also, due to the time it takes to conduct each round by mail questionnaire, the entire sequence may take several weeks or months to complete. The director must be sure at the outset that the persons on the panel will be available to participate throughout the sequence. College professors, for example, may spend considerable time travelling during the summer and not be available to fill out questionnaires (Martino, 1972:53).

The second task required by the rule of creating the proper conditions for the expert is that the sequence director provide the panel with as much relevant background information as is available.

Communication should be facilitated as much as possible. The prior formulation of an appropriate model, even a very tentative one of the operation-analytical kind, serves to communicate the problem to the expert with clarity and permits the receipt of his answer without risk of misinterpretation. The expert's performance is aided greatly if he has ready access to relevant information that may exist elsewhere (Helmer, 1968:119).

The sequence director should compile a package of background information on the plans of the proposed transportation facility and all the data that has been collected on the economic, environmental, and social aspects of the area that will be impacted by the facility. In addition, specialists from the agency (who are not on the panel) should be available for consultation with the experts whenever possible.

## Conducting a Delphi Sequence<sup>27</sup>

A Delphi sequence is carried out by interrogating the panel of experts with a series of questionnaires. Each successive submission of a questionnaire is referred to as a "round". The description of the process to be carried out is described here in terms of rounds.

Round One. The questionnaire for this round is completely unstructured. The sequence directors asks the panel to forecast the events that might occur after the construction of the proposed transportation facility. After the panelists' forecasts are returned to the director, he must consolidate them into a single integrated set of events. This involves consolidating similar events, eliminating events that are irrelevant to the purposes of the director (with considerable caution), and preparing the final list in as clear terms as possible. This list then forms the basis of the second questionnaire.

Round Two. The panelists are presented with the list of events and are asked to estimate the most likely dates by which these events will occur. They are also asked to give reasons for their estimates, that is, reasons why the event will not occur earlier or later than the estimate given. The estimates may include "never", or it may include "later" to indicate that the event will occur beyond the time horizon of the forecast.

After the panelists' estimates are returned to the director, he must prepare a consolidated statistical summary of the panel's opinions, and tabulate the reasons given for each estimate. The third questionnaire

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<sup>27</sup>Discussion in this section is taken from Martino (1972:21-26).

consists of the list of dates, the panel median date for each event, the first and third quartile dates for each event, and the reasons given for each estimate. This becomes the questionnaire for the third round.

Round Three. The panelists are presented with the questionnaire and asked to review the arguments and formulate new estimates of the dates when each event will occur. The experts are asked to justify each estimate that falls outside the interquartile range (that is, below the first quartile estimate and above the third quartile estimate) and to comment on the views at the opposite extreme. After the panelists' revised estimates and arguments are received by the sequence director, he again follows the steps of round two to prepare a revised questionnaire.

Round Four. This is often the final round of a sequence, although more rounds can be conducted if the director thinks that the panel is converging in its estimates. The procedures of round three are repeated. If this is the final round, the panelists may or may not be asked for arguments to support their estimates, depending upon the needs of the sequence director. When the director receives the revised estimates he computes the medians and quartiles and analyzes the various arguments presented by the panel, or at his option, he may wish to present the report without arguments.

In the cases where the panel has presented contradictory events, a thorough analysis should be conducted. In the cases where no convergence toward a relatively narrow range of values occurs, opinions begin to polarize around two distinct values, so that two different schools of thought emerge. This may be an indicator that forecasts are being made

on different data bases or on different interpretations of the same data. The director has the option of conducting more rounds in hopes that a convergence will occur, or he may wish to interview the various experts in depth regarding their position after the last round has been completed. In one variation of the Delphi procedure, each expert is asked to give a numerical rating from 0-10 as to the amount of confidence he places in each estimate he makes. This might help eliminate polarization of estimates.

### Strengths and Weaknesses of Delphi

Strengths. The Delphi technique is an excellent procedure for synthesizing the opinions of a wide variety of experts into a comprehensive forecast. Delphi retains most of the advantages of face-to-face confrontation without disadvantages such as dominant individuals overwhelming others by the sheer weight of their personality rather than force of rational discussion. The sum of information available to the experts is at least as great as the sum of the knowledge available to any of them. Also, groups tend to be more willing to take risks than are individuals. If fellow professionals on a panel agree with the unpopular views of one expert, he is more likely to voice his convictions and to hold them in the face of opposition, even if some risk to his professional reputation is involved. If the panel is made up of experts from a wide spectrum of relevant areas, the biases of one professional group will tend to be balanced out by the biases of the other groups.

Studies by Dalkey (1969) and others in which groups of experts used Delphi to make estimates of obscure past events such as the number of WACS

in the Army at the end of World War II or the number of indoor toilets in Arkansas in 1940 indicate that the procedure produced fairly accurate estimates with small ranges of variation. Delphi can be applied to any area where forecasts are needed. The method is restricted in application only by the range of experts available to serve on a panel.

Weaknesses. There is at least as much misinformation available to a panel as is available to any one of its members. Consensus among the panel can mean agreement based on bad information as well as agreement based on good information. Since the experts are chosen on the basis of their having more specialized knowledge than the sequence director, it may be very difficult to detect bad forecasts based on misinformation or bad judgment. There is always a temptation for a panelist to make his estimate coincide with the median response rather than taking the time to justify a different viewpoint, thus biasing the estimate. There can be considerable problems in getting mailed questionnaires filled out and returned by busy professionals. In addition, the full process of conducting the sequence can extend for a lengthy time period, and involve considerable time, effort, and energy on the part of the sequence director.

Finally, relationships may exist between forecasted events as was noted in the discussion of scenario construction, but the panel may not consider the various interactions among events when making their forecasts; this produces a set of "linearly dependent" forecasts. The cross-impact matrix method was developed to overcome this weakness. It will be discussed in the following section.

#### CROSS IMPACT MATRIX ANALYSIS

As was noted in the discussion on scenario construction, potential



relationships may exist between individual forecast events. In many instances, certain sets of events are mutually reinforcing or mutually inhibiting. These relationships are called "cross impacts" in the forecasting literature. Cross impact matrix analysis is an experimental approach by which the probability of each item in a forecasted set can be adjusted in view of the judgments relating to potential interactions of the forecasted items. Cross impact analysis is an alternative to causal modelling, but complementary to it in many respects. Cross impact matrices can be used with many types of forecasts, since the source of the forecasts is immaterial. Thus, a cross-impact analysis can be useful as a follow-up to a scenario construction or a Delphi study, even if efforts were made during these procedures to take interactions into account.

The interaction between any two variables can be broken up into three distinct components, the first component is the mode of interaction. One event may enhance or diminish the likelihood of a second event; it may advance or delay the other event; it may necessitate or obviate it. The second component is the force of the interaction, that is, whether the influence of the first event on the other is strong or weak. The third component of interaction is the time lag of the influence. One event can begin to influence another immediately; some time may be required for influence to be felt; or an influence may die out after some time period. In comparing the two events for possible interaction, all three components; mode, force, and time lag must be considered. (Martino, 1972: 271-272).

The configuration of a cross impact matrix is shown in Figure VIII-6. This matrix shows the interactions among three events  $E_1$ ,  $E_2$ ,  $E_3$ . These events have probabilities  $P_1$ ,  $P_2$ , and  $P_3$  that they will occur at all. The

events are forecast to occur in years  $Y_1$ ,  $Y_2$ , and  $Y_3$ . In other words, the events are arranged in the matrix in chronological order. The three events form both the rows and columns of the matrix. Each cell indicates the mode, strength and time lag of the event in the corresponding row and column. Diagonal cells indicate interaction of each variable with itself, a meaningless concept. For this reason, these cells are ignored. Notice

EVENT HAPPENS

Event	Probability	Year	$E_1$	$E_2$	$E_3$
$E_1$	$P_1$	$Y_1$	//////////	enhance 10% immediate	necessitate 50% 7 years
$E_2$	$P_2$	$Y_2$	diminish - 20% 5 years	//////////	enable 0% immediate
$E_3$	$P_3$	$Y_3$	diminish - 10% immediate	prevent - 70% immediate	//////////

EVENT DOESN'T HAPPEN

Figure VII-6. Illustrative Cross Impact Matrix

Source: Joseph P. Martino, Technological Forecasting for Decision-Making (New York: Elsevier, 1972), p. 273.

that an interaction between any two events  $E_i$  and  $E_j$  is represented twice, once by cell  $E_iE_j$ , and once by cell  $E_jE_i$ . Since an event can only be influenced by an earlier event, the duplication of cells is used in the following manner. (1) The cell above the diagonal indicates the interaction that takes place if the earlier event occurs. (2) The duplicate

cell below the diagonal indicates the interaction that takes place if the earlier event fails to occur. For example, cell  $E_1E_3$  indicates the effect of  $E_1$  on  $E_3$  if  $E_1$  occurs, while cell  $E_3E_1$  indicates the effect if  $E_1$  fails to occur.

Interaction components in the cells are shown in the order: mode, strength, time lag. For example, cell  $E_1E_2$  indicates that, if event  $E_1$  occurs, the likelihood of event  $E_2$  is enhanced by 10 percent and the effect is immediate. On the other hand, cell  $E_2E_1$  indicates that if event  $E_1$  fails to occur, the effect will be to diminish the likelihood of  $E_2$  by 20 percent, and the impact is delayed by 5 years. (In other words, if  $Y_2$  is earlier than 5 years after  $Y_1$ , the detrimental effect of the failure of  $E_1$  to occur will not have time to take effect; if  $Y_2$  is equal to or greater than 5 years after  $Y_1$ , the detrimental effect will have time to occur.) Notice that in cell  $E_2E_3$ , the effect of the occurrence of  $E_2$  is to enable  $E_3$  to happen, but that it does not increase the likelihood of the occurrence of  $E_3$ , and the effect is immediate. This paradoxical estimate is probably due to the probability of  $E_3$  being assigned on the assumption that  $E_2$  would occur. Thus the occurrence of  $E_2$  would not raise the likelihood further. Conversely, if  $E_2$  fails to occur, the effect is to prevent the occurrence of  $E_3$  immediately and to reduce the likelihood of  $E_3$  occurring at all by 70 percent. This may be interpreted that another enabling event may take place, but that the estimated likelihood is very low.

This example illustrates how a cross impact matrix can be filled in. By following a systematic procedure, the forecaster can be assured that he has not overlooked any interactions. Several observations should be made at this point. First, it is not necessary that there be interactions among

all possible pairs of events. In some instances, two events may be totally unrelated; the occurrence or non-occurrence of one will have no effect at all on the likelihood of the other. Next, there need not be any connection between the impacts from an earlier event occurring or failing to occur. If an earlier event is a sufficient but not a necessary condition for the occurrence of a later event, then the failure of an earlier event does not necessarily diminish the likelihood of the later event. Third, in some cases, in the course of adding probability increments to the likelihood of the occurrence of an event due to the impacts of various other events, the computed probability may go below a likelihood of 0 percent or above a likelihood of 100 percent. These impossible figures should be adjusted to some degree of likelihood arbitrarily close to 0 percent and 100 percent, say 2 percent in the first instance and 98 percent in the second. The likelihood of occurrence should not be set exactly to 0 percent or 100 percent, since there is always some probability of a future event occurring, no matter how small, and no future event is absolutely certain to happen.

#### Forecasting by Means of Cross Impact Matrix Analysis

Once the cross impact matrix has been constructed, it can be used to prepare a composite forecast or scenario by "playing out" the matrix. This is done by allowing each event to occur or not occur on the basis of its probability and adjusting the likelihood probabilities and dates of occurrence of other events according to the impact data in the matrix. This can be done in the following manner. The first event  $E_1$  is selected which has probability  $P_1$  of occurring. Some random device is employed to determine if the event "occurs." This could be done by tossing coins,

using random number tables, or rolling a die. If the event occurs, then the adjustments called for in cells of the  $E_1$  row above the diagonal are consulted and the adjustments called for are made. All the other events have their probabilities and dates adjusted. If the event fails to occur, the adjustment called for in column  $E$ , below the diagonal are made. Event  $E_2$  is then selected and the procedure is repeated until all events have been selected. In the "playing-out" process, adjustments in the chronology of events may have to be made if the dates of certain events are changed enough. When two events are forecast to occur on the same date, a random procedure is used to decide which event occurs first; then the adjustment process is carried out as usual. When the final event has been decided, the forecaster has a complete set of forecasts that are internally consistent and which represent one possible "future history".

If there are  $n$  events, then there are  $2^n$  possible sets of forecasts. Many users of cross impact matrices computerize the process of playing out the matrices. The computer plays out a particular cross impact matrix thousands of times, the results are summarized, and the summary serves as the basis of a scenario or other forecast. These summaries can also be analyzed to find critical events that seem to make considerable difference in situation outcomes by the occurrence or non-occurrence.

#### Conducting a Cross Impact Matrix Sequence<sup>28</sup>

Although cross impact matrices can be constructed by a single expert, the procedure can be expected to have more utility if constructed in a procedure similar to a Delphi sequence. This section discusses the

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<sup>28</sup>This section is taken from Craven (1972).

practical aspects of conducting a cross-impact matrix through the use of a panel of experts.

Number of Events. For all practical purposes, a list of 25 to 30 events should be used to define a situation. An initial list of 40 to 50 events may be used and reduced to a smaller size by the panel at the beginning of the sequence. The initial list of events may be compiled by the sequence director, or may be a composite list from a Delphi sequence.

The Panel. The cross-impact panel should be chosen in the same manner as the Delphi panel. However, instead of conducting the sequence by means of a mailed questionnaire, the experts should be assembled and queried as a group. The panel should be limited to no more than eight experts, preferably to 5 or 6 persons. The panel is likely to take an intolerable amount of time to converge on an answer when the number exceeds eight persons.

Subjective Probabilities. When a suitable final list of events has been agreed on by the experts, the participants are asked to forecast the date of occurrence of each event. If the spread of dates is wide, those outside the Interquartile Range are asked to explain their forecasts to the panel and another round of estimates is carried out. This procedure is repeated for a maximum of four rounds, whether convergence occurs or not. After the panel has made its forecasts for each event, the median dates are entered as the estimated date of occurrence, and an initial probability of 50 percent is entered as the initial estimate that the event will occur on that date (since 50 percent of the panel forecast an earlier date of occurrence and 50 percent forecast a later date.)

Constructing the Impact Matrix. Constructing the matrix calls for two monitors, one who will record the consensus of the panel, and the other to operate two slide projectors and to supervise the voting. The panel face the projection screen as shown in Figure VII-7. If the spread of probabilities is arbitrarily wide, the monitor can conduct a series of rounds to try to elicit convergence. After the voting is completed for each event, the mode, median force, and median time lag is entered into the pair of impact cells, and the process is repeated for another event until all interactions have been forecast. From experience, this will require at least 6 to 8 uninterrupted hours to complete.

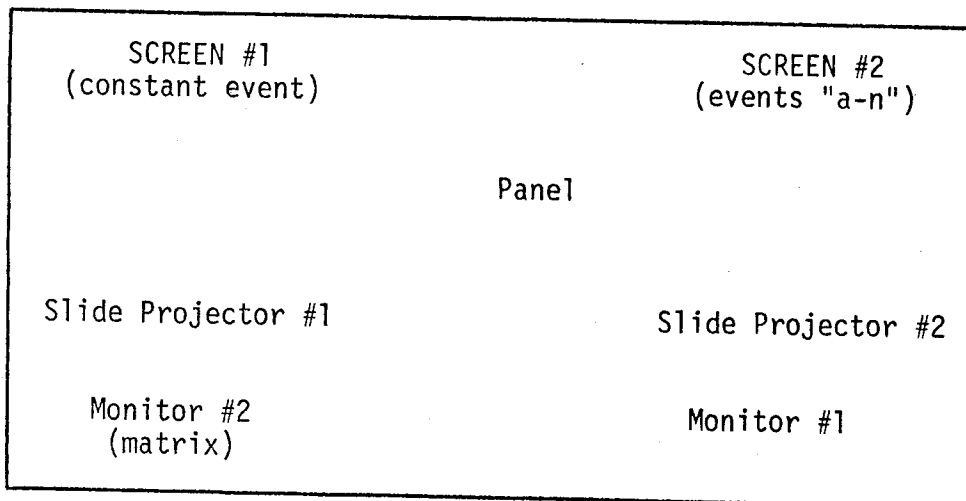


Figure VII.-7. Suggested Arrangement for Conducting a Cross Impact Matrix Sequence

Monitor #1 begins by displaying an event on screen #1 and asks the panel to estimate the mode, force, and time lag of impact on each event that follows at a later time; first assuming that the event occurs, then assuming that the event does not occur. Voting is done either by means of

flash cards, note pads and felt-tip markers or slates and chalk. The voting is done with a minimum of discussion. If the spread of probabilities is arbitrarily wide, the monitor can conduct a series of rounds to try to elicit convergence. After the voting is completed for each event, the mode, median force, and median time lag is entered into the pair of impact cells, and the process is repeated for another event until all interactions have been forecast. From experience, this will require at least 6 to 8 uninterrupted hours to complete.

### Strengths and Weakness of Cross Impact Matrix Analysis

Strengths. The cross impact matrix provides an excellent method for examining the interaction among several forecasts. Although originally designed to complement Delphi forecasts, it can be used with forecasts from any source. Small matrices can be played out "by hand" and consistent forecasts obtained. Larger matrices can be analyzed by high-speed computers. If computer-generated sequences are combined, key events can be seen and thus provide the planner with valuable information about the impacts of those events.

Weaknesses. The considerable effort required to assemble a panel of experts in one place at one time and to get them to agree to devote a large block of time and effort to the construction a cross-impact matrix may be more than the planner is willing the expend. The impact matrix contains  $n^2 - n$  cells for which impacts must be estimated. A list of events does not have to be very long before the process of estimating interactions becomes unmanageable. At some point, the additional benefits to be gained from the inclusion of events is outweighed by the costs of obtaining



forecasts for them. In addition, unless careful attention is given to the process of constructing the matrix, the process first tends to become routine, then mechanical.

## SUMMARY

Forecasting can be used as an input into the planning and decision-making process by providing a means of delineating and articulating the probable social, economic, and environmental impacts of a transportation system. Forecasts do not state what the future will be. A forecast tells only of the implication of available information about the past. Forecast techniques are classified according to whether they are exploratory or normative. In the exploratory approach, the forecast begins with a present state of affairs and proceeds forward to establish a likely pattern of events. In the normative approach, goals and objectives are specified and the forecast works backward to the present to see what capabilities exist to meet future goals.

### Forecasting Methods

Scenario Construction and Model Building. A scenario is a narrative description of a potential course of development which might lead to some future state of affairs. A scenario can either be a direct extrapolation of present conditions or formed by adding new conditions to the present environment. Scenarios are powerful tools when based on causal models. Causal models represent the effects on some variables caused by changes in others. A scenario constructed on the basis of a well-constructed causal model is more likely to be internally consistent and to take interaction among factors into account.

Delphi. The Delphi method derives its importance from the realization that there are areas in which planning decision must be based on personal expertise rather than on prediction derived from well-established theory or research. The Delphi method is a means of seeking group consensus while avoiding some of the problems of face-to-face confrontation. The Delphi procedure is characterized by three features: (1) anonymity; (2) iteration and controlled feedback; and (3) statistical group responses. A Delphi sequence is carried out by interrogating a panel of experts with a series of questionnaires.

Cross Impact Matrix Analysis. Cross impact matrix analysis is an experimental approach by which the probability of each item in a forecasted set can be adjusted in view of judgment relating to potential interactions of the forecasted items. The cross impact matrix can be "played out" to provide a consistent forecast of a possible future. Computers can be utilized to play out series of forecasts which may be analyzed to forecast the most likely outcome of sets of events.

The forecasting methods presented in this chapter are practical, have much potential for transportation planning, and are particularly applicable to project level decision-making. These methods greatly extend the ability of the planner to obtain valuable long-range estimates of the social, economic, and environmental impacts of proposed facilities, to maximize the benefits of the facility at a minimal cost to the social system and to the physical environment. Forecasting methods also can be applied to the needs of the decision-maker who must make decisions regarding the more engineering-oriented or technological aspects of transportation decision-making.

CHAPTER VIII  
SUMMARY AND EVALUATION OF METHODS USED TO PREDICT  
SOCIAL IMPACTS

Social impacts assessment of urban freeway construction is unlike many of the techniques utilized for standard economic evaluations of highway projects. In the latter, economic variables such as higher property values, increased commercial development, and increased neighborhood or citywide tax bases all point to the beneficial effects of urban highway improvements. Because these economic factors influence the attitudes and concomitant reactions in regard to freeway construction, economic benefits do reflect on the social impact of such projects. On the other hand, urban residents take into account other factors in assessing the personal consequences of freeways to themselves and to their residential area. Especially when residential areas are cohesive, homogeneous environments, inhabitants personally affected by a highway project can be very resistive to the entire implementation process. On the other hand, social impacts, unlike economic effects of project construction, tend to be short-term in nature, at least for those urban inhabitants residing in or near the project corridor.

The most crucial factor that differentiates pronounced social impacts from other forms of freeway project evaluation is the very localized character of intense social effects -- that is, on residents living within the immediate project area. In planning for urban highway improvements, projections of transportation need for these networks are determined. Nevertheless, plans that would clearly benefit the public-at-large, and that are

feasible engineering designs, may change the entire structure of existing residential areas. The questions concerning the means by which "need" should be weighed, and the measurement of trade-offs between the public need and localized need, are not easily resolved. In the majority of cases, freeway planners should have several design options and a specific site is then determined according to engineering, economic, environmental, and sociological assessments.

The approaches to evaluation employed should vary according to the manner in which conflicts are resolved politically (Hudson, et al., 1974:258). Each of the broad approaches to social impacts analysis presented in this report can be used differentially, as suggested by Hudson, et al., (1974: 258-260):

1. *Encroachment.* One set of interests can essentially invade the territory and rights of others, by legal or other means. A regional transportation network might thus invade a neighborhood through eminent domain; or a neighborhood might muster the political support to suppress the implementation of network plans . . .
2. *Compensation.* Here explicit recognition is given to parties that may incur net losses from the implementation of plans that benefit others. Provision is made, however, for gainers to compensate losers . . . Yet there remain a number of problems with the compensation principle: losers are not always in a position to negotiate even minimum indemnification; many aspects of the burden which communities bear from public projects are not recognized as liabilities of the implementing agency; the question of how to distribute net benefits beyond minimum levels of compensation raises legal and political issues which block implementation even if there are potential gains for everyone . . .
3. *Insulation.* A third strategy to resolve differences between network and neighborhood systems is to design an interface between them in such a way as to insulate one from the other. Thus, whenever possible, interaction would be

limited to intended consequences, with sharp barriers to insure independent functioning in other respects . . .

4. *Adaptive design.* Friction in the boundaries between local and network systems cannot be avoided by a strategy of insulation alone. Often, an area may have such a dense infrastructure already in place that radical realignment of activities is infeasible . . . Thus, a sizeable portion of the job of mediating between the objectives of micro- and macro-scale systems will place its burden on a sequence of short-range mutual adjustments. This calls for incremental rather than comprehensive planning . . .

It also invites solutions that operate on dimensions other than physical realignment. In particular, the strategy of adaptive design would stress behavioral factors such as incentives affecting the uses of existing space, and the technical redesign of facilities largely within the existing physical distribution of activities.

With pure encroachment, either by highway departments or by opposing interest groups, social impacts assessment is not necessary, simply because one group has "won" without considering any objective evaluations of the proposed facility. Monetary compensation for relocatees and insulation of the facility are the two most commonly used strategies at present. With current compensation procedures and the insulation of a new facility through special design features and highway beautification, the sociological evaluation can be an extremely useful guide. However, adaptive design, as defined above, makes a special demand that evaluation serve a more encompassing function than simply the application of a decision rule. An adaptive design strategy should at least be attempted in the technical planning of new facilities.

The three forms of social impacts assessment discussed in this report have been: (1) field observation; (2) demographic analyses; and (3) resident surveys. Unsolicited citizen input has not been examined extensively (see Chapter V), nor have computer programs which have been developed to

measure social feasibility. Citizen participation studies have been undertaken in many transportation studies (see, for example Weiss, 1974, and Adkins and Burke, 1974). Public involvement implies a transportation decision-making process, and may often be less amenable to empirical analysis. Computer programs for the examination of social impacts at a project level, on the other hand, are very inflexible and cannot adequately deal with the complex, subjective aspects of project assessment. Automated computer routines are more appropriate for statewide transportation planning and research, where the unit of analysis requires a large data file.

The three sociological approaches examined in this report have been suggested because of their ability to handle technical, as well as more subjective, input data; this is particularly true for both field observation and survey analyses. Chapter VII discusses long-term forecasting techniques---the Delphi approach, scenario construction, and cross-impacts matrices. Each of these futuristic procedures is dependent on a highly valid and consistent data base. Because of the need for detailed background information for accurate socioeconomic forecasts, one of the three primary data bases described earlier in the report---either observational input information, demographic, or survey data---is required. Whether the forecasting procedure is based on experts' evaluation of a future situation or is dependent on statistical extrapolation, the prediction of outcomes is only as valid as the available input data.

#### METHODOLOGICAL COMPARISONS

The choice of techniques depends on the objectives and needs of the project study. The procedures described range from "tentative guideline" techniques to get rapid approximations of social impact (such as cursory observational procedures) to in-depth, detailed evaluations. As has been

noted, all three basic approaches tap different forms of data input. Nevertheless, they do overlap for many predictive variables (see Table VIII-1). Field observation that is long-term and undertaken by trained researchers, for example, has the capability of providing a maximum amount of variable input, if used alone. Surveys of a representative sample of project area residents also have the capability of comprehensive, objective coverage.

Rapid data collection: A fuller evaluation of the three approaches can be observed in Table VIII-2. As noted above, field observation can provide a rapid means of social impacts assessment, or can present an in-depth examination of residential and institutional characteristics, varying with the degree of precision required. Demographic data also can be acquired rapidly if census tract publications or computer tapes are utilized.

Cost of data collection: Both cursory field observation and demographic analyses from census accounts are less costly than personal interviews of area residents. A mail-out questionnaire to a representative resident sample is an additional cost-effective alternative, as discussed in Appendix D.

Flexibility of data collection procedures: Field observation is more flexible than either of the other two methods. Input variables can be added or omitted when required in specific instances. Boundaries of viable residential areas or "core" areas can be delineated without the constraints of arbitrary census tract or "stereotyped" boundaries. With census tracts used as neighborhoods, for example, project routing alternatives may traverse the same census tracts, so that evaluation of alternatives becomes difficult.

Table VIII-1. Overlap of Predictive Variables Among the Three Basic Approaches

	Prox- imity to City Center	Propor- tion of Mixed Land Usage	Popula- tion Density	Propor- tion of Undevel- oped Land	Age of Dwell- ings in Area	Loca- tion of Social Insti- tutions	Loca- tion of Neigh- borhood Bound- aries	Residen- tial Sta- bility	Ethnic Character- istics
Field Observa- tion	X	X	X	X	X	X	X	(X)	X
Demo- graphic Data	X		(X) <sup>a</sup>		X		(X) <sup>b</sup>	X	X
Survey						(X)	X	X	X

X: Variables in these cells can be obtained with the method suggested for this row.

(X): Variables can be obtained by this method, with some limitation or reservation.

<sup>a</sup> Average number of persons per dwelling or per room is one measure of population density obtained from census tract data.

<sup>b</sup> Boundaries of neighborhoods obtained through census tabulations are census tract boundaries, arbitrarily delineated.



	Socio-economic Status of Residents	Age Distribution	Transportation Characteristics	Use of Local Facilities	Neighboring	Participation in Area Associations	Identification/Evaluation of Area	Community Values of Residents	Highway Project Involvement
Field Observation	X	X		(X)	(X)		(X)	(X)	
Demographic Data	X	X	X	(X)					
Survey	X	X	X	X	X	X	X	X	X

Table VIII-2. Evaluation of the Three Basic Approaches Used to Predict Social Impact

Evaluation Criteria	Approach or Methodology		
	Field Observation	Demographic Analysis	Resident Survey
1. Rapid method of data collection	X <sup>a</sup>	X	
2. Low cost approach	X	X	
3. Flexible	X		
4. Simple, concise presentation of impacts		X	X
5. Consistency of input data		X	X
6. Currency of input data	X		
7. Use of quantifiable information	(X)	X	X
8. Use of intuitive, subjective information	X		X
9. Ability to depict design solutions	X	(X)	(X)

(X) = Appropriate evaluation of the method with one or more limitations.

<sup>a</sup>Field observation can be cursory and rapid, or can be an in-depth, comprehensive method of social impacts assessment.

Simplicity, consistency, and currency of data: With aggregation of survey results and with demographic analysis, the highway project planner can retain consistency in data retrieval. For example, in the use of identical variables across census tracts, a consistent, comparable body of information can be gained. With land use analyses (as obtained through field observation) a concise, pictorial representation is possible. Further, mapping of viable residential area boundaries, and of social institutions and localized facility service areas, as well as of other area characteristics, can be explored. Maps or other pictorial portrayals provide a more vivid, and perhaps more comparable approach for the non-sociologist. Demographic data, unless utilized immediately after the decennial census in which it becomes available, cannot be considered current.<sup>29</sup> Field observation can always be updated and currency maintained. Surveys are current only at the time of original project evaluation and may not be valid during the public hearing stage, right-of-way acquisition phase, or construction stage.

Use of quantifiable information: Quantifiable, technical knowledge of proposed freeway impacts is characterized by an objective format which allows the input data to be formally and systematically examined (see Hudson, et al., 1974: 257). This form of social impacts assessment has been emphasized with all three methods. Each methodology has subsumed within it specific procedures in order to quantify variable measurement. With quantifiable information--such as a comprehensive resident survey--social, economic, and environmental impacts can be assessed, and weighted by the respondents themselves. Field observation

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<sup>29</sup>In addition, census tract data is normally not available until at least two years after census enumeration.

is less generalizable across several project investigations, because this form of data input is difficult to quantify. The variables suggested for field observation in this report, however, have the potential for quantification. Weighting or ranking of each of the eighteen key variables examined (refer again to Table VIII-1) has not been undertaken, primarily because of the problem presented in finding a common unit of measurement (i.e., dollars, acres, dwelling units, or numbers of people). Further, since these eighteen variables have been suggested in this report, but not tested in actual project routing situations, it would be inappropriate to rank them at this time. The importance of each variable will, in all probability, vary according to the individual project plan.

Use of subjective information: Quantifiable, objective data should be supplemented with some intuitive understanding of the project study area. Such joint information gathering can be supplied by either field and participant observation or surveys of residents. Personal knowledge is less easily codified and less subject to scientific verification (Hudson, et al., 1974:257), so that subjective, intuitive assessments are more open to criticism and are normally less acceptable to urban highway planners.

Ability to depict design solutions: Finally, and most important, each of the three methodological approaches encompassed in the report should be able to search for design solutions. To be more specific, each approach should be able to ascertain the most appropriate route, based on the potential social impacts. An adequate set of procedures should provide the highway planner with criteria for assessing the benefits, as well as adverse effects, of alternate routes. In some cases, nevertheless, there will be no optimum solution. Furthermore, where displacement of dwellings is incurred, many residents are almost certain to decla


themselves "losers" and as having been victimized by the particular route alternative chosen. With each of the three approaches, desirable and undesirable features should be clearly delineated. The social gains and losses need to be recognized. Contradictions or trade-offs should be highlighted, so that social adjustments can be made as well as routing adjustments when possible.

#### OVERVIEW OF SOCIAL IMPACTS ASSESSMENT

"Summary" sections at the conclusion of each chapter, especially Chapters III, IV, and V, should provide an overview of the substantive topics and specific procedures discussed in this report. Table VIII-3 represents an attempt to draw together the key variables encompassed in these earlier chapters. For more detailed information about procedures, however, refer to previous chapters. The key factor to be noted in examining Table VIII-3 is that social impacts assessments, when used in isolation of economic and engineering factors, point to a fewer number of net benefits. The goal in presenting Table VIII-3 is to provide a means for highway project planners to minimize disruptive social impacts. Alternative routing plans also can be charted on a table, similar to Table VIII-3. Following the tabular evaluation of route selection criteria, two examples of project sites are presented to provide a clearer portrayal of social impacts assessment. The two "residential types" which follow Table VIII-3 depict the relative desirability of freeway introduction. These residential forms utilize a combination of characteristics which may prove useful to the highway planner in the process of route selection in residential areas.

Table VIII - 3. Route Selection Criteria for Social Impacts Assessment (n = 18 variables or factors)<sup>a</sup>

Predictive Variables <sup>b</sup>	Categories of Predictive Variables		
<u>Land Use Characteristics:</u>			
Proximity to city center			
	Central city	Residential area within city boundaries	Suburban area (or commuter's zone)
Proportion of mixed land use			
	Homogeneous residential use	Mixed land use	
Density of population			
	50 or more persons per acre	8 or less persons per acre	
Proportion of undeveloped land			
	90% or more developed land area.	Two or less dwellings/acre	
Age of dwellings in area			
	Constructed prior to 1940, mixed land use, heterogeneous residents	Constructed prior to 1940, homogeneous residential area	Constructed after 1940

<sup>a</sup>Dark portions (  ) represent critical area or areas where route location is less desirable.

<sup>b</sup>For further information and references regarding the categories and dividing points used for the predictive variables, see Chapters III, IV, and V.

Table VIII - 3. (continued)

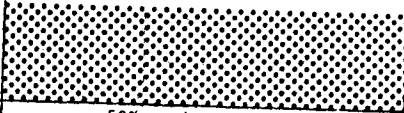
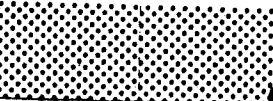
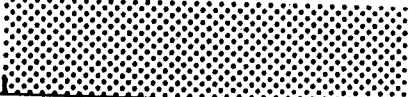
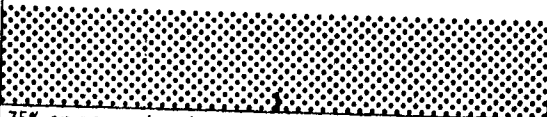
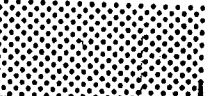
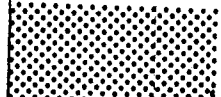
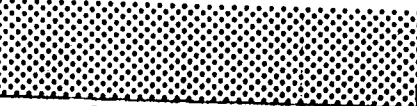
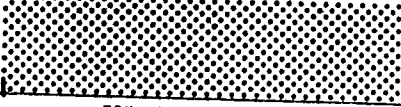
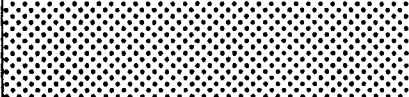

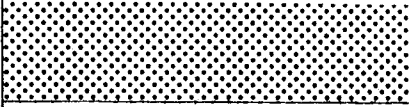


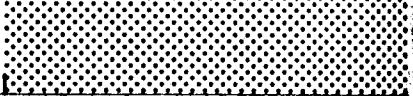

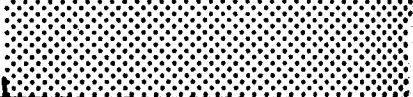
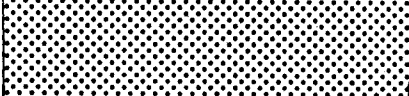

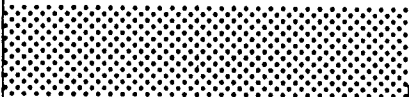

Location of social institutions		>50% residents' use of institutions in immediate area	<20% residents' use of institutions in immediate area
Location of neighborhood boundaries		Segmentation of viable neighborhood	Bordering of neighborhood(s) Lack of neighborhood boundaries
<u>Aggregate Characteristics of Residents (at a Neighborhood or Census Tract Level):</u>			
Stability of area and housing tenure	Average residency <4 years	 Average residency >8 years	
Ethnicity of residents			
Socioeconomic status of residents	75% or more minority residents	Ethnically mixed	Homogeneous Anglo
Age distribution of residents	Low	 Middle to upper Social class homogeneity Social class heterogeneity	
Transportation characteristics of residents	>35% residents <16 yrs.	<20% residents <16 yrs.	>15% residents >59 yrs. <5% residents >59 yrs.
<u>Socio-Psychological Characteristics (Individual Attributes):</u>	 >85% with private auto(s)		
Use of local facilities	 >50% of facility use in immediate area		 <75% with private auto(s)

Table VIII - 3. (continued)

Neighboring - close friends		
	>50% close friends within walking distance	<10% close friends within walking distance
Neighboring - close relatives		
	>25% close relatives within walking distance	Absence of close relatives within walking distance
Area association participation		
	<20% participation in one or more area associations	>50% participation in one or more area associations
Identification/evaluation of area		
	<40% residents feel strong ties, would recommend area to friends	>60% residents feel strong ties, would recommend area to friends
Individual community values		
	High aesthetic values	High concern with economic well-being
Highway issue involvement		
	>15% participation of area residents	<5% participation of area residents



As noted earlier, the relative desirability of freeway introduction in urban residential areas depends not on single, isolated factors but rather on the combination of characteristics which make up the area. It is in the consideration of all factors that route selection can most effectively minimize disruptive social impact. In this context, two "residential types" are presented to illustrate the variations of predictive factors which operate together in an urban community.

#### Residential Type A

*The neighborhood located near the city center undergoes a long process of land usage, resulting in a high degree of development. Usage is frequently mixed, with the development of commercial establishments along major streets in residential areas. Any tracts of vacant land are rare. Housing is typified by the preponderance of older dwellings, usually constructed prior to 1940. These dwellings are single-family units which may be owned by the residents or multiple-family rental units. Density of the population is not high, with only 16 to 20 persons occupying an acre. Residents are members of minority groups; blacks and Mexican-Americans make up the large proportion of the area's population. They fall into a lower to lower-middle socioeconomic status, employed for the most part in blue-collar, manual labor positions. Among the Mexican-Americans, Spanish is the primary language in the home. Residents are relatively stable; many have occupied their homes for over 20 years, and the average length of residency is well above eight years. The neighborhood is typically made up of an older population; most individuals are over 45 years of age and the elderly over 59 are disproportionately represented. In addition, over one-fourth of the households do not own an automobile; as a result, use of facilities and institutions in the local area is high. Neighboring occurs to a larger extent, made essential by the income inadequacy of the lower-income population. There is a high degree of participation in the churches and voluntary associations in the area. Residents, on the whole, have a favorable opinion of their neighborhood.*

and identify the area as their "home." There is a pervasive sense of "belonging" to the area apart from the larger metropolis. Involvement in the issue of freeway introduction tends to be relatively high as a result of their close orientation to the neighborhood.

#### Residential Type B

Central city neighborhoods may also be composed of a series of newer apartment complexes constructed since 1965. Land usage is generally mixed with commercial development and older single-family dwelling units located among the high intensity multiple-family unit development. As a result of this apartment development, the density of population is quite high, with well over 50 persons residing on a single acre. Residents are typically homogeneous Anglo and are upper-middle class. They are employed in professional, white-collar occupations, having a relatively high degree of education and a substantial amount of income. Average length of residency is less than four years. In addition, the area is underrepresented by younger individuals; less than 20 percent of the population is under 16 years of age. Similarly, there is a significant number of single individuals and married, childless couples. Residents in this area are highly mobile. Most households, over 85 percent, own at least one automobile, and many own two or more. Because of ownership of a highly flexible means of transportation, residents are not tied to the local area for goods and services. Facility and institutional usage in the local area is not, as a result, as frequent or as necessary to the residents. Neighboring is also less frequent; because of their mobility throughout the city, friends and relatives may live in other parts of the metropolitan area without restricting contact. Furthermore, their self-sufficiency and economic security precludes a dependence on neighbors for life necessities. Participation in voluntary organizations occurs on a citywide basis and is not limited to the local area; residents may participate, for example, in professional organizations or nationally chartered clubs. As a result of these rather loose ties to the neighborhood and an orientation toward the larger metropolis, residents do not feel a strong sense of belonging to the area. Consequently, the freeway issue may activate less than 5 percent of residents, though they possess greater political clout than lower-income residents.

As can be anticipated, based on Table VIII-3, Residential Type B exemplifies a more appropriate routing site. Both residential types described were located in central city areas; however, Residential Type A, while having mixed residential and commercial land use, also is a viable, stable residential area. Freeway introduction would be less compatible with the more localized interests of Residential Type A residents. Alternative route evaluations are not often as distinctive and divergent as the two residential areas described above. Nevertheless, each of these two potential sites exemplifies the use of the key variables summarized in Table VIII-3, and in earlier chapters, for adequately assessing net social impacts.

## SUMMARY

The evaluation process for different transportation improvements should reflect the uniqueness of individual projects, as well as the scale of potential impacts for each project. The costs in terms of time, manpower, and monetary investment for particular social impacts assessments should be highly variable. Evaluation measurements presented in this report are usable for varying levels of project planning. The primary goal has been the provision of a comprehensive set of techniques, rather than procedures directed toward particular cities or specific projects.

Sociological input variables and measurement techniques outlined in the report were obtained through a survey of the existing sociological and transportation impact literature, reviewing previously utilized techniques as well as other sociological indicators not used in earlier social impact evaluations. The predictive factors were organized into three broad dimensions of prediction: land usages and community/neighborhood form; demographic characteristics of area residents; and socio-psychological attributes of residents. With the use of these three dimensions, highway planners can more accurately predict the social consequences of project implementation. The three chapters describing these operationalized dimensions are thus tools to be used prior to the project implementation process.

In many cases, impact evaluation is undertaken at only one point in time. While this report, Social Impacts: Evaluation of Highway Project Development in Urban Residential Areas, provides techniques for predicting the net impacts before the transportation facility is introduced, two chapters were provided to present methods for the assessment of both short-term

impacts (during and immediately following highway construction) and long-term social forecasting techniques (with a ten- to twenty-year predictive capability).

The inclusion of appropriate social assessment techniques as a part of environmental impact evaluations should provide state and district highway officials with adequate input data for project-level decision making. It is anticipated that this comprehensive presentation of social indicators and techniques will not precipitate a more costly evaluation for highway agencies, but simply a more organized and quantified framework for social assessment than has been used in the past.

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APPENDIX A  
GLOSSARY OF TERMS

- Attitude - A predisposition or tendency to act consistently toward specific related objects and situations.
- Behavior - Any response or reaction of any individual. This concept includes bodily reactions and movements as well as verbal statements and subjective experiences.
- Catchment Area - Any city sub-area with distinctive characteristics, especially a distinguishing feature of residents, such as common ethnicity or social standing.
- Causal Model - A model based on the concept that the occurrence of events is determined by cause and effect relationships; it represents the effects on some variables caused by changes in others.
- Census Tract - A small, relatively homogeneous subdivision of a city or metropolitan area used in the tabulation and analysis of census data.
- Cohesion - The integration of group behavior as a result of social bonds or "forces" that hold members of a group in interaction over an extended period of time.
- Commercial Areas - Districts which support the retail trade, business, cultural, and entertainment functions of the city.
- Community - A concentrated settlement of people in a limited territorial area. Communities provide many of the resident's daily needs through a system of interdependent relationships. There is also a certain amount of mutual cooperation, shared interests and goals, and identification with the inhabitants in the geographic area. A community may be synonymous with a town or a city, but is usually treated as a large sub-area of a city.
- Custom - A form of social behavior which has persisted for a long period of time, is well established, and has become traditional.
- Cross Impact Matrix Analysis - An experimental forecasting approach by which the probability of each item in a forecasted set can be adjusted in view of judgments relating to potential interactions of the forecasted items.
- Delphi Sequence - Forecasting method which utilizes the opinions and personal expectations of a panel of experts, making systematic and effective use of informed intuitive judgment and feedback information.



- Demography - A form of analysis dealing with the size, distribution, change, and composition of population.
- Ethnicity - A group's possession of common racial, nationality, cultural, or linguistic traits and an identity which causes them to be viewed as a subgroup of a larger society.
- Exploratory Forecast - Forecasting technique which initially recognizes the present state of affairs and moves forward in time to establish likely patterns of future events.
- Field Observation - A research technique in which the investigator observes his subjects under normal, usual environmental conditions of life, rather than under laboratory conditions.
- Forecasting - A means of delineating and explaining probable outcomes in the future and estimating how the more desirable outcomes can be produced by program implementation.
- Goal - A condition or object sought by an individual or group to satisfy a need.
- Human Ecology - The study of community structure through the analysis of the spatial distribution of persons, groups, and services, under varying specified conditions. Human ecology is often defined in broad terms as the relationship between people and their environment.
- Indicator - Any measurable phenomenon that is used to measure the presence of another phenomenon which cannot be measured directly or conveniently.
- Institutional Areas - Districts which include medical centers (hospitals, homes for the elderly), educational centers (schools, universities) and cultural centers (auditoriums, museums, religious centers, libraries).
- Knowledgeables - Those individuals who are considered to be informed of neighborhood settings and attitudes of residents. Knowledgeable individuals can provide a representative presentation of these behavioral and attitudinal characteristics.
- Land Use - The particular set of human activities or functions which occur in a specific area, including residential, commercial, industrial, and institutional usages.
- Lower Class - A rough designation of social class or status determined by the low income, occupational or educational levels.

- Matrix - The tabular arrangement of data in rows and columns, in order to assess the relationships among variables being studied.
- Middle Class - A designation of class or status, including, for example, the salaried class of managerial, professional, technical, and clerical workers of moderate income.
- Natural Areas - A territorial area with some common, unifying characteristic, emerging without planning from the operation of ecological processes. The term is most often applied to specialized areas of the city, such as the central business district, a financial district, a slum, or a Negro district. These areas are not delimited by political boundaries.
- Neighborhood - A small territorial unit, usually a subdivision of a larger community, in which there is a sense of local unity, the existence of face-to-face contacts, and the provision of essential services for local residents.
- Neighboring - Social interaction and often the exchange of services among physically close residents.
- Normative Forecast - Forecasting technique in which future goals are initially specified and the forecaster works backward to examine existing capabilities to meet these goals.
- Opinion - A conclusion or judgment about a specific event, object, or situation; an opinion is often considered synonymous with an attitude.
- Participation - The engagement in community activities or projects outside of an individual's professional or occupational work situation.
- Perception - The interpretation by an individual of a specific situation, according to prior learning, activities, interests, and experiences.
- Personal Resource - The material and nonmaterial traits or items possessed by an individual which aids him in daily existence, including time, money, energy, or skills.
- Population - All people residing within a delimited geographic area (such as a metropolitan area); also, the total number of people with a given characteristic.
- Residential Areas - Districts which contain those structures associated with daily habitation, including single- and/or multiple-family dwelling units, grocery stores, elementary and secondary schools, and neighborhood churches.

- Residential Linkage - Those social bonds or ties to individual residences and to make a residential area cohesive.
- Residential Mobility - The rate of movement to and from residential dwellings during a given time period.
- Role - Expected patterns of behavior, including specific duties and rights, associated with a particular position within a group.
- Scenario - Narrative description of a possible course of developments which may potentially lead to a future state of affairs.
- Social - Having to do with interrelationships between individuals or groups.
- Social Adjustment - Those types of relationships which provide satisfaction to an individual with his social position.
- Social Barrier - Physical or nonphysical phenomena which restrict the free interaction of individuals and of groups.
- Social Behavior - Behavior given in response to the behavior or expected reaction of others.
- Social Bonds - The integrative forces or attractions that hold together members of a group, involving agreement with and acceptance of the goals, norms, and role structure of the group.
- Social Diagnosis - The process of determining or identifying the patterns of social relationships and interaction within a study area.
- Social Institution - Interrelated set of social roles, organized to satisfy an important social function or need. In the changing urban environment, institutions are increasingly interdependent, representing adjustments to the complexities of urban regions.
- Social Integration - see Cohesion.
- Social Relationship - A pattern of social interaction between two or more persons, involving meaningful communication and an awareness of the probable behavior of the other person.
- Social Structure - The pattern of interrelated statuses and roles found in a group constituting a relatively stable set of social relationships.
- Socioeconomic Status - The combination of various social and economic indexes of rank, including income, family background, education, values, and prestige of occupation.

Study Area - That portion of a neighborhood or community undergoing evaluation for the location of a highway.

Suburb - A relatively small community that is part of the urbanized area adjacent to and dependent upon a central city.

Upper Class - A rough designation of social class or status determined by the high income, high levels of educational achievement, prestige, power, and style of life of its holders.

Value - An abstract principle of behavior to which the members of a group feel a strong, emotionally toned, positive commitment and which provides a standard for judging specific acts and goals. Values provide standards as to how things should be, i.e. what is desirable.

Voluntary Association - A group freely organized for the pursuit of some interests, in contrast to officially established agencies.

Working Class - The category of skilled and unskilled manual workers, sometimes extended to include low-paid clerical and other white collar workers.

## APPENDIX B

### FIELD OBSERVATION

#### FIELD OBSERVATION AS A DATA COLLECTION METHOD

As used in this appendix, *field observation* refers to any data collection method whereby the researcher witnesses or experiences events or phenomena firsthand in the social area under investigation. Technically speaking, sample surveys are a field observation technique, but are traditionally considered to be a methodologically distinct means of data collection. For this reason, sample surveys are discussed in a separate appendix and the discussion here is limited to the more informal and unstructured field observation techniques. Zelditch (1969) divides field observation techniques into three broad classes. These are as follows:

Unobtrusive Measures, Enumerations, and Surveys. This includes all types of passive observation techniques where the researcher is not an active participant in events in the social area. These techniques include "windshield surveys", observations of physical traces in the social area, and all types of direct, repeated, countable observations. Observation in this sense entails minimal participation compared with that required in participant observation.

Participant Observation. The researcher directly observes events in the social area and participates in the sense that he develops and maintains durable social relations with residents of the area. He may or may not play an active part in events, and he may or may not interview participants in events which may be considered part of the process of observation.

Informant Interviewing. The researcher obtains information presumed factually correct about past events in the social area and the participants in these events from an active participant in a formal, unstructured setting. Interviewing during an event itself is considered part of participant observation.

A discussion of the most important points of these methods is given in the following sections.

#### UNOBTRUSIVE MEASURES, ENUMERATIONS, AND SURVEYS

This category contains all types of field-observation data collecting techniques in which the researcher does not use some type of direct, face-to-face interaction with social area residents to obtain information. The approach to be described in this section relates closely to the type of field observation discussed in Chapter III, regarding the use of field observation for discerning land use and neighborhood characteristics. This includes such activities as driving around the neighborhood and counting the number of automobiles visible, or passively observing subtle and complex social interactions among area residents. Technically speaking, almost any type of data that can be obtained from a sample survey or from secondary sources such as census data may also be obtained from field observation techniques.<sup>1</sup> Thus, statistics regarding the physical condition of housing in an area can be obtained by directly observing a random sample of dwelling units. However, as is discussed in another section of this report, some types of data are more efficiently and cheaply collected by methods other than field observation, but the latter method provides for the addition of "human element" to the objective quantitative data collected.

The following are some illustrations of ways unobtrusive measures or passive observation techniques can be used to augment objective forms of field observation emphasized in Chapter III.

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<sup>1</sup>Census information is collected only once in ten years and, while highly reliable at the time of enumeration, may not be current enough to depend on solely.

1. The degree to which there is a sense of community identity on the part of area residents can be determined. For example, do residents engage in "neighboring" activities such as visiting, taking care of each other's children, shopping together, etc? Are yards and streets kept clean and free of trash and garbage? Are community facilities such as schools and parks free from vandalism? To what degree are commercial establishments such as grocery stores and restaurants patronized by local residents?

2. The extent to which there is an "ethnic identity" can be observed. For example, are conversations carried on in a language other than English? Are the dress and mannerisms of residents distinctive? Are there street signs and advertising signs in a language other than English? To what extent do grocery stores and restaurants carry ethnic food items such as "soul food"?

3. The importance of public community facilities to area residents can be determined by observing what type of activities take place in them, as well as how often they are used by area residents. For example, what type of activities take place in parks and other open space in the area? Are school playgrounds used after school hours? Are church facilities used for any activities other than Sunday worship services? Are there important community facilities such as a free clinic or a day care center that have not been previously identified?

Observation of physical traces can provide the researcher with valuable information. Land use and city planning maps provide one important information source in this regard. Also, public records such as police reports can provide a wealth of data about certain types of activities. The presence of paths

worn into the grass in open areas gives evidence of regular, heavy pedestrian traffic which may require further investigation. Observation of physical traces may be used in combination with other techniques, such as a survey. Thus, instead of asking a respondent to relate how far he travels in his car for various types of activities, a more accurate and less subjective record could be obtained by providing him with a form asking the respondent to record his odometer readings before each trip began and again after each trip ended.

The two following sections deal with participant observation and informant interviewing, providing an additional focus on alternative types of field observation techniques not emphasized in the report.

#### PARTICIPANT OBSERVATION

In participant observation, the researcher seeks to become a member of the social group under study to the extent that he can understand its members *in their own terms*. Fellman describes participant observation in the following manner:

The field study enables the investigator to portray to the agency hiring him an area as a living complexity. He can move beyond simple statistics of length of residence and value of home to style of life and meaning for residents.... Field work is, in a manner of speaking, the closest we can get to interviewing a community (Fellman, 1970:129).

#### The Process of Participant Observation

By the very nature of participant observation, the researcher views each social area as a unique entity with its own special structure and characteristics. This implies that participant observation must necessarily be carried out in an unsystematic and unstructured manner. For this reason, the process cannot be described in a list of hard and



fast rules describing what must be done in every field situation. However, there are some general guidelines for conducting such a study.

Fellman advocates the following approach. He states, "the trained field worker suspects that the social reality of a community lies in people's day-to-day activities there, in the human relationships that surround and comprise those activities" (Fellman, 1970:128). Participant observation is the process of observing these activities and reporting them in a meaningful manner. For the transportation researcher, observation is comprised of the following:

- (1) A "feel" of the area of investigation, that is, determining the strength or brittleness of people's ties, and the special events and problems that would go undetected by survey techniques.
- (2) Investigation of interrelationships and interactions, and the extent of emotional sustenance in the vicinity.
- (3) Investigation of length of residency in present homes and in the area and a development of some understanding of the strength and depth of ties to the area.
- (4) Writing up of careful notes. The researcher must familiarize himself with surface data such as use patterns within the social area, the location of community facilities, and the extent to which residents are tied to their surrounding area (Fellman, 1970:128).

The key element in participant observation is that the researcher must become close to the people he reports on. Lofland explains what "becoming close" entails:

(1) [The researcher] should have been close in the physical sense of conducting his own life in face-to-face proximity to the persons he tells about. (2) This physical proximity should have extended over some significant period of *time* and variety of circumstances. (3) The [researcher] should have developed closeness in the social sense of intimacy and confidentiality. He should have developed relationships that provided him reasonable access to the activities of a set of people through their entire round of life. (4) He should have conducted his recording activities in such a way that his reportage can give close and searching attention to minute matters. He should have paid attention to the minutiae of daily life (Lofland, 1971:3. Italics in original source.)

### Limitations and Advantages of Participant Observation

Dean, et al. (1969) list the following limitations and advantages of participant observation, which also apply in varying degrees to all other field work techniques.

Limitations. *Because of the non-standardized way the data are collected, they are not generally useful for statistical treatment.* This means that quantitative relationships usually cannot be established and the researcher has to depend on a more impressionistic interpretation of the data for arriving at generalizations.

*A second major limitation flows from the researcher's use of the relationships he establishes in the field, that is, the likelihood of bias.* Since the direction the investigation takes frequently changes on the basis of the emerging data, there is great danger that the research worker will guide the inquiry in accord with wrong impressions he has gotten from the first informants contacted. Or his own personal characteristics or personality needs may attract him into stronger relationships with certain kinds of informants than with others, and thus prepare the way for his receiving an undue amount of information from persons who are biased toward one point of view.

Advantages. The field worker is not as bound by prejudice: *he can reformulate the problem as he goes along.*

*Because of his closer contact with the field situation, the researcher is better able to avoid misleading or meaningless questions.*

*The impressions of a field worker are often more reliable for classifying respondents than a rigid index drawing upon one or two questions in a questionnaire.*

*Unstructured observation and interviewing usually [places the researcher] in direct contact with the data in the field. The survey director is typically several steps removed from the data-gathering process. This remoteness frequently impairs the researcher's understanding of the difficulties of communication that his questions evoke when asked by a semi-skilled interviewer.*

*Using unstructured methods, the researcher can ease himself into the field at an appropriate pace and thereby avoid rebuff by blundering into delicate situations or subject matter. The survey researcher may find to his surprise that some aspects of his questionnaire are explosive in certain localities.*

*The field worker can constantly modify his categories, making them more suitable for the analysis of the problem he is studying. The survey researcher is often stuck with the categories or variables he originally used in conceiving the problem.*

*The field worker can generally impute motives more validly by contrasting stated ideals with actual behavior, supplemented by the informant's reactions to "feed-back". Here, the researcher describes the informant's motives as they appear to him for corroboration or modification.*

*The field worker can select later informants in such a way as to throw additional light on emerging hypotheses....*

*The field worker can generally get at depth material more satisfactorily than the survey researcher. He can postpone immediate data gathering to cultivate the relationship and draw out depth material only when the informant is ready for it....*

*The field worker absorbs a lot of information that at the time seems irrelevant. Later, when his perspective on the situation has changed, this information may turn out to be extremely valuable. The survey researcher limits himself to what he considers important at the offset even though he has some serious misconceptions about the problem.*

*It is much easier for the field worker to make use of selected informants' skills and insights by giving these informants free rein to describe the situation as they see it. The field worker frequently wants his informants to talk about what they want to talk about; the survey researcher has to get them to talk about what he wants.*

*The field worker can usually move more easily back and forth from data gathering in the field to analysis at his desk. He has less of an investment to junk, if he started out on the wrong track, than the survey researcher does.*

*Difficult-to-quantify variables are probably less distorted by unstructured observation and interviewing than by an abortive effort to operationalize them for quantification by a survey. There is no magic in numbers; improperly used, they confuse rather than clarify.*

*The field worker has a big advantage over the survey researcher in delicate situations where covert research is essential ... where he wants to make observations while ostensibly just participating.*

Finally, there is the ever-present dollar sign. Because the survey involves expenses such as recruiting and training interviewers, administering and supervising the field work, coding and punching the questionnaires, and running the hundreds of tables for analysis, *surveys are generally more expensive than field observation and interviewing* (Dean, et al., 1969:21-24).

#### INFORMANT INTERVIEWING

It often happens in field research that the researcher will become more friendly with some members of the social area than with others. Such persons may begin to see themselves as the researcher's helpers. They volunteer information and are concerned with the successful outcome of the research project. When relationships are relatively regularized and involve personal attachments, such persons are called *informants*. Such relations should always be kept in good repair, within the constraints of publically appearing partisan (Lofland, 1971:111). In addition, the researcher may enter the social area with the express intention of developing close enough relationships with knowledgeable residents so that he can interview them to obtain more intimate information and candid observation of a nature that cannot be obtained in the more formally-structured, brief contact survey interview.

Blum (1970:90) lists three general principles which hold for all types of informant interviewing. These are: (1) The researcher must have the trust and confidence of the persons who give the information. (2) He must not only speak their language, but he must have a human understanding and ability to penetrate a "world" different from his own. (3) He must be highly conscious of psychological dynamics. According to one researcher:

These qualities are necessary preconditions for securing scientifically valid information. They are not easily acquired, but fortunately the researcher can in many ways benefit from the very fact of being an outsider. The outsider has to overcome distrust. But if he has given evidence that he does keep all information secret and is trusted as a human being, he can get more information than an insider (Blum, 1970:90).

Trice (1970:79) states that the "outsider" label can be most effectively used by endowing it with a neutrality and divesting it of the threat which it seems to contain in three ways: (1) by insisting that it is the residents of the social area who have the information and "expertness", not the researcher, and that he is merely the outside medium through which their experience and knowledge can be woven together; (2) by studying, as closely as possible, the communication system between the various factions and groups within the social area. A knowledge of this system affords an opportunity to disseminate the neutrality of the outsider role; and (3) overt behavior consistent with "outsiderness", i.e., by declaring emphatically that the researcher was *not* taking sides with any group in the community, and that he has no prejudgments about the community.

## Problems of Potential Bias

Informant interviewing contains several sources of potential bias, both on the part of the researcher and the informant, of which the researcher should be aware. Lofland suggests the following set of questions to be used to evaluate information obtained from informants;

1. *Directness of the report.* Is this account a direct observation or does it come second-, third-, or fourth-hand and is it therefore to be treated with more caution as fact, even though it may be accurate as public imagery of an event?
2. *Spatial location of the reporter.* Even if first-hand, what was the spatial location of myself or the reporter such that this view might be accurate in many respects but still highly skewed or partial?
3. *Social locational skewing of reported opinions.* With regard to reports of opinion and belief, what might there be about the relation between myself and a member that would lead him to give this kind of account to me, and another kind of account to others? For informant reports of opinions and beliefs, what might there be about the relation between the member and the informant that leads to a particular emphasis in the member's account?
4. *Self-serving error and bias concerning events.* From what I know on other grounds about my own or this reporter's commitments, values, and announced biases, are there any reasons to be suspicious of the content of this report? Does it fit all too conveniently with what I want to believe or what this reporter might want to believe about people and events? That is, is this report *self-serving* and therefore to be regarded with caution?
5. *Previous plain error concerning events.* From what is known about previous observations by myself or by this reporter, am I myself an accurate observer?; or is this reporter usually an accurate observer? Have I or the reporter made errors in the past, even though these are not self-serving errors?
6. *Internal consistency of the report.* Is this report consistent within itself? Are there spatial-temporal facts stated at one point that are contradicted or made impossible by spatial-temporal assertions at other points? Were the events of this report possible within the time and space constraints given in the report or known about on other grounds? Do the people involved unaccountably contradict themselves within this report?

7. *External consistency: agreement among independent reports.* Is this account consistent with other accounts of the same events? Have I assembled enough independent accounts of this event, subjected them to the above questions, and then compared among them for the degree of their agreement? (Lofland, 1971:112-113)

## FIELD OBSERVATION AND CITIZEN PARTICIPATION

In the process of field observation, the researcher should get a "feel" for the social area. He should become involved in the activities of the area under investigation to the extent that he can discern the social patterns that exist there. He should be able to delineate the various social groups, the power structure that exists among them, the conflicting goals of these groups, as well as to identify community leaders. This is precisely the type of information needed by highway representatives to carry out the process of citizen participation in a potential impact area. Therefore, the field observation activities should be closely coordinated with the citizen participation and the public meeting activities.

In reality, the process of determining the social impact of a proposed transportation facility and involving potentially affected citizens in the planning process cannot be separated, although they may be carried out in separate steps. For this reason, the researcher who conducts a field observation study should view himself as involved in two roles: one as a representative of the highway department to the social area; and one as a representative of the social area to the highway department. In the

first role, the researcher collects the data necessary for the sociological analysis, but he also serves as a source of information about the proposed plans and the citizen participation process to the residents of the social area. In the second role, the observer represents, as lucidly and as accurately as possible, the views and feelings of the residents to the highway department. He should also provide an "insider's" viewpoint of how the planning process should be conducted within the social area.



## APPENDIX C

### USE OF CENSUS MATERIALS

Two of the major problems in using Census data are: (1) where and how to access the particular type of data needed for the researcher's demands, and (2) comparability of data collected in different census periods. Each of these problems is discussed in this appendix.

#### SOURCES OF CENSUS DATA

The major sources of census data are the final reports of the various decennial censuses of the population. The information from these reports is available in three main forms: (1) standard published volumes, (2) standard computer tapes, and (3) custom reports prepared by the Census Bureau. The types of information in the standard published volumes and computer tapes for the 1970 census is shown in Table 1. The Texas Transportation Institute has access to the 1960 and 1970 DUALabs tapes for Texas which can be utilized to obtain data for Texas census tracts.

In addition to the data supplied in standard form by the Census Bureau, some consideration should be given to the development of computer tapes containing Texas census data in a form that would be most useful to the research needs of the THD. Such tapes can be compiled by the Census Bureau at cost. This tape could be along the lines of the "Worker File" described by Roswell (1974). The Worker File is a series of tapes containing for each worker the following record:

1. Primary or secondary earner (primary = highest earner)
2. Household relation (basic relation code)
3. Mode of travel
4. Size of household (number of persons)

Table 1. Publications and Computer Tapes Available for the 1970 Census of the Population

**Population Census Reports**

**Volume I.**

**CHARACTERISTICS OF THE POPULATION**

This volume will consist of 58 "parts"—number 1 for the United States, numbers 2 through 52 for the 50 States and the District of Columbia in alphabetical order, and numbers 53 through 58 for Puerto Rico, Guam, Virgin Islands, American Samoa, Canal Zone, and Trust Territory of the Pacific Islands, respectively. Each part, which will be a separate cloth-bound book, will contain four chapters designated as A, B, C, and D. Each chapter (for each of the 58 areas) will first be issued as an individual paperbound report in four series designated as PC(1)-A, B, C, and D, respectively. The 58 PC(1)-A reports will be specially assembled and issued in a clothbound book, designated as Part A.

■ Series PC(1)-A.

**NUMBER OF INHABITANTS.**

Final official population counts are presented for States, counties by urban and rural residence, standard metropolitan statistical areas (SMSA's), urbanized areas, county subdivisions, all incorporated places, and unincorporated places of 1,000 inhabitants or more.

■ Series PC(1)-B.

**GENERAL POPULATION CHARACTERISTICS**

Statistics on age, sex, race, marital status, and relationship to head of household are presented for States, counties by urban and rural residence, SMSA's, urbanized areas, county subdivisions, and places of 1,000 inhabitants or more.

■ Series PC(1)-C.

**GENERAL SOCIAL AND ECONOMIC CHARACTERISTICS**

Statistics are presented on nativity and parentage, State or country of birth, Spanish origin, mother tongue, residence 5 years ago, year moved into present house, school enrollment (public or private), years of school completed, vocational training, number of children ever born, family composition, disability, veteran status, employment status, place of work, means of transportation to work, occupation group, industry group, class of worker, and income (by type) in 1969 of families and individuals. Each subject is shown for some or all of the following areas: States, counties (by urban, rural-nonfarm, and rural-farm residence), SMSA's, urbanized areas, and places of 2,500 inhabitants or more.

■ Series PC(1)-D.

**DETAILED CHARACTERISTICS**

These reports will cover most of the subjects shown in Series PC(1)-C, above, presenting the data in considerable detail and cross-classified by age, race, and other characteristics. Each subject will be shown for some or all of the following areas: States (by urban, rural-nonfarm, and rural-farm residence), SMSA's, and large cities.

**Volume II.**

**SUBJECT REPORTS**

Each report in this volume, also designated as Series PC(2), will concentrate on a particular subject. Detailed information and cross-relationships will generally be provided on a national and regional level; in some reports, data for States or SMSA's will also be shown. Among the characteristics to be covered are national origin and race, fertility, families, marital status, migration, education, unemployment, occupation, industry, and income.

**Housing Census Reports**

**Volume I.**

**HOUSING CHARACTERISTICS FOR STATES, CITIES, AND COUNTIES**

This volume will consist of 58 "parts"—number 1 for the United States, numbers 2 through 52 for the 50 States and the District of Columbia in alphabetical order, and numbers 53 through 58 for Puerto Rico, Guam, Virgin Islands, American Samoa, Canal Zone, and Trust Territory of the Pacific Islands, respectively. Each part, which will be a separate cloth-bound book, will contain two chapters designated as A and B. Each chapter (for each of the 58 areas) will first be issued as an individual paperbound report in two series designated as HC(1)-A and B, respectively.

■ Series HC(1)-A.

**GENERAL HOUSING CHARACTERISTICS**

Statistics on tenure, kitchen facilities, plumbing facilities, number of rooms, persons per room, units in structure, mobile home, telephone, value, contract rent, and vacancy status are presented for some or all of the following areas: States (by urban and rural residence), SMSA's, urbanized areas, places of 1,000 inhabitants or more, and counties.

Table 1. (Continued)

■ Series HC(1)-B.

**DETAILED HOUSING CHARACTERISTICS**

Statistics are presented on a more detailed basis for the subjects included in the Series HC(1)-A reports, as well as on such additional subjects as year moved into unit, year structure built, basement, heating equipment, fuels, air conditioning, water and sewage, appliances, gross rent, and ownership of second home. Each subject is shown for some or all of the following areas: States (by urban, rural-nonfarm, and rural-farm residence), SMSA's, urbanized areas, places of 2,500 inhabitants or more, and counties (by rural and rural-farm residence).

**Volume II.**

**METROPOLITAN HOUSING CHARACTERISTICS**

These reports, also designated as Series HC(2), will cover most of the 1970 census housing subjects in considerable detail and cross-classification. There will be one report for each SMSA, presenting data for the SMSA and its central cities and places of 50,000 inhabitants or more, as well as a national summary report.

**Volume III.**

**BLOCK STATISTICS**

One report, under the designation Series HC(3), is issued for each urbanized area showing data for individual blocks on selected housing and population subjects. The series also includes reports for the communities outside urbanized areas which have contracted with the Census Bureau to provide block statistics from the 1970 census.

**Volume IV.**

**COMPONENTS OF INVENTORY CHANGE**

This volume will contain data on the disposition of the 1960 inventory and the source of the 1970 inventory, such as new construction, conversions, mergers, demolitions, and other additions and losses. Cross-tabulations of 1970 and 1960 characteristics for units that have not changed and characteristics of the present and previous residence of recent movers will also be provided. Statistics will be shown for 15 selected SMSA's and for the United States and regions.

**Volume V.**

**RESIDENTIAL FINANCE**

This volume will present data regarding the financing of privately owned nonfarm residential properties. Statistics will be shown on amount of outstanding mortgage debt, manner of acquisition of property, homeowner expenses, and other owner, property, and mortgage characteristics for the United States and regions.

**Volume VI.**

**ESTIMATES OF "SUBSTANDARD" HOUSING**

This volume will present counts of "substandard" housing units for counties and cities, based on the number of units lacking plumbing facilities combined with estimates of units with all plumbing facilities but in "dilapidated" condition.

**Volume VII.**

**SUBJECT REPORTS**

Each report in this volume will concentrate on a particular subject. Detailed information and cross-classifications will generally be provided on a national and regional level; in some reports, data for States or SMSA's may also be shown. Among the subjects to be covered are housing characteristics by household composition, housing of minority groups and senior citizens, and households in mobile homes.

**Joint Population-Housing Reports**

**Series PHC(1).**

**CENSUS TRACT REPORTS**

This series contains one report for each SMSA, showing data for most of the population and housing subjects included in the 1970 census.

**Series PHC(2).**

**GENERAL DEMOGRAPHIC TRENDS FOR METROPOLITAN AREAS, 1960 to 1970**

This series consists of one report for each State and the District of Columbia, as well as a national summary report, presenting statistics for the State and for SMSA's and their central cities and constituent counties. Comparative 1960 and 1970 data are shown on population counts by age and race and on such housing subjects as tenure, plumbing facilities, value, and contract rent.

**Series PHC(3).**

**EMPLOYMENT PROFILES OF SELECTED LOW-INCOME AREAS**

This series will consist of approximately 70 reports, each presenting statistics on the social and economic characteristics of the residents of a particular low-income area. The data relate to low-income neighborhoods in 54 cities and seven rural poverty areas. Each report will provide statistics on employment and unemployment, education, vocational training, availability for work, job history, and income, as well as on value or rent and number of rooms in the housing unit.

Table 1. (Continued)

**Additional Reports**

**Series PHC(E).**

**EVALUATION REPORTS**

This open series will present the results of the extensive evaluation program conducted as an integral part of the 1970 census program, and relating to such matters as completeness of enumeration and quality of the data on characteristics.

**Series PHC(R).**

**PROCEDURAL REPORTS**

This open series presents information on various administrative and methodological aspects of the 1970 census, and will include a comprehensive procedural history of the 1970 census. The first report issued focuses on the forms and procedures used in the data collection phase of the census.

**Computer Summary Tapes**

The major portion of the results of the 1970 census will be produced in a set of six tabulation counts. To help meet the needs of census users, these counts are being designed to provide data with much greater subject and geographic detail than it is feasible or desirable to publish in printed reports. The data so tabulated will generally be available—subject to suppression of certain detail where necessary to protect confidentiality—on magnetic computer tape, printouts, and microfilm, at the cost of preparing the copy.

**First Count**—source of the PC(1)-A reports; contains about 400 cells of data on the subjects covered in the PC(1)-B and HC(1)-A reports and tabulated for each of the approximately 250,000 enumeration districts in the United States.

**Second Count**—source of the PC(1)-B, HC(1)-A, and part of the PHC(1) reports; contains about 3,500 cells of data covering the subjects in these reports and tabulated for the approximately 35,000 tracts and 35,000 county subdivisions in the United States.

**Third Count**—source of the HC(3) reports; contains about 250 cells of data on the subjects covered in the PC(1)-B and HC(1)-A reports and tabulated for approximately 1,500,000 blocks in the United States.

**Fourth Count**—source of the PC(1)-C, HC(1)-B, and part of the PHC(1) reports; contains about 13,000 cells of data covering the subjects in these reports and tabulated for the approximately 35,000 tracts and 35,000 county subdivisions in the United States; also contains about 30,000 cells of data for each county.

**Fifth Count**—will contain approximately 800 cells of population and housing data for 5-digit ZIP code areas in SMSA's and 3-digit ZIP code areas outside SMSA's; the ZIP code data will be available only on tape.

**Sixth Count**—source of the PC(1)-D and HC(2) reports; will contain about 260,000 cells of data covering the subjects in these reports and tabulated for States, SMSA's, and large cities.

The tapes will generally be organized on a State basis. To use the First Count and Third Count tapes, it will be necessary to purchase the appropriate enumeration district and block maps.

The term "cells" used herein to indicate the scope of subject content of the several counts refers to each figure or statistic in the tabulation for a specific geographic area. For example, in the Third Count, there are six cells for a cross-classification of race by sex: three categories of race (white, Negro, other race) by two categories of sex (male, female).

In addition to the above-mentioned summary tapes, the Census Bureau will make available for purchase certain sample tape files containing population and housing characteristics as shown on individual census records. These files will contain no names or addresses, and the geographic identification will be sufficiently broad to protect confidentiality. There will be six files, each containing a 1-percent national sample of persons and housing units. Three of the files will be drawn from the population covered by the census 15-percent sample and three from the population in the census 5-percent sample. Each of these three files will provide a different type of geographic information: One will identify individual large SMSA's and, for the rest of the country, groups of counties; the second will identify individual States and, where they are sufficiently large, will provide urban-rural and metropolitan-nonmetropolitan detail; and the third will identify State groups and size of place, with each individual record showing selected characteristics of the person's neighborhood.

Source: U.S. Bureau of the Census, Characteristics of the Population, 1970.

5. Number of employed persons in household
6. Automobiles available to household
7. Earnings of individual
8. Household income
9. Occupation
10. Industry
11. Value of owner-occupied unit one family, detached, without business
12. Other owner-occupied unit
13. Monthly gross rent
14. Number of units in structure
15. Age
16. Sex
17. Race or ethnicity (white, Negro, Spanish-American)
18. Class of worker
19. Hours worked (during week)
20. Years of school completed (highest grade attended plus finished grade distribution)

The record should be coded to the finest geography possible, as follows:

1. Residence--state, county, place, tract, block
2. Work site--state, county, zip, tract, block (Boswell, 1970:60).

These and other data descriptors can also be obtained in the published decennial reports.

### Current Population Survey

In addition to reports based on the decennial census, the Census Bureau periodically publishes reports based on the Current Population Survey. Data from these reports, when combined with such data as school attendance records, can be used to compile more current estimates of certain population characteristics than is available from the decennial reports. Also, under certain conditions, the Census Bureau will add questions to its Current Population Survey interview schedule to obtain data for public agencies.

## STRENGTHS AND WEAKNESSES OF CENSUS DATA

One of the problems of using decennial Census data to analyze trends in population characteristics is that data collected at one time may not be directly or even indirectly comparable to similar data collected at another time. Three reasons for this problem are: (1) changes in the definition of variables or ways of classifying data, (2) changes in enumeration procedures, and (3) changes in the boundaries of enumeration areas such as census tracts. There are many instances where the Census Bureau has changed the definition of variables in order to make them more meaningful or because the old definitions have become obsolete. For this reason, the researcher should carefully read the definitions provided by the Census Bureau for each time period under consideration to make sure the data are comparable. In some instances, a conversion factor can be used in situations where the definition of a variable has changed in order to make data comparable.

In some cases, an implicit redefinition of a variable occurs because of a change in the way data were collected. For example, the 1970 census was largely conducted by means of mailed, self-administered questionnaires. Under this procedure, it is estimated that a greater proportion of persons reported themselves as being Negro than were so reported in 1960. Thus, comparison of data for a certain census tract for 1960 and 1970 might show an increase in the percentage of Negroes there when none had occurred in reality. Finally, due to population shifts and changes in U.S. Bureau of the Census administrative procedures, the boundaries of census tracts and other enumeration areas are changed from one census period to the next. This is a particularly frustrating problem for the researcher attempting

to analyze trends. In some instances, the redefinition of tract boundaries is extensive enough to seriously hamper the research project. For this reason, the comparability of census tracts should be investigated at the outset of the research in order to be able to plan how to deal with the problems likely to be encountered.

Census data and other forms of related demographic information are widely used. Perhaps the most important feature of census data is the high quality of enumeration; census surveys provide a greater degree of accuracy from which a highly dependable data base can be obtained. Census publications, such as those outlined in Table I, are readily obtained and require low monetary costs.

Census tabulations either: (1) cover the total population of a particular areal unit, or (2) encompass a carefully selected sample of the population, depending on the actual data descriptors utilized. Many researchers cannot attain the sampling reliability of the decennial census. In addition, the sample (or, in many cases, the total population) provides a much larger data base than can be obtained by the individual researcher in most circumstances.

## APPENDIX D

### CONDUCTING A SAMPLE SURVEY

Designing, organizing, and conducting a sample survey to obtain social data needed for the types of analyses presented in Chapter V requires a certain amount of technical knowledge for success. Only by carefully planning a survey from initiation to completion can reliance be placed in the findings. This appendix briefly describes the steps involved in the planning and execution of a survey. These steps are grouped somewhat arbitrarily under 12 headings:<sup>1</sup>

1. Objectives of Survey
2. Population to be Sampled
3. Data to be Collected
4. Degree of Precision Required
5. Methods of Measurement
6. Construction of Record Forms
7. Development of the Sampling Frame
8. Selection of the Sample
9. The Pretest
10. Organization of the Field Work
11. Summary and Analysis of the Data
12. Information Gained for Future Surveys

#### OBJECTIVES OF THE SURVEY

Before undertaking a survey or choosing the methods by which it is to be conducted, it is important to formulate a clear statement of the

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<sup>1</sup>Topics covered are taken from Cochran (1963: 5-8).



objectives of the study which, in this case, entails a social impacts assessment of urban freeway introduction. Without this step, it is easy to forget the objectives when involved in the details of planning and to make decisions that are contrary to the objectives.

#### POPULATION TO BE SAMPLED

The word *population* is used to denote the aggregate from which the sample is chosen. The population to be sampled (the *sampled* population) should coincide with the population about which information is wanted (the *target* population). Sometimes, for reasons of practicality or convenience, the sampled population is more restricted than the target population. If this occurs, it should be remembered that conclusions drawn from the sample apply *only* to the sampled population. Judgment about the extent to which the conclusion will also apply to the target population must depend on other sources of information. Any supplementary information that can be gathered about the nature of the difference between sampled and target population may be helpful (Cochran, 1963:6). The population must be clearly defined by a set of rules. In sampling a neighborhood as a population, for example, rules must be set up to define what comprises that neighborhood. These rules must be usable in practice. The enumerator must be able to decide in the field, with little difficulty, whether or not a doubtful case belongs in the population.

#### DATA TO BE COLLECTED

The person conducting the survey should be careful to verify that all data collected are relevant to the purposes of the survey, and that no essential data are omitted. There is a tendency to ask too many questions,

some of which are never analyzed. A questionnaire that is too long lowers the quality of *all* questions, the important as well as the unimportant.

The survey designer should decide at this point what specific questions must be answered by the survey. Related questions which are "interesting" but not essential to the investigation should be considered on the basis of their importance, the additional cost of their inclusion, and whether or not they may take the place of more pertinent questions. The decisions made should be recorded so that the surveyor can have them when he drafts the detailed plans. If it is later proposed that still other questions be added, the surveyor can evaluate such proposals in light of the objectives and decisions previously made.

#### DEGREE OF PRECISION REQUIRED

The results of sample surveys are always subject to some uncertainty because only part of the population has been measured and because there are errors in measurement. This uncertainty can be reduced by: (1) taking larger samples, and (2) using superior instruments and extensive quality control procedures. Both of these usually involve some increase in expenditures in time and money. For this reason, it is important to specify the degree of precision that is desired so that costs can be held to a minimum. It is strongly advised that the services of a professional statistician be obtained at this point so that the amount of sampling error that can be tolerated consistent with good decision making can be determined.

There are two conditions a sample must fulfill in a social survey:

- (1) It must be possible to make *substantive statements*, i.e., statements about variables in the population with a tolerable amount of

certainty, and

- (2) It must be possible to generalize from the sample to the target population with a tolerable amount of uncertainty.

Fortunately, these two requirements can be met simultaneously through proper sampling techniques. However, the procedures involved require a high degree of technical knowledge, and should be performed by an expert statistician.

## METHODS OF MEASUREMENT<sup>2</sup>

There are three major alternative measurement instruments that may be utilized to obtain the information needed for the types of analysis presented in this report. These alternatives are: (1) personal (face-to-face) interview, (2) telephone interview, and (3) mailed questionnaire. The major advantages and disadvantages of each of these techniques are as follows:

### The Personal Interview

The advantages of the personal interview are:

1. The personal interview usually yields a high percentage of returns, for most people are willing to cooperate.
2. It can be made to yield an almost perfect sample of the general population because practically everyone can be reached by and respond to this approach.
3. The information secured is likely to be more current than that

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<sup>2</sup>This section is taken from Parten (1950:71-105).

secured by other techniques since the interviewer can clear up seemingly inaccurate answers by explaining the questions to the informant. If the latter deliberately falsifies replies, the interviewer may be trained to spot such cases and use special devices to get the truth.

4. The interviewer can collect supplementary information about the informant's personal characteristics and environment which is valuable in interpreting results and evaluating the representativeness of the persons surveyed.
5. Scoring and test devices can be used, the interviewer acting as experimenter.
6. Visual material to which the informant is to react can be presented.
7. Return visits to complete items on the schedule or to correct mistakes can usually be made without annoying the informant. Thus, greater numbers of usable returns are assured than when other methods are employed.
8. The interviewer may catch the informant off guard and thus secure more spontaneous reactions than would be the case if a written form were mailed out for the informant to mull over.
9. The interviewer can usually control which person or persons answer the questions, whereas in mail surveys several members of the household may confer before the questions are answered. On the other hand, group discussions can be held with the personal interview method if desired.

10. The personal interview may take long enough to allow the informant to become oriented to the topic under investigation. Thus, recall of relevant material is facilitated.
11. Questions about which the informant is likely to be sensitive can be carefully sandwiched in by the interviewer. By observing the informant's reactions, the investigator can change the subject if necessary or explain the survey problem further if it appears that the interviewee is about to rebel. In other words, a delicate situation can usually be handled more effectively by a personal interview than by other survey techniques.
12. More of the informant's time can be taken for the survey than would be the case if the interviewer were not present to elicit and record the information.
13. The language of the survey can be adapted to the ability or educational level of the person interviewed. Therefore it is comparatively easy to avoid misinterpretations or misleading questions.

Some limitations of the personal interview follow:

1. The transportation costs and the time required to cover addresses in a large area may make the personal interview method unfeasible.
2. The human equation may distort the returns. If an interviewer has a certain economic bias, for example, he may unconsciously ask the questions so as to secure confirmation of his views. In opinion studies especially, such biases may operate. To prevent such coloring of questions, most opinion surveyors instruct their interviewers to ask the question exactly as printed on the schedule

3. Unless the interviewers are properly trained and supervised, the data recorded may be inaccurate and incomplete. A few poor enumerators may make a much higher percentage of returns unusable than if the informants filled out and mailed the interview form to survey headquarters.
4. The organization required for selecting, training, and supervising a field staff is more complex than that needed for surveys conducted by other methods.
5. It is usually claimed that costs per interview are higher when field investigators are employed than when telephone or mail surveys are used. This may not be true if the area to be covered is not too great. If the general public in a community is to be surveyed, the costs of securing a representative sample by telephone or mail inquiries will probably equal or exceed the cost by the personal interview method, since in the end personal follow-up will be necessary to round out the sample.
6. The personal interview usually takes more time than the telephone interview providing the persons who can be reached by telephone are a representative sample of the type of population to be covered by the survey. However, for a sample of the general public a telephone inquiry is not a substitute for a personal interview. The lowest income groups may not have telephones.
7. If the interview is conducted in the home during the day, the majority of the informants will be housewives. If a response is to be obtained from a male member of the household, most of

the field work will have to be done in the evening or on week ends. Since only an hour or two can be used for evening interviewing, the personal interview requires a larger staff for studies requiring contacts with an employed population.

### The Telephone Interview

A summary of the merits of the telephone interview method follows:

1. The telephone interview is the quickest of the survey techniques. Interviewers can complete about thirty calls per hour if the calls are brief.
2. The refusal rate is usually low among people who are reached by phone.
3. It is easy to train and supervise interviewers since they can work in one room directly beside the supervisor.
4. The approach and questions are easy to standardize from one interviewer to another.
5. The cost per completed interview is low for the sample covered.
6. The geographic distribution of the sample can be easily controlled. An address listing of numbers is usually available and can be used for drawing the sample.
7. For studies of middle- and high-income groups, the telephone interview may be satisfactory because most of them have phones.
8. Interviews may be scattered over a wide area within a city without adding to the cost.
9. As compared with a mail questionnaire, the telephone survey is preferable because it usually costs less per return. Returns

are higher on first solicitation, and they can be more effectively controlled from the point of neighborhood distribution.

The disadvantages of this method may be summarized as follows:

1. As a sample of the general population, telephone subscribers are not representative. Thus, unless the telephone interview is supplemented by a method that covers nonsubscribers, it should not be used.
2. Detailed data cannot be gathered by this method because the informants soon become annoyed or impatient. If the schedule is too lengthy, the informant may either hang up or give unreliable answers.
3. When observation of the situation is an important element, the telephone interview is not useful. If the interviewer is supposed to evaluate the answers as to trustworthiness, he has very little to go on in a short telephone conversation.
4. Information about the respondent must be limited to one or two facts. Such items as age, nationality, income, etc., are difficult to secure by telephone.
5. Attitude scales must be used with caution. Also, opinions are less likely to be given freely since the informant cannot be certain of the credentials of the person calling.
6. The brevity of the introduction and questions does not give the informant much time to orient himself to the subject matter of the survey. Reactions requiring careful thought -- such as criticisms of existing transportation facilities, detailed opinions of proposed transportation facilities, etc. -- should not be obtained by this technique.



7. The telephone situation neither encourages the respondent to amplify his replies nor gives the interviewer much time to jot down the comments. A face-to-face interview is more conducive to a considered response.
8. The task of checking the no-answers, wrong numbers, busy signals, etc., is time-consuming but must be done if the sample is to be representative of telephone subscribers.
9. It is difficult to secure privacy on party lines.
10. There may be instances when the telephone technique is used by so many groups that informants develop an antagonism to all telephone inquiries.
11. The surveyor must be careful not to antagonize informants by phoning too early or too late in the day. One well-known survey agency makes it a policy never to call before 8:30 a.m. or after 10:30 p.m.
12. Misinformation is hard to detect and check in short inquiries.

#### The Mailed Questionnaire

The advantages of the mailed questionnaire may be summed up as follows:

1. If mailed questionnaires are used, it is possible to cover a wider geographical area and to reach a much larger population with given funds than could be accomplished by personal interviews with each informant. This lower cost applies primarily if personal follow-ups are not made.
2. Mailing costs are relatively low compared with the transportation and time costs for a field staff.

3. The expensive and time-consuming task of training a staff of investigators is eliminated. This assumes, of course, that a large staff will not be needed to collect the schedule data from the people who do not answer the questionnaire.
4. The informant may answer questions more frankly by mail since anonymity is assured. On the other hand, some respondents may hesitate to put their ideas in writing for fear that their schedules may be identified even though unsigned. Actually, it is questionable whether anonymity is either an advantage or a disadvantage.
5. The questionnaire may reach groups who are more or less protected from solicitors and investigators. In high-rent apartment houses or private homes where servants protect the occupants from solicitors and other doorbell ringers, for example, it is often difficult for investigators to gain admittance. Of course, the mere fact that the mail is received does not guarantee that it will not be filed in the wastebasket by a secretary or even by the addressee as soon as he glances at the heading.
6. Personal antagonism to investigators which may lead to a refusal to give the desired information is avoided.
7. If time is not an important consideration and if the sample extends over a wide area, the cost of securing practically complete returns is probably lower than in the personal interview method.
8. The questions are standardized, whereas in the personal interview the investigator may alter them or suggest answers.

9. The questionnaire can be answered at the convenience of the respondent. This gives him time to deliberate on each point, and if necessary to look up information needed to fill in the items. However, he may consult other members of his household, so his reply may be more representative of the family's point of view than of his own.
10. It is claimed that the mail questionnaire brings many more returns from the male respondent than does the telephone or personal interview method.
11. Where the persons to be reached are located in widely scattered areas of cities and are a mobile element of the population, it may be easier to locate them by mail (registered or special delivery) than by other methods.

Most of the advantages of the mailed schedule over the personal interview are offset by the following serious drawbacks:

1. The people who return questionnaires are not representative of the groups to whom the schedules are sent. This limitation is sufficiently great to outweigh almost all the advantages listed above. Unless every effort is exerted to adjust for nonresponse or to obtain practically complete returns from everyone solicited by mail, the technique should not be used.
2. The returns from mailed questionnaires sent to the general public may be very low, sometimes ranging from about 10 to 20 percent. The percentage of returns varies greatly, however, with different schedules and informants. One survey of medical doctors in New York State received about 50 percent returns

without follow-ups. By continued effort the returns may be increased to 70 or 80 percent of the sample.

3. Since the informant fills in the data on the questionnaire without the assistance of an investigator, he may misinterpret questions, omit essential items, or send in material which cannot be put in form for tabulation, thus making it necessary to discard many of the questionnaires.
4. The questions used must be simple and practically self-explanatory, since no training can be given the informant on their meaning and on how to fill out the schedule.
5. In most studies the questionnaire must be relatively brief if high returns are to be obtained.
6. If the sample is to be unbiased, it is necessary to supplement the mailed returns with information obtained by personal interviews with the nonrespondents.
7. Checks on the honesty and reliability of returns are difficult to devise when the personal interviewer does not see and size up the informant.
8. It is practically impossible to return unsatisfactory or incomplete schedules to the informant for correction.
9. Because most people would rather talk than write, questionnaires must be made very interesting to induce responses.
10. An up-to-date address list of potential survey informants is difficult to find.
11. Mail returns from the last third of the respondents come in slowly; hence the mail survey must be spread over a relatively

- long period, if a high percentage of returns is to be secured.
12. Many questions which might antagonize the respondent cannot be included on the mail questionnaires but can be asked in personal interviews when the informant gradually can be led around to the subject.

These three measurement procedures are not mutually exclusive. For example, it may be desirable to combine telephone interviews with mailed questionnaires, or with personal interviews as a follow-up method when no response or incomplete responses are obtained from particular parts of the sample. Also, routine, nonsensitive data may be collected from one sample of the population, by mail or phone, and sensitive information obtained from another sample by personal interview.

#### CONSTRUCTION OF RECORD FORMS

A major part of the preliminary work is the construction of the record forms on which the questions and answers are to be entered. Whenever possible, answers should be precoded, that is, entered in a manner in which they can be routinely transferred to mechanical equipment. In order to develop good record forms, it is necessary to know precisely the structure of the final summary tables that will be used for drawing conclusions. For this reason, "dummy tables" or table "shells" for all summary tables should be constructed as a preliminary step in the construction of the record forms. These dummy tables also facilitate the evaluation of the questions included in the survey.

## DEVELOPMENT OF THE SAMPLING FRAME

Before selecting the sample, the population must be divided into parts which are called *sampling units*. These units must: (1) cover the whole of the population, and (2) they must not overlap, in the sense that every element in the population belongs to one and only one unit. For the social survey used here, an appropriate sampling unit is the *household*.

The complete list of sampling units is called a *frame*. The construction of the sampling frame is one of the major practical problems in conducting a survey. The person conducting the survey should have a critical attitude toward any list that has been routinely compiled for some purpose. Many times such lists are found to be incomplete or to contain an unknown amount of duplication. For example, if a city directory is used as the frame for the survey, households in housing units that have been built since the directory was compiled will be omitted. Similarly, housing units that have been subdivided into two or more apartments may only list one household. The drawing of a sample representative of the population requires an accurate sampling frame. For this reason, considerable time and effort should be devoted to this task.

## SELECTION OF THE SAMPLE

A variety of plans can be developed by which the sample may be selected. For each sampling plan that is considered, rough estimates of the sample size can be made from the requirements of the degree of precision determined earlier. From this, the relative costs and time requirements for each sampling plan can be calculated and compared.

## THE PRETEST

It is advisable to try out the questionnaire and the field methods on a small scale. This almost always results in improvement in the questionnaire and in the techniques of administration. Very often, the pretest will reveal problems that will be serious on a large scale. For example, a pretest may reveal that residents of a low socioeconomic neighborhood will not answer the door if the interviewer wears a tie, because this is the customary attire of bill collectors and door-to-door salesmen. The pretest also helps to revise estimates of costs and time requirements. If the pretest sample is properly selected from the population, it can be included as part of the overall survey, thus lowering costs and improving the statistical accuracy of the survey.

## ORGANIZATION OF THE FIELD WORK

The size of the survey, the techniques used in collecting data, and the amount of tabulation and analysis to be done will largely determine the extent and complexity of the organization required. Parten (1950: 126-129) provides the following useful rules which are applicable to every survey, regardless of size and complexity:

1. *Whenever possible, put instructions in writing.* This insures against making hasty and inconsistent judgments and precludes errors arising from forgotten instructions.
2. *Guard against too much division of authority and overlapping of responsibility.* Everyone should know (a) to whom he is responsible, (b) with whom he should consult if his instructions do not cover a

specific situation, (c) for what operation he is responsible, and (d) what types of cases should be turned over to the person specializing in "problem cases".

3. *Delegate some authority but also keep in touch with the details of the operation.* The survey director should always be aware that he is in the position of an executive of a business undertaking and follow good rules of business administration.
4. *Keep account of the time and cost of the survey.* Actual performance should be closely compared with the plans. If the survey is running ahead or behind the schedule or allocated budget, the plans should be adjusted accordingly.
5. *Set up a routine check of the quality of every operation.* It should be clearly understood by all survey personnel that all work will be checked (including the survey director's) and that incorrect work will have to be corrected. Standards of what constitutes "allowable" error should be clearly stated before the survey begins and strictly enforced. (Most sources of error should have been located in the pretest and adjustments made before the main survey begins.)
6. *After errors have been detected, see that someone is responsible for making corrections at every point affected.* Often a staff worker corrects a mistake where he happens to catch it without going back to other tabulations or data in which the same error may have been made. The result is that when analysis is begun, figures that should agree do not.
7. *Require production reports periodically on the quantity and type*



*of operations performed.* Frequent comparisons should be made between the amount of work planned and amount accomplished by each individual in the survey. Such comparisons allows the survey director to spot problem areas and bottlenecks and to take appropriate action before they become major problems.

8. *When possible, divide each job into several definite operations* which can be done by one worker and checked by another within a specified time.
9. *Avoid too many transcriptions of the data.* The more times the data are transcribed, the greater the probability of mistakes in copying and verification.
10. *Require the worker who does the operation to initial the record of it.* This makes it possible to determine who makes an error or whose record requires further clarification.

#### SUMMARY AND ANALYSIS OF THE DATA

If the previous steps have been carried out properly, this step should be almost routine. A final editing should be conducted at this stage in order to amend editing errors and to delete data that are obviously erroneous. Decisions about tabulating procedures are needed in cases where answers to questions were omitted by respondents and where erroneous data were deleted in the editing process. Then, the tabulations on the data are performed.

#### INFORMATION GAINED FOR FUTURE SURVEYS

The more information that is initially known about a population, the easier it is to devise a sample that will give accurate estimates. Any

completed sample is potentially a guide to improved future sampling, in the data it provides about the means, standard deviation, and about the costs involved in getting the data.

Also, things never go exactly as planned in a complex survey. The survey director should keep a detailed log so that he can have a record of the mistakes in execution of the survey and to see that they do not occur in future surveys.

## APPENDIX E

### LEGISLATIVE CONSIDERATION OF SOCIAL IMPACT

Congressional recognition of the potential social impacts of highway construction in urban communities has been a fairly recent phenomenon. Most attempts to compensate for adverse nonuser effects have been on an individual basis and financial in nature, ultimately intended to reduce public dissension. In assessing the success of the Uniform Relocation Assistance Act of 1970 in Texas, Buffington describes program policy (Buffington, 1974:1):

The expanded relocation program was designed to compensate and mitigate inconvenience to relocatees to such a degree that resistance to highway projects, at least in a purely personal basis, would be greatly reduced if not eliminated. The further effect would be to improve the highway agency's image and permit more efficient acquisitions of right-of-way.

However, consideration of social and environmental effects of freeway introduction as a part of the planning process has also been acknowledged. These directions of public policy are made apparent in the following Congressional Acts.

The Federal Aid Highway Act of 1962 addressed the two issues of financial compensation to relocatees and comprehensive planning. The Act authorized a limited program of relocation assistance to tenants and owners involuntarily moved from residential sites. In addition, moving payments of up to \$200 were awarded to residents, subject to the authorization of individual states (Levin, 1970).

Section 134 of the Act made federal funding dependent on a comprehensive planning framework developed cooperatively by states and local

communities for any highway project. The process was required to include an evaluation of all modes of transportation and their respective impacts on metropolitan development (Texas Advisory Commission on Intergovernmental Relations, 1974).

The Federal-Aid Highway Act of 1968 essentially extended the provisions of the 1962 Act. Relocation payments were increased with the provision of "additives" to the fair market value of residential units. Moving payments were also increased, and relocation services provided. Payments by each state were made mandatory. In addition, Congress propounded a new declaration of policy which called for an efficient relocation of persons displaced by federal highways and warned against the leveling of disproportionate burdens on small numbers of individuals (Hartman, 1972).

The Act also required state highway departments to review the social, economic and environmental impacts of highway construction during the hearing process. The results of this evaluation were to be submitted to the Bureau of Public Roads for their approval (Manheim, et al., 1971).

The Policy and Procedure Memorandum 20-8 developed by the Bureau of Public Roads in January of 1969 listed 23 of these potential social, economic, and environmental impacts of freeway introduction for consideration. The list, which was to be a starting point for examination of freeway effect, included such things as (U.S. Department of Transportation, 1969):

1. Aesthetics
2. Public health and safety
3. Residential neighborhood character and location
4. Social service costs
5. Natural and historic landmarks
6. Noise, air, water pollution
7. Displacement of families
8. Replacement housing

The National Environmental Policy Act of 1969 made mandatory the analysis of many freeway alternatives and their impacts on the urban area. Reporting requirements for state highway departments were outlined. In addition, the Act recommended the use of the interdisciplinary approach to impact assessment, including the use of social scientists and environmental designers to give adequate weight to the "unquantified environmental amenities and values" of urban areas.

Citizen involvement in the freeway planning process was encouraged in Section 2(b) of the Act which recommended public hearings and the dissemination of relevant information to the public on possible courses of action in an attempt to obtain the opinions and views of all interested parties.

The Federal-Aid Highway Act of 1970, in Section 136(b) directed the Secretary of Transportation to develop guidelines for the full evaluation of potential social, economic and environmental effects of a proposed facility. Moreover, it encouraged that the final selection among route alternatives be made in the public's overall best interest (Manheim, et al, 1971).

The current provisions for relocation assistance are based on the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. This Act unifies the relocation provisions of all displacing agencies, including highway and urban renewal departments. Compensation includes:

- (1) moving allowances of up to \$500;
- (2) additives to the fair market value of acquired property of up to \$15,000 for homeowners;
- (3) rent supplements of up to \$4,000, paid in four yearly installments, for tenants;

- (4) interest payments covering the differences in interest rates of new and old mortgages.

In addition, the Act provides for relocation assistance advisory services. These services include the dissemination of current information of the availability and cost of replacement housing. The displacing agency may also use its funds to construct replacement housing if shortages are apparent.

The Federal-Aid Highway Act of 1973 makes available funds for the further implementation of planning procedures initially recommended in Section 134 of the 1962 Act. In addition, it requires the submission to Congress of route feasibility study reports as well as reports of citizen participation studies. The Act also reflects a shift toward local decision-making by delegating significant responsibility to local and state governments (U.S. Department of Transportation, 1974a).