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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM
REPORT **156**

TRANSPORTATION DECISION-MAKING

A GUIDE TO SOCIAL AND ENVIRONMENTAL CONSIDERATIONS

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM REPORT **156**

TRANSPORTATION DECISION-MAKING

A GUIDE TO SOCIAL AND ENVIRONMENTAL CONSIDERATIONS

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Research Council was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as: it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communications and cooperation with federal, state, and local governmental agencies, universities, and industry; its relationship to its parent organization, the National Academy of Sciences, a private, nonprofit institution, is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

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The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

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FOREWORD

By Staff
Transportation Research Board

This report will be of particular interest to transportation administrators, engineers, and planners in all disciplines involved in transportation decision-making, as well as a variety of community groups. It presents an integrated approach for systematically incorporating social, economic, and environmental factors into transportation planning and decision-making. Professionals participating in system and project development will find parts of the report tailored to their needs. Transportation administrators will find sections of the report cover a number of policy and institutional implications associated with implementation of the procedural recommendations. Those involved in both project studies and agency management will find the overview of the proposed approach to be helpful in considering (a) the coordination of federal, state, regional, and local institutions; (b) the issues of equity; (c) the amelioration of negative impacts; (d) the easing of mobility problems for the transportation disadvantaged; and (e) the determination of costs that include social and environmental costs.

The increasing emphasis on social and environmental values has focused attention on the need for improving integration of a transportation facility with the community. To achieve desirable levels of integration, research was programmed by AASHTO to (a) develop a practical method for evaluating the immediate and long-term effects of highways on the social and environmental considerations of communities, and (b) test, evaluate, and refine the method by applying it to specific cases covering a range of situations. Because the process must maximize the probability that significant community values will, in fact, be considered, even if the state of the art does not allow all of these values to be measured quantitatively or precisely, the research emphasizes development of an approach in the context of the location process. Although the scope encompasses all types of highways, the study findings are applicable to all types of transportation facilities, many other public works projects, and all phases of planning.

The study was conducted by the Transportation Systems Division, Department of Civil Engineering, Massachusetts Institute of Technology. In the initial phase, funded in 1969, MIT prepared a study design that served as the working plan to provide solutions to meet the need for a pragmatic approach to the problem. The conclusion to the first phase was an unpublished draft report, "Community Values in Highway Location and Design: A Procedural Guide."

The second, and final, phase included (1) working with selected state highway departments to implement the proposed approach and adapt it to specific situations; (2) extending the approach for use in metropolitan area, statewide multimodal, and systems-level planning; (3) extending, testing, and refining the techniques set forth in the Procedural Guide; and (4) revising the Procedural Guide to reflect the additional knowledge.

The approach developed recognizes and considers the following ten elements

basic to the consideration of environmental and social values in transportation planning:

1. Differential effects.
2. Community values.
3. Community interaction.
4. Evaluation and reporting.
5. Consideration of alternatives.
6. Identification of impacts and affected interests.
7. Process management.
8. Interrelation of system and process planning.
9. Institutional arrangements and decision-making.
10. Implementation.

These elements are described in an overview and then discussed individually in detail. To assist in incorporating these elements into the transportation planning process, specific techniques that might be used are described. Most of the techniques can be adopted individually without difficulty. They are intended for use in developing and evaluating alternative transportation plans with the participation of other state and federal agencies and local citizens and officials. Some of these procedures are already current practice in some agencies. Several have been tried in other professions; others have been recommended in the published literature or were suggested in discussions with federal and state highway officials. Many more stemmed from direct observation of the problems transportation agencies are facing.

The report is closely related to the requirements of the process guidelines set forth in Federal Highway Administration Policy and Procedure Memorandum 90-4, and is structured to assist in the revision and implementation of action plans. The overview discussion of the ten elements is roughly analogous in scope and level of detail to the FHWA PPM. The remaining sections of the report correspond in many ways to the content of an action plan.

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An important component of the research was the field studies performed in cooperation with the Georgia Department of Transportation and the Michigan Department of State Highways and Transportation. This cooperation enabled the research staff to test, adapt, refine, and extend many of the research findings, and portions of the work reported herein are a direct result of this experience. Acknowledgment is made for the assistance and cooperation provided by all those with whom the researchers were privileged to work in Atlanta, Ga., and Lansing, Mich., particularly G. Robert Adams, George Boulineau, and Sid Davis.

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The California work permitted the initial field application of the proposed approach and served as the basis for the early research on system planning and institutional arrangements. Stuart Hill, Robert Fisher, Michael Stephenson, Charles Whitmarsh, and Larry Wieman were instrumental in this aspect of the research. Thanks are extended for the insights and opportunities that they and the other California people provided.

The Federal Highway Administration work was performed in conjunction with the development and implementation of FHWA Policy and Procedure Memorandum 90-4, Process Guidelines (Economic, Social, and Environmental Effects on Highway Projects). This provided additional opportunities to discuss the subjects of transportation and community values with transportation officials, community interests, and environmental groups from all over the United States. A great deal was learned from these interactions, which indirectly influenced both the form and substance of the NCHRP research. Thanks are extended to Michael Lash, Lee Mertz, Phil Darling, George Duffy, Fred Hemple, Russ Machol, and Rex Wells for the opportunity of working with them in this phase of federal highway development.

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TRANSPORTATION DECISION-MAKING

A GUIDE TO SOCIAL AND ENVIRONMENTAL CONSIDERATIONS

SUMMARY

Highway agencies in the United States are evolving into transportation agencies whose primary concern is the effective use of all modal facilities for the movement of passengers and freight. At the same time they are being asked to consider a broader range of possible direct and indirect social, environmental, and economic effects in all aspects of their decision-making. In almost all cases this has proven to be a difficult, and sometimes controversial, challenge.

This report presents an integrated approach for systematically incorporating social, economic, and environmental factors into transportation planning and design. Specific techniques are described for implementing the approach, together with examples illustrating their use in actual studies. Most of the techniques and procedures can be adopted without difficulty and, in fact, many represent the current practice in several states. Taken together, however, the proposals reflect an approach to transportation planning and decision-making that is significantly different from what has been traditional. Full implementation may require major changes in policies, work styles, and institutional arrangements.

Basic Findings

Three key findings form the basis of the proposed planning approach and supporting techniques, as follows:

1. *The over-all process through which social, economic, and environmental considerations are brought into transportation planning and decision-making is as important as the particular techniques used for predicting impacts.* The issues of "the environment" cannot be handled simply by hiring a few sociologists or ecologists; nor can opposition be eliminated simply by a program of citizen participation. Decision processes must be structured so that the inevitable conflicts among competing interests can be resolved with a full understanding of the choices made.

2. *Issues of social equity must be explicitly recognized and taken into account in transportation decision-making.* The planning, design, implementation and operation of a transportation system is as much a political process as it is a technical one: every decision involves the need to balance the gains to some interests against the losses to others. This requires that the total set of effects, on all groups, be considered using procedures that pay particular attention to the differential effects—how individual groups gain and lose.

3. *Different groups of people can be expected to have different interests and different priorities.* The importance people attach to a particular factor depends on the context. Consensus objectives, if they exist, are generally at too abstract a level to provide guidance to those responsible for specific choices among alternative actions. At the operational level, it can safely be assumed that different interests will have different priorities. Further, these interest groups may have only a partial understanding of their objectives, and their priorities are likely to be dynamic,

changing with time. As individuals are confronted with new issues they clarify their understanding of their preferences, and perhaps modify them through the process of making choices.

It is clear, then, that trying to determine "community objectives" in the abstract (by certain kinds of opinion polls, for instance) provides little help to transportation decision-makers. Similarly, techniques such as linear scoring functions and cost/benefit analysis that assign different weights (i.e., importance) to factors cannot be assumed to represent "public preferences." The best way to find out about people's transportation preferences is to ask them how they feel about specific alternatives and why they feel that way. By identifying who would gain and who would be harmed, the planner can modify alternatives to reduce negative impacts, increase benefits, and develop compensatory programs.

Planning Approach

The described approach and supporting techniques stress:

1. Community interaction. Early, effective, knowledgeable involvement of the public helps to clarify issues and identify both the incidence and magnitude of impacts and aids in the development and evaluation of proposals. Community interaction normally will utilize several techniques simultaneously as part of a coordinated and carefully managed program to gather information, distribute information, and interact with community groups. Emphasis should be placed on small group, face-to-face interaction and on the use of existing institutions and channels of communication. Agency staff must have an attitude of openness and responsiveness and be able to listen and learn from community inputs.

2. Evaluation and reporting. Evaluation can be defined as the process of periodically appraising alternative transportation program packages to ascertain their acceptability, desirability, and feasibility; to identify issues, tradeoffs, and major areas of uncertainty; and to determine future tasks for the planning staff. Evaluation should take into account the incidence of all significant impacts and the different viewpoints held by agencies, officials, and concerned groups and individuals. Evaluation should occur throughout a planning process to assist in structuring the learning that takes place among the participants. A systematic evaluation process is an important management tool in determining matters requiring further study, in controlling the quality of work performed, and in setting priorities for subsequent activities. Documentation of work performed and decisions made is crucial to effective evaluation. Required reports such as the Environmental Impact Statement can then become natural products of a planning process.

3. Consideration of alternatives. A range of transportation improvements involving various types of highway facilities, other modes, transportation regulations, controls, and constraints, as well as the no-build option, should be examined in system- as well as facility-oriented studies. Alternatives should serve as a catalyst to meaningful and constructive debate in the community of affected interests and should be a focal point for bringing out issues and clarifying community objectives. Communities generally have a unique and valid understanding of their problems and of potential solutions, and should be encouraged to develop alternative transportation-related proposals. These proposals should be studied by an agency in sufficient detail to determine their feasibility, desirability, and equity.

4. Identification of impacts and affected interests. Timely identification of the nature, magnitude, and incidence of potential social, economic, and environmental effects facilitates the development of alternatives that avoid or minimize adverse

effects and that take full advantage of opportunities to increase benefits. The process of identifying, analyzing, and evaluating effects must be designed to account explicitly for qualitative as well as quantitative information and to recognize the uncertainty associated with predictions. Numerous prediction procedures are available, ranging from quick approximation methods to precise measurement tools, and the choice should be a function of the immediate needs of the study.

5. Process management. Effective use of expertise and resources, both of the transportation agency and of other institutions and agencies, is necessary to achieve the "systematic interdisciplinary approach" required by the National Environmental Policy Act of 1969. A process should be decisive, yet managed in a style that will enable it to be open, dynamic, flexible, creative, and responsive to changing conditions and the needs of the community. Important qualifications for a project or study manager are the ability to manage an interdisciplinary group, understanding in at least a general sense the language and techniques of each discipline, and the ability to work with community groups effectively and constructively.

6. Institutional arrangements and decision-making. The arrangement and organizational structure of institutions influences the manner in which social and environmental effects are investigated, and to a large degree determines the effectiveness with which these considerations are incorporated into transportation planning and decision-making. Responsibilities for conducting studies, providing data, preparing reports, and making decisions should be allocated so as to maximize efficiency and effectiveness, promote coordination, encourage public input, provide equal access to decision-makers and the decision-making process, provide a clarity of decision-making authority, and permit an orderly process of appeal of transportation decisions. Conflict is inevitable among interests and institutions; the structure should make it possible for such conflicts to be resolved constructively.

A desirable pattern of institutions, however, is not something that can be determined in the abstract, but must be tailored to the local situation. In developing institutional arrangements, a state can play a strong role in providing incentives to local and regional institutions to stimulate the development of capabilities that would allow them to assume increased responsibilities for transportation planning and design.

System Planning

Most transportation agencies have found it difficult to deal with region-wide effects during project studies; many options desirable from an environmental viewpoint already may have been foreclosed, and many adverse effects already may have been established by system planning decisions. To overcome these problems, increased attention must be given to social and environmental considerations in system planning decision-making, especially in decisions on programming.

System planning should be viewed, not as a phase of planning preceding project studies, but as a framework within which project decisions can be made, serving to coordinate ongoing project studies. This can be achieved by emphasizing corridor and subarea studies, by preparing a system environmental report, and through a redefinition of the traditional system plan format.

System plans should be defined using a strategy of implementation decisions being made over a period of time, thereby enabling system-level options to be kept open longer. Plans formulated according to such staged strategic commitments can more readily respond to changes in conditions as portions of a system are brought into operation or as new information becomes available, than can target-year master plans.

Periodic review and reassessment of transportation decisions should be built into all stages of system and project studies to provide a mechanism of accounting for new information and changes in previous assumptions or estimates. The programming activity represents a key forum for this reconsideration. The programming process should produce a single program document covering all modes and showing the schedule of all transportation actions, including capital investments in facilities, service improvements, and planning and design studies.

Process Objectives

It is proposed that the objectives of all phases of a transportation planning and design process should be:

1. To clarify issues of choice.
2. To fully inform decision-makers.
3. To achieve substantial, effective community agreement on a course of action that is feasible, equitable, and desirable.

Four-Phase Strategy

Implementation of the findings and attainment of the proposed process objectives require sufficient flexibility in the planning process to facilitate modifications as new knowledge is developed. Although the specific tasks to be carried out must be determined for each study, a four-phase strategy is recommended as providing a workable framework for any stage of a planning process, as follows:

1. Study design.
2. Exploration of alternatives.
3. Detailed analysis.
4. Choice.

Roles of the Transportation Professional

The proposed approach assigns broad duties to the transportation professional. In addition to the traditional responsibility for developing technical plans, transportation professionals also need to assume the following roles:

- Community advisor.
- Ombudsman and spokesman.
- Impartial negotiator.
- Agent of, and advisor to, the decision-making authority.

Applicability

The planning approach and supporting techniques are based on investigations of current planning and design procedures in a cross section of states; analysis of the state-of-the-art of research; review of legislation, administrative directives, and court decisions; and performance of research studies. The recommended approach and many of the techniques have been used in field applications performed cooperatively with the states of Georgia, Michigan, and California. They have been developed specifically for highway decisions at both system and project levels. Although the research initially was oriented to the construction of freeway-type facilities in urban areas, subsequent phases have examined smaller-scale projects, rural settings, and different geographic regions. The findings and recommendations should be applicable to the operations of all national, state, and metropolitan highway organizations

and to the full range of service improvements. The results should be adaptable with few modifications to the planning of other transportation modes (transit, air, rail). In addition, the approach should be applicable in fields other than transportation; that is, power plant and refinery siting, urban development flood control projects, and similar public works decisions. In sum, the basic principles should be valid for the spectrum of public policy problems.

Use of the Guidelines

The discussions of this report are not intended as a rigid set of specifications to be adopted as a whole. It is expected that each agency will modify and adapt the approach and techniques described to its own unique conditions and style of work.

Chapter Two presents an overview of the proposed approach. Chapter Three presents detailed procedural findings to aid in system and project development. Chapter Four, intended primarily for agency management, discusses detailed findings with respect to the policy and institutional implications of the procedural recommendations. Major federal requirements for the treatment of social and environmental effects during highway planning and design are summarized in Appendix A. Technical issues associated with the prediction of certain environmental and social impacts are discussed in Appendix B.

CHAPTER ONE

INTRODUCTION AND RESEARCH APPROACH

THE CHANGING ROLE OF HIGHWAY AGENCIES

For much of this century, highway agencies in the United States have had a broad mandate to build roads. They first were asked to "get the farmer out of the mud"; more recently, their job has been to create a network of fast, safe, efficient highways spanning the country. These urgent needs have, for the most part, been met, and once again the mandate is changing.

Highway agencies, including those in predominantly rural areas, are being asked to examine an expanding range of transportation options. Various types and levels of capital investment in fixed facilities are being studied. In addition, operating, pricing, and regulatory policies, vehicle control strategies and experiments, and demonstration projects are being considered. Major attention is being devoted to the interrelationships among all modes of transportation—highways, air, rail and various transit technologies—and a number of agencies now have the authority to consider ways of increasing the efficiency of these other modes. The concern is with effective utilization of transportation facilities as a multimodal system to move passengers and freight. Thus, highway agencies are placing greater emphasis on utilizing all available modes and options to meet the need for better transportation service.

THE IMPACTS OF TRANSPORTATION

Within this broadened mandate, transportation agencies are being asked to systematically identify a wide range of possible direct and indirect social, economic, and environmental effects and to give these effects increased consideration in their decisions on agency actions. In almost all cases, this has proven to be a difficult and frequently controversial challenge. For, although modern transportation facilities provide major direct benefits—fast, efficient movement of people and goods, unprecedented mobility and access, and increased safety—like most physical systems they also introduce a multitude of other effects on the human and natural environment. Some of these effects may be advantageous, as, for example, when a road serves as a structuring device to separate industries from homes or is used to shape and direct new development. Sometimes, however, transportation facilities impinge upon matters that indi-

viduals and communities value highly, such as conservation of resources, preservation and enhancement of neighborhoods, and cleaner air. When this is the case, there is the potential for conflict among competing objectives.

The impacts of transportation facilities have come under increasing scrutiny as concern for the natural and social environment has moved to the forefront. Highways, because of their central role in American transportation, have received particular attention; but, increasingly, projects such as the construction of rail rapid transit systems and the abandonment of rail lines are receiving equally high attention as the social and economic impacts of such actions become more clearly understood.

In recognition of the need to account for social, economic, and environmental factors in the planning and development of projects, transportation professionals have devoted much effort to improving procedures for the identification and measurement of impacts and the abatement of potentially adverse effects. At the same time, federal and state laws and directives requiring public involvement, coordinated comprehensive urban planning, special treatment of sensitive lands, and detailed reports of the probable effects of proposed actions have emphasized the widespread concern that transportation projects be planned so as to minimize, if not avoid completely, any adverse consequences.

Although significant advances are being made in the development and refinement of methods for dealing with social and environmental factors, there is widespread recognition that improved analysis tools by themselves cannot ensure that transportation proposals will fully reflect environmental considerations and community interests. The importance of *early* information on potential impacts and community viewpoints has become apparent; attempts to respond to community wishes and to mitigate adverse effects by modifying substantially completed proposals have proven both costly and relatively ineffective. There is a clear need to tie together social and environmental assessments and the decisions that are made on transportation proposals, so that the choices made reflect the knowledge gained through studies.

In short, the over-all process through which social, economic, and environmental considerations are brought into transportation planning and decision-making is as important as the particular techniques used for predicting impacts.

PROCEDURAL CHANGES IN TRANSPORTATION PLANNING AND DECISION-MAKING

In recent years a number of changes have occurred in the procedures through which transportation projects are developed. Some of these changes are the direct result of recent environmental laws and associated judicial decisions; many others are the products of agency actions taken to increase responsiveness to social and environmental concerns.

Among the changes that are occurring are the following:

- Responsibility for transportation studies is being redistributed among state, regional, and local institutions, with state agencies assuming a larger role in transit planning and with local and regional institutions taking part in decisions that formerly were primarily the state's responsibility.
- Citizens are more actively participating in transportation planning, are requesting full access to information developed in project studies, and are emphasizing the need to minimize social and environmental disruption.
- Transportation agencies are directing more effort toward coordination of transportation plans with the plans and proposals of other state, regional, and local agencies.
- Transportation agencies are devoting increasing attention to issues of equity, the disaggregate effects of transportation proposals, and means of ameliorating negative impacts and easing the mobility problems of the elderly, the young, the poor, and the disabled.
- The allocation of scarce resources is becoming a vital concern in transportation planning and decision-making, and the concept of project cost has been expanded to include consideration of the cost of eliminating or minimizing adverse effects.

These changes mark a shift in orientation from the traditional almost exclusive concern with projects, the products of the transportation planning and decision-making process, to an emphasis on the process itself. And transportation agencies are not alone in their concern for improving these processes; the quality of the transportation planning process is receiving growing public attention.

THE ISSUE OF PUBLIC CONFIDENCE

Many agencies are finding that the degree of public confidence they command depends in large part on the acceptability of their planning and decision-making procedures. Transportation agencies have taken a number of actions that have increased public confidence in their procedures: many have established environmental units and have broadened disciplinary capabilities; innovative experiments in citizen participation have been undertaken; new study procedures are being initiated. In addition, the Process Guidelines (FHWA PPM 90-4) and the resultant state Action Plans demonstrate major commitments to change by the states and by the Federal Highway Administration (*26, 27*).

However, although these are important and constructive steps, many constraints and problems still exist. Actual practices change slowly within organizations as large and complex as state transportation agencies.

Two major concerns relating directly to public confidence often are expressed: first, that social and environmental factors are not being considered centrally enough in reaching decisions about transportation; second, that the range of alternatives investigated is unduly limited. In many states, some segments of the public hold these sentiments so strongly that there is an effective base of anti-highway opinion in the form of politically active citizen groups that frequently oppose highway improvements. Segments of the public no longer have confidence in the decisions made by highway agencies and, rightly or wrongly, highway agencies are perceived as being opposed to many of the things that these elements of the public feel to be

important, resulting in conflicts over the priorities for allocation of environmental and fiscal resources.

Increasingly, people are rejecting the notion that all "needs" must be satisfied. They, along with the Congress, are requesting that "need" not be based only on the provision of fast, safe, and efficient transportation, but that transportation decisions also account for the costs of adverse social, economic, and environmental effects (*67*). This implies that the option of no new highway construction must be explicitly considered, along with different standards or types of facility improvements, operational improvements, and the relation to other transportation modes.

Thus, the challenge remains for transportation departments not only to successfully and expeditiously implement their Action Plans, but also to initiate further improvements in their planning and decision-making processes.

RESEARCH APPROACH

The general approach and specific techniques described here result from research performed since the fall of 1968 by the Transportation and Community Values Project of the Massachusetts Institute of Technology. Research sponsorship during this five-year period has included the American Association of State Highway and Transportation Officials through the National Cooperative Highway Research Program, the California Department of Transportation, and the Federal Highway Administration of the U.S. Department of Transportation. The conclusions developed are based on investigations of current planning and design procedures in a cross section of both rural and urban states; analysis of the state-of-the-art of research; review of legislation, administrative directives, and court decisions; and the performance of individual research studies. The recommended approach, including many of the techniques, has been used in field applications performed cooperatively with the states of California, Georgia, and Michigan. These efforts provided the invaluable opportunity of working closely with state personnel in testing, adapting, refining, and extending many of the concepts and techniques developed during the early phases of the research. The resulting report is designed to meet presently recognized needs while remaining sufficiently flexible to respond to future developments.

The work, for which this constitutes the final report, has been conducted as NCHRP Project 8-8(3), "The Impacts of Highways Upon Environmental Values." The objectives of the research were to develop a practicable method for evaluating the effects of various types of highways on environmental values, test and refine the method through application, and establish guidelines for use in highway planning, location, and design. The research has proceeded in three phases. Phase I (1968-69) was an initial analysis, study design, and development of a detailed research work program. This phase built heavily on highway planning experiences in Seattle, Wash.; Houston, Tex.; Baltimore, Md.; Kansas City, Mo.; Boston, Mass.; San Francisco, Cal.; and St. Louis, Mo. A basic approach for highway project location and design was developed in Phase II, and is described in a September 1971 interim report, "Community Values in Highway Location and Design: A Procedural Guide" (*11, 48, 50, 51*). During Phase III (1971-73) this basic approach and supporting procedures were field tested in cooperation with the Georgia Department of Transportation and the Michigan Department of State Highways and Transportation, extended to statewide and urban area system planning and to rural conditions, and refined based on the results of the field tests.

Specific examples from both the Georgia and Michigan cooperative activities are included in Chapters Three and Four. In brief, the activities with Georgia DOT focused on a potentially controversial north-south freeway proposed for the west side of Atlanta. The purpose of the effort, performed in association with Atlanta University, the Atlanta Regional Commission, and the Metropolitan Atlanta Rapid Transit Authority, was to develop a study design for the west Atlanta subarea, which encompasses approximately one-half of the city's population. The work, whose aim was both to define the scope of the study and to develop a widely accepted study process, emphasized public involvement and was multimodal.

The Michigan activities involved participation in a 75- by 100-mile regional transportation study in the northwest portion of Michigan's lower peninsula and focused on the possible upgrading of two major north-south state highways. The area is rural in character and includes major recreational sites that serve as a base for the state's tourist industry. The study investigated a range of possible transportation improvements and identified potential social, economic, and environmental impacts of both a local and statewide character. The effects of improved highway facilities on regional economic development and environmental quality were of particular importance.

The California studies were initiated in 1970, preceding the Georgia and Michigan field applications, and were concerned with application of the interim research results to the location of a possible major new expressway in the Los Angeles area. Other major elements of the California research were the development of procedures and techniques for systematic treatment of community and environmental factors in statewide planning and programming, in urban area planning, and in transportation corridor analyses. In performing the research, attention was given to institutional implications as well as to procedural aspects and to the development of improved mechanisms for effectively integrating system and project studies (*52, 54, 62, 64, 63, 31, 21, 32*).

The Federal Highway Administration research is based on Section 109(h) of Title 23, United States Code, which calls for "guidelines designed to assure that possible adverse economic, social and environmental effects relating to any proposed project on any Federal-Aid system have been fully considered in developing such a project." The MIT research team developed recommendations with respect to the processes through which environmental effects are to be considered in highway planning, location, and design. These recommendations resulted in issuance, in September 1972, of FHWA Policy and Procedure Memorandum 90-4, "Process Guidelines for Consideration of

Social, Economic and Environmental Effects" (*67*). Included as part of this study was the preparation of technical reports, training aids, and other materials to provide assistance to state highway agencies and to FHWA in implementing the guidelines (*66, 76, 71, 72, 23, 9*).

The Process Guidelines resulted directly from the NCHRP research and reflect the experiences gained in field applications of the research. The FHWA sponsorship has provided numerous additional opportunities to review findings and recommendations with U.S. Department of Transportation staff, highway and transportation agency personnel in many states, representatives of related federal and state agencies, environmental and public interest groups, and staff members of the Congressional Public Works committees.

The three cooperative field applications and the many meetings with individuals having an interest or responsibility in transportation have provided invaluable insights into transportaton agency operations and greatly aided the development of the approach and techniques described in this report.

PURPOSE OF THE REPORT

This report presents an integrated approach for systematically incorporating social, economic, and environmental factors into transportation planning and decision-making that stresses:

- Timely identification of the nature, magnitude, and incidence of potential social, economic, and environmental effects so that in all phases of transportation planning, alternatives may be developed that avoid or minimize adverse effects and that take full advantage of opportunities to increase benefits.
- Early, effective, knowledgeable involvement of the public to clarify issues and to aid in the development and evaluation of proposals.
- Effective use of expertise and resources, both of the transportation agency and of other institutions and agencies, with a maximum of flexibility and openness.
- Consideration of a range of transportation improvements involving various types of highway facilities, other modes, transportation regulations, controls, and constraints, and the no-build option.

Because transportation planning is conducted in a variety of institutional and environmental settings and serves a range of needs, the discussions emphasize over-all procedures—strategies, work styles, ways of viewing problems —that should be generally applicable to transportation agencies at the national, state, regional, and local levels of government, and in rural as well as urban settings. To assist in making these procedures operational, specific techniques that might be used in implementing the approach also are described.

The procedures are intended for use in developing and evaluating alternative transportation plans with the participation of other state and federal agencies and local citizens and officials. Some of these procedures are already current practice in some agencies. Several have been tried in other professions; others have been recommended in the published literature or were suggested in discussions with federal and state highway officials. Many more stem from direct observation of the problems transportation agencies are facing.

A major objective is to present recommendations that can be put into immediate operation. Thus, most of the methods and techniques can be adopted individually without difficulty. Taken together, however, the proposals reflect a philosophy of transportation planning and decision-making that is significantly different from what has been traditional. The over-all approach, then, has far-reaching implications for the transportation professional.

USE OF THE REPORT

The report is intended to satisfy the needs and interests of transportation administrators, engineers, other disciplines involved in transportation decision-making, and also a variety of community groups. The discussions are not intended as a rigid set of specifications to be adopted as a whole. It is expected that each agency will modify and adapt to its own unique conditions and style of work the approach and techniques described.

It is not necessarily intended that the report be read sequentially from cover to cover, though that may be desirable in some instances. In reality, the various sections have been designed so that they can be read and used separately.

Chapters One and Two present an overview of the proposed approach, developing recommendations for systematic and effective incorporation of social and environmental considerations in transportation planning, design, and decision-making. As such, this material is applicable to both the administrator and those involved in project studies and agency management.

Chapter Three is oriented specifically to those actively participating in system and project development. It discusses the recommendations and basic approach in greater depth in the four major activity areas of community interaction, evaluation and reporting, consideration of alternatives, and identification of impacts and affected interests. For each activity, specific procedures and techniques that can be used in implementing the general recommendations are presented, and examples illustrating the use of various procedures on actual studies are described.

Chapter Four is directed at those individuals whose primary responsibility is agency management. It discusses a number of policy and institutional implications associated with implementation of the procedural recommendations. Areas covered are process management, the interrelation of system and project planning, institutional arrangements and decision-making, and recommendations for implementation.

Chapter Five discusses application experience with the proposed approach and its supporting procedures. Chapter Six draws some general conclusions and suggests the research indicated as necessary to implementation of the procedures.

Legal requirements to be satisfied by a planning and design process are summarized in Appendix A. Appendix B

discusses technical issues associated with the prediction of certain environmental and social impacts.

The report is closely related to the requirements of the Process Guidelines, Federal Highway Administration Policy and Procedure Memorandum 90-4, and is structured to assist in the revision and implementation of Action Plans (*26*). The section on "Social and Environmental Considerations in Transportation Decision-Making" (Chapter Two) is roughly analogous in scope and level of detail to the FHWA PPM. The remaining sections of Chapter Two and all of Chapters Three and Four correspond in many ways to the content of an Action Plan.

CHAPTER TWO

FINDINGS—OVERVIEW

SOCIAL AND ENVIRONMENTAL CONSIDERATIONS IN TRANSPORTATION DECISION-MAKING

Several findings form the basis of the approach to planning set forth in this report. These findings, in the form of basic planning guidelines, are introduced here and are discussed in detail in Chapters Three and Four.

Differential Effects

Any decision in transportation planning affects many groups. Choices on what transportation mode is utilized, what kind of service is provided, which of several possible corridors is selected, what decisions are made about location and design treatment of a facility, and even the determination of design standards, although seemingly only technical decisions, almost always have significant social and environmental implications.

The total set of these effects, on *all* groups, must be considered using procedures such as those described in Chapter Three, with particular attention paid to the *differential* effects—which groups gain and which lose. Although a change in the transportation system (such as the upgrading of a highway) may bring benefits to many people in an area, some particular groups may bear a high cost or receive little or no benefit.

Every decision about highways will involve the need to balance gains to some interests against losses to others. It is essential that the process of planning, designing, implementing, and operating transportation systems explicitly recognize and take into account such issues of social equity. *The planning and design of transportation systems is as much a political process as it is a technical one.*

Community Values

There is no single set of values underlying any community. Different groups of people can be expected to have different interests and different priorities, and the importance people attach to a particular factor depends on the context. For example, one group might generally prefer the development of recreation facilities to the preservation of wilderness areas; another group might generally prefer just the opposite. But in a specific instance people who are usually supporters of wilderness preservation might prefer building a park.

Although there may be consensus objectives, these are generally at such an abstract level as to be nonoperational from the point of view of the need for distinguishing among alternative actions. At the operational level it can safely be assumed that different interests will have different priorities. Further, these interest groups have only a partial understanding of their objectives, and their priorities with respect to these objectives are dynamic, changing over time. As individuals are confronted with new issues or new opportunities to make choices, they clarify their understanding of their preferences—and perhaps change them—through the process of making choices.

Most people have difficulty in formulating meaningful, consistent statements of objectives. In fact, most people probably have preferences that are inconsistent, until that point where by having to make a choice they must impose a certain partial consistency on their preferences. In particular, if asked to express their preferences in the abstract in terms of the relative weights to be given to different attributes of highway projects—for example, construction cost versus safety versus parkland takings versus social disruption—most people will have difficulty formulating a complete, exhaustive, consistent set of weights.

When confronted, however, with a small number of explicit alternative actions or projects and also with statements of their likely impacts, most people can with some introspection reach a conclusion about their preferences for the several alternatives. This requires far less information about their underlying, partially-known values; they need only express preferences about a small number of differences, not about all possible combinations. Thus, by examining and weighing the differences between alternatives, information about preferences and community values is gradually clarified.

It is clear, then, that trying to determine "community objectives" in the abstract (by certain kinds of opinion polls, for instance) is a futile exercise. Similarly, tech-

niques such as linear scoring functions and cost/benefit analysis which assign different weights (i.e., importance) to factors cannot be assumed to represent "public preferences." Not only do different people have different preferences, but any one person's preferences also depend on the choices available and the specific effects of those choices.

The best way to find out about people's transportation preferences is to ask them how they feel about specific alternatives and why they feel that way. Some people will stand to gain from a particular alternative; others will lose. By identifying who would gain and who would be harmed, the planner can modify alternatives to reduce negative impacts and increase benefits and can develop compensatory programs. (Cf. Chapter Three)

Community Interaction

Early, effective informed participation of the community—federal, state, and local agencies and officials, interest groups, and individual citizens—is necessary in all phases of transportation planning, starting during statewide and urban area system planning, and continuing through corridor, location, and design studies, and even into construction. Such interaction helps the transportation agency to identify and predict both the incidence and the magnitude of social and environmental impacts and to learn what issues various people consider to be important. Also, community groups can serve as a useful source of suggestions for solutions to transportation and related community problems.

The public must provide inputs to the decision-making process. Deliberate efforts to search out differing viewpoints and to secure participation of a wide variety of groups and individuals are needed in order for a decision-maker to be able to consider differing public preferences effectively.

Different levels of participation should be provided, depending on interest. Participation may range from general awareness to periodic attendance to intensive involvement.

A community interaction program normally will use several techniques simultaneously as part of a coordinated and carefully managed program to gather information, distribute information, and interact with community groups. Emphasis should be placed on small group, face-to-face interaction and on the use of existing institutions and channels of communication. Agency staff must have an attitude of openness and responsiveness and be able to listen and learn from community inputs. (Cf. Chapter Three, section on "Community Interaction")

Evaluation and Reporting

Evaluation as described in Chapter Three, section on "Evaluation and Reporting," encompasses the comparison of alternatives and the analysis of impact data, taking into account the incidence of all significant impacts and the different viewpoints held by other agencies, officials, and concerned groups and individuals.

Evaluation should assist in structuring the learning that takes place among all the participants in a transportation planning process by identifying significant tradeoffs, clarifying issues of choice, and indicating major areas of uncertainty.

Evaluation and reporting should occur throughout a planning process. In this way, a systematic evaluation process is an important management tool in determining matters requiring further study, in controlling the quality of work performed, and in setting priorities for subsequent activities.

Documentation of work performed and decisions made is crucial to an effective evaluation process. By recording such information, required reports like the Environmental Impact Statement become natural products of evaluation.

Consideration of Alternatives

A wide range of both long- and short-term courses of action are available in system- as well as facility-oriented transportation studies and should be examined as part of any decision-making process. These include investment in fixed facilities, operating policies, pricing policies, and use of new technologies. In addition to direct transportation system options, there are a variety of options available regarding the activity system, including land-use controls and staggered work hours.

Transportation options should be considered to be only one part of a more comprehensive course of action, being effectively coordinated with such nontransportation components as replacement housing, impact amelioration programs, and joint development.

Alternatives should be developed and presented throughout technical studies as a catalyst to meaningful and constructive debate in the community of affected interests, and to assist in bringing out issues and clarifying community objectives. The development of alternatives should be initiated early enough in the process, using the kind of techniques demonstrated in Chapter Three, section on "Consideration of Alternatives," so that this debate can influence further development and refinement of alternatives, with adequate time to explore the issues that different segments of the community think are important.

It is especially crucial that the alternative of no new construction be examined fully. This examination should be consistent with that given other kinds of alternatives and should provide the basis for use of the option as a reference point in defining potential beneficial and adverse impacts.

Alternatives proposed by affected interests should be studied in sufficient detail to determine their feasibility, desirability, and equity. This investigation should be consistent with the attention given to alternatives developed by professional staff. Communities generally have a unique and valid understanding of their problems and of potential solutions, and should be encouraged to develop alternative transportation-related proposals.

Identification of Impacts and Affected Interests

In analyzing transportation options, a wide variety of impacts must be considered, including user-oriented consequences such as travel time, operating costs, and level of service; facility-related factors such as capital investments, maintenance costs, and safety; and social, economic, and environmental factors such as land use and activity effects,

neighborhood character and community cohesion, displacement of families and jobs, air quality, noise, effect on tax base, property values, public services, energy consumption, and disruption of ecosystems. Identification and study of impacts must occur in coordination with technical studies so that alternatives may be modified to take advantage of beneficial opportunities and to avoid or reduce potentially harmful consequences. Numerous procedures to predict various impacts are available, ranging from quick approximation methods to precise measurement tools, and the choice of prediction methodology should be a function of the needs of the study. (Cf. Appendix B)

Not all social, environmental, and economic impacts can be expressed in quantitative terms and measured with a high level of accuracy. The process of identifying, analyzing, and evaluating such effects, therefore, must be designed to account explicitly for qualitative information and to recognize uncertainty using the approaches described in Chapter Three, section on "Identification of Impacts and Affected Interests."

It is essential that the differential effects of impacts be determined so that effective programs to mitigate adverse effects can be developed. Impact prediction should be carried out in association with public involvement activities because many impacts can be identified most readily through interaction with the affected community and the significance of many impacts is dependent on personal values and priorities. Other agencies can contribute much useful information and may be able to provide technical assistance and resources.

Process Management

A transportation planning process must be managed so as to provide the "systematic interdisciplinary approach" required by Section 102(2)(A) of the National Environmental Policy Act of 1969.

A process should be decisive, yet managed in a way that will enable it to be dynamic, flexible, creative, and responsive to changing conditions and to the needs of the community. Personnel, fiscal, and time resources should be allocated periodically, based on an explicit establishment of objectives and determination of needs. A major responsibility of management is the development and revision, as necessary, of a process strategy and associated work program. (Cf. Chapter Four, section on "Process Management").

Important qualifications for a project or study manager are the ability to manage an interdisciplinary group, understanding at least in a general sense the language and techniques of each discipline, and the ability to work with community groups effectively and constructively.

The qualifications for project management and for management at various levels within a state transportation organization, especially at top levels, should allow these positions to be filled by professionals other than civil engineers. There is no reason why, because of educational background, engineers are inherently more competent to deal with transportation problems than are many other professionals. This is not to say that engineers should be excluded from these important positions; rather that no specific advantage or requirement should be given to those with engineering background as opposed to personnel with other kinds of professional backgrounds.

Interrelation of System and Project Planning

System plans as defined and illustrated in Chapter Four, section on "Interrelation of System and Project Planning," refer to the sum of the facility, operating, and policy changes proposed over time for the transportation system of a particular geographic region. System plans should be developed on a statewide basis as well as for urban or regional areas, and system planning studies should treat all modes together with emphasis on their complementary and competitive relationships.

A proposed project improvement, be it the introduction of a new modal system or an operational improvement to an existing roadway, should be viewed as part of the total multimodal system of a region; in competition with other modes (existing or new), and with full consideration of the total door-to-door trip, including access modes. The key characteristics of a transport system are the service it offers to prospective users and its costs (direct and indirect, including externalities such as social and environmental impacts). That is, technology hardware is a means and not an end.

Changes in demand, in technology, and in public priorities should be anticipated, and system planning should explicitly take into account the uncertainties inherent in long-range forecasts. System plans should be defined using a strategy of implementation decisions being made over a period of time, thereby enabling system-level options to be kept open longer. As portions of the system are brought into operation and as new or revised data become available, the implementation and decision-making schedule may be revised. Plans formulated acording to such staged strategic commitments can more readily respond to changes in conditions and new information than can target-year master plans based on highly uncertain estimates. Although a master plan for some future year has certain advantages in that it is tangible and easy to visualize, it tends to foreclose future options by current decisions, and to remain fixed over time, unable to respond to new information, revised impact estimates, or changes in such contextual elements as land use, socioeconomic activity patterns, and operating policies.

Coordination among various phases of system and project planning should be increased. Because of the length of the planning process, there is a need for systematic contingency planning, and for a project programming process that explicitly incorporates both budget constraints and community/environmental considerations.

Periodic review and reassessment of transportation decisions should be built into all stages of system and project studies to provide a mechanism of accounting for new information and changes in previous assumptions or estimates. The structure of the decision process and the relationships among institutions should be specifically designed to stimulate this review and reassessment.

The programming activity represents a key forum to reconsider system plans in light of ongoing project studies and also to reconsider current project studies in light of

recent system planning. Programming thus represents the most effective means of integrating system and project studies. The programming process should produce a single program document covering all modes and showing the schedule of all transportation actions, including capital investments in facilities, service improvements, and planning and design studies.

Institutional Arrangements and Decision-Making

The arrangement and organizational structure of political and technical institutions as shown in Chapter Four, section on "Institutional Arrangements and Decisions," influences the manner in which social and environmental effects are investigated in transportation planning and decision-making and to a large degree determines the effectiveness with which these considerations are incorporated therein. Responsibilities for conducting studies, providing data, preparing reports, and making decisions should be allocated in such a way so as to maximize efficiency and effectiveness, promote coordination, encourage public input, provide equal access to decision-makers and the decision-making process, provide a clarity of decision-making authority, and permit an orderly process of appeal of transportation decisions. Conflict is inevitable among interests and institutions, and the structure should make it possible for such conflicts to be resolved constructively.

Existing institutional arrangements and organizational structures should be examined to determine whether in fact they are consistent with these ends and to discover ways of improving their capacities to deal effectively with social and environmental considerations. In some cases, redefinition of responsibilities, reorganization, or creation of new institutional structures may be desirable.

A state can play a strong positive role in providing incentives to local institutions at the regional and subregional level to stimulate the development of capabilities that would allow them to assume increased responsibilities for transportation planning and design.

A desirable pattern of institutions, however, is not something that can be determined in the abstract. but must be tailored to the local situation.

Implementation

Determining what change should occur (what to do), is easier than determining how to bring about that change (how to do it). Implementation of major changes of the nature proposed requires a carefully coordinated and sequenced set of changes in training, policy, personnel, and practice executed over a period of time. (Cf. Chapter Four, section on "Implementation.") The process of implementing changes is as important as the changes themselves.

A number of organizational barriers exist which work against change in general and, in particular, the introduction of increased environmental sensitivity within transportation agencies. A social system tends to react to new changes in ways that keep old policies and practices stable. Major changes such as those being recommended tend to provoke complex and compensating reactions. Unless the interrelationships between different parts of an organization are accurately identified, the organization may react to subvert the intended change. A coherent diagnosis of the organization can help those who initiate change to anticipate these reactions and plan for them.

OBJECTIVES OF THE PLANNING AND DESIGN PROCESS

The guidelines enumerated in the previous section must be reflected in transportation planning agencies and decision-making processes if public confidence is to be maintained. Providing transportation tailored to the needs of the people it serves is the ultimate goal of the transportation planning process; but ensuring that this goal is reached requires far more than simply planning and implementing facilities. Decisions on transportation must reflect not only transportation needs, but also the needs to preserve the environment and to treat all parties equitably.

To do this, the activities of community interaction, evaluation, consideration of alternatives, impact prediction, management and decision-making must be treated as integral components of a planning process. The recommended approach reflects a particular set of objectives. Specifically, the objectives of the transportation planning and design process should be:

- To clarify issues of choice.
- To fully inform decision-makers.
- To achieve substantial, effective community agreement on a course of action that is feasible, equitable, and desirable.

Clarifying Issues of Choice

Transportation decisions significantly affect the future of the area involved: its potential for growth and development; its businesses, job market, and economic structure; its environmental systems, both ecological and manmade; and its people's daily lives. Conflicting interests and priorities are bound to exist. Some groups and interests will stand to gain; others will incur either direct losses or losses of opportunities.

The transportation agency should work to clarify for the public and the decision-makers the issues of choice—to explore with interested groups and individuals the range of transportation decisions that might be made, to determine the implications of each as fully as possible, and to explicitly bring out the tradeoffs among alternatives.

To do this effectively:

1. All interested parties should have the opportunity to get involved in the planning and decision-making process.
2. Alternative actions sufficiently different to represent real choices should be investigated with the public.
3. Planners, decision-makers, and citizens should know both what the effects of each alternative would be and how particular groups and interests would be affected.
4. Opportunity for meaningful negotiation on what comprises an equitable distribution of gains and losses should be provided.

Informing Decision-Makers

Authority to make transportation decisions may rest solely with transportation personnel, or it may be shared with state or local officials, other agencies, or even a special task force. Regardless of who the decision-makers are, in order to make wise choices they need full information on the study to date and the potential consequences of each course of action.

Even though their authority may not extend directly to transportation, decision-makers in programs such as land use, housing, and public utilities also need to be kept informed of the proceedings of transportation studies and to coordinate their plans with transportation plans. The transportation agency has the responsibility of making sure that *all* decision-makers have sufficient up-to-date, accurate information on transportation proposals.

Achieving Substantial, Effective Community Agreement on a Course of Action That Is Feasible, Equitable, and Desirable

Ultimately, agreement is desired on a course of action to be taken; indeed, that is the main objective of a transportation study. However, there are other choices in the planning and decision-making process for which agreement is important, and which, if achieved, may help to achieve agreement on a final choice.

For example, agreement should be sought on:

1. General aspects of the planning and design process, including:
   - The scope and timing of studies.
   - The roles and responsibilities in the process of state agency staff, local agencies and officials, and interest groups.
2. The community interaction program, including:
   - Agreement to participate in a process.
   - Means for direct participation.
   - Use, if any, of indirect techniques such as surveys and field work.
   - Timing and format for public hearings.
   - Availability of data and draft reports and the public role in reviewing them.
3. Interim decisions, including:
   - What alternatives are deserving of further study, and whether new alternatives are needed.
   - What impacts should be given highest priority for study and most importance in decision-making.
   - Whether the scope of studies or the schedule for decisions should be modified.

Agreement on these interim choices does not guarantee that agreement will be reached on the final choice. Full consensus, even on these earlier choices, may well be unattainable when the potential gains and losses involved are significant. But by striving for substantial agreement, the transportation agency is likely to unearth the major issues of choice and thus will be better equipped to develop equitable solutions and to inform decision-makers. Furthermore, without general agreement that the study *process* itself was equitable, it will be much more difficult to reach agreement on the final decision.

A FOUR-PHASE STRATEGY FOR PLANNING

Implementation of the findings presented and attainment of the proposed process objectives require sufficient flexibility in the planning proecss to facilitate modifications as new knowledge is developed. Although the specific tasks to be carried out must be determined for each study, a four-phase strategy is recommended as providing a workable framework for any stage of a planning process—system planning; corridor, location, or design studies; or even preparation of plans, specifications, and estimates.

The four phases of the basic process strategy are:

I. Study design.
II. Exploration of alternatives.
III. Detailed analysis.
IV. Choice.

Phase I. Study Design

The objectives of the study design are to initially define the transportation problems to be addressed; to establish a data base; to acquire a basic understanding of the interests, needs, plans, and objectives of potentially affected communities and citizens; and to develop a work program.

The transportation agency will have some conception of the transportation problems of the area under study at the outset. However, interested parties may have different views of their transportation needs and may be able to point out needs not identified by the agency. It is necessary, then, to have public input in defining the transportation needs and desires that should be addressed in the study. To do this effectively, the agency should publicize that studies are beginning, make available the data that led to the study initiation, inform the public about prior transportation decisions and agency responsibilities, and provide mechanisms for public input.

The study design phase is the appropriate time to assemble basic data on social, environmental, and economic characteristics of the study area, as well as transportation and other technical data. Coordination with other agencies is vital; they will be a valuable source of data and also will provide input on their plans and objectives. Community interaction activities are an additional source of data and provide an initial sense of what the significant technical, social, environmental, economic, and political issues are likely to be.

The results of the study design phase are:

1. An initial definition of the scope of studies, including the types of alternatives to be considered, the roles and responsibilities of transportation agency staff and of other agencies, officials, and interest groups, and the community interaction program.

2. An initial work program, including identification of data needs, scheduling of technical studies, and timing of community interaction activities.

Phase II. Exploration of Alternatives

The objective of this phase is to develop an understanding of the available courses of action by discussing with the public a variety of alternatives, each of which reflects different objectives. The intent is not to develop a final solu-

tion but to bring out the issues involved in the particular study and to help all concerned to improve their understanding of the advantages and disadvantages of various alternatives. Because a wide range of possible alternatives is to be explored, sketch planning and approximate impact prediction techniques are appropriate.

Extensive interaction with the public is conducted during this phase, with special emphasis on bringing into the process all those who may be affected by or interested in the planning process. Information on alternatives and their impacts is presented, and the public's reactions and suggestions for modifications or for additional alternatives are gathered and fed back to the technical activities. Also, the transportation planning activities are coordinated with other community and regional plans.

Data collection continues throughout this phase. It is important to maintain complete data files and document the alternatives considered, their impacts, and the responses of groups and individuals. Draft evaluation reports on studies may be produced and may be reviewed by interested parties.

During this process, the agency and the public will develop a sense of what alternatives are deserving of further study, what issues must be addressed, and what additional data are needed. Modifications should be made as necessary to the scope of studies, the work schedule, and the community interaction program. The result of Phase II is a clarification of the issues of choice, with a preliminary identification of a few alternatives that seem to have the greatest potential for acceptability.

Phase III. Detailed Analysis

The objective of Phase III is to subject the alternatives selected in Phase II to detailed development and analysis in order to achieve feasible, equitable, and desirable courses of action.

In-depth prediction of the potential impacts of the alternatives under study is performed. By examining the incidence and magnitude of these impacts with the public, the agency develops ways of modifying alternatives to alleviate negative impacts and obtain additional beneficial impacts. Associated programs such as land-use control plans, public services and utilities plans, joint development programs, and relocation assistance and other compensatory programs also are developed in detail, and the means of funding both transportation plans and related programs are determined.

Community interaction activities focus on determining the acceptability of the alternatives and associated programs and may suggest additional impacts to be addressed and new alternatives or modifications to alternatives to be considered. The agency works with the community to find feasible compromises that would result in more equitable and desirable plans. This often will require bargaining and negotiation with particular interests. Detailed evaluation reports are prepared.

The results of this phase are one or perhaps a few detailed courses of action—transportation proposals plus associated development, coordination, and impact alleviation programs—that represent the agency's best efforts and best reflect community preferences.

Phase IV. Choice

The objective of Phase IV is to make a decision on a particular course of action.

If substantial community agreement has been reached on a particular course of action during the detailed analysis phase, Phase IV merely formalizes that agreement at a public hearing with appropriate reports being prepared and circulated.

In many cases, however, no clear-cut preferred course of action will have been found. In this case, the agency prepares reports on the alternative courses of action, discussing for each alternative its advantages and disadvantages and the views expressed by various groups and individuals and pointing out the tradeoffs among alternatives. Public participation is aimed at checking that these reports are accurate, obtaining further input, and, when possible, attempting to find compromises.

Complete reports on the alternatives, their impacts, and other results of the study and negotiation process are then provided to the designated decision-making authority for selection of a preferred course of action.

Interrelation of the Four Phases

Although there is a general progression of the planning process from one phase to the next, there are a number of activities that are conducted throughout the planning process, varying primarily in the depth or level of detail of study. For example, impact prediction and community interaction activities would normally occur in each of the four phases. As new information becomes available, it may be necessary to cycle back to an earlier phase or level of planning and make revisions. Thus, although the intent of the study design phase is to gather basic data and determine the general scope of studies, much information will be obtained only in the later phases, and this information may require that the scope of studies be modified. Similarly, information on alternatives developed during the detailed analysis phase, or new alternatives suggested then, may necessitate a return to Phase II, exploration of alternatives. The point is that there are no rigid dividing lines between phases; flexibility needs to be retained in order to adjust work activities as new information becomes available.

THE ROLE OF THE TRANSPORTATION PROFESSIONAL

The proposed process implies broad duties for the transportation professional. In addition to the traditional responsibility for developing technical plans, transportation professionals also assume the following roles:

1. Community advisor. Transportation professionals work with interest groups to develop alternatives that reflect their needs and desires. They also help people to clarify their objectives and broaden their perceptions of the impacts of alternatives on themselves and others. To do this, effective two-way communication must be established.

2. Ombudsman and spokesman. Transportation professionals have an obligation to identify and voice the interests not represented in the planning process. This often will mean speaking for national, statewide, or regional interests; for those who otherwise may not be heard, such as

low-income communities who may not have the resources to participate effectively, minorities, the elderly, and the disabled; and for those considerations (historic, aesthetic, or ecological, perhaps) for which no spokesmen come forth. Professional responsibility includes the provision of technical assistance to interest groups and may extend to the actual development of alternatives responsive to their particular needs and interests.

3. Impartial negotiator. Because conflicts among interests may arise, transportation professionals must identify tradeoffs and search for equitable compromises. Their duties include promoting understanding of the positions, needs and preferences of the various interests, stimulating negotiations among groups who are in conflict, and developing alternative "packages," including relocation and replacement housing, impact amelioration, joint development, and so on, through which compensation might be provided either in kind or as a *quid pro quo* to those who would be adversely affected by a particular proposal.

4. Agent of, and advisor to, the decision-making authority. Transportation professionals are responsible for fully informing decision-makers on the alternatives, their impacts and the manner in which various interests may be beneficially and adversely affected, the reactions of different interests and segments of the public, and of the issues involved. In general, they may also act as the representative of the decision-making authority during the course of studies.

In sum, transportation professionals have the responsibility for developing projects and providing service compatible with the social and environmental goals of the communities affected, as well as satisfying a demand for mobility.

CHAPTER THREE

FINDINGS—PROCEDURAL GUIDELINES

COMMUNITY INTERACTION

Introduction

One of the key elements of the planning process described in Chapter Two is the provision of timely and constructive public involvement. Indeed, the participation of other federal, state, and local agencies; officials; interest groups; and the general public is essential to such activities as the consideration of alternatives, the identification of impacts and affected interests, the determination of value-related information, and even the making of viable decisions by those in positions of authority. Legal requirements for public hearings, A-95 clearinghouse reviews, and environmental impact statement circulation are only a partial means of obtaining constructive public involvement; many more techniques normally are required to achieve effective involvement early and throughout a process, and to obtain the participation of the full range of potential interests.

This section describes both general characteristics and specific techniques of community interaction and provides examples of successful community interaction programs.

A Community of Interests

The community of concern is everyone with a stake in the transportation planning process. Included are the residents, property owners, employers and employees within the study area; federal, state, regional and local agencies; elected and appointed officials at all levels of government; potential users of the transportation facilities; and interested persons from outside the study area. The community of concern, then, is broader than the concept of neighborhood: it is a community of interests.

A literal interpretation of this definition could indeed be "society at large." In practice, however, the community with which the agency will deal will consist of those who may be directly affected by the study and those with strong concerns about the potential impacts of the transportation decisions to be made.

Community Interaction as a Communications Process

Community interaction can be viewed as the process of communications necessary to incorporate social, economic, and environmental considerations into all phases of a transportation planning and decision-making process. Information must be exchanged by the transportation agency and other agencies, officials, interest groups, and the general public. Thus, community interaction addresses questions such as:

- Who sends information and who receives it.
- Information content—the kinds of information sent and received.
- Communication channels—the means available for sending information, and the means available to receive it.
- Sources of interference, distortion, and interruption—the things that may prevent information from being received or understood as intended.
- Feedback mechanisms—ways of obtaining responses

to messages sent and to check on the accuracy of transmission and reception; and

- Efficiency of communication—how well particular mechanisms are transferring information.

Effective communications between the agency and the community requires the development of cooperative relationships. The agency and the community must work together to identify and clarify relevant issues, develop and analyze a range of transportation alternatives, and attempt to reach agreement on a variety of decisions. Thus, community interaction is concerned with the opportunities provided for citizens to get involved; with operating styles and how they enhance or detract from good working relationships; with the timing of participatory efforts; and with the relationships among participation activities, technical work, and decision-making.

In short, community interaction is all the ways in which the agency and the community learn about each other and work together to enhance the transportation planning process.

Contribution to Other Planning and Design Activities

The community is an important source of information. In many cases, other agencies and organizations can provide data or even technical assistance to the transportation agency. Citizens and interest groups may be able to provide information that the agency could obtain only at great expense if at all. But perhaps more importantly, the need for and implications of transportation projects depend in large measure on the attitudes and aspirations of citizens. People may have differing goals and priorities. In some cases conflicts may arise, the resolutions of which will require value judgments to be made. Participation helps obtain information needed to guide the development of alternatives, to expand the data base, to help in evaluation of both data and alternatives, and to inform decision-makers.

Although a good community interaction program can improve the quality of technical studies, community interaction is also dependent on, and affected by, technical studies. Indeed, the public expects the agency to present and discuss its technical work; and the public clearly needs information developed in technical studies if it is to make meaningful contributions.

In a sense, there is a partnership between the public and the agency staff. The staff members are experts with responsibilities for performing studies, but they also must be open and sympathetic to the public. Staff members should carry out their technical work with input from the community, while informing the community of the uncertainties and implications of the work. In response to community requests for analyses, they should either perform the requested analyses or explain in understandable terms why such explorations would be wasteful.

It follows that community interaction activities and technical studies must be coordinated to meet each other's informational needs. But sometimes there is a tendency to insulate technical work from community interaction. The result is a less useful interaction program and a technical process that may not address community needs: neither the community nor the agency is served.

Relation to Decision-Making

Community interaction is necessary to achieve the process objectives defined in Chapter Two of clarifying issues of choice, informing decision-makers, and achieving substantial, effective community agreement. Although community interaction has clear implications for the decision-making process and is required to achieve the public support necessary for any decision, community interaction by itself does not mean that citizen groups have authority for any part of the formal decision-making responsibility legally vested in a transportation agency. (The relationship to decision-making is discussed at greater length in Chapter Five and the section on "Institutional Arrangements and Decision-Making" in Chapter Four.)

Activities of both the private and public sectors are shaped in part by transportation. Whether the potential impacts of transportation projects are major or minor, long term or short term, the choices being made will affect people. Participation is their opportunity to help determine what tradeoffs among alternatives should be made.

Decisions within the community of interests can significantly affect the transportation system (for example, decisions to build housing developments or to set land aside for recreation uses). There is a clear need to coordinate transportation planning with these other planning efforts.

Finally, the norms of our political culture support citizen participation; Americans expect to have a role in influencing governmental decisions that affect them. Participation, for the citizen as well as the agency, is thus an affirmation of democracy, an indication that people can govern themselves. Interaction with the public demonstrates that citizens can provide meaningful input to governmental agencies.

Although the delegation of power to representatives by voting in elections is recognized as a legitimate form of participation, the vote is too occasional and nondirective to act as a powerful force in an issue area such as transportation planning. Because it is virtually impossible for the public to indicate its preferences on a single issue by casting ballots for candidates, there is a need to provide opportunities for citizens to participate more directly in specific policy-, system-, and project-related decisions.

Measuring the Effectiveness of Interaction

Effective interaction is difficult to measure. One method sometimes cited is to count heads at meetings, the thought being that the agency's program is successful if it can stimulate high attendance. But there are too many unknown factors influencing meeting attendance for it to be a reliable indicator. Low meeting attendance may indicate a desire to let officials and others do the planning, or a preference to learn of the plans by other means, or any of a number of things other than poor publicity. Likewise, large turnouts may only indicate dissatisfaction with the agency.

A similar measure is the percentage of people responding

to a survey, the reasoning being that the higher the response rate, the greater the effectiveness of the participation. This fails, however, to take into consideration the quality of the survey, the means of distribution, or the nature of the information received and whether or not the information contributes in any way to the study.

Some persons equate effective interaction with a "build" decision. If a community is opposed to construction because of misconceptions and narrow thinking, then a program that "sets right" such thinking and results in building may be viewed as successful. But it is also true that construction may be opposed because its adverse effects are believed to outweigh potential benefits. "Successful" community interaction in this case could result in a no-build decision.

The more meaningful parameters of successful community interaction are less visible than meeting attendance or a "build" decision. The important concepts are whether or not all affected persons were allowed an equal opportunity to participate, understood the planning process, and understood the issues of choice; and whether or not the contributions and preferences of these interests were given due consideration by the agency in making its decision.

Providing equal opportunity to participate is not as easy as it might seem at first glance. The way in which a community interaction program is structured and carried out strongly influences who will participate. Merely announcing the opportunity to comment or providing everyone with exactly the same ways of participating—treating all groups alike—does not insure equal opportunity. Different groups may require different agency efforts if equal opportunity is to be achieved. Different efforts also may be required to ensure that the planning process and the issues of choice are understood. The agency can do much to increase understanding of the process by clearly laying out what it can and cannot do and by carefully documenting its actions. Understanding of issues can be increased by talking about alternatives rather than abstract values and by using models, photographs, and other display techniques—by relating planning to those things that concern people and by helping people visualize possible changes.

A good interaction program helps people to see the advantages of and reasons for other points of view and influences the substance of the planning process. But an effective interaction program will not assure universal happiness. People will want different outcomes, and those who disagree with the decisions made may be convinced that the process "favored" others. Nevertheless, a process that is open and well documented tends to provide ample evidence to disprove any charges of bias.

Disincentives to Interaction

Despite the potential benefits of interaction, there are several factors that tend to work against its success. Disincentives exist on the part of both the agency and the citizen. Unfortunately, a feedback effect may develop, such that the factors that discourage the agency from conducting an effective participatory program may also create an environment in which people are discouraged from participating, and vice-versa. Agencies should be aware of these disincentives so that actions can be taken to counter them.

From the agency's viewpoint, participation may be seen as disruptive. The belief is sometimes expressed that those who participate are usually a small, but highly vocal, minority who oppose the agency's plans, and that their input is not representative of the feelings of the majority. Thus, participation is seen as providing "ammunition" to those trying to block agency actions, and as being of little value, or even of harm, to the agency.

There are three responses. First, an effective interaction program will take steps to ensure that all viewpoints are identified. It may be true that those who oppose a proposed project are more likely to come forward to express their views than those who favor it; but this merely indicates that the agency needs to expend more effort in obtaining the full range of viewpoints. Second, early and open interaction can get issues out into view so that the agency can take steps to alleviate many of the problems which if unabated might lead to opposition. An interaction program thus can reduce the likelihood of controversy. Finally, some agency proposals are likely to meet with opposition no matter what kind of interaction program the agency has. This is true of any governmental decision, not just transportation decisions, and simply cannot be avoided. In fact, many would argue that one of the strengths of the American system is that citizens, even if they are in the minority, can and do oppose their government's actions. At any rate, avoiding or limiting interactions will not prevent the development of opposition and in fact may make that opposition more rancorous. The agency will be in a far better position should controversy arise if it can point to the fact that through its interaction program it is fully aware of opponents' viewpoints and has taken reasonable steps to mitigate problems.

From the viewpoint of the citizen, participation may be discouraged by several factors. Quite often, people who are interested or able to contribute to an agency's activities have little time available to participate or do not know how to contact the appropriate people within an agency, or simply lack the initiative to take the first steps necessary to communicate their ideas. In such cases the agency can encourage input by providing means for involvement which do not require the person to contribute vast amounts of time and by publicizing the means by which people can get involved. Another factor that may discourage people from participating is the aura of complexity that often surrounds transportation planning. Some elements of the public, as well as agency staff themselves, may even feel that only experts make meaningful contributions. Although there are certainly some aspects of transportation and environmental analyses that may be beyond the knowledge of the lay public, the vast majority of issues are well within the public's ability to understand. Agencies can do much to facilitate interaction by making information readily available in a form that the nonexpert can understand.

A much more serious disincentive, however, is the belief that participation is a hollow exercise. People may feel that the important decisions already have been made, that their inputs will be ignored, or that the choices available to them

are so few as to be meaningless. To overcome this attitude, the agency should start its interaction program early in the process, provide meaningful channels of participation, and be sure that it responds as fully as possible to questions and issues raised.

Techniques

An effective community interaction program requires not only:

- *Direct interaction:* two-way, face-to-face contact and communication between agency staff and the community; but also
- *Information gathering:* the collection of data about the community, its nature, its needs and goals, and the different points of view of its members; and
- *Information giving:* the dissemination of agency information on the scope and process of studies, the issues of choice, and the data relevant to those issues.

Techniques for each of these three basic activities are identified in Table 1. This listing is indicative of the range of techniques that might be used; there is no attempt to be comprehensive, and an agency may find other techniques or variations of those listed to be equally useful. For example, role-playing and simulation games have been used by some agencies both as a training aid and as a means of "modeling" an actual situation. Certain techniques required by law, such as the A-95 clearinghouse and environmental impact statement reviews, are not listed, though these clearly can play an important role. There is, of course, some overlap among the three categories; working meetings, for example, are listed as an interaction technique, but they also both collect and disseminate information. The categorization merely indicates the primary direction of information flow—from the community to the agency, from the agency to the community, or both ways at once.

In addition, a few special-purpose techniques are identified. They are put in a separate category because generally they would be used only in unusual circumstances.

An effective community interaction program will require the coordinated use of several techniques from each of the three basic areas; information gathering and distribution, by themselves, will not achieve the objectives of community interaction. An important consideration is to select a mix of techniques that will ensure broad and representative coverage, recognizing that some techniques will reach some interests and not reach others. Timing is important, for activities carried out too early or too late in the process will not yield maximum benefits. Similarly, the agency must consider the resources available for community interaction, and must remember that the type of community being dealt with, and the particular groups in that community, should affect the type of technique used.

The remaining portions of this section provide summary guidelines for each of the techniques identified in Table 1, including possible uses and advantages and disadvantages. Among the items discussed are issues associated with the choice of what specific techniques to use; with descriptions of specific characteristics that an effective community interaction program should possess and the steps to be followed in initiating a program of interaction activities. This is followed by presentation of four exemplary programs.

Information Gathering Techniques

Information about potentially affected communities—their social and economic characteristics; their plans, needs, and aspirations; their neighborhoods; their special problems—is necessary to identify potential social, economic, and envi-

TABLE 1
CATALOG OF COMMUNITY INTERACTION TECHNIQUES

COMMUNITY INTERACTION TECHNIQUES			
INFORMATION GATHERING	INFORMATION DISTRIBUTION	INTERACTION	SPECIAL PURPOSE
EXISTING SOURCES COMPILED STATISTICS DESCRIPTIVE INFORMATION WORKING WITH LOCAL OFFICIALS MONITORING NEW DEVELOPMENTS ANALYZING PLANS, PROGRAMS, AND REPORTS MONITORING MASS MEDIA NEWSPAPERS RADIO AND TELEVISION OTHER MEDIA FIELD WORK SURVEYS	POSTERS, BILLBOARDS, AND SIGNS MAIL NOTICES, BROCHURES, NEWSLETTERS, FLIERS NEWSPAPERS LEGAL NOTICES ADVERTISEMENTS NEWS ARTICLES FEATURE COLUMNS AND ARTICLES NEWS RELEASES LETTERS TO THE EDITOR RADIO AND TELEVISION ANNOUNCEMENTS NEWS COVERAGE TALK SHOWS AND COMMUNITY-ORIENTED PROGRAMS DOCUMENTARIES COMMUNITY ORGANIZATIONS DISPLAYS, MAPS, MODELS	SMALL GROUP MEETINGS WORKING MEETINGS WORKSHOPS HEARINGS AND OTHER LARGE PUBLIC MEETINGS FIELD OFFICES PUBLIC INFORMATION CENTERS ADVISORY COMMITTEES, STEERING COMMITTEES, OTHER GROUPS	REFERENDA TECHNICAL ASSISTANCE MEDIATION AND ARBITRATION OMBUDSMAN CHARETTE

ronmental impacts and the interests that would be affected by these impacts. Obtaining such information is a major task, but not an impossibly difficult one. A wealth of data has already been compiled for nearly every local community, thanks to extensive government and privately supported censuses and surveys of population, income, business, labor, manufacturing, construction, public health, and so on. Official records on taxes, education, voting rates, and the like also are readily available. In addition, there are innumerable other sources of information that can be tapped with minor effort—in universities and in private organizations, for example. Thus, the initial task is not so much a matter of how to generate information, but rather of determining what sources are most relevant, and what additional data, if any, are needed for the purposes at hand.

Before setting out to compile data on affected communities, the agency should make sure that the information will be worth the effort required to obtain it. Care should be taken that the data are in the form and at the level of detail needed to put the information to use. Attention should be given to the timing of data collection; information that is out of date by the time it is needed or that is gathered too late to guide planning will be of little use.

Thus, in gathering information the following considerations should be taken into account:

- What information seems needed?
- What will be done with the information once it is obtained?
- In what form should the information be compiled?
- What level of detail is necessary?
- What is the best way to obtain the information?
- Is the information appropriate at this time?
- Is the information worth the effort required to obtain it?

Existing Sources.—A first step in gathering information about a community is to determine what useful data already exist. Often the agency will be able to get a good initial sense of the community at minimal cost simply by utilizing existing sources.

Compiled Statistics.—A number of sources of information on communities are readily available in public libraries, government agency offices, and city halls. Censuses of population characteristics, income, business, employment, and so on often are summarized in one document; a quick examination of these data will help the agency establish a starting point for its studies of the community. For example, one can obtain the percentages of elderly, unemployed, welfare recipients, school children; the average number of autos per household; percentage of foreign born and foreign stock (an ethnicity indicator); housing values and conditions; land use, development, population trends, and so on. Because precautions are taken to keep individual responses confidential, census data may be too aggregated for some purposes, but they provide useful background information.

Other agencies and governmental bodies—federal, state, and local—usually have detailed information on particular communities, often at the neighborhood level. These data may be of use to the highway agency both in getting a feel for the community and in developing an interaction program. Voting rates, for example, may be a rough indicator of general participation rates; tax rates may point out what might happen if homes or businesses were displaced; data on the sewer system may indicate potential problems should a highway encourage new growth.

Descriptive Information.—Histories are often available even for small villages, and a quick perusal may provide some insight into the nature of the community—how it grew, what its traditions have been, who its people are. At another level, local civic groups (such as chambers of commerce, good government associations, and service organizations) often make available literature on their communities that points out what they feel are their communities' strong points, places of special interest, and, sometimes, problems. Universities too may have collected significant information which the agency can tap.

Working with Local Officials.—Local officials usually are an excellent source of information about the community. Their intimate knowledge of local goals and aspirations, the problems of the community and particular neighborhoods, and of groups who may be especially concerned about transportation, can be invaluable to the agency. The agency will wish to establish communication with these officials in any event, so there is a ready-built opportunity to learn about the community. The agency should note, however, that officials will describe the community as they see it, and others may disagree or emphasize other factors.

Monitoring New Developments Affecting Urban and Regional Systems.—Because highways affect, and are affected by, urban and regional systems—other parts of the transportation system, housing, finance, the job market, utilities, and so on—the agency needs to keep abreast of new and anticipated developments in each of these systems. In this way, the agency can take steps to assure that its plans and decisions are well coordinated with the new conditions. The agency may also identify and avert future problems and may discover potential solutions to problems that would be caused by various alternatives.

The A-95 process and other "early warning" procedures for notifying other agencies is a good starting point for the monitoring of new developments affecting urban and regional systems. In urban areas, the 3-C or regional planning agency will be able to provide much useful information. However, additional effort may be necessary to obtain sufficiently detailed information for use in the more advanced stages of highway or transportation planning.

Analyzing Plans, Programs, and Reports Made for a Community.—Plans, programs, and reports developed by individuals, groups, and institutions often are an expression of their values and priorities. Reviewing these materials is a way to obtain factual information about a community in a short time, and may indicate some of the values of the community. A good working knowledge of plans is necessary for the proper coordination of highway proposals with other relevant plans and will aid the agency in predicting potential impacts, uncovering issues, and developing ideas for alternatives.

Plans that may be relevant include comprehensive or master plans for communities (typically funded by Federal

701 funds); traditional land-use inventories and plans; master plans for regions, subregions, or counties; plans of large institutions and regulated services (electric company); plans of city services (water, sewage, street repairs); and plans of community interest groups (home owners' associations, tenants' groups, service and garden clubs). Reports on particular problems, needs, or possible courses of action may provide much valuable information.

Analysis of plans need not be a major time-consuming effort. It will not be necessary to study every plan in depth; the agency may wish merely to scan and reference some plans.

Several words of caution are appropriate. Whether a plan is up to date should be verified, and the amount of support for the plan determined. Community plans are often developed to meet federal or state requirements; for instance, a plan is necessary to participate in federal urban renewal or rehabilitation projects. Some plans are no more than paper exercises. Many such plans have been developed by consultants who knew how to satisfy the external (federal) requirements but did not necessarily feel empathy with the community. Such plans may be of limited use in identifying the goals of anyone in the community. The agency should assess which if any community residents feel that their goals are expressed in the various community plans.

Monitoring the Mass Media.—The mass media are a bountiful source of information about the important current events, issues, priorities, needs, problems, and goals of a community.

There are a number of information media in any community: newspapers, newsletters, local bulletin boards, radio stations, and television channels are the most common. The methods used to monitor each of these will vary with their relative importance in the community and with the agency's needs. A few examples follow; these should be adapted to fit the case at hand.

Newspapers.—It is often convenient to establish files of newspaper clippings, which may be filed by topic, labeled by date and source, and cross-referenced as necessary. Most public libraries save copies of major papers on microfilm; the agency may wish to save intact copies of other papers and newsletters, cross-referencing relevant articles.

Monitoring newspapers is best done by agency staff. Clipping services may be available, but often the clipping service overlooks relevant articles or does not recognize issues that may affect the highway planning process. Furthermore, if a clipping service is relied upon, information may be too slow in getting back to the agency to be of maximum usefulness.

Radio and Television.—Listening to local talk shows and news broadcasts allows the agency to monitor many community conversations. Selective monitoring and analysis can help the agency learn about community interests, conflicts, and values; it may provide information on how the agency is viewed by certain community groups; and it may indicate when the agency should enter into certain on-going discussions.

Some radio and television stations make transcripts of editorials, speeches, and specials available to the public. Many produce program listings, which may be available from the station or may be printed in local papers. These listings will point out shows especially worth monitoring.

Other Media.—In many areas, local bulletin boards are an important communication channel. Periodic checks of these boards may yield useful information. The newsletters of some organizations, especially those interested in transportation, ecology and so on, also should be monitored when available.

Field Work.—Social/anthropological field work is a means of gathering nonstatistical information that is intrinsically inaccessible through questionnaires and other data-gathering tools. The purpose is to discover and explore cultural patterns, life styles, and clusters of values and their significance in the eyes of the people being studied. Rigorous field work can take a highly trained anthropologist or sociologist months or even years, for continuing, intensive effort is needed to establish the rapport conducive to information gathering.

In some cases, particularly when it appears that proposed alternatives may affect extremely sensitive neighborhoods, an agency may wish to devote resources to a careful field work effort. First, however, the agency should examine the need for such information and the alternative means of gathering it. For some projects, this level of effort clearly is not needed. In some areas, universities may have conducted extensive field work efforts, and the agency should turn to them for guidance.

Less rigorous field work nevertheless can yield useful information. Of greatest importance is to approach the neighborhood with an open attitude, and to carefully observe the nature of the community. Some highway agencies have staff members drive or walk around a neighborhood, observing its homes and businesses, its congregating places, its people; talking to people about their feelings toward the neighborhood, their ties to homes, local institutions, families and friends; and their attitudes toward transportation changes. Another variation is to attend or observe public meetings of elected and appointed groups, community groups, and special interest organizations. Although such data should not be assumed to be of general validity, it is useful in establishing a feel for the community and a sense of neighborhood boundaries.

Surveys.—Surveys, questionnaires, polls, and similar devices are used to elicit facts, opinions, or attitudes from a selected sample. Before deciding to conduct a survey, the agency should ascertain that the desired information cannot be obtained from existing sources or by other methods. Then the survey must be carefully designed, tested, administered, and interpreted. Survey design and analysis is a highly technical skill; several universities offer graduate degrees in polling and surveys. Thus, it is strongly recommended that a qualified social scientist be responsible for any survey efforts an agency may wish to conduct. Even then, surveys are subject to misuse and can never replace interaction with concerned citizens.

Surveys rely on the fact that scientific sampling methods permit information gathered from a relatively small number of respondents to be projected with a specified level of confidence to the entire group of interest, or "population."

Careful sample selection is absolutely necessary before such projections may be meaningfully made. Survey questions must be designed both to elicit the desired information and to avoid misinterpretation. The means by which a response is made must also be selected with care, because it has a significant effect on the interpretation of the response. It is always necessary to pretest surveys to see whether the questions are clear and the responses elicited are of the desired form. Usually, several drafts are needed. Similarly, the method of analysis of the data obtained must be designed for the particular survey. The result is that surveys are quite expensive and time consuming and require substantial numbers of trained personnel.

Fact surveys may be used to obtain information such as number of years at a given address, travel patterns, and so on. At first glance, such questions seem relatively simple to draw up. However, it will not be especially useful to know merely that X% of the respondents travel to work by auto; they may do so because they like to drive, or because the bus takes twice as long; or they may hate driving but have no other choice because no transit options exist. Fact questions must be designed to obtain responses that are useful to the agency in developing alternatives, or identifying problems, or the like, and not just to gather bits of data.

Opinion surveys attempt to elicit preferences between alternatives or viewpoints about particular issues, and attitude surveys ask about general preferences and viewpoints without relating to specifics. These types of surveys are especially difficult to design well, are difficult to execute well, and are particularly susceptible to misinterpretation. Questions, for example, may be worded in a way that brings out particular response patterns, and the interviewers' attitudes, demeanors, inflections, and the like may introduce biases. Aggregation of responses may hide significant differences of opinion.

The most serious problem of opinion surveys is that they may be misused. The results can far too easily be interpreted as the analyst sees fit. The agency must avoid the temptation of presenting a neat stack of data that represent the "community's opinions" as an easy way out of the more time-consuming process of interacting with citizens to bring their opinions to bear on decisions and recommendations. Reliance on survey data puts too much emphasis on judgments developed during just a few minutes of contemplation of the issues involved. Citizens' opinions tend to develop, change, and become clarified during the course of studies; the choices to be made will change; in some cases, even the makeup of the community will change. Surveys simply cannot be a substitute for ongoing, direct interaction with the public.

In some circumstances informal questionnnaires may be useful even though the sample is small and biased. Open-ended questions are usually best; specific information may be requested, or just the opportunity to make a comment may be provided. For instance, an agency might distribute questionnaires at meetings, asking questions about group membership, transportation problems encountered, how the respondent found out about the meeting, and so forth, and asking for any other comment the respondent might wish to make. Although the lack of scientific sampling prevents projection of such information to a population or group as a whole, this type of informal question can help the agency get feedback on how well its publicity is working, who has been reached and who else might be contacted, and so on. It also gives people another channel for voicing their concerns. Even though this type of questionnaire is less sophisticated than the scientific surveys previously discussed, it should be carefully designed and pretested; the help of an expert will be worthwhile.

Information Distribution Techniques

Those in charge of planning transportation facilities need to provide a variety of information to the public. This information may be viewed as falling into two categories: announcements and study information. Both categories are important to an effective public participation program and ultimately to the success of the over-all planning and decision process, and for both there are a few basic rules:

- Select the channels by which information is to be transmitted so that the information is most likely to reach the desired audience.
- Use several different channels of communication to maximize target audience coverage.
- Tailor the message to the medium used for transmission.
- Tailor the message to the target audience.

Announcements are the easier of the two types of output information, but they nevertheless demand careful planning. Many highway agencies have learned through experience, for example, that legal notices of upcoming hearings by themselves are rarely sufficient to stimulate large turnouts.

Because different media reach different audiences, it is always preferable to use several channels of communication; notices in several newspapers will not reach those who rely on local radio for the news. The selection of media will depend on local availability and usage and on the resources that can be devoted to announcements; but it should be kept in mind that there are many low-cost mechanisms that may obtain very good responses.

Announcements should be designed to catch the eye (or ear) and hold attention, and they should be brief and to the point. Trying to convey large amounts of information via an announcement is likely to swamp the audience and reduce effectiveness. It is better to be brief and use supplementary means to communicate details.

The more common channels for making announcements are:

- Posters, billboards, and signs.
- Mail notices.
- Newspaper notices, articles, and advertisements.
- Radio and television announcements, news spots, and advertisements.
- Publication in newsletters and bulletins of community organizations.
- Sound trucks and hand fliers.

Providing *study information* is a crucial part of the

agency's information dissemination activities, for unless the public is well informed their participation will be of reduced value. Study information includes general background topics such as the procedures used for transportation planning, how the environment may be affected, what legal requirements and constraints must be dealt with, and what has happened to date in a particular study. It also includes detailed reports, plans, and data on what alternatives are being investigated, predictions of impacts of each alternative, public responses, and so forth.

The agency should provide information in a form that people without special training in transportation planning can understand. Special attention must be given to terminology, because even the terms most familiar to agency staff may cause confusion among outsiders. However, the agency also should take care to avoid oversimplifying its reports or glossing over serious issues.

The more common channels for providing study information are:

- Articles and feature stories.
- TV and radio feature stories, talk shows, and documentaries.
- Publication in media of community organizations.
- Guest speakers for organization meetings.
- Agency-produced newsletters, slide shows, pamphlets, etc.

Posters, Billboards, Signs.—An effective way of making announcements of upcoming events, and perhaps the most practical technique for small and medium-size projects, is to place posters, billboards and signs in gathering places and high-visibility spots. Likely locations are bulletin boards in churches, civic centers, places of employment, laundromats, supermarkets, taverns, and in store windows.

Mail Notices, Brochures, Newsletters, Fliers.—The agency's list of interested individuals and groups can be used to give notice of upcoming events. Pamphlets and other descriptive material for specific projects also can be distributed to those on a mailing list.

Several recent studies, including I-66 in Virginia and the Boston Transportation Planning Review, have published monthly newsletters containing material such as background information on housing availability and land use, descriptions of available alternatives, impact studies, meeting announcements and results, summaries of published reports, "letters to the editor," and even an "op-ed" page permitting community participants to present their own viewpoints.

General "occupant" mailings can be effective for a specific neighborhood, but are relatively costly. The best way to contact individuals or groups is via personal letter or telephone.

General notices can become quite comprehensive in nature, to the point of including many information gathering features. For example, a recent land-use transportation study in Sheffield/Rotherham, United Kingdom, utilized a "do-it-yourself" planning kit for public distribution. The kit had four parts depending on level of interest, the most advanced containing basic study data such as typical costs, budget levels, traffic demand data, capacity relationship, so that interested groups could carry out their own preliminary analyses of transportation alternatives.

Newspapers.—Newspapers may be used to reach the general public both for making announcements and for providing descriptive material. For announcements, the agency may consider the following:

- Legal notices. These are required for public hearings, but they should not be relied upon as the sole means of publicity simply because too few people read legal notices.
- Advertisements. Some newspapers occasionally donate free space for announcements of special community interests as a public service. More frequently, the agency will have to pay to advertise. Ads have to be fairly large to attract readers, and thus they can be expensive, especially in major papers. Smaller papers (weeklies, for example, or ethnic papers) may be more apt to publish free announcements and usually have lower advertising rates. The smaller papers also may have the advantage of reaching particular neighborhoods or groups more directly than a metropolitan or multi-town daily.

One form of advertising is to produce special supplements that can be distributed with newspapers.

Because of the expense and the uncertain readership, paid advertisements would usually be used only for special events.

- News articles. Articles initiated by the news staff can be an important way for the public to learn about the transportation planning process.

News articles may range from announcements of upcoming meetings to reports of past events to feature articles on particular issues, the planning process, and so on.

The agency can encourage coverage by notifying newspeople of events that should be of interest. It is useful to establish personal contacts within the news and editorial staffs, and to designate agency representatives so that newspeople will know who to contact about potential stories.

- Feature articles and columns. Feature articles and columns may be written by a journalist or, through special arrangement and with appropriate bylines, by a member of the agency staff. Topics might be particular events or background information; these articles thus can be a useful educational device.

For large or particularly important projects, the agency may choose to propose that a special transportation column be published periodically. A column, in particular, could include a question and answer section.

If the agency chooses to write feature articles or columns itself, care should be taken to ensure that the article clearly distinguishes fact from opinion.

- News releases. Most agencies periodically prepare formal news releases for submittal to the mass media. Often these releases are strongly pro-agency (or pro-project).

Unfortunately, if the public is cynical about the agency or if the particular project is controversial, these releases may make matters worse. As with all other information released for public consumption, it is vital that fact be separated from opinion and that unresolved issues and matters of disagreement be recognized explicitly.

- Letters to the editor. The agency may wish to write

letters to news editors for announcements or to explain or clarify certain points.

Radio and Television.—Effective use of radio and television requires different skills from those needed for written communication. The audience does not have the opportunity to peruse the message, so it must be shorter, more concise, and less complex.

Radio time, and especially TV time, is quite expensive, so as a general rule an agency will not wish to purchase time except in unusual cases. However, there are many ways an agency can get free time; some of these are listed in the following. Where public television is available, the agency may find greater opportunities (including lower prices) to make use of this medium.

- Announcements. Many radio and TV stations provide free time for announcements in the public interest. Stations also may make community events announcements on a daily or weekly basis as part of their news programs.
- News coverage. As with newspapers, radio and TV news staff may be interested in covering special events, and the agency should develop appropriate channels of communication to encourage this. Many local stations also do short feature stories as part of the news program; the agency may wish to explore this possibility with news staff.
- Talk shows and community-oriented programs. Local radio and TV stations produce talk shows and community-oriented programs. Usually they are looking for new topics, and thus they may welcome the opportunity to take a look at transportation issues. This gives the agency an excellent opportunity to provide educational information. Participants frequently are subjected to questioning, so the agency representative must be a person who can speak off the cuff.
- Documentaries. For projects of major importance, or where transportation itself has become an issue, television stations may be interested in doing a documentary. This is an opportunity to explore transportation problems and issues in depth. However, the agency should note that documentaries are often editorial expressions of opinion—they may take sides.

Community Organizations.—Many organizations send or distribute periodic newsletters or bulletins to their members. The agency may seek permission to use these private media to make announcements or to publish short articles, or to have its material enclosed with the organization's. Also, these organizations are frequently looking for speakers for luncheon or dinner meetings, providing an opportunity to present general study information and to participate in limited question-and-answer exchanges.

Displays, Maps, Models, Demonstration Projects.—Several highway agencies have found that scale models of the project area, models or photo collections of different types of alternatives, maps, and so on, displayed in prominent places (agency offices, civic centers, etc.) help the public better understand the issues, benefits, and problems of transportation proposals.

The agency may wish to build prototypes to illustrate special features of its proposals. For example, several agencies have built prototype transit facilities on a small scale so that the public can see what a particular form of transit would look like, how it would work, and so on. Prototypes also can be used by agency staff to work the bugs out of an idea.

Models, maps, and demonstration projects can be expensive and time consuming; they also can be misleading. For example, architects' or artists' drawings may look very different from the real thing. Demonstration projects, because they are generally small-scale and short-lived, can have very different results from full-scale permanent projects.

Interaction Techniques

Effective community participation requires direct interaction with the community—two-way, face-to-face contact and communication. Direct interaction is the best way to find out what people are concerned about, what they think should be studied, how they react to alternative proposals. It is the only way to obtain much necessary information on neighborhoods and people.

Small Group Meetings.—Small meetings have proven to be a more effective and important way of communicating with interested groups or collections of unaffiliated citizens than have formal public hearings or large mass meetings. The agency can provide detailed information on its activities, obtain opinions on the scope and timing of studies, and gather a variety of information that simply cannot be obtained through other techniques.

Meetings may be initiated by the agency or by an interested group specifically to discuss the transportation study. Alternatively, the agency may ask or be asked to attend a meeting whose primary focus is something other than the transportation study. The agency can start out by contacting known organizations to see if an initial meeting is desired, by publicizing its willingness to meet with interested groups, and by identifying communities or neighborhoods where a meeting might be appropriate. It is useful to ask known groups, local officials, and so on their opinions on who else should be contacted.

The timing of meetings is important. Initial meetings should be held early in the study so that people can comment meaningfully on the scope of the study, alternatives and impacts that should receive attention, and so on. The agency should be prepared to discuss its initial proposals for the study design so that there is something to focus on. On the other hand, proposals that are highly detailed may lead some people to conclude that decisions have already been made *de facto* and that their comments will have no effect. It is important to explain what decisions have been made and which options are still open.

The places where meetings are held can affect their success. Holding a community meeting at the local country club may be fine for businessmen and suburbanites, but it could easily scare off poor people. The location should be well known and easily accessible, and it should have facilities suitable for holding meetings (comfortable seating, large enough rooms, perhaps blackboards). Local schools often will be a good choice.

The time of day the meetings are held is another important variable. Daytime meetings will not be attended

by those who cannot get off from work. Conversely, evening meetings may be inconvenient for a businessman's association whose members go home to scattered suburbs.

The agency also should consider other community events that might conflict with its meetings. One highway agency found to its dismay that it had scheduled a meeting at the time when the county fair was being held.

Finally, agency staff need to be sensitive to the effects that their dress and comportment will have on the people they are dealing with. Communicating well is a talent, but it also is a skill that can be learned and that improves with practice.

Effective communication at small meetings is aided if participants can sit at a table or in a circle rather than being divided into speakers and audience. This is true even when meetings approach a size of 60 persons, in which case two or three circular rows might be arranged around a large table.

Working Meetings.—The purpose of working meetings is to resolve, or attempt to resolve, specific matters, which could range from a mutual understanding of a group's stance on a particular issue to a compromise on what alternatives should be studied.

Working meetings are more likely to be successful if the number of participants is kept small (usually a dozen or less), because it is difficult to negotiate with many people at a time. It is also useful to reach some agreement on an agenda ahead of time so that participants can prepare for the meeting.

Workshops.—Workshops can give the community a chance to learn about the transportation study and how to participate in its planning, can provide multiple opportunities for the technical staff and the public to communicate on a person-to-person basis, and can be an important symbol of the agency's desire to receive and make use of citizens' contributions. A workshop could be a day-long activity, could run for several consecutive evenings or for a week-end, or could be scheduled on an "every Tuesday evening during the month of May" basis. It could be held in a particular neighborhood or on a city- or region-wide basis.

The workshop (alternatively called an open house, etc.) is a multitechnique activity. The agency should make a variety of background materials available and should use a number of display techniques—maps, diagrams, models, and perhaps slide shows. The workshop is also a good opportunity to gather information (e.g., via questionnaires), to expand the mailing list, and to offer to meet with residents of a particular neighborhood and with organizations. Agency staff can make presentations; but more importantly, they can talk to visitors and learn a great deal about the community.

Depending on the stage of planning, people who attend the workshop could be asked to help determine the scope of the study, to help set up a schedule of activities, to examine proposed alternatives, and to suggest others—to join in setting the direction of future activities. For example, staff members could sketch out alternative route locations and let people react—or sketch their own alternatives.

The agency should publicize a workshop well ahead of time and may wish to send invitations to particular groups; for example, local officials and representatives and organizations that seem to have a special interest. But the workshop provides a unique opportunity for the general public, particularly unaffiliated citizens, to get involved. Thus it is recommended that the workshop be open to anyone who is interested.

Because those who attend generally will be self-selected and cannot be be expected to be in any sense representative, the workshop is not usually an appropriate forum for making major decisions. But it can be an important source of data, suggestions, and guidance.

It is important to note down suggestions made or criticisms raised.

Hearings and Other Large Public Meetings.—Public hearings are required by law for many federal projects; some states also have hearing requirements. Consequently, the highway agency must hold some hearings; but it may choose to hold additional hearings.

Formal hearings simply cannot be the only interaction mechanism. It is impossible to have "conversations" at large hearings or meetings; the communication is typically limited to brief question-and-answer periods and to the making of statements. Many people, uneasy because of the size of the meeting or its formality, will not speak out. In addition, the required hearings come so late in the planning process that information first received then either would be ineffectual or would necessitate massive restudy. Participation needs to start long before the required hearings, while planning options are still open.

The public hearings do serve several purposes: they are a capstone for the participatory process; a milestone in the decision-making process; a chance for people to make their views formally known; a chance for people to hear the views of others expressed and explained.

Besides the required legal announcements of the hearing, the agency needs to notify by mail every group or individual that it has reason to believe is interested; the agency should make sure that the public is well informed about the issues weeks in advance of the hearing, so that concerned groups and individuals have adequate time to prepare their presentations. This also means that the public has to have access to any information it may need and which the agency has, during this period of time prior to the hearing. If a draft environmental impact statement is required, it can serve as one basic medium of providing the public with an analysis of the issues. The draft environmental impact statement must, of course, be circulated prior to the required hearing.

The agency should make sure that the newspapers give the issues to be discussed at the hearing adequate, early coverage; if the papers cannot be persuaded to do it, the agency, as a last resort, should run large, paid advertisements. In this time between announcement of the hearing and the date on which it is to be held, agency staff should make every effort to familiarize the public with the issues through displays in municipal buildings, schools, and at other spots where the public is likely to see them. Brochures or other forms of data on specific issues should also be available for the asking from the agency.

At the hearing, a fact sheet should be distributed. This handout should include data on the proposals under consideration, announce that written statements may be submitted within a specified time limit for inclusion in the public record of the hearing, and explain how to file written comments.

The moderator should be experienced at running large meetings, and it is preferable that he or she be a disinterested party. Adequate time should be allowed for both the agency's presentation and others' presentations, questions, and comments.

Graphic material has to be legible for the entire audience. In making its presentation, the agency should take care to discuss issues in enough depth that the layman is neither left in the dark nor overwhelmed (i.e., "snowed").

An effort must be made to prevent people from being intimidated out of making statements. Microphones in the audience should be placed in such a way that a person does not have to face the whole audience to pose a question or make a statement. One effective way of doing this is to have microphones placed in the aisles, about half-way back, so the person will face front when speaking into it.

The time and place of the hearing should be set to encourage attendance. The issues in deciding daytime versus evening and location (e.g., central city versus local neighborhood) are much the same as with small group and other types of meetings based on voluntary attendance.

The agency may wish to consider holding pre-hearing meetings to make sure it is ready to hold the formal hearings.

Because large public meetings allow the agency and others to present information and to hear questions and opinions from a sizeable group of people, the agency may choose to hold such meetings periodically. The agency can avoid the formality and strict procedure of required hearings at these meetings. However, there are several drawbacks to a large meeting. The sheer numbers of attendees will discourage some people from speaking. The speaker versus audience division is almost impossible to avoid. More serious is the tendency of large public meetings to force people to take a stand which, because it was made publicly, will be difficult to modify. Thus large meetings should be used cautiously, particularly if a study is controversial.

Field Offices.—Field offices or drop-in centers can be a convenient interface between the agency and the potentially affected community. Especially when the agency planning offices are remotely located or when the study is in a particularly intensive phase, a field office may provide important continuity for the community interaction program.

A field office could be located in permanent offices; for example, states who do most of their planning in a headquarters office may wish to establish a field office in each construction district, adding staff as appropriate when particular studies are under way. When the field office is intended to reach a particular neighborhood or community, the agency should consider renting office space. As an alternative, the agency may be able to borrow space in public buildings. Trailers are especially useful when the agency wishes to establish a field office for short periods of time in several areas. In any case, the field office should be easily and conveniently accessible and visible (or well signed). It is important to publicize where the field office is, what its purpose is, what hours it is open, what kind of information is available, and so on.

The field office can be used to distribute information; the agency should have pamphlets, maps, and other background information available. The office also can be an important information gathering device; for example, visitors could be asked to fill out questionnaires. If it is to be a good interaction technique, the agency should make sure that people will be comfortable there; seats should be available, and refreshments would be a boon.

The field office also can serve as "home base" for the community interaction program, and if the physical layout is suitable could be used as a site for small group meetings.

Field offices require significant resources, particularly time and manpower, if they are to be useful for interaction purposes. Without sufficient staffing, the field office may be reduced to an information disseminating mechanism, a task that generally can be accomplished more effectively by other means. Thus the agency should give serious thought to the potential public interest and to its own resources before establishing a field office.

Public Information Centers.—An agency may wish to establish a public information center within its working offices. The center would be a focal point for the public so citizens would know how to get in touch with the agency. The center would act much like the field office, giving out information, gathering information, and providing physical space and opportunities for interaction with the public.

The danger is that the center might shield from public contact, or might be viewed as shielding, those actually carrying out studies. If a public information center is expected to enhance the interaction process, its purpose should be to facilitate closer contact between the actual study staff and the public, not to act as a buffer or to assume sole responsibility. It must be staffed by people who are well informed and interested in interacting with the public, not just shuffling them in and out.

Advisory Committees, Steering Committees, and Other Groups.—Advisory committees are often established to advise decision-making on a continuing basis. A number of versions exist, ranging from "blue ribbon" (expert) panels, to open membership committees, to special task forces. 3-C agencies are required to have policy and technical committees; some have established citizens committees as well.

The attractions of advisory committees are that they make possible some degree of continuity of participation; those involved get to know each other, making working relations easier; and committee members are, or become, better informed about transportation than the average citizen. The difficulties with advisory committees are myriad; some of the more common problems are the following:

- When advisory committee members are selected because of their special expertise, they are rarely representative of the community. If their views and opinions are given particular weight, others in the community may be

outraged. Technical or professional expertise does not necessarily bestow legitimacy upon its holders.

- When advisory committees are appointed by local officials, even when the aim is to select a representative membership, there tends to be suspicion and resentment among those not included, especially if the committee "legislates" for the community.
- In some areas, advisory committees have been established as the only channel for public opinion and nonmembers have been told that they are being sufficiently represented (whether they thought so or not). Thus they have prevented public participation, the very thing they were ostensibly intended to accomplish. In some cases, advisory committees have been given broad authority and have proceeded to meet behind closed doors and without public contact. Where such abuses have occurred, advisory committees have an extremely bad name.

It is recommended that an advisory committee be used only if requested by a community and, if used, that membership be open to all who want to work on the committee and that all meetings be public. Because of the serious issues of legitimacy and representativeness, it is recommended that, although the agency should be responsive to committee suggestions, no particular authority be given to committee recommendations and opinions. An open advisory committee may encourage increased intensive participation; it may be an efficient source of information about the community, and it may even produce new alternatives. Its meetings can become a forum for discussion of local problems, and may provide indicators of how the community at large will react to specific proposals. But if the advisory committee is a closed elite group, the agency may find itself with more problems than benefits.

Special-Purpose Techniques

The techniques listed in this section would not be used regularly, but might be considered for special purposes. Alternatively, they may be suggested to the agency by outside groups. A wide variety of such special-purpose techniques can be identified. For example, some use has been made of adult education courses designed to introduce individuals in an in-depth manner to various aspects of a study, including the definition of alternatives, identification of direct and indirect effects, prediction of transportation demand, and evaluation of alternative courses of action. The techniques described in the following are representative of those most frequently suggested.

Referenda.—Referenda, the practice of submitting an issue or measure to popular vote, may be proposed by a legislative body or by popular initiative. The referendum may be binding or merely an expression of voter sentiment.

The referendum is used with some regularity to determine transportation funding questions. Infrequently, referenda have been called to settle project-level transportation controversies.

Proponents of transportation referenda argue that the vote allows the general public to join in making a decision that will have significant effects on their lives. The referendum has a broad potential base (all voters within the designated jurisdiction) and therefore is potentially most representative of public opinion of any practical mechanism for obtaining citizen input. The main difficulty, of course, is that it is nearly impossible to meaningfully establish who has the right to vote except in those few cases where a project's anticipated use and anticipated social, economic, and environmental effects are strictly local. The geographic boundaries that define the usual voting districts rarely coincide with the location of affected interests. For example, some of the potential users of a project may come from another state; people concerned about development of a recreation-rich area may live and vote throughout a multistate region.

Referenda can bring about a number of other difficulties. A binding referendum can halt a proposal (although procedures for reversal may exist), but a pro vote cannot guarantee implementation: the necessity of compliance with legal requirements and the availability of appeal procedures (e.g., court suits) may make the vote moot. Nonbinding referenda may have political weight but lack the force of law and thus are powerful only to the extent that decision-makers grant them recognition.

Serious questions also must be raised about the extent to which referenda can express public will. A low voter turnout casts doubt on the results; a good analogy is the survey whose sample is biased. And the referendum is susceptible to other pitfalls of surveys: question wording may elicit particular response patterns; some voters may not understand the issues involved, or care about them; response options reduce complex issues to overly simplistic choices; results offer little guidance or direction for future activities and may not be valid as time passes, because opinions may change. But perhaps the worst problem is that a referendum cannot meaningfully resolve issues of equity of distribution of positive and adverse impacts.

The agency often will have little if any say about whether a referendum will be held on transportation issues. When it does, it should approach the idea with great caution.

Technical Assistance.—Communities or particular groups may have special transportation needs that they feel are not adequately addressed by agency proposals, or they may feel they will be adversely affected in ways that have not been adequately investigated by agency studies. The purpose of technical assistance is to provide the wherewithal for these communities or groups to develop proposals and to conduct studies that meet their particular needs or reflect their interests.

Many towns and small cities, for example, are unable to maintain a sufficient staff to adequately handle local transportation planning and may be worried about the effects on local traffic of the state agency's proposals. Technical assistance could be provided either through earmarked funds to hire professionals or by directly "lending" agency staff to supplement the community's staff.

Particular groups also may have special transportation needs that are not being addressed. A typical example would be the elderly, whose mobility problems often are not addressed in community-wide transportation planning. Technical assistance here, too, could come as earmarked funds or direct staff assistance.

A more complex problem arises when particular groups are dissatisfied with the agency's transportation proposals. In this case, direct staff assistance is less likely to be useful because perceived or actual control of the staff by the agency may lead to lack of credibility.

One possibility is that an advocate planner be hired to champion the best interests of his client group. Advocate planners may develop alternative proposals for client groups, and also may act as technical consultants to help review and critique agency proposals. Advocate planners thus help their clients to do more than oppose transportation proposals; they can develop sophisticated, technically sound plans of their own and can provide more meaningful criticism of the agency's proposals.

A question that often arises is who should fund advocacy planning. In many instances, the groups who most need an advocate planner lack the resources to hire one. Therefore, it has been suggested that the agency fund advocate planners. But if the agency pays the advocate planner directly or exerts control over his selection or supervision, he may lack credibility in the community. Thus it is generally preferable that the community or group be given earmarked funds for, and control over the selection of, the advocate planner. This leads to another question: who should be given funds to hire an advocate planner, inasmuch as there may be a number of groups that would benefit from one's aid? If there is a citizen's advisory committee, or similar group, the agency might enlist their aid in making such decisions.

A potential problem is misrepresentation of the client group's position by the advocate planner. Because of this, it is important that the client group have control over the planner, and that meetings between the planner and the agency be open. It would be highly undesirable for the agency to depend on the advocate planner as the only spokesman for the group he represents.

Mediation and Arbitration.—Mediation and arbitration are both methods of intervention between conflicting parties by a third person or group to promote reconciliation, settlement, or compromise; arbitration goes further to hand down a decision.

In transportation planning, either mediation or arbitration may be useful to settle conflicts between governmental bodies (e.g., the state agency and the city government). Mediation may also be useful in resolving conflicts between the agency and community groups or between community groups. In the latter case, the agency may assume the role of mediator—as it does informally, for example, by looking for compromise alternatives. However, for the agency to formally play this role may be dangerous; it may leave itself open to charges of favoritism.

Arbitration is viable only to the extent that the parties in conflict can be held by the outcome, and so is likely to be useful in working with community groups only in special circumstances.

Ombudsman.—The ombudsman is an investigative officer charged with the responsibility of protecting the public from bureaucratic bungling or abuse of power. Having an ombudsman provides the public with a specific person with whom complaints can be lodged. Typical duties would include hearing and responding to complaints, rectifying mistakes or abuses and cutting "red tape," making reports and recommendations for corrective action, and general improvements in agency operations and decision-making.

Charette.—Charette is a highly intensive effort to produce plans and solutions to particular problems within strict deadlines. Typically, a steering committee whose membership is open to interested persons meets weekly over a period of two or three months to deveolp topics for the charette, identify issues, and collect data. The charette is highly publicized, and because committee membership is open, new issues can be added at any time.

Once preparations are complete, one or two weeks of full-time working sessions are held, often conducted at night and on weekends. Participation should involve key decision-makers and all important interests, but also should be open to everyone from the community. The sessions are oriented to achieving a consensus recommendation. Working against a deadline forces people to crystallize their ideas into proposals and helps induce the kind of intense issue analysis that is needed to formulate alternative solutions and to compromise on stated positions. Though professional planners and designers are present, they act chiefly as technicians, illustrating the consequences of following one line of reasoning or another.

This technique depends on the cooperation of a variety of people, and can help to establish a positive working relationship between the agency and the community. However, it requires sizeable commitment of agency resources. Some community residents, especially those who work evenings or have small children, may not have time to participate; others may be frightened off by the seeming complexity of issues, feeling that they cannot make meaningful contributions.

Characteristics of an Effective Community Interaction Program

The usefulness of any one technique or any set of techniques depends in part on the type of study being performed, current study objectives, the nature of the affected community, and the characteristics of the responsible agency. To obtain the best results, it is necessary to design a *program* of community interaction activities, taking into consideration the uniqueness of the situation, and to coordinate the community interaction program with technical activities.

The type and intensity of interaction activities should be adjusted periodically to reflect current needs. For example, when a study is starting up a relatively high proportion of community interaction resources might be devoted to exchanging information; later, more intensive discussion of issues would be important.

The time demands of running a participatory program are substantial. However, a great deal of time is also consumed if projects are delayed or rejected by those who have not been involved.

Designing and carrying out a good program of community interaction is not simple; it takes careful thought and continuing management. Although the details of each

program will vary, there are a few general characteristics of effective programs, as follows:

1. Participation should not be limited to, or channeled only through, local elected officials. Local officials have an important role in community interaction, not only because they legally are the representatives of all the community but also because they have specific decision-making powers. The agency must recognize local officials' special position in the community and must include them in the planning and decision-making process. However, it is necessary to interact with interest groups and private citizens as well. There are practical limitations on the extent to which local officials can be expected to voice, or even identify, the range of issues which exist in the community at large. In addition, office holders may change over the course of the planning process.

A strategy that might minimize the problem of local officials feeling bypassed is for the transportation agency personnel to stress their role as "staff" to local officials in helping to develop the information on which those local officials must make a decision. There are pragmatic reasons for this: local officials often have a very limited staff with limited expertise in some of the necessary professional areas. The ideal case would be a true partnership, where through cooperative agreement each level of government would contribute staff, and agency and local staff would work hand in hand to run interaction processes.

2. Alternative means for getting involved should be provided. People have varying amounts of time and resources to devote to transportation planning, and they have varying amounts of interest. For example, some may wish to participate intensively; others may prefer to participate on a regular basis (or just now and then) at a lower level of intensity; and still others may wish only to be kept informed about the progress of studies, with opportunities to participate should they so desire at some point. The agency must recognize this and select a range of techniques that will encourage meaningful involvement whatever the frequency and level of intensity each group or individual prefers.

The agency also should select the methods for inviting participation with an eye to the community and the groups with which it is dealing. People's education and experience, self-confidence, and knowledge of politics and government affect their sense of efficacy and thus may influence their tendency to participate in different kinds of activities. For example, formal meetings may be attractive to businessmen but not to people who rarely participate in group activities. The agency should do as much as it can to make everyone feel comfortable in the participation process.

The agency should continue to invite participation throughout the course of studies. Not all persons will become aware of the agency's studies at the very beginning, no matter what level of effort the agency expends on publicizing the initiation of the study process. Also, many groups of individuals may develop an interest in the study as issues of importance to them emerge. The agency therefore should devote continuing efforts to expanding the public's knowledge of participation opportunities. It is dangerous to rely totally on those who first expressed an interest in the project to identify all issues and the concerns of others.

Means should be provided for new participants to quickly understand what has transpired to date. Up-to-date handouts or briefing sessions should be available or a cumulative loose-leaf binder of handouts and related material might be provided. A summary of past events is important to put the process in perspective for the entering citizen. Involvement is not encouraged if "late" participants find themselves lost and confused, and the base of participation may never expand to include all community viewpoints. The plans may then be seen as the product of a narrow elite and rejected by others.

3. The agency should utilize and enhance existing communication channels. On very small projects it is often possible to work with interested citizens and groups on a direct basis via small group or "one-to-one" meetings. On larger projects, it takes more effort to identify those potentially interested in decisions, and it would be extremely difficult and time consuming to communicate directly with all of them. Yet large meetings are not conducive to an in-depth analysis of particular issues.

An agency should utilize existing communications channels where possible. For example, even small communities have a number of organizations—church groups, service clubs, business or farm organizations, PTA's, and so on—that can be contacted. By meeting with members of such organizations, the agency can utilize their already established communication channels and can tap an already existing source of knowledge and concern.

4. Opportunities for participation should be continuously provided throughout all stages of transportation studies, including system planning and programming, location, and design. During system planning it is difficult to identify and predict many impacts, and thus it is difficult to identify who would be affected or how particular interests would be affected. Most people are primarily interested in short-term issues that affect them directly, and it will always be difficult to motivate some people to deal with decisions that involve consequences that may be far removed, perhaps 10 to 20 years in the future. Thus, special efforts are needed to obtain public input in system-level studies.

One strategy is to seek out groups and individuals with ongoing interest in particular kinds of impacts (for example, ecology or economic development). Although such persons will change as time passes, many of the impacts in which they are concerned will remain of interest.

Another strategy is to discuss some of the shorter-term issues that interest the average citizen together with the longer-range "big" questions; those who come to talk about present problems will find out about the long-range problems as well, and how these may relate to their present concerns.

There also should be substantial public involvement in programming decisions. Decisions on the programming of projects for implementation or for further planning have a substantial effect on each project. Therefore, those concerned about each project are likely to have a stake in programming decisions.

Programming, as is discussed in Chapter Four, section on "Interrelation of System and Project Planning," provides the most general link between system and project planning, and involvement of the public in programming can enable them to better understand the linkages between long-term and short-term issues. In fact, programming decisions can be one type of shorter-term issue to stimulate interest in system-level planning.

5. The agency should attempt to reach agreement with participants on a variety of topics, but should recognize that it may be necessary to reconsider decisions. Agency staff can seek agreement on what matters should be investigated in the study; on what community interaction activities should be undertaken; on interim decisions such as what transportation alternatives should be given further attention; and on a final choice. But because it is impossible to guarantee that everyone with a stake in those decisions will be involved at a particular point in time or that conditions will not change, the agency should maintain the flexibility to respond to new participants and to new facts and issues that may emerge.

Although it certainly would be easier if all decisions could be maintained and although it is confusing to have "system planning issues" brought up during design discussions, such things will happen. It is not unusual for there to be a sizeable delay between the initial planning and the construction stages of major projects. People move, and other people's attitudes and circumstances change. Even if everyone who would be potentially affected by early decisions were involved at that stage, there is nothing to guarantee that those decisions would be viable years later. No community interaction program can guarantee the viability of previous decisions. No matter how much effort is devoted to early citizen participation, the decisions reached must be viewed as changeable.

6. Interaction should be structured around matters over which the agency has jurisdiction, but other issues should be handled considerately. Throughout the planning process, the agency should point out what it legally can do and what things are outside its jurisdiction. However, people still may bring up issues not clearly connected with the study or even with the agency.

The agency should be as responsive as possible to such concerns. In some instances, the agency may find that issues that seem irrelevant at first glance can indeed be addressed in its planning efforts, although their integration may require imaginative and resourceful thought. In other instances, the agency should try to direct the concerned citizen or group to the proper authorities or even to assist in bringing the issue to the attention of those with jurisdiction over it.

7. Agency staff should work to establish positive personal relationships with participants. Staff members must be skillful listeners and good at bringing out issues without creating personal antagonisms. They must be careful to avoid "putting people down," intentionally or unintentionally, in the way they present information, respond to questions, or structure the interaction process.

It is often difficult not to answer with anger or to become impatient in trying situations. But if people feel they are being belittled, ignored as "too ignorant" of transportation issues, or treated as adversaries, it will be impossible to develop the good working relationships necessary for effective community interaction. Staff members who undertake community interaction must have sufficient self-confidence to operate effectively in a sometimes threatening environment.

8. The agency should establish an explicit communications strategy. Study activities, including community interaction activities, should be carefully documented; otherwise much information may be lost. The staff should prepare periodic summaries for the decision-makers and for general circulation, describing what decisions have been made so far and the current schedule for further studies and decisions.

Most basic data and internal documents should be available to those who wish to see them. For example, draft working documents should be available for review, and comments should be sought from the public. There are some exceptions; for example, information given to and received by the agency in confidence must be kept confidential. Similarly, information that is the result of judgments about people rather than about issues (e.g., impressions of the strength of a group's commitment to a particular stand or whether or not two groups might be willing to negotiate a compromise on their respective points of view) should not be made public. But unless there is a compelling reason to keep certain information for internal use only, an "open files" policy should be established.

9. Every agency office involved in transportation decisions should engage in community interaction. Planners and decision-makers need to have direct contact with the public. A public information office (or individuals trained in public relations) can be useful in performing functions such as maintaining mailing lists, publicizing meetings, and directing inquiries to the proper office. But a major purpose of community interaction is to help guide technical studies and to provide information needed by decision-makers. There is a danger that an information office can act as a filter if it has complete or even primary responsibility for interaction to the exclusion of other technical staff units.

10. Participation mechanisms should ensure that minority rights are safeguarded. Particular care should be taken to protect minority interests through the participation of appropriate levels of government, interest groups, and agency personnel. Local governments may be able to prevent the state from causing negative impacts to some groups through refusal to agree to projects in their jurisdictions. State and federal review procedures can also be used to monitor whether all residents are being treated fairly, by allowing comments to be circulated to those who potentially may be treated inequitably. Some groups—the elderly, handicapped, etc.—may not be well represented at the local level or within a particular project context, but may conceivably be able to bring influence to bear at the state or federal levels, where it is possible for them to lobby more effectively for programs to meet their needs.

Initiating a Community Interaction Program

Setting up a program of interaction activities, as defined earlier in the introduction to this chapter, involves decisions affecting such things as which information gathering, distribution, and interaction techniques to use; when these techniques should be employed; and the assignment of responsibility for conducting the various activities. A key to success lies in early identification of who wishes to participate and how, and in early agreement with participants on participation activities. Future emphasis is then placed on updating that agreement.

Although there are many sequences of steps which would allow agency staff to initiate a successful community interaction program, the steps employed should at least include the following:

1. *Contact local elected officials and their principal staff.* Explain the agency's procedures as they might apply to the proposed study, and ask for their views on (a) the scope and timing of the study, (b) their own participation, (c) what other public or private groups would be affected by or interested in the study. It is desirable to meet with local officials individually or in company with their staffs to assure that there will be sufficient time for each person to present his or her views and make suggestions. However, if there are no other pressing items on an agenda, many officials also could be contacted at a regular forum that brings together such officials and their representatives. In urban areas, this could be the policy committee for the 3-C transportation planning process, or other areawide or regional policy groups.

Where minor studies are contemplated, initial contact might be made by mail, and a subsequent meeting might be offered. It is likely that for such projects local officials would delegate the handling of all communication on the project to their staffs.

In all initial meetings or initial mailings to officials (as well as to others), the agency should lay out clearly and concisely the things it can and cannot do under its legal authority and the existence of other statutes or regulations that may effectively constrain agency actions. For example, some alternative locations may be prohibited by special state laws. Such communications should be careful to distingiush the requirements of law from administrative regulations and decisions. Many problems and issues may be outside the scope of the agency's ability to resolve, and future misunderstanding can be avoided if the agency can educate others as to the constraints on its actions. Of course, as part of the study efforts, those agency, official, and interested group participants involved may decide to work together to attempt to change these constraints.

2. *Contact private interest groups, civic associations, and media representatives* known to the agency's staff or suggested by others. This also should be done individually to the extent possible. Ask their opinions on (a) scope and timing of the proposed study, (b) their preferences for involvement, and (c) who else should be contacted.

3. *Use mailing lists and other available public and private media* to notify the more general public of the proposed studies and to invite their participation. Examples of different types of potentially affected interests who might be contacted are given in the later section on "Identification of Impacts and Affected Interests." An information meeting or a contact point within the agency should be offered for those individuals or groups who wish to become involved or express an opinion.

4. *Structure participation by offering the level of involvement desired by officials, private interest groups, and individuals,* as follows:

(a) Identify those who want to participate regularly or periodically in the study and try to reach agreement with them on a format and structure for their participation. For instance, all might desire periodic small meetings, or they might want to constitute an informal advisory group to review things together. They also may want to receive periodic written communication.

Here the differences between very major and minor studies are likely to become most apparent. Large numbers of people probably will not seek regular meetings or a regular newsletter oriented to a minor upgrading project, whereas they might desire such mechanisms for a study involving major capital expenditures. The variations in standard procedures (such as may be defined in a state's Action Plan) for an individual study should be agreed upon cooperatively, so participants will know that the agency is operating legitimately.

For very large studies, many groups or individuals, though interested, may not be able to participate regularly but may wish to rely on someone else who shares their viewpoint to express that viewpoint during the study. They may therefore choose others as informal representatives for them, though this does not imply that such representatives should make commitments for those who rely on them to express viewpoint.

For smaller projects it is more likely that everyone who wishes to be involved will simply do so.

(b) Identify those who want to receive drafts of study materials and those who want to be notified of meetings.

(c) Identify those who prefer less intensive involvement, such as periodically receiving brief study summaries or announcements of major decision points so that they know of their opportunity to be heard even if they do not utilize it.

(d) If the project is major or has system-wide implications, offer opportunities for participants to become aware of the system implications of choices for the project. If desired, meetings would be held to bring together participants in the project study and those in all other studies with which it is interdependent. If the outcome of the study may have important implications for regional or statewide programming decisions, those concerned with programming should also be kept aware of study activities.

5. *Negotiate agreement on the course of studies.* For most small projects, it is likely that all parties will quickly agree on the agency's standard study procedures for such

projects, as detailed in the state's Action Plan and this step would take virtually no time. For large or special projects, however, the design of the study may involve some degree of effort on the part of the agency and the interested officials and citizens. Although the basic framework for studies may be provided in an agency's Action Plan, a study design phase would outline the specifics relevant to this project such that all parties would understand what specific study procedures would be used and what level of effort would be expended. Methods of developing study designs and work programs are described in more detail in Chapter Four, in the section on "Process Management."

Case Studies

This section examines community interaction activities in four transportation studies. The studies took place in very different social and environmental settings and dealt with different transportation planning stages, as follows:

Northwest Michigan: regional transportation planning.
Atlanta, Ga.: study design in large metropolitan area.
Boston, Mass.: urban transportation planning.
Maine: project studies in rural conditions.

The discussion is not intended to be comprehensive or to analyze the studies in depth, but to illustrate the variety of techniques used, the dynamics of community interaction, and the timing and interrelation of techniques used within a single study. The purpose simply is to demonstrate how different "programs" of techniques are appropriate in different contexts. Other important aspects, such as how community interaction actually influences the course of technical studies and contributes information to the decision-making process, are illustrated as succeeding parts of this chapter and of Chapter Four.

The Northwest Michigan and the Atlanta, Ga., studies, because they served in part as field applications of this research, are described in more detail than are the Boston and the Maine examples. Subsequent discussions include numerous references to the Michigan and Georgia experiences; the background information provided here serves as the basis for these additional examples.

1. Northwest Michigan

The Northwest portion of Michigan's lower peninsula is basically rural, with several small urban growth centers (Fig. 1). It is a major tourist and vacation area, primarily due to its proximity to Lake Michigan and the many lakes of its glacial topography. The region has a total population of 158,000 but attracts people from Michigan, Illinois, Ohio, Indiana and beyond for boating, swimming, fishing, hiking, camping, hunting, and skiing. Much of the land is state-owned. The study area itself is about 75 miles east-west and 100 miles north-south.

The transportation study was initiated in 1972 with proposals to upgrade U.S. Routes 31 and 131. These roads currently are two-lane, north-south arterials, one near the western coast and the other through the center of the region. South of the study region, the routes have already been upgraded to four-lane limited-access facilities.

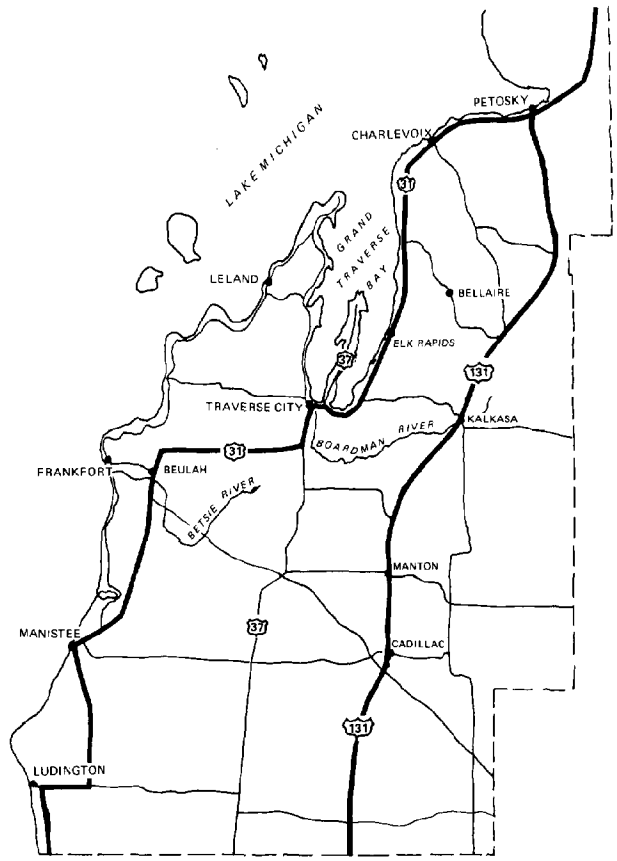


Figure 1. Northwest Michigan Regional Transportation Study, Routes 31/131.

The Michigan Department of State Highways and Transportation is highly centralized, with the district offices performing only maintenance functions. The distance to the study area from the central office in Lansing ranges from 100 to 225 miles; visits to the area are viewed as major expeditions. The problem was how, from its Lansing headquarters, to involve a population dispersed over a large area in a long-range system planning study.

Prior to the initiation of major technical activities, public meetings were held in May 1972 in each of the region's four major growth centers in order to introduce the study. Brochures describing the study, some preliminary traffic analyses, and questionnaires were made available at these sessions. The questionnaire also was printed in some newspapers. Publicity for the meetings was provided by a press release. The objectives of the meetings were to inform the public of the study and of the planning process, and to learn about the public's concerns.

A second round of meetings was held in the same four cities in August 1972 to further increase the public's awareness of the study and to help insure continuity of contact. In anticipation of the meetings, material was mailed to 840 organizations in the region. The material included a revised questionnaire, an invitation to the meetings, and a slip to be returned if further information or questionnaires

were desired. Press releases were accompanied by cover letters, and in some cases were followed up by telephone calls. Fifty posters were placed throughout the region in high-visibility spots such as store windows or bulletin boards. The May brochures were redistributed at the August meetings.

Following the August meetings county and local governmental officials were interviewed. The interviews were later extended to informal leaders—those persons active in the community but not holding official positions.

The media were also used to gather information. The last two years of all major regional newspapers were scanned to gather information on what issues were of concern to persons in the region and to identify potential spokespersons. A survey of industrial users was conducted in conjunction with the regional planning agency to help determine the implications of a threatened discontinuance of rail freight service in the region and to investigate how these firms were presently using these rail lines and other transportation modes.

No formal citizen advisory committees were used, although agency personnel attended meetings held by the transportation advisory committee of the Northwest Michigan Economic Development District and Regional Planning Commission.

Public meetings served as the core of the Michigan interaction program, and were begun at the initiation of the project in order that the public be involved from the outset. Considerable experimentation was performed with the format of these meetings, and it is useful to examine this experience as it proved to be rather typical.

The May 1972 meetings were formal and were held on weekday evenings. One staff member gave a formal presentation with slides, followed by a general question-and-answer session. This staff member also answered the questions from the audience, although other personnel were available if needed.

The meetings in August were more informal. Instead of a speech and slide show, several staff members were spread around a large room with visual aids such as maps and posters. It was intended that the citizen would walk around and get involved with the agency personnel on a one-to-one basis. In this way, persons too shy to comment in front of large groups could talk in more comfortable surroundings. In addition, the time of others would not be spent listening to matters of limited or personal concern.

As persons left the August meetings, they were interviewed on their reaction to the format. Although most appreciated the more informal atmosphere, some indicated that they felt lost as they walked into the meetings and found many people standing around a room. This feeling of aimlessness was attacked in two ways for the last two August meetings: (1) an orientation sheet was available at the entrance to explain the meeting format, and (2) sign posts were erected near the scattered personnel to identify their expertise (planning, traffic, environment, route location, right-of-way, and regional). In addition, team members not engaged in discussions were alerted to help orient persons as they came in.

Although the intent was that persons could drop in at any time between 1 and 4 PM and between 7 and 9 PM, most came at 1 or 7 PM. Furthermore, most seemed to expect a presentation by the agency. The informal, drop-in nature of the August meetings was not well publicized. The fact that many persons expected a speech is no reason to consider the informal format unsuccessful.

The Michigan Department of State Highways and Transportation plans to combine the formal and informal formats in the next series of meetings. The meetings will open with a formal presentation lasting 30 to 45 minutes. A half hour or so will be allotted for questions. The meetings then will break into subgroups similar to those used in the informal meetings.

In this way, it is hoped that the advantages of both the formal and informal situations can be retained. Questions of general interest can be answered once rather than several times, leaving more time available for other matters. Also, remarks made by some may spark thoughts for others.

2. *Atlanta, Georgia*

Atlanta is representative of a number of U.S. cities under two frequently conflicting pressures—continued economic growth and environmental and social sensitivity. Atlanta is commonly recognized as the business capital of the Southeast. In recent years, it has both approved construction of a new transit system with rail and busway components and delayed construction of new freeways planned for its Eastside district.

The Atlanta Area Transportation Study Report published in 1971 recommended a freeway in the Westside area of Atlanta connecting the I-75, I-85 interchange at Brookwood Station north of the CBD with I-85 near Hartsfield International Airport southwest of downtown Atlanta (Fig. 2). The principal "need" for this freeway was to relieve longer-distance through trips on the combined I-75, I-85 connector through downtown Atlanta and the planned I-485 and to provide for central area access from the north, northeast, and northwest sectors of the region. In May 1972 a consultant reported on a limited traffic service analysis of the Westside area and recommended as the most desirable of four alternatives from a traffic service standpoint a freeway in the outer portion of the corridor and a new distributor close in near Northside Drive. The outer freeway would carry the longer-distance trips and the distributor would serve central area access and circulation.

The Westside houses the majority of Atlanta's black population, contains several major black universities, and has a number of lower-income and industrial neighborhoods. The Georgia Department of Transportation recognized that the introduction of any major transportation improvements in this area could have enormous social, economic, and environmental effects and potentially could become as controversial as the proposed Eastside improvements.

In undertaking the new Westside studies, the Georgia DOT decided to work cooperatively with Atlanta University, a black university located in the corridor of the proposed freeway, in conducting an open, participatory study design. The objective of the study design was to develop

a preliminary statement of the major issues facing the area and to determine the scope and requirements of a Westside transportation evaluation study to be subsequently conducted by GDOT and other cooperating institutions and agencies.

The study design process was initiated with letters sent by

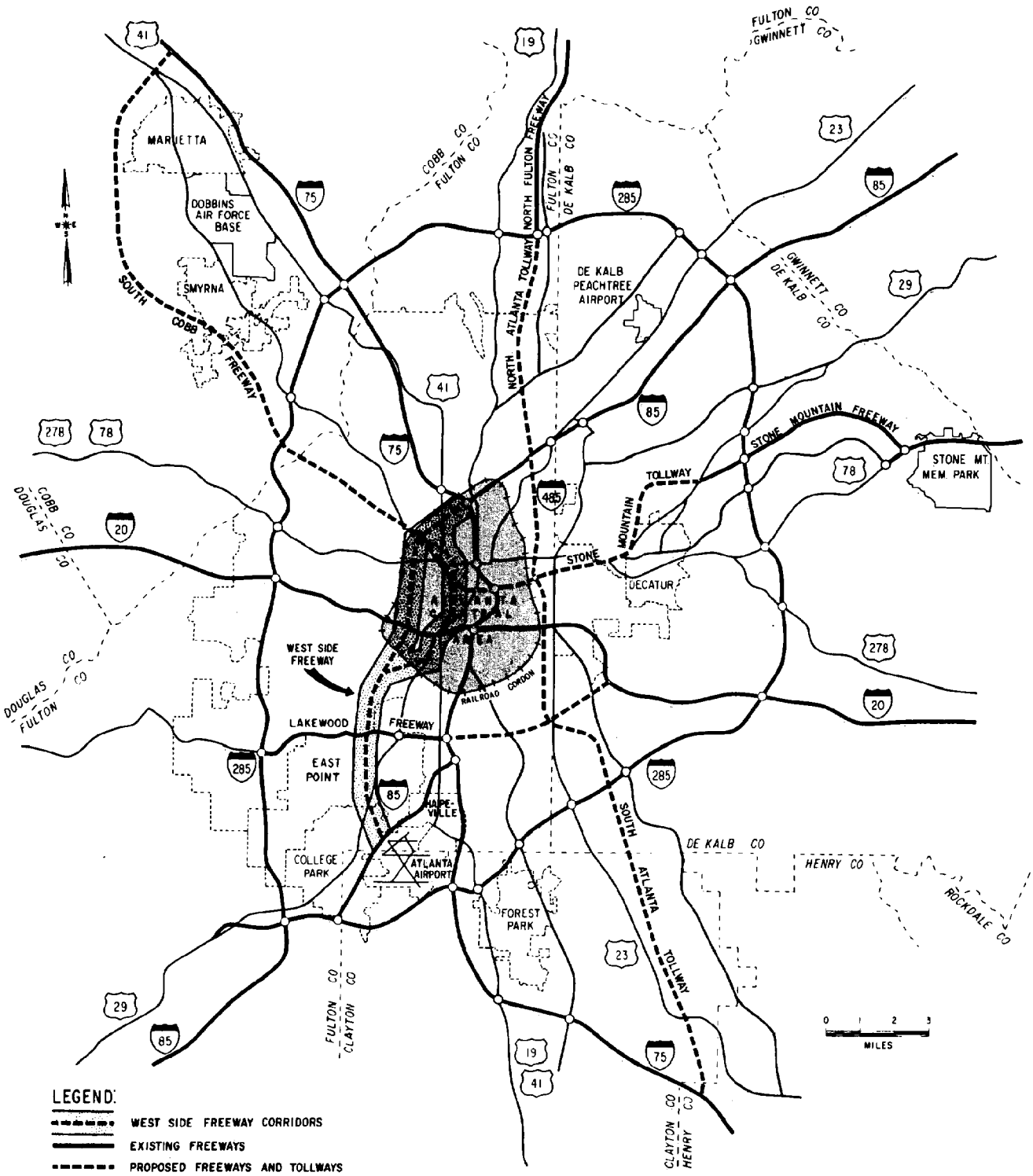


Figure 2. Atlanta (Ga.) Westside Transportation Evaluation Study.

the Georgia Department of Transportation to the mayors of Atlanta, College Park, East Point; to county commissioners, city aldermen, state and local representatives; and to the heads of the Atlanta Regional Commission (ARC), Metropolitan Atlanta Rapid Transit Authority (MARTA), and Atlanta Model Cities Agency, inviting them to participate in a formal study design team. The study design team was charged with completing their task in five months. Because of budget and staffing constraints, it was decided that the focus of the citizen participation program would be a series of large public meetings to be held at a central location in the project corridor. A second meeting site was added later when it became apparent that some corridor residents were reluctant to come to the principal site. Meetings were held biweekly, and smaller spin-off meetings with individual interest groups were encouraged.

The study design community interaction activities were loosely guided by the following set of objectives:

(a) Legitimize a new planning process in which the public could be actively involved, if they chose to be.

(b) Gather information useful in writing a study design.

(c) Inform the public about prior transportation decisions, agency responsibilities, and mechanisms by which citizens could help develop the study design.

To obtain public participation in the meetings, the study design team compiled a list of 100 local and regional interest groups, which were sent letters informing them of the study design and inviting them to attend the first scheduled public meeting. These groups ranged from Westside area neighborhood associations and business interests to the Georgia Conservancy. They included both pro-freeway groups such as the Chamber of Commerce and Central Atlanta Progress and avowed freeway fighters like the Atlanta Coalition on the Transportation Crisis. There also were many nonaffiliated citizens, groups of elderly residents, and other groups not in the pro or con camps.

The letters inviting participation included a map of the study corridor, a stamped return postcard, and an information brief. The postcard was included to determine how many of those invited would attend and whether there were any additional participants who might come. Approximately 21 percent of the postcards were mailed back. The information brief contained background data on the earlier Atlanta Area Transportation Study (AATS) and post-AATS technical work completed prior to September 1972; brief discussions of the distinction between the study design and the actual study; the basic philosophy underlying the planning process; and discussion of the requirements set down by FHWA PPM 90-4, the Process Guidelines.

A press release announcing the study design process was sent to the *Atlanta Constitution-Journal* and several small neighborhood papers on the same day that letters were received by the 100 interest groups. The press release was developed by the Georgia DOT Public Information Office and was approved by the study design team. A second press release announcing the time and location of the first public meeting was sent out nine days later (a week prior to the meeting). Articles appeared in several neighborhood papers, but the *Constitution-Journal* ran no articles based on the press releases. Because the team could not obtain news coverage in the major papers, Georgia DOT paid for advertisements to announce the public meetings. These ads usually were run for several days prior to each meeting.

In addition to the newspaper articles, other techniques used to inform the general public about the large meetings included flyers passed out at local shopping centers and on MARTA buses, team members appearing on a television news program, team members appearing on a Westside-oriented radio talk show, announcements on other popular metropolitan radio stations, and placement of signs at strategic locations near meeting sites. Another check on attendance of the 100 invited interest groups was provided by telephoning them just prior to the first meeting. Attendance lists were kept for each meeting.

To facilitate a two-way flow of information, much effort was expended to prevent the atmosphere of the public meetings from taking on the formality of a traditional public hearing. The meetings were held in a high school cafeteria rather than the auditorium so that more flexible seating arrangements could be obtained, and so that the study design team members and the public would not be rigidly separated.

The meeting format usually consisted of presentations by members of the study design team, after which the floor was opened to a general question-and-answer session. Several microphones were placed throughout the room so that people could be heard easily. At some of the later meetings the staff presentations were brief and the attendees then divided into smaller groups to discuss particular issues related to the study. These groups then reported their conclusions to the whole group after a specified time period. To encourage substantive discussion, "working papers" on each study design topic were made available to the public at least one meeting prior to their discussion. All large public meetings were recorded by a court reporter, and the record was made available to anyone who wanted a copy.

The study design team encouraged local neighborhood groups to invite team members to make presentations at group meetings. A number of such small meetings also were held with local planners and developers doing work that might affect the study.

Team members were always available to the public through a central phone number. Whenever team members took calls from the public, they filled out a citizen response form. These forms contained: date; name, address, and telephone number of the person calling; subject of call (environmental, economic, social, transportation, non-transportation, esthetics); put on mailing list (yes/no); response to the call by the team member (e.g., "mailed information brief to John Smith on March 17, 1973"); and the signature of the team member handling the call.

A draft document was completed in April 1973, and subjected to extensive review by state officials and by community residents (*112*). The study design discussions raised several issues, many of which were never completely resolved. Chief among these was the clarification of roles to be played by Georgia DOT, the Atlanta Regional Commission, and the City of Atlanta. Other key issues were the

relationship between a Westside Freeway and regional development, and the degree to which nontransportation issues should be addressed in the study. Eventually it was decided not to undertake further technical studies in the Westside until a region-wide plan update, already under way by ARC, could be completed. This decision was based in large part on the wide range of transportation solutions that the community requested to be studied. Additional results of the participatory Atlanta study design are discussed as part of the sections on "Process Management," and "Institutional Arrangements and Decision-Making," Chapter Four.

3. Boston, Massachusetts

The recently completed Boston Transportation Planning Review (BTPR) represents probably the largest and most comprehensive attempt at an open, area-wide participatory planning process. The 18-month, $3.5 million study covered the entire Boston metropolitan area and concerned both highway and transit modes. Because the BTPR has been extensively analyzed elsewhere (*62, 109, 119, 125, 140*), this example focuses only on definition of the variety of community interaction techniques employed. Gakenheimer (*109*) and Sloan (*140*), in particular, provide in-depth analyses of the results of the participation activity.

The restudy was initiated in January 1970 after years of controversy, when the Governor of Massachusetts made a decision on the basis of a citizens' task force report to restudy transportation in the Boston area. This decision was followed by establishment of a steering committee to design the study. The committee included representatives of state agencies, local cities and towns, and environmental groups, business interests, and neighborhood-oriented groups. The groups participating in the study design reached a general consensus on the scope of the study with the objective being to reassess three Interstate Highway projects and determine the directions for Boston transportation policy in the decades ahead. When the study began the populace was already strongly polarized, with groups firmly committed to pro- and anti-highway positions. The Planning Review was supposed to clarify the various issues of choice so that the Governor could evaluate the available short-term options and decide on a course of action.

Staff to perform the study was selected cooperatively. A 15-member review committee made up of representatives from state agencies, local governments, and private groups read proposals from the 15 firms interested in the prime contract and reached virtual unanimity on the selection of the prime consulting firm and project manager.

The BTPR was scheduled to last from July 1971 to January 1973 and was divided into three phases, with each phase ending with decisions on which alternatives should be dropped and which kept for more detailed study. Phase I, which ended in November 1971, considered any and all proposals in a sketch planning fashion. Those alternatives deemed preliminarily acceptable were subjected to more detailed analysis during Phase II, the next 8 months of study. Phase III was a design and evaluation period for the remaining alternatives.

Although the entire planning process was open to the public, an intensive core group called the Working Committee was established to provide a forum for continuing intensive citizen and agency input. The membership of the Working Committee was fairly representative of the kinds of major groups concerned with transportation in the region. There were representatives of local governments, principal state agencies, and private interests, including a highway builder's association and an anti-highway coalition of neighborhood groups. Committee membership, however, was open and the study director expanded the committee at the suggestion of members who felt that certain interests were not represented sufficiently. Meetings of the Working Committee were held each week and were chaired by the BTPR study director. The meetings were open to the press and the public, though they were not advertised extensively; about 35 persons regularly attended.

An intensive period of open community meetings occurred during Phase I with the purpose of getting all the issues out on the table. Participants were asked to speak of transportation problems and possible solutions with no thought given to cost. Although cost obviously would become a limiting factor, the staff wanted to encourage free thinking about solutions.

All staff members of the BTPR interacted with the public to varying degrees, although the demands of technical work and the tight time schedules did increase the need for some structuring of citizen input. It was estimated by one BTPR staff member that the top five or six professionals on the staff spent half their time in contact with the public or in preparation for such contact.

Some BTPR staff members were devoted full time to community interaction. The participants in the Study Design negotiated an agreement with federal and state agencies to commit 10 percent of the total $3.5 million budget to the establishment of a special study element and associated staff concerned with Community Liaison and Technical Assistance (CL/TA). CL/TA members were recruited locally and reported directly to the state-appointed Project Director, not to the consultant manager. In this way the CL/TA staff was less influenced by loyalty to technical products, or by the needs of consulting firms.

For community liaison, the CL/TA staff attempted to get persons involved in the process, set up meetings with technical staff, and listened to complaints and suggestions. Technical assistance included surveys to study special mobility needs, assistance to communities or groups in their applications for funding, and translation of community needs into transportation proposals.

The BTPR tried to have as open a process as possible, including open meetings, public availability of technical documents, and early release of memoranda and draft reports. Community interaction techniques used extensively included:

Public Information

Press releases
Press conferences
Television
Newspaper features
Legal notices

Mailing list
Newsletter
Month-in-review
Interim and final reports
Technical memos
Review of drafts
Graphic displays

Meetings

Working committee
Subregional working committees
Regional meetings
Public hearings
Neighborhood meetings
Informal working sessions
Briefings for elected officials and agency staff

Surveys

Scientific sample
Questionnaire distribution (no controlled sample)

4. Maine

Community interaction is sometimes associated only with the construction of new freeways in urban areas, or with cases involving significant opposition. But substantial community interaction has proven to be useful in planning rural projects and in situations where there is a virtual consensus for improved highway facilities. The Maine Department of Transportation has been successfully employing a community interaction program based on the use of informal "informational" meetings (*71*). The typical Maine project is represented by the rebuilding of a few miles of two-lane road in a rural area. Populations are measured in the hundreds, not hundreds of thousands. Displacements are correspondingly small in number if they occur at all.

A study is initiated by mailing of an announcement and questionnaire to all residents and businesses located within the corridor of study. The announcement describes the purpose of studies and the field survey procedures to be followed. The questionnaire (see Fig. 13) requests information on historic sites, environmental areas, cemeteries, or other similar features that may be of particular significance. This information is intended as both a check on and a supplement to that obtained through the formal A-95 clearinghouse review.

Informational meetings are held in parallel with technical design studies so that interaction can be oriented to helping to identify the effects of existing alternatives and to suggest potentially new alternatives. These meetings are open to the public, with municipal officers and property owners meeting together. Informal records are kept of these meetings.

A formal public hearing is held only after the agency has been able to "talk the thing through" with all interests and has achieved as much agreement as possible. The objective of the hearing is to make sure, finally, that the public knows what the Department has done and is going to do, and that agreement on the course of action to be followed has in fact been reached.

EVALUATION AND REPORTING

Introduction

Evaluation, narrowly defined, is the task of appraising alternative transportation plans to ascertain their acceptability and to develop a recommendation for a decision. In recent years, evaluation moved from the field of "judgment" to a seemingly more rational, objective basis with the use of "benefit/cost analysis" and similar economic criteria. Today, however, in the context of the wide range of social and environmental effects to be considered and the diverse views of different groups as to the values to be applied, it can be misleading if not dangerous to use solely economic methods for evaluation.

A broader, more subtle approach to evaluation of transport plans and projects is required. Such an approach is described and demonstrated in this section.

Evaluation as a Basis for Decision-Making

Evaluation can be broadly defined as the process of periodically appraising the alternative transportation program packages to ascertain their acceptability, desirability, and feasibility; to identify issues that have arisen; and to determine future tasks for the planning staff.

To be effective, evaluation must be clearly and directly related to decision-making. The planning and design of transportation facilities and services can be characterized as a process that gathers certain data, makes decisions based on those data, and communicates those decisions to the audience presumably affected by the decisions. Typically, key decisions are made throughout the course of studies. Decisions are made to collect certain data but not others, to develop particular alternatives but not others, to interact in certain ways with groups or individuals, to ask certain questions, and so on. Some of the most important decisions concern actions that are not to be undertaken.

The manner in which these decisions are made and communicated has significant effects on those people affected by them. Documentation of the bases for decisions is important to internal staff as well as to other agencies, officials, and the public. There are many instances of opposition to agency proposals made at public hearings or other meetings when it is perceived that the real decisions have already been made. Also, many significant decisions have been made in the past without explicit documentation of their basis. As time passes or personnel leave the organization the rationale for many decisions leaves with them. This situation should be considered unsatisfactory by agencies that may find themselves being asked questions about past decisions by the public or the courts and lack the documentation with which to respond.

The output of evaluation depends on what stage a study is in. Early in project or system studies the output might be a clear definition of what kinds of alternatives are to be considered, what impacts are especially important, and which interest groups desire to be involved. Later, as alternatives are more clearly defined, emphasis shifts to documenting key impacts, and the preferences and potential acceptability of each alternative to various interest groups.

As important decisions are made about which alternatives should be dropped, these decisions and the reasons behind them should be carefully documented and reported to the public and relevant agencies.

One evaluation report is the Environmental Impact Statement, or equivalent, which would draw on previous evaluation efforts so as to document the entire process to that point. Other kinds of evaluation reports are generally prepared in connection with other major planning or project decision points; for example, a state or regional transportation plan should be accompanied by an evaluation report identifying the distribution of positive and adverse impacts, describing the issues of choice, and examining alternatives to the proposed plan. It should be emphasized, however, that the output of evaluation is not necessarily voluminous mounds of paper. Memos, brief reports, oral briefings, slides, maps, and graphs are all legitimate mechanisms of communication. The goal of evaluation should be to convey the important information necessary to assist those responsible for making decisions, in as brief a space as possible.

The audience for an evaluation report will include planning staff, elected officials, other agencies, the general public, and other transportation agency staff not participating in the particular project being discussed. Some information will be sent to all of these people; some will be of interest to fewer persons. The periodic application of evaluation is emphasized as a means for coordinating various work activities and stimulating active citizen participation throughout the planning process.

Requirements

The evaluation and reporting process is intended both as an internal management aid and as a systematic means of providing timely and comprehensive information to decision-makers, local, state, and federal agencies and officials, and the public. To do this effectively, evaluation and reporting should:

1. *Indicate the differential incidence of impacts resulting from different alternatives.* Reports must document in a disaggregate form who will receive the benefits and who will bear the costs of implementing change in the supply of transportation facilities and service. Information on the gainers and losers from proposals must then be communicated to the relevant decision-makers and the public.

2. *Highlight the tradeoffs among alternatives.* Decision-makers and private citizens alike must be informed on the issues of choice. It must be clear to all concerned which attributes of one alternative must be traded off against attributes of other alternatives.

3. *Operate on qualitative, as well as quantitative, information.* Many of the impacts of transportation facilities are qualitative in nature and cannot readily be represented by a number. Attempts to reduce all impacts to numerical analysis tend to hide the real issues with which decision-makers must wrestle.

4. *Treat uncertain and incomplete information.* Many social, economic, and environmental impacts will almost always have a high level of uncertainty associated with their estimate, especially during system planning stages when alternative projects are insufficiently specified to permit complete impact analyses. Even quantitative data, such as traffic demand data, are inherently uncertain. Uncertainty should be explicitly documented and recognized by evaluation.

5. *Recognize that different interests place different relative values on different objectives and impacts.* Just as impact information should remain in as disaggregated a form as possible to indicate the manner in which various interests may be beneficially and adversely affected, value-related information should also remain disaggregated. Different interests will have different preferences and these cannot be realistically combined. Further, an interest's values, or preferences, cannot be determined in the abstract, but are relative to specific and meaningful actual choices.

6. *Guide a process by periodically setting priorities for future staff work.* Evaluation should not be performed just at major decision points. Evaluation should serve as an important management function to define priorities for future community interaction, impact prediction, and development of alternatives. By setting up a process of periodic systematic review, staff are better able to respond to the issues identified and modify the alternatives being studied. Staff can concentrate their efforts on the minimization or elimination of potentially adverse effects and on the further development of those alternatives identified as being potentially acceptable to the public; they are less apt to expend valuable resources in activities of marginal value.

7. *Be clearly related to the decision-making process.* Major decision points should be publicized well in advance of their occurrence, and the public should be informed about who the actual decision-makers are. Because agency staff are often the principal source of information to decision-makers, it is important that their reports (including drafts) be available for public scrutiny, written in language understandable to the public, related to the real issues of choice, and that the public have access to decision-makers prior to the time when decisions must be made.

8. *Document decisions made, and the issues considered.* The public as well as the courts are increasingly asking for information about the basis for decisions. By periodically evaluating the issues that arise, the agency staff compiles a history of the planning and design process as it occurs. Moreover, the environmental impact statement required by federal law becomes a natural by-product of the planning process. Planners and decision-makers can be more sensitive to the desires of the public through frequent attempts to analyze and resolve the issues associated with a project, and the conveyance of this information to the affected public. Also, because many important decisions are made on a day-to-day basis by low- and middle-level agency staff, and some of these decisions may have as great an effect on a project's outcome as high-level decisions, documentation of the reasons for decisions should be done when those decisions are made.

Approach to Evaluation

Input to Evaluation

The evaluation process operates on the information gathered through community interaction, the data produced during impact prediction, and the alternative program packages under consideration, in an effort to distill out the issues and assess the desirability of each proposed action. This information may be categorized as information about actions, information about values, and information about what is not known, but should be known. The information about actions is summarized in terms of impacts on groups or individuals. Information about values is represented by the manifest preferences that have been expressed by various people.

The Evaluation Method

The following evaluation method, as is demonstrated in the succeeding examples, need not be followed in strict sequence, as it is more likely that the analyst will end up emphasizing different activities at different stages of the planning process. The method consists of four activities (Fig. 3):

Activity I. View the Issues from the Perspective of Each Identified Affected Interest.—The thrust of this step is to view the consequences of proposed alternatives as they affect particular groups and individuals, and as those groups perceive them.

(a) *Examine each identified affected interest, one by one.* Select each interest in turn and go through the following steps (b)-(d). Procedures for the identification and grouping of interests are described in the earlier section on "Community Interaction" and the later one on "Identification of Impacts and Affected Interests."

(b) *Review the impact information.* How does each action affect that interest? If negatively affected, are reasonable compensatory measures included in the action?

(c) *Review the expressed opinions, goals, and preferences for that interest, and the results of (b).* What is the opinion expressed by the interest toward each action? Why? Is there uncertainty about the interest's attitude toward an action? What kinds of interaction with that interest would help to clarify their expressions of preferences? Can a ranking of alternatives by the interest be determined? Are there modifications of any action that would make it more acceptable to the interest? Are there any other actions that the individual or group has proposed for consideration or might be likely to propose?

(d) *Review the impact data and their uncertainty.* Are there impacts for which the interest wants more, or more accurate, information? Are there impacts not yet predicted that are considered to be important by the interest?

Activity II. View the Issues from the Perspective of Each Action.—

(a) Examine each proposed action, in turn, and go through the following steps (b)-(e) for that action.

(b) *Issues of community concern.* How does the proposed action respond to people's concerns? To transportation issues? To related issues? How can the action be changed to make it more responsive to such concerns? Do other agencies or governmental bodies have jurisdiction over some issues being raised?

(c) *Issues of feasibility.* Is the action feasible technically? Legally? Financially? If not, what could be done to make it feasible?

(d) *Issues of equity.* Who would receive benefits from this action relative to the do-nothing alternative? Who would receive adverse effects that cannot be adequately compensated?

(e) *Issues of potential acceptability.*
- Which interests would be likely to support this action? To oppose it?
- For whom is there uncertainty as to their likely attitudes? Why?
- Would additional information on this action's effects be useful? Which effects? What are the relative priorities for impact prediction?
- Would additional information on anyone's preferences be useful? Whose? What are the relative priorities for community interaction?
- Would some modification(s) of the action increase its desirability?
- What modifications? What are the relative priorities for development of alternatives?

(f) Summarize the major assets and liabilities of this action.

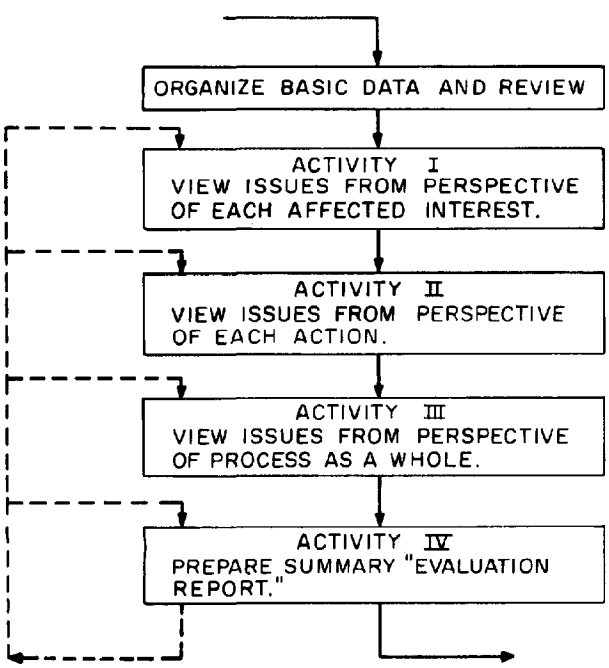


Figure 3. Basic activities of the evaluation method.

Activity III. View the Issues from the Perspective of the Process as a Whole.—To gain further insights, all the actions are considered together, in a search for "patterns" or relationships extending across several, many, or all actions and/or interests.

(a) Review the results of the preceding steps.
(b) Is there any action(s) for which the disadvantages are sufficiently great that it should be removed from further active consideration?
(c) Issues of community acceptance. Are there different groups of people who share similar views about each of a group of several actions? All actions?
- Are there groups that have opposing views about a single action? Some group(s) of actions?
- For interests in conflict over actions, are there other actions on which they would not conflict? Can compromises be reached by modifying alternatives or developing new ones?
- Is there any action(s) that could have or does have substantial community acceptance?

Activity IV. Summarize the Results of the Previous Activities.—

- What are the major arguments for or against particular alternatives?
- What are the major areas of conflict, both among alternative goals and/or among affected interests?
- Which actions have the greatest potential for public acceptance?
- What are the priorities for further work in the consideration of alternatives, the prediction of impacts, community interaction, and integration with system studies?

The results of using the evaluation method should be documented and reported to decision-makers and other interested persons. Such documentation and reporting could take a variety of forms, but would usually include some summary evaluation report supplemented by briefings and meetings.

Relation of Evaluation to the Environmental Impact Statement

The proposed evaluation method is designed to be compatible with the Environmental Impact Statement (EIS) required by Section 102(2)(c) of the National Environmental Policy Act of 1969. This act requires that before decisions are made on major federal actions, a statement be circulated describing:

(i) the environmental impact of the proposed action,
(ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,
(iii) alternatives to the proposed action,
(iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
(v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Such a statement must satisfy two conflicting but essential considerations. First, the *intent* of this reporting requirement is to insure that the federal agency fully informs others of the potential consequences of its proposed actions. To inform people, an impact statement should be brief and readable, and people should not have to wade through hundreds or even thousands of pages to elicit the information of interest to them. But, second, the EIS must be thorough and represent a complete analysis. For many large projects, this implies a length of several hundred pages.

One way out of this dilemma may be to have one part of an environmental impact statement provide a cogent summary, with other sections filling in the details. The summary section could be based on the recommended evaluation method, and the rest of the statement would add the detailed descriptions required by Section 102(2)(c) and its implementing guidelines (*150, 151*). Alternatively, the framework of the evaluation method can be used to present the full set of information and the EIS format requirement can be used as the basis for the summary as shown in the following section.

In any case:

(a) The evaluation method can assist in producing a report that meets the spirit and intent of 102 (2)(c) and FHWA PPM 90-1.
(b) The EIS should evolve from a natural reporting strategy, such as is represented by the proposed evaluation method.
(c) The essence of both an EIS and the recommended Evaluation Report is a discussion of tradeoffs.

Relation of Method to Other Evaluation Techniques

The evaluation method described in the foregoing made no mention of evaluation techniques, such as benefit/cost ratios, that have been used in the past. It is useful to relate the proposed method to these other means of evaluation. These techniques fall into three major groups: pure judgment, economic analysis, and rating and utility/cost schemes (*165*).

1. *Pure judgment.* In this approach, the basic method of evaluation is judgment. In some cases, the judgment is that of a professional engineer, planner, or economist, using technical data on the costs and feasibility of a project. In other cases, the judgment is that of a political decision-maker, perhaps with some attention to technical data, perhaps weighing only the "political" or financial advantages and disadvantages of a project.

Variations in this approach which are more systematic in nature are possible. These would include the use of peer reviews, professional panels, or a structured reporting format such as that utilized in the evaluation method proposed herein.

A further extension of the judgment approach is to support the systematic application of judgment through the use of one or more analytical approaches.

The stress on "pure" judgment reflects the fact that, although some judgment enters into all evaluation methods, this method generally relies solely on judgment. Another way of putting this is that evaluation and choice are tightly intermingled; as the issues are weighed, a decision is made.

2. *Economic analysis.* In this second approach, the evaluation of projects is based on an economic analysis of costs and benefits where all impacts (benefits and costs) are measured in dollar terms. For public-sector decisions, the basic approach has largely been that of benefit/cost analysis, considering primarily user benefits. Through use of appropriate interest rates, etc., "costs" and "benefits" at different times are made comparable (for example, by placing on an equivalent annual basis or using the net present value approach). Then, each alternative project is evaluated by determining the total costs and the total benefits for the project and computing a benefit/cost ratio for the project; projects are compared on the basis of these ratios.

This approach, with numerous variations and modifications, has been used in highway project planning and for other kinds of public-sector transportation investments as well.

3. *Rating schemes.* In this type of approach, procedures are established for weighing the various "impacts" of a project and computing a "score" for each alternative. The various alternatives are then compared on the basis of their scores.

The Linear Scoring Function (LSF) is one special case that illustrates the rating scheme approach (*149, 163*). More advanced forms of rating schemes include various mathematical programming formulations. In the linear scoring approach, a total score (S_i) is defined as:

$$S_i = \sum_{j,k} (w_{jk}\, x_{ijk})$$

in which

S_i = total score for alternative i;
w_{jk} = weight placed on impacts on interest j of type k; and
x_{ijk} = level of impact of type k on affected interest j, for alternative i.

The values of x_{ijk} are the data defining the impacts of each action (i) on every interest (j) for all types of impacts (k). Once these data are obtained, the Linear Scoring Function approach requires the establishment of a set of weights (w_{jk}) to be used in computing a total score (S_i) for each alternative. The alternatives then are compared on the basis of the relative values of their scores (S_i).

Each of the approaches summarized in the foregoing has certain advantages and disadvantages when compared to the basic requirements to be satisfied by evaluation. Rather than viewing evaluation as the application of a single technique as is frequently done, it is both desirable and necessary to assume a broader perspective where a number of techniques ranging from benefit/cost and cost/effectiveness analyses on through more judgmental approaches are used in combination as part of an over-all evaluation process. In such an approach: (a) mathematical analysis techniques can have a useful role, but they should not have a dominant role; (b) subjective judgment is essential; (c) what is needed is a basic evaluation method such as that proposed whereby subjective judgment can be applied systematically, using analysis techniques in a supporting role where useful.

In the past, too, much emphasis has been placed on one technique, such as the benefit/cost ratio, to the detriment of social and environmental concerns which could not readily be valued in numerical or money terms. Although these evaluation techniques can provide useful information (even if only economic information), they must be used within a larger strategy aimed at illustrating all the issues that confront decision-makers.

The problems with using only benefit/cost analysis or linear scoring functions instead of a broader approach to evaluation are several. Most fundamentally, they attempt to "add together" things that cannot be legitimately added together by a technical or staff analyst. Most critical choice issues tend to be hidden due to the desire to reach a "total score" for each alternative. Within any "total score" there is a distribution of impacts on various groups, with some gaining and some losing. Thus, the "total score" purports to represent what is good for society, but it fails to recognize the existence of different, and frequently conflicting, interests within society and the legitimate desire of these interests for equitable treatment.

Any benefit/cost analysis or linear scoring function uses "weights" for particular impacts, where values are assigned that represent the importance of those impacts, But *whose* "weights" should be used? Different groups have different weights, which largely are not determinable in the abstract. Only a very naive group would agree to a compromise on a set of weights beforehand and then find that the resulting "highest score" alternative has disastrous results for them. Each group's values are important in the choice, and their importance should not be diluted by aggregating together the values of many groups. The convenience of having one "total score" does not outweigh the loss of information about the tradeoffs necessarily involved in the choices among alternatives. These techniques tend to hide the issues—who gains? who loses?—instead of bringing them out.

To overcome these limitations of benefit/cost analysis and linear scoring functions, the recommended evaluation approach is structured so as to stimulate people's understanding of what their actual goals and preferences are. In this way, the approach differs substantially from others. Other approaches to evaluation attempt to define goals or values first, then apply those abstract statements of preference to alternatives. The most basic difference between the recommended approach and others is that the recommended approach does not assume that persons can consistently formulate their goals and values in an operational way without going through a *process* of looking at choices as they evolve over time. Other approaches to evaluation, such as benefit/cost analysis or linear scoring functions, are traditionally applied at one point in the process, and used as a basis or justification for a final choice. In the recommended approach, such narrower techniques could be used but as one of many ways to explore choices and values, not as a quick and easy basis of making decisions.

Example: A Rural Location Project

To illustrate application of the proposed evaluation method, an example based on a rural location project is presented. The objectives of the example are:

1. To demonstrate the kind of evaluation report that is desirable.

2. To illustrate procedures that can be used as aids in developing the evaluation report.

3. To demonstrate how the evaluation report can meet the federal requirements for an Environmental Impact Statement.

4. To demonstrate the feasibility and utility of the recommended approach, even on relatively small projects.

This type of project has been chosen as the initial example because it has some challenging issues, yet is small enough in scope to be presented in detail. The specific project is a proposed relocation or reconstruction of 3⅓ miles of US 1A in the coastal town of Harrington, Me. This report was developed from information presented in an Environmental Impact Statement for the project (*155*). (The source of data for this example, although exemplary in many respects, was deficient in that all significant impacts of the "do-nothing" alternative were not identified. Because these data are essential in any evaluation of alternatives, estimates of the likely impacts were made by extrapolation from other data in the source document. In addition, judgments have been made about likely results of community interaction; thus, assumptions have been made which may alter the actual project in some respects.)

Characteristics of the Area

The town center, the focal point of the project, is located near the intersection of US 1 and US 1A on the banks of the Harrington River, an estuary of the Gulf of Maine (Fig. 4).

The State Transportation Department's primary purpose in proposing an improvement to US 1A is to reduce the high accident rate of the existing road through the town center. Substandard horizontal and vertical alignment throughout the center, the narrow bridge on US 1A crossing the river, and the intersection of US 1A and US 1 have combined to cause an accident rate approximately twice the statewide average for similar highways. Moreover, considering only the 0.6-mile section of US 1A south of the intersection, the rate is about four times the average. A secondary purpose is to improve service for through traffic, which makes up about 69 percent of the north-south traffic on US 1A. Current average daily traffic is 2,620 vehicles.

1. Socioeconomic factors.

Population.—The town of Harrington has 553 residents according to the 1970 census. This represents a 23 percent decrease from the 1960 census. Of the 553 residents, approximately 420 reside within the study area and 350 in what can be called the town center of Harrington. The majority of Harrington's out-migrants over the past 20 years were young people who could not find gainful employment due to the lack of industry. The age structure of Harrington is that of an older community, with 54 percent of the residents over 35 years of age.

Economic activity.—The majority of Harrington's residents base their economic activity on a capitalization of natural resources for monetary compensation. Although detailed statistics indicating the extent of economic activity are not available, the three major categories are blueberry cultivation, pulpwood cutting, and lobstering, with worm and clam digging secondary in importance. Any alignment that impacts significant blueberry fields, tree stands, or lobster habitats not only would have an impact on the natural ecology but also could seriously affect the economic activity of the town.

Retail trade.—The eleven businesses in Harrington are all located on US 1. Ten of the businesses are located within the study area. These ten businesses employ about 20 persons, with gross retail sales of approximately $150,000 recorded in 1970. Analysis indicates that approximately 20 percent of all of Harrington's retail sales are attributable to tourist-oriented or one-stop sales.

Existing land use.—Of the 3,200 acres within the study area, 147 acres are used for residences, businesses, community facilities, and refuse. In addition, approximately 150 acres are used for farming, 40 acres for a dairy farm south of Route 1 across from the high school, and 100 acres for blueberries. There are 128 single-family dwellings, of which three are vacant.

Planning aspects.—There are no regional or economic growth factors which in conjunction with the project would cause significant new development. Furthermore, projected population indicates a decrease by 1990 so that Harrington will probably experience little development in the next 20 years.

2. Visual features. The central area of Harrington is a densely populated community of mixed land uses located about and overlooking the Harrington River and its estuarine areas. A strong sense of "town center" is formed by the intersection of US 1 and US 1A and the location of adjacent land uses such as the grocery store, post office, church, and residences. The physical form of the area is characterized by Colonial and Federal period residential structures and churches which appear to be in harmony with the natural environment. The structural quality of nearly all the buildings is sound.

The visual impression of Harrington, coupled with the fact that its residents have a high degree of interaction due to similar life styles and participation in the town meeting form of government, forms Harrington's community identity.

Views of the river and estuarine area are afforded from the town center at the 1-1A intersection, along US 1 east of the intersection, and from behind the residential development on the easterly side of US 1A west of the river.

3. Ecological environment. Two streams are in the area of the project—the Harrington River and Curtis Creek. The Harrington River has been assigned a classification suitable for recreational boating, fishing and similar activities with the exception of primary water contact. Jones Creek waters have been classified suitable for water contact recreation and fishing. On the salt marsh, there is a great deal of estuarine vegetation, principally *Spartina alterniflora* (saltwater cord grass). Upland areas contain a variety of trees. Several species of wildlife are found within the area.

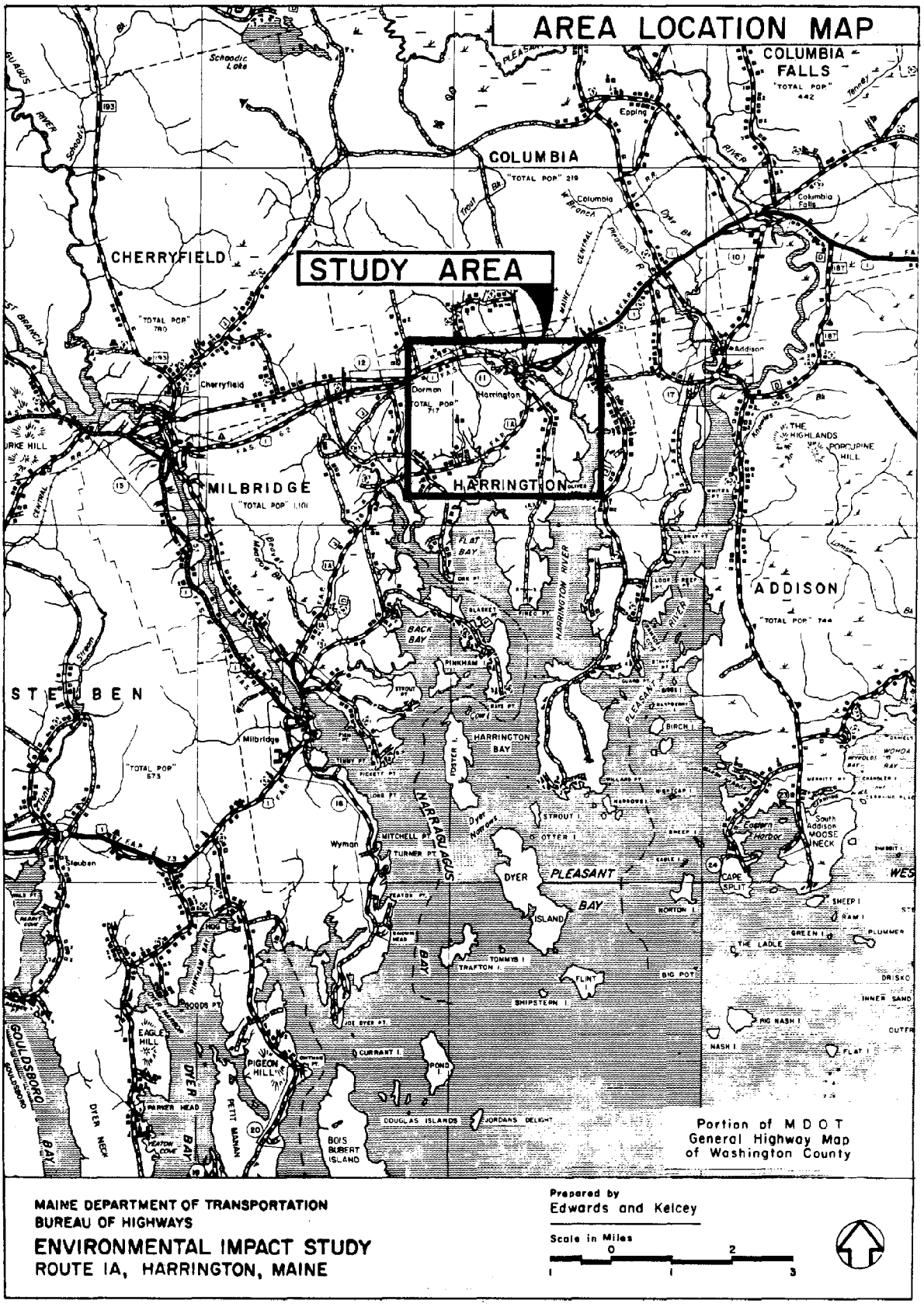


Figure 4. Study area; Harrington, Me.

Major Alternatives

The study includes analysis of four alternate routes, as shown in Figure 5, and the do-nothing alternative. All routes have a common point of beginning on US 1A in West Harrington, some 3 miles southwest of the center of town, and a common point of ending at the northeasterly end of the center. There are no highway grade separations.

A new bridge over the Harrington River was constructed in 1968 on US 1 approximately 0.6 miles west of the intersection of US 1 and US 1A and about a mile upstream of the existing US 1A river crossing.

The basic differences in the alternate locations are in whether they cross the river on a new bridge or on an existing bridge and whether they bypass the center or go through it on essentially existing location.

Alternative 0: This is the "do nothing" alternative—no improvements at all.

Alternative 1: This is a bypass to the south of the town center on a new location across the Harrington River and adjacent salt marshes. The 2-lane facility would have 12-ft lanes and 8-ft shoulders, and a minimum right-of-way width of 120 ft. The new river crossing would be approximately ½ mile downstream from the existing US 1A structure.

Alternative 2: This alternative goes through the town center but with the existing US 1A bridge across the river replaced by a new structure. Improvements would be made in horizontal and vertical alignment in the town center and elsewhere. Same design features as Alternative 1.

Alternative 3: Goes through the town center and makes use of the US 1 bridge constructed in 1968. Same design features as Alternative 1.

Alternative 4: Makes use of the US 1 bridge but bypasses the town center to the north.

Major Affected Interests and Probable Impacts

The interests affected, and the types of impacts most important to each interest, are summarized in Table 2. This information was developed in part through community interaction.

Table 3 gives the level of impact on each interest for each alternative.

Issues from the Perspective of Each Affected Interest

The following discussion summarizes the issues as seen from the viewpoint of each affected interest:

1. Through traffic. From the viewpoint of through travelers, all alternatives are preferred to the "do-nothing." Alternatives 1 and 4 are most preferred, with both having high speeds and relatively low accident rates because they bypass the town center. Alternative 3 is next preferred, with Alternative 2 last.

2. State Department of Transportation. From the viewpoint simply of total cost (construction and ROW), the null alternative is most preferred, then Alternative 3, then (at about the same costs) Alternatives 1, 4, and 2.

3. Town center—businesses, residences, general environment.

Socioeconomic.—By diverting US 1A traffic from the town center, Alternate 1 would tend to reinforce the community identity of Harrington. Economic activity within the town would be impacted by bypassing a grocery store, a lunch counter, and a gasoline station, which serve tourist or one-stop customers. Alternate 1 will decrease traffic and increase safety through the town center.

Alternate 2 would take the most structures: 7 single-family residences, and two commercial structures. All are located within the town center, so that Alternate 2 would have the greatest potential of adversely impacting the community identity of the town, as well as the psychological disposition of those persons being displaced. It is estimated that as much as 18 months would be required to satisfactorily relocate these persons. Alternate 2 will displace a gasoline station and an auto parts store, but these might be relocated near the new road. Because of the considerable amount of property to be taken, Alternate 2 is expected to have the most adverse impact on the local tax base. By improving the existing horizontal and vertical alignments it would improve safety within the center.

Alternate 3 takes three occupied single-family residences, a gasoline station, and an auto parts store. There would be a potential for adversely impacting community identity. Relocation problems and reduction of tax base would be

TABLE 2
MAJOR INTERESTS AND POTENTIAL IMPACTS; HARRINGTON, ME.

INTEREST	IMPACT
Through traffic	Speed Distance Accident rate
State dept. of transportation	Total cost of R-O-W and construction
Businesses in town center	Displacement and possible loss of business Loss of business from through traffic
Residents in town center	Displacement Loss of community identity Jobs lost
Town center environment	Volume of through traffic Safety Air quality Noise, general Noise, special nonresidential uses Visual School safety
Town government	Local tax base loss
Other areas	Residential displacements Air quality Noise Visual
Natural ecology	Upstream marsh (*Spartina alterniflora*) Downstream marsh (*Spartina alterniflora*) Estuarine areas (turbidity, contaminants) Tree acreage Water runoff White-tail deer migratory patterns

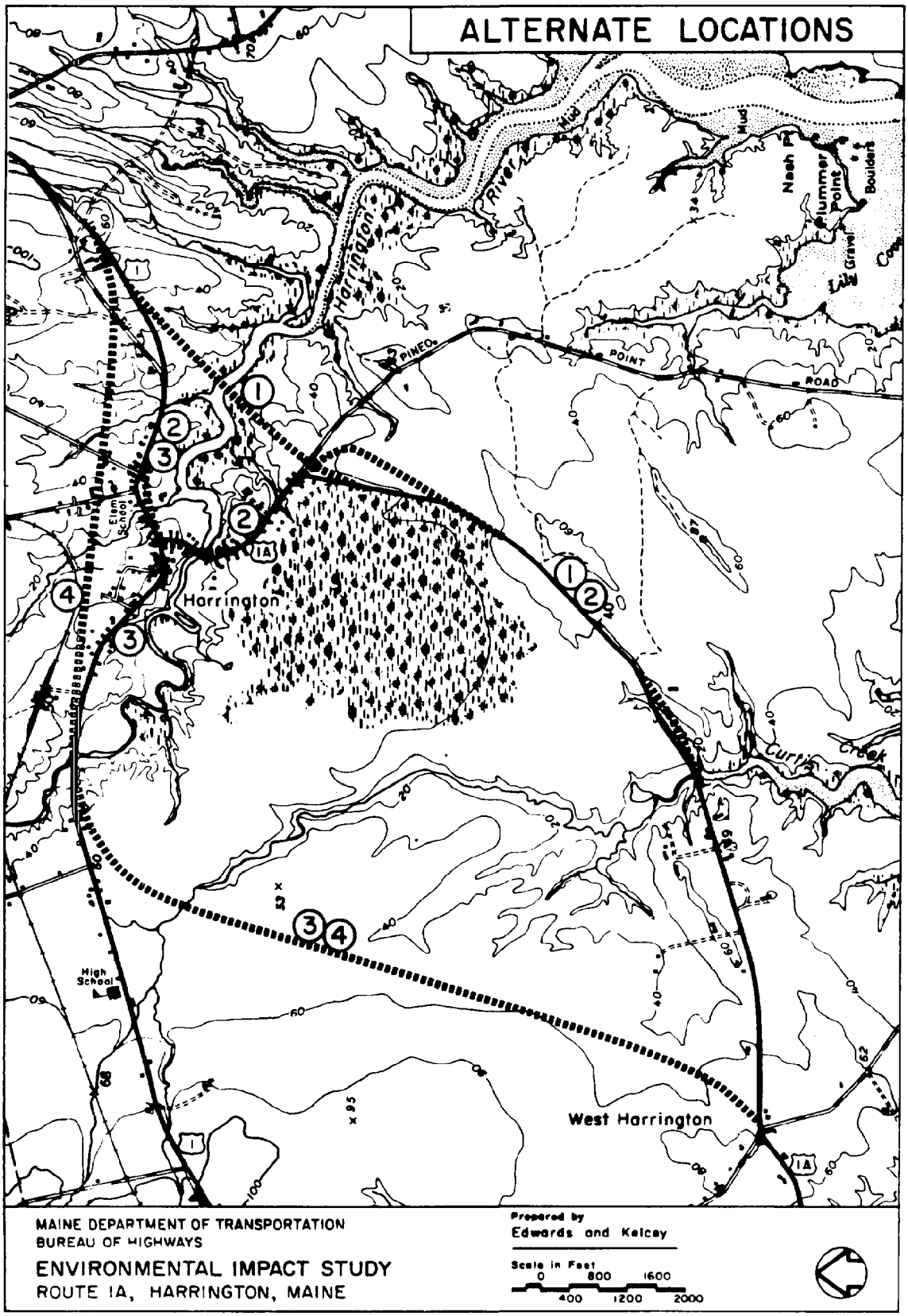


Figure 5. Map of alternate locations; Harrington, Me.

TABLE 3
ESTIMATED IMPACTS OF VARIOUS ALTERNATIVES; HARRINGTON, ME.

INTEREST/IMPACT TYPE	ALTERNATIVE 0	1	2	3	4
1. THROUGH TRAFFIC					
- SPEED (AVG)	25 MPH	55 MPH	30 MPH	30 MPH	55 MPH
- DISTANCE	3.7 MILES	3.2 MILES	3.8 MILES	3.8 MILES	3.7 MILES
- ACCIDENT RATE FACTOR[1]	4	1.2	3.5	2.5	0.6
2. STATE DEPT. OF TRANS. ($1000)					
- ROW COST	0	22	205	129	122
- CONSTRUCTION COST	0	1447	1377	1050	1416
- TOTAL COST	0	1499	1582	1179	1538
3. TOWN CENTER BUSINESSES					
- DISPLACED	NONE	NONE	GAS STATION, AUTO PARTS STORE	SAME AS 2	NONE
- LOSS OF BUSINESS FROM THROUGH TRAFFIC	NONE	YES - TO GROCERY STORE LUNCH COUNTER GAS STATION (ABOUT 10% OF TOTAL RETAIL SALES)	NONE	NONE	YES - TO RESTAURANT, GROCERY STORE LUNCH COUNTER 3 GAS STATIONS (ABOUT 20% OF TOTAL RETAIL SALES)
4. TOWN CENTER RESIDENCES					
- DISPLACED	NONE	NONE	7 SINGLE-FAMILY	3 SINGLE FAMILY	NONE
- RELOCATION PROBLEMS	NONE	NONE	YES	YES	NONE
5. TOWN CENTER ENVIRONMENT					
- THROUGH TRAFFIC VOLUME (ADT) - 1970:	2620	1400	2620	2520	1250
- 1990:	4350	2325	4350	4180	2075
- SAFETY	POOR	GOOD	POOR	FAIR	GOOD
- AIR QUALITY (ug/m^3 CO-1990)[2]	825	306	825	536	386
- NOISE (dBA L_{10} - 1990)					
- AT 50 FT DISTANCE	73	70	73	73	70
- METHODIST CHURCH	70	70	70	74	70
- BAPTIST CHURCH	73	70	73	73	70
- ELEMENTARY SCHOOL	58	54	58	58	65
- VISUAL	NONE	(SEE TEXT)	(SEE TEXT)	SMALL	NONE
- SCHOOL SAFETY IMPACT	NONE	NONE	NONE	NONE	150' FROM SCHOOL
6. TOWN GOVERNMENT-TAX BASE LOSS	NONE	SLIGHT	HIGH	MODERATE	SLIGHT
7. OTHER AREAS					
- RESIDENTIAL DISPLACEMENTS	NONE	NONE	NONE	NONE	3 UNITS
- AIR QUALITY	NONE	NONE	NONE	NONE	NONE
- NOISE	NONE	SOME	SLIGHT	SOME	EXTENSIVE
- VISUAL					
- VIEW OF HARRINGTON RIVER	NONE	YES	NONE	NONE	NONE
8. NATURAL ECOLOGY					
- SALT MARSH DISPLACEMENT	NONE	1.5 ACRES	NONE	NONE	NONE
- UPSTREAM SALT MARSH	NONE	IMPROVED	IMPROVED	SOME	SOME
- DOWNSTREAM SALT MARSH	NONE	SOME	SOME	CONSIDERABLE	CONSIDERABLE
- INCREASED RUNOFF	NONE	SOME	SOME	MUCH	MUCH
- TREE ACREAGE	NONE	SLIGHT	SLIGHT	25 ACRES	28 ACRES
- WHITE-TAIL DEER MIGRATION	NONE	NONE	NONE	SOME DISRUPTION	SOME DISRUPTION
- LOWERING OF WATER TABLE	NONE	SLIGHT	SLIGHT	SOME	SOME
- EROSION FROM NEW SLOPES	NONE	SLIGHT	SLIGHT	SOME	SOME

[1] RELATIVE TO STATEWIDE AVERAGE FOR THIS TYPE OF FACILITY.
[2] WORST CONDITION OF SEVERAL TOWN CENTER LOCATIONS.

proportionally less than in Alternate 2. The impact on economic activity would be the same as the impact exerted by Alternate 2 and safety would be somewhat improved within the town center.

Alternate 4 displaces three occupied residential units that are dispersed over a wide area. Instead of adversely impacting commnuity identity, Alternate 4 would tend to reinforce it by redirecting both US 1 and US 1A traffic out of the town center. Economic activity would be impacted by bypassing a restaurant, a grocery store, a lunch counter, and three gasoline stations, all of which serve tourist or one-stop customers. This location would be 150 ft from the elementary school and would adversely impact the school in terms of safety.

Visual.—The town center and the area along US 1A east of Curtis Creek are areas of high visual quality. Alternate 1 would have an impact on both these areas, by changing the view of the Harrington River and its estuarine areas from a view composed of natural elements to one that has a man-made facility in the background. Neither the river crossing nor the displacement of birch trees is regarded as a major adverse visual impact, and both can be mitigated by design considerations.

Alternate 2 would also affect these areas. It would impact the birch trees in the same manner as Alternate 1, but instead of altering the view of the Harrington River it would impact the visual character of the town center by taking seven residential structures and two businesses. The residential structures are of good visual quality; one of the businesses, a gasoline station, is not.

Alternate 3 would not impact any significant visual features of the natural environment on new location from West Harrington to US 1, and would have small visual impact within the town center by displacing two businesses and two residences.

Alternate 4 would have the same minimal impact as Alternate 3 from West Harrington to US 1 and will have less visual impact as it bypasses the town center on new location.

Air pollution.—Alternates 2 and 3 generally have higher concentration of carbon monoxide at most test stations. Alternate 2 gives a concentration of 825 $\mu g/m^3$ of CO in the town center. Alternate 3 gives the lowest concentration at this point, although it has higher values than Alternate 1 at other stations. Alternates 1 and 2 give relatively high concentrations (445 $\mu g/m^3$) outside the town center and hence are less objectionable than would be the same concentration within the center. None of these readings is close to the carbon monoxide standards established by the Environmental Protection Agency, and hence would presumably pose no dangers.

Predictions indicate that Alternate 2 has the highest air pollution load, followed by Alternate 3. These data also indicate that Alternate 1 would result in slightly less harm than Alternate 4. The only federal standard that is violated is that for the predicted concentration of 164 $\mu g/m^3$ of hydrocarbons at one of the ten test stations for Alternate 2 with a south wind.

Noise pollution.—Alternate 1 uses a new connector, but the new land area it exposes to noise is small. At distances of 100 ft and more this connector produces little change in the noise environment southeast of the town. Alternate 1 will improve the noise environment in the town center and will offer no limitation to the expansion of the town. The impact on the area exposed by the new connector is more than offset by the improvement in the environment of the town center.

Alternate 2 approximates the conditions that could be expected with no new construction. Some improvement will result from the construction because it will produce smoother traffic flow within the town center, but this effect is offset by the fact that the traffic will also be traveling somewhat faster. In summary, Alternate 2 can be considered to have a neutral effect on the noise environment of the area.

Alternates 3 and 4, which use a new connector between US 1A and US 1, have a maximum noise impact on this new area, without any significant compensating benefit to other areas. Alternate 4 can be considered worse because of the new construction to the north. Furthermore, Alternate 4 encloses more of the town within a boundary of noise that limits future expansion and places low-noise environments farther from the center of activity in the town.

Comparing the impact of these alternates to an existing condition without construction, Alternates 3 and 4 both have a negative effect on the environment, with the effect of Alternate 4 being more severe than that of Alternate 3.

4. Natural ecology. Alternate 1 displaces approximately 1.5 acres of salt marsh. However, the bridge across the Harrington River will be of sufficient length so that there is no encroachment on the *Spartina alterniflora* zone. Thus, continuation of unrestricted flow will leave the productivity of the upstream and downstream marshes unaffected.

For Alternates 1 and 2, temporary turbidity and sedimentation will be caused by the construction of new bridges over the Harrington River and over Curtis Creek, although these can be minimized through appropriate construction procedures. The bridge across Curtis Creek will be of sufficient length so that there is no encroachment on the original *Spartina alterniflora* zone; this will allow a return to conditions closer to those that originally existed in the upstream marsh.

Alternates 3 and 4 will displace an estimated 25 and 28 acres of woodland, respectively, resulting in increased runoff of stormwater. Loss of additional acreage of spruce and spruce-hardwood mix between West Harrington and US 1 is likely because of changes in the water table and in the soil. Alternates 3 and 4 would disrupt the migratory patterns of white-tailed deer in the area between West Harrington and US 1.

Due to the construction on marine sediment deposits, all of the alternates can cause a chain reaction leading to turbidity, sedimentation, and salinity change, and consequently reduced productivity in the estuarine areas. Construction on new location offers more potential harm than improvements to an existing location. Thus, Alternates 3 and 4 are more susceptible than Alternates 1 and 2. Various construction procedures will be considered in appropriate situations, including:

(a) The use of ditches at tops of slopes to intercept any surface flow that might lead to erosion of new cut slopes, and at toes of slopes to keep highway slope drainage from damaging adjacent vegetation. However, any ditches dug into the highly erodible marine sediments should be paved.
(b) Extreme efforts will be made to vegetate new slopes cut into the marine sediments. It seems likely that continual maintenance will be necessary.
(c) Settling basins will be used to the fullest extent practicable. The retardation of flow will allow some of the sediments and contaminants to settle out.
(d) The use of a borrow material of higher than ordinary porosity to replace highly porous surface material in fill sections located in areas of near-surface groundwater.
(e) Removal of vegetation will be kept to a minimum.

Future land development will further aggravate the possibilities of turbidity, sedimentation, runoff, and contaminants reaching the estuaries. Alternates 3 and 4, having more construction on new location, are more likely to attract such development. Other than the possibility of denying access on all new locations, there is nothing the State Department of Transportation can do to preclude or reduce these effects. Strictly enforced sanitary codes would help to keep contaminants from reaching the estuaries.

5. Summary by interest. To summarize, Table 4 gives the relative preferences of the alternatives from the viewpoint of each interest. Because there are several impacts of concern for some interests the tradeoffs among impacts that likely would be acceptable to particular interests have been estimated through community interaction.

TABLE 4
PREFERENCES OF ALTERNATIVES FROM THE PERSPECTIVE OF EACH INTEREST; HARRINGTON, ME.

INTEREST	PREFERENCES				
	1ST	2ND	3RD	4TH	LAST
THROUGH TRAFFIC	1	4	3	2	0
STATE DEPT. OF TRANS. (BUDGET ONLY)	3	1-2-4	-	-	-
TOWN CENTER BUSINESSES	2-3	1	0	4	-
TOWN CENTER RESIDENCES	1	4	0	3	2
TOWN CENTER GENERAL ENVIRONMENT	1	4	3	2	0
TOWN GOVERNMENT	1-4	0	3	2	-
OTHER AREAS	0	2	3	1	4
NATURAL ECOLOGY	0	2	1	3	4

Issues from the Perspective of Each Action

1. Feasibility. Each of the actions is feasible as it stands.

2. Community concerns and possible design modifications. Concerns have been expressed about the unavailability of replacement housing, loss of business to bypassed establishments, and excessive takings of salt marsh. These concerns could be overcome by compensatory or other design actions, such as:

- Developing replacement housing for families displaced —Alts. 2 and 3.
- Acquiring land on new road locations for resale to businesses desiring to relocate to be near traffic; or payment of loss-of-business compensation (which would be infeasible without additional state legislation)—Alts. 1 and 4.
- Takings of salt marsh could be reduced by different design of bridge at additional cost, increasing the amount of structures—Alt. 1.
- Compensatory payments to town government for tax base loss—Alt. 2.
- Design modifications, such as improved traffic control devices and barriers, to increase safety.

3. Equity and potential acceptability. If the foregoing steps are not taken to respond to the community concerns, the relative equity of each action could be summarized thus:

- From the viewpoint simply of the natural ecology, the do-nothing alternative would be the most preferred; however, it would continue the high accident rate and other adverse impacts on the human environment of the town center.
- Without replacement housing provided by outside sources, Alternative 2 is inequitable in the burden it places on the seven households displaced; so, to a lesser extent, is alternative 3. However, the number of families is so small that early communication with the families affected could determine if there really is a problem. If so, explicit design attention could be devoted to the design of individualized relocation assistance to substantially ameliorate any problems. If the houses are structurally sound, one course of action for the highway department is to relocate the existing structures to nearby state-acquired property.
- Similarly, Alternatives 2 and 3 may be inequitable in their impacts on the two local businesses. However, it should be possible to provide either sufficient relocation payments or replacement sites or both to compensate for these adverse effects.
- The loss of business due to bypassing through traffic is a significant adverse impact from Alternatives 1 and 4. This is directly in conflict, however, with the overall significant improvement in the town center environment as a consequence of the reduced through traffic. It may well be that this increases local shopping and reduces the loss of business, as has happened in other bypass cases. Even if not, the issue is first one of conflicting values within the town itself; from the viewpoints of all the interests in the town, is increased environmental quality (safety, noise, air quality, etc.) worth the loss of business to the affected businesses? Are there any compensating steps open to the town—for example, a partial reduction of real estate taxes for a 5-year period, or town underwriting of parking and other improvements to make the stores more attractive, or of an advertising campaign to boost the sales

to local customers? In any event, this should be discussed with spokesmen for various interests in the town.

- The adverse noise impact of Alternative 4 on the elementary school might be partially overcome by increased use of insulation, etc.; this has not been analyzed, however.

Issues from the Perspective of the Process as a Whole

There is no action for which the disadvantages are sufficiently great that it should be removed from further consideration. If none of the design modifications suggested previously is undertaken, the following conflicts would arise:

1. Although Alternatives 1 and 4 are most attractive from the viewpoints of service to through traffic, town center residents, and over-all town center environment, Alternative 4 might be opposed by town center business interests because of its substantial loss of business; alternative 1 might be opposed by environmental interests because of its salt marsh intrusion, and Alternative 4 because of its impacts on areas previously unexposed to traffic and on downstream water environment.

2. The "do-nothing" alternative is attractive only because it preserves the environmental *status quo* in areas outside the town center (and involves no construction expenditure or displacements), but this must be weighed against substantial increased environmental degradation in the town center due to future traffic growth if nothing is done to reduce or bypass that traffic.

3. Most of the adverse effects of Alternatives 2 and 3 can be alleviated by compensating design modifications (i.e., replacement housing); and possibly for Alternatives 1 and 4 also (through business-oriented compensatory actions, e.g.).

From the point of view of the process as a whole, Alternative 1 is likely to have the greatest potential for substantial community acceptance, provided modifications are made to reduce further the degree of salt marsh intrusion, the exterior treatment of the bridge over the Harrington River is such as to enhance the view fom the town center, and specific steps are taken to ease the burden of business losses from traffic diversion.

If further time and resources were available, the following work should be given high priority:

1. Community interaction to find out actual replacement housing needs of families that would be relocated with each of the alternatives; to find out desires of businesses potentially displaced; and to obtain the views of the community on possible actions to compensate local businesses from loss of trade, and on the issue of the over-all desirability of enhancement of the environmental quality of the town center even if there are some business losses.

2. Development of alternatives, including relocation plan and potential replacement program; housing and businesses; visual design treatment of river crossing for Alternative 1; safety protection for elementary school and possible noise insulation. Additional alternatives might be developed that would bypass the town on the east side and cross the river at a point with minimal marsh intrusion.

3. Prediction of impacts. More information is needed on actual accident rate changes for various alternatives, and on potential sales losses to local businesses.

Summary *

The *recommended course of action* is Alternative 1. Its *environmental impacts* are (see Table 3) some salt marsh intrusion, some visual intrusion, and some loss of one-stop business to local firms. Steps can and will be taken to minimize these effects, although these *adverse impacts* cannot be totally avoided. On the other hand, the recommended action enhances environmental quality significantly by improving the town center through reducing accidents, air pollution, and traffic noise; and enhances upstream water conditions in the Harrington River.

Alternatives to the proposed action include the do-nothing alternative and three others. The do-nothing alternative has no negative impacts on the natural ecology but has significant adverse impacts on the human environment in the town center. Although each of the other three alternatives has some advantages relative to the recommended one (especially no salt marsh intrusion), each also has disadvantages that outweigh the advantages—such as significant residential displacements (Alts. 2 and 3), or business displacements (Alt. 4), noise and safety impacts on a local school (Alt. 4), and introduction of a highway facility in a previously undisturbed area (Alts. 3 and 4).

In terms of effects of *short-term use versus long-term productivity*, potentially Alternate 1 will have minimal adverse impacts that would affect long-term productivity. Therefore, the relationship between man's short- and long-term ecological productivity is more favorable along this route. The proposed highway is a long-term use with respect to man's social environment and a short-term use with respect to his natural environment.

Alternate 1 will directly displace approximately 1.5 acres of salt marsh, resulting in a small decrease in productivity, although proper bridge design will assure that the productivity of the marsh upstream and downstream is unaffected.

In terms of *irreversible and irretrievable commitments of resources*, Alternate 1 will displace approximately 1.5 acres of salt marsh and it is doubtful that the salt marsh could be returned to its productive state if the land were ever to be reclaimed.

Comments and suggestions received during the review process are summarized in the following pages (omitted from this reconstructed example).

Example: The West Side Highway Project (New York City)

Many urban projects may be sufficiently large and complex that the level of detail employed in the Harrington, Me., example evaluation report may be impractical. In these

* This section is structured consistent with the formal requirements of Section 102(2)(c) of NEPA. The substantive detail of the earlier sections is not repeated here, but only summarized. As discussed earlier, in a more complex situation with hundreds of pages of data corresponding to Sections I-III, this summary section would be more detailed and could stand alone as meeting the formal requirements of an EIS.

cases, the large number of interests affected implies that the proposed evaluation method is best used not as the sequential application of the four activities but rather as a guide throughout the study for the preparation of necessary background and management material. Evaluation becomes a continuous and highly dynamic activity, with one or more portions of the proposed four steps being used as appropriate to respond to daily, weekly, and monthly management needs. As the study proceeds, material necessary for an environmental impact statement or other required project reports is gradually accumulated in a format and style that will facilitate the final publication of such documents.

The West Side Highway Project (WSHP) in New York City demonstrates this application style of the evaluation method. Evaluation was intended to help inform people as to the most important aspects of choices among alternatives. Two aspects are demonstrated:

1. Identification and analysis of issues.
2. Use of a preliminary evaluation summary report.

Because of the complexity of the project, only an overview of key evaluation features is provided, along with examples of the substantive content of individual documents.

The West Side Highway Project is concerned with the deteriorating West Side Highway in Manhattan from the southern tip of the island to 42nd Street (Fig. 6). The alternatives examined span a wide range, including new Interstate alignments and designs, rebuilding of the existing structure, and tearing down the existing structure but providing no new highway. All new alternatives contain some provision for transit.

TABLE 5
EXAMPLE POLICY STATEMENTS; NEW YORK CITY WEST SIDE HIGHWAY PROJECT

Develop plans that will assist in the consolidation of motor, rail and seaborne goods movement, storage, and distribution activities along the project corridor.
Develop alternative land-use strategies that promote orderly rather than precipitous change along the waterfront consistent with the adjacent neighborhoods.
Provide equitable compensations and assistance to persons and businesses displaced and/or relocated as a result of reconstructing the highway.
Discourage the attraction of additional regional travel diversions within the corridor, in excess of those currently taking place. Assume the capacity of the tunnels will not be expanded in the future; i.e., program additional capacity for the highway only to accommodate the diversion of traffic from the West Side street system and projected corridor growth.
Investigate the potential opportunity for utilization of mass transportation within the highway corridor based on its demonstrated need and utility, and on its anticipated inherent benefits; and having determined the degree to which such public transportation services and facilities are warranted, incorporate them in the project.
Investigate the role of goods distribution and production activities along the corridor and, where feasible, develop a means to preserve land areas and develop facilities for the purpose of reducing the cost and increasing the efficiency of providing goods and services for Manhattan—with particular attention to the areas in close proximity to the Lincoln and Holland Tunnels.

Issue Identification and Analysis

A major emphasis of the proposed approach to evaluation is the identification and analysis of issues from the perspective of affected interests, alternative actions, and the process as a whole. The WSHP provides an illustration of the dynamics of how this issue information was gradually developed and documented over a period of time.

At the start of the study, 34 policy statements were negotiated by representatives of the state, city, and local community interests. Six examples of these policy statements are presented in Table 5. These statements illustrate the need for an approach to evaluation that is flexible with respect to input and output, is capable of treating a broad range of impacts (qualitative as well as quantitative), and recognizes the differential incidence of impacts.

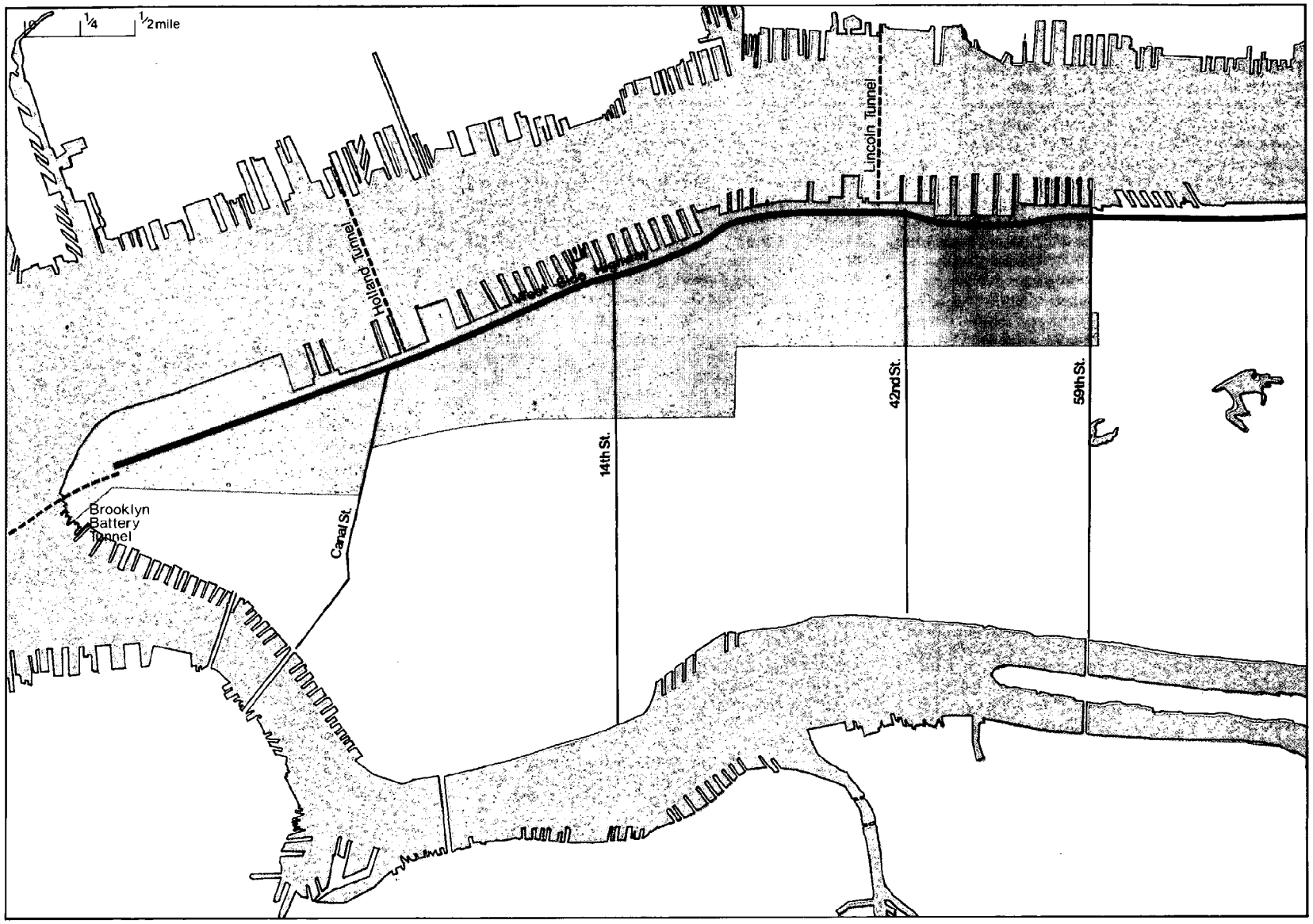
The policy statements, although they omit some important factors (e.g., cost), were relied upon in the beginning stages of the study as an indication of the issues and range of impacts that should be considered in the evaluation of alternatives. More detailed identification was obtained by staff members through continuing contact with public agencies and private groups, either through meetings or the exchange of documents. Also, community-level design teams were formed so that individual staff members could become more familiar with the problems of particular areas.

As the study proceeded, issue papers examining in more detail the effects of alternatives on particular interests were prepared and circulated to all interested participants.

For example, a preliminary report on the Gansevoort Destructor and Marine Transfer Station was prepared. This is a solid waste disposal complex located on the Hudson River at West Gansevoort Street. It consists of an incinerator, marine transfer (barging) station, salt shed, and peripheral truck parking. One alignment at this location would take the existing incinerator, but leave the marine transfer station undisturbed except for disruption of access. An alternative alignment would take the marine transfer station but leave the incinerator undisturbed.

The first section of this Gansevoort report described the existing facilities, priorities, and constraints as expressed by the New York City Sanitation Department. The second section described the effects of the two alignment locations, replacement options, and phasing. The third section discussed specific sites upon which replacement facilities might be constructed. The fourth section discussed planning parameters, timing, funding, and strategies for implementation. An appendix discussed the state of the art in solid waste treatment technology.

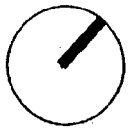
A second example of a working document that "views the issues from the perspective of an affected interest" is the analysis of the impact of project alternatives on Battery Park City. Battery Park City is a major mixed-use development proposed for construction on landfill at the southern end of the West Side Highway corridor. The Battery Park



But always there is the barrier of the existing West Side Highway, separating the waterfront from the communities behind it. Large portions of the areas east of the elevated highway are filled by warehouses and industrial loft buildings, once thriving, but now suffering from increasing vacancy and neglect.

The West Side between Midtown and the Battery was once a symbol of New York's leading role in commerce and manufacturing, and its dominance of maritime activity in this country. But the drastic declines in Manhattan's manufacturing and shipping sectors have left sizeable portions of "The World's Most Valuable Real Estate" either wholly unused or grossly underused.

Illustration 1 **Location of the West Side Highway Project**



North

Figure 6. Map of study area; New York City West Side Highway Project.

City Authority initially took the position that any alignment for new highway or transit facilities below Harrison Street should be inside the present pier bulkhead line.

The intent of the WSHP staff analysis for Battery Park City was to facilitate mutually cooperative planning efforts. Alternatives were divided into two broad categories—inboard at Battery Park City and outboard at Battery Park City. However, specific design features which would affect Battery Park City were examined in detail. Most prominent among these were the design features "highway construction timing" and "right-of-way acquisition."

These examples are just two of the many documents prepared by the WSHP staff to analyze variations in design features as they relate to particular interests. These documents served to guide decisions as to which program elements should be studied in more detail. Decisions to suspend development of particular options were submitted to a study steering committee for approval.

Preliminary Evaluation Summary Report

The proposed approach to evaluation includes periodic preparation of an Evaluation Summary Report. Six months after the initiation of technical studies, a 95-page report called the "Preliminary Analysis of Alternative Program Packages" was prepared by the WSHP staff and circulated to participants in the planning process.

The introduction emphasizes that

> the intent of this report is not to make a final choice, but rather to help guide the management of activities throughout the remainder of the project. More specifically, this report is intended to aid the Steering Committee in making decisions about
> (1) Selection of alternatives with the greatest potential;
> (2) Need for modification of alternatives currently under study and the development of related program elements;
> (3) Over-all direction of the West Side Highway Project planning effort.

Thus, the intent of this WSHP report closely parallels the intent of the Summary Report in the proposed approach to evaluation.

The second section of the report describes eight "program packages" at a sketch design level of detail, with each package composed of a combination of a highway alignment, interchange locations, transit options, and land-use proposals. The eight program packages do not incorporate all feasible combinations of program elements. Rather, interchange locations, transit options and land-use proposals are associated with the highway alignment with which they are judged to be most compatible. This section also provides a brief description of existing corridor travel patterns and identifies design variables that appear to be of major importance in determining future travel patterns. Finally, this section presents order-of-magnitude construction cost estimates for each of the alternatives.

The third section of the report provides a more detailed description of program package alternatives and examines their effects on specific land uses, local streets, and so forth. The section is partitioned into three subsections according to the three Community Planning Districts along the corridor. Graphics illustrate the mainline locations of highway and transit configurations, typical cross sections, and land uses along the corridor that may be significantly affected by the choice among alternatives. Also, summary tables for each Community Planning District show the differences between alternatives in each of five functional categories (transportation, land use, community goals, construction impacts, and environmental impacts). Figure 7 and Table 6 are examples of the kinds of material presented in this third section of the evaluation report.

This preliminary evaluation summary report was circulated to the public and to the participating agencies in order to stimulate thoughts on decisions that were upcoming. The report summarized, at a particular point in time, where the process stood and the important choices to be made, and how the available alternatives measured up against the policies that various agencies and groups had agreed the project should serve.

The format of the report thus combines the results of the first two steps of the recommended evaluation method. First, the policy statements agreed on by the steering committee of the project were grouped into impact categories. Then each alternative was analyzed *vis-à-vis* each policy statement. The material corresponding to the output of activity three of the evaluation method (view the issues from the perspective of the process as a whole) discusses priorities for further study, as those were the major decisions faced at that time, rather than a final choice among alternatives.

Summary

The variety of "evaluation reports" prepared by the West Side Highway Project provide practical examples of the use of the proposed evaluation method and reporting strategy throughout the stages of a planning process. In these applications the WSHP staff did not follow exactly the sequence of activities shown in Figure 3, but they did ask the same kinds of questions.

CONSIDERATION OF ALTERNATIVES

The focus of any transportation planning effort is the development and consideration of alternative courses of action. Good design practice requires not only developing a means of providing fast, safe and efficient transportation but also taking into consideration the views of the interests potentially affected by a transportation change; eliminating or minimizing adverse social, economic, and environmental effects; and identifying associated opportunities for developing positive community benefits. This is most effectively accomplished through systematic consideration of a range of alternatives.

This section describes various design methodologies. Discussion of general requirements, a basic design strategy, and the components of an alternative course of action leads to an examination of specific techniques for generating alternatives. What is recommended is systematic application of professional judgment *supported* by design aids. Just as complete reliance on mathematical models is dangerous, unrestrained reliance on design as an "art form" to

be accepted without question is equally dangerous and unacceptable in today's society. Emphasis is given throughout to the important role of community interaction.

The section does not describe a single step-by-step "how to design" method, nor does it present a comprehensive catalogue of design solutions. Rather, it offers some suggestions and sketches out some basic concepts that are intended to stimulate design approaches and assist in responding to the challenges of design. Although the techniques described can contribute to a more systematic process and facilitate documentation of the rationale for both day-to-day and major design decisions, design practice must always include human judgment.

In presenting these ideas, it is recognized fully that although the laws, courts, and communities are all asking for a broad interpretation of the alternatives to be considered, state highway agencies in particular still operate under very real constraints that prevent them from developing alternatives in the way they might want to.

- Agencies may have control only over variables that are sufficient to eliminate a symptom and not over variables necessary to resolve the real problems. For example, they can introduce traffic control measures to reduce congestion, but cannot control the development of land use that may result in even more congestion.
- A highway agency may have little or no authority to study other modes, and probably even less authority to construct nonhighway modal facilities.
- There frequently are different implementing agencies for different kinds of highway or transit projects. Within the highway program, there also may be different categories of funding having different programming implications. For example, traffic engineering, Interstate, and local street improvements may be handled not only by different procedures but also by different institutions.

Although these kinds of constraints exist, they should not prevent transportation agencies from attempting to change them or from investigating options that will affect the nature of the facility being proposed. In particular, an agency should take the initiative in working with other agencies to develop coordinated programs of action.

A Design Strategy

Role of the Designer

The term "designer" has traditionally been applied by highway agencies to those persons performing geometric or structural design tasks. As defined here, a "designer" has a much broader role—one that is ongoing throughout all phases of project development, including the very early

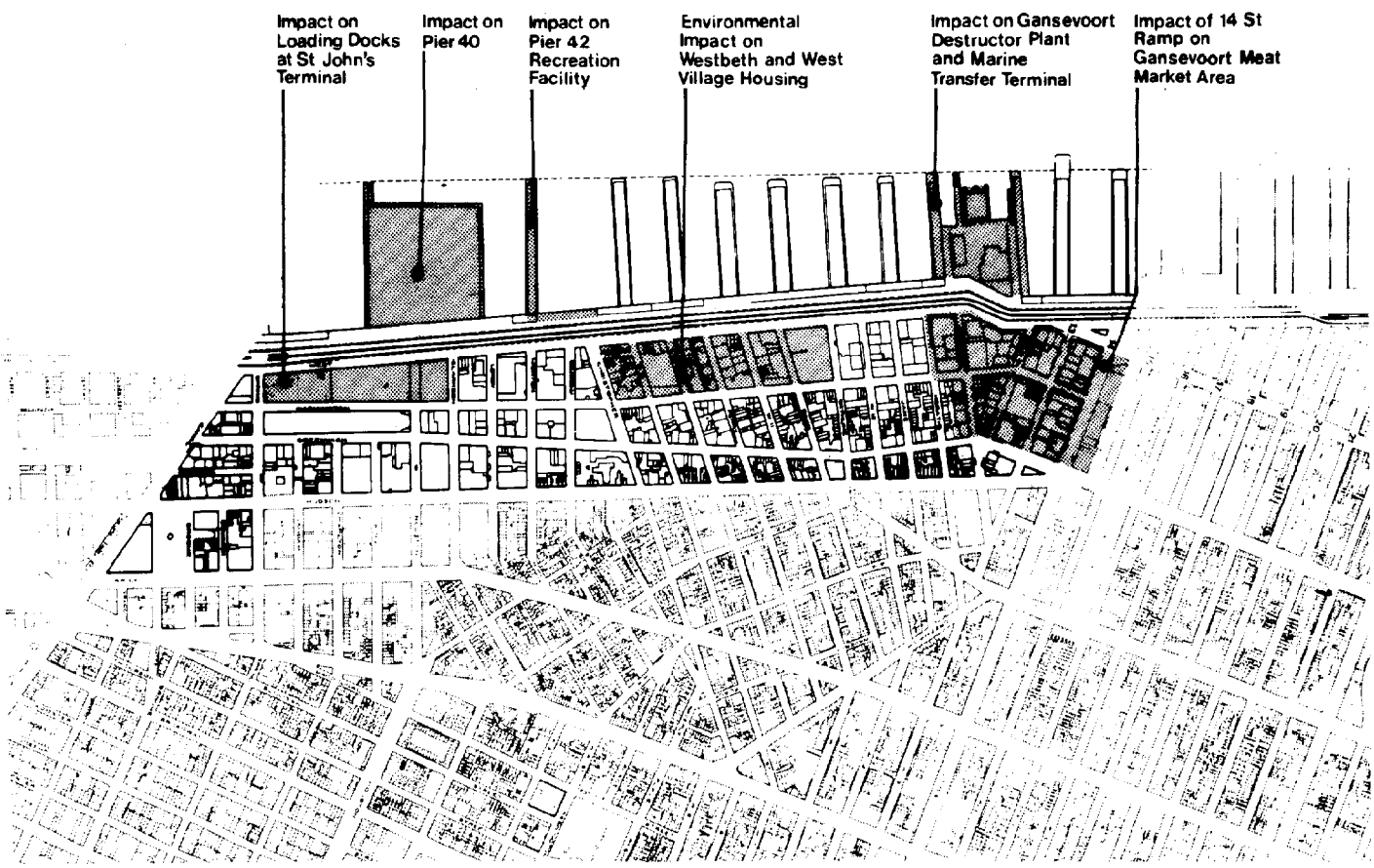


Figure 7. Issues for Community Board Two; New York City West Side Highway Project.

TABLE 6
LAND-USE IMPACTS; NEW YORK CITY WEST SIDE HIGHWAY PROJECT

EVALUATION CATEGORY: LAND-USE IMPACTS COMMUNITY BOARD 2
POLICY STATEMENTS: 5) Preserve and revitalize Waterfront; 6) Provide public access to the Waterfront; 12) Provide orderly change along Waterfront; 16) Assure compatibility of Highway and planned projects; 17) Assure compatibility of Highway and existing activities.

MEASURES	Program Package F	Program Package I	Program Package G	Program Package H
Outboard				
Degree of impact on:				
Pier 40	Outboard alignment, without quayside redesign, eliminates use for shipping. With quayside redesign, shipping could resume after reconstruction, but with 2 instead of 3 berths.	Midboard alignment, without shed redesign and reconstruction, eliminates cargo handling and precludes passengers. With shed redesign, shipping operations could resume after reconstruction.	Inboard depressed alignment is without appreciable effect.	Inboard depressed alignment is without appreciable effect.
Access to Riverfront	Outboard highway offers greatest access to the riverfront and offshore areas.	Midboard alignment offers substantial access to potential riverfront recreation and to potential finger parks and piers.	Inhibits physical access to River by an inboard depressed highway.	Limits visual access to River by an inboard elevated highway.
Gansevoort Destructor and Marine Transfer Station	Outboard highway does not take the Destructor, but it eliminates the Transfer Station.	Midboard alignment isolates these facilities from each other, precluding continued operation without reconstruction of the Transfer Station.	Inboard depressed highway eliminates the Destructor, while not touching the Transfer Station.	Inboard elevated highway eliminates the Destructor but stays clear of the Transfer Station.
Piers 54 & 56 Police Autos	Impairs use for vehicle storage by taking 150' at the pierhead.	Would probably eliminate use for vehicle storage because alignment bisects the pier reducing one-half of the storage capacity.	Would probably eliminate the continued use for vehicle storage because alignment takes headhouses.	Would probably eliminate the continued use for vehicle storage because alignment takes headhouses.
Inboard				
Degree of impact on:				
Morton Street Pier & Recreation Strip	Inhibits the existing recreational use, as the outboard highway takes 150' at the pierhead , and landlocks the facilities. But with redesign and reconstruction, it could enhance riverfront recreation.	Inhibits the existing recreational use, as the midboard alignment takes center section of pier. But, with redesign and reconstruction, it could enhance riverfront recreation.	Enhances the existing recreational uses, as highway is depressed and inboard.	No appreciable change from existing conditions, but a new inboard elevated highway would continue undesirable environmental and aesthetic impacts.
Greenwich Village Residential	Outboard alignment would encourage residential expansion toward River, and would provide potential parcels to accomodate such growth.	Midboard alignment also would encourage residential growth toward River, but would provide smaller area for potential new development.	A depressed inboard highway might encourage residential expansion if sufficiently covered and buffered.	An inboard elevated highway restricts residential growth to River by its substantial physical constraint, as well as undesirable environmental and aesthetic effects.
Gansevoort-14th St. Meat Market	No appreciable difference among the mainline alignments. However, an interchange is provided in the area of 14th Street. Local Traffic circulation in the area will be improved by all alignments.			

stages of statewide and urban area system planning. Designers are all those individuals having a responsibility for the development of alternatives; their activities include the development not only of geometric and structural plans but also related programs such as relocation housing, compensation, joint development, and construction specifications that are required for implementation of a transportation project. It follows, then, that designers include not only highway engineers but also relocation specialists, right-of-way experts, architects, ecologists, and even the public.

A range of alternatives needs to be considered at all levels of analysis, from system planning and programming through location and design; in all contexts, urban and rural; and for all scales of projects, whether an upgrading of a two-lane road or construction of a new freeway. The range of alternatives to be considered, however, will vary with the location, nature, and stage of a project. For a secondary road upgrading in a scenic rural area, primary attention is likely to focus on design standards and preservation of existing environmental amenities. Consideration of other modes for this type of project would likely be limited to the potential for bike paths. In contrast, the design stages of a major new urban highway may involve such diverse program elements as other transportation modes, joint development, air-rights construction, replacement housing, areawide community action programs, manpower training and employment, and rehabilitation of historical sites.

The option of no new construction needs to be openly and explicitly considered. This "null" or "no-build" alternative should be compared to other proposed courses of action and considered as a viable choice during all phases of planning and design. This option can serve as a reference point for stating benefits, as well as adverse effects, of construction-oriented options. Studying the no-build alternative helps to ensure that the full consequences of all alternatives are adequately described and evaluated and that the tradeoffs involved in deciding to go ahead or terminate a project are clear. It is unlikely, however, that the no-build choice can be used as a justification for a project.

It is important that all aspects of a course of action be explicitly considered as options, especially early in a planning or design process. Each decision about the location, design, and nontransportation aspects of a proposal will partially determine the impacts that proposal will have. If decisions such as the number of lanes, design standards, or interchange characteristics are established as "givens," the impact levels they control are also at least partially set and the ability of the designer to make an alternative more acceptable is restricted.

Inherent in this broad role of a designer is the belief that through choice of available design variables it is possible to control a wide range of social, economic, environmental, and transportation impacts. Judicious choice of design features not only can minimize adverse effects on a community but also may be able to assist in the development of programs, whether directly or indirectly related to transportation, that will also be to the mutual benefit of both the community and the transportation agency.

The Role of Alternatives

Alternatives serve different roles at different stages of a process. After developing a basic understanding of the physical, social, and political characteristics of a study area and the concerns of people affected by the study, alternatives initially serve to illustrate the choices that must be made and the tradeoffs that exist. Early in a study, a number of actions directed toward achieving a range of different objectives should be produced rapidly to facilitate effective community interaction and impact prediction. Rough sketches provide sufficient design detail at this stage. After responses to these initial alternatives from the public and other government agencies are evaluated, the emphasis shifts to modifying and combining alternatives to narrow the range of choices. Included in this process is an explicit attempt at designing to minimize adverse impacts. As the range of alternatives is narrowed, increasing attention is given to design detail and to other related program elements.

Reacting to specific proposed actions assists all interests to identify tradeoffs and clarify their objectives and priorities. Although attitude surveys and similar techniques are frequently considered the most effective way of obtaining value-related information, a central thesis of the approach being recommended is that information on objectives and value priorities cannot be determined in the abstract, but only in relation to specific and well-understood alternative courses of action. By responding to proposals and suggesting new alternatives, people obtain a better understanding of their own preferences and the concerns of others.

Example: Michigan Route 31/131 Northwest Region Study.—This general strategy is being used in the regional transportation study of Routes 31 and 131 in Michigan's Northwest Economic Development District. The study was begun in the summer of 1972 with public meetings and other community interaction activities to establish channels of communication with as many interest groups as possible and to collect a base of initial data. Initial sketch alternatives were developed in the fall of 1972 on the basis of the environmental data collected. These alternatives were directed toward achievement of a range of different goals identified through public meetings, a newspaper search, and personal interviews (cf. the ensuing section, "Techniques"). The impacts of these alternatives were then determined and another set of meetings was scheduled to focus on the identified major issues. The third stage of the process calls for major modifications to and a narrowing of the initial set of alternatives, to be developed by working closely with the major interest groups, resolving conflicts, and providing alternatives that address specific concerns. This third stage of the Michigan study is intended to produce an alternative that is acceptable to the greatest number of interests possible and that addresses, to the best of the designers' ability, the concerns of those that do not find the solution acceptable.

Elements of an Alternative

An alternative course of action consists of many program elements, for each of which a variety of choices is available. These choices might be viewed as independent variables

that can be combined to form an alternative; each available as a "control knob" for varying the impacts. A sample list of such variables is given in Table 7.

An alternative, therefore, is best thought of as a "package" including, in addition to geometric and structural components, operating policies and program elements intended to minimize, eliminate, or compensate for negative impacts and to enhance community benefits and opportunities. Thus, an alternative is made up of a number of program elements, changing any one of which results in a new course of action. Several categories of program elements can be identified: (1) basic transportation elements, such as new freeways, improved arterials or secondary roads, bus or rail transit provisions, new technology, traffic engineering improvements; (2) corridor development and coordination, including multiple use of rights-of-way, relocation assistance, replacement housing, school compensation, park development; (3) management of rights-of-way, including programs to control development, protect open space, or prevent deterioration of an area between route adoption and construction; (4) construction procedures, such as noise abatement procedures, traffic rerouting, and soil conservation; (5) maintenance and operations, including landscaping, snow removal, emergency services, bus lanes, pricing, parking; and (6) legal, institutional, and administrative provisions, such as changes in funding programs or new compensatory programs.

Early consideration of all elements of an alternative is necessary to permit determination of probable impacts. For example, it is difficult to make a meaningful choice among alternative locations without some indication of the basic design features. This procedure improves the likelihood that plans adopted at one level of study will be acceptable at successive levels of study.

Example: Boston Transportation Planning Review.—The BTPR considered some of the less common elements in its analysis of the Boston area transportation system. It became clear as the study progressed that many interests were explicitly willing to accept congested highways, and to develop partial rather than total solutions. In describing to the Highway Research Board the kind of alternatives that came under consideration, Walter Hansen of the BTPR staff said (*119*):

> Here is a question we were forced to answer: "Is a parking pricing policy a substitution for the construction of highway facilities?" Our best technical answer was: "Yes, by gosh, it is. If the public chooses to regulate themselves through parking pricing policies, you can probably get about the same impact on the level of service on the highway system with a dollar increase in pricing as you can with an eight-lane expressway." That choice was put up for the final decision, and the Governor, in concert with the Mayor, announced as part of his policy a parking freeze and the possibility of parking pricing in the core area of Boston.
>
> This "Well, can't we change the regulations, or the policy, or the statutes?" attitude also has come up in communities that are heavily impacted by truck traffic. One of the major functions of the previously planned expressway system was to reduce truck traffic on local streets and arterials. One area—Cambridge—happens to be be-

TABLE 7
ELEMENTS OF A TRANSPORTATION ACTION

- MODE
- TYPE OF VEHICLE
- TYPE OF SERVICE:
  - TRIP PURPOSE SERVED
  - FREQUENCY OF SERVICE
- TYPE OF FACILITY:[1]
  - NUMBER OF LANES
  - SIZE OF MEDIAN
  - SPECIAL-PURPOSE LANES PROVIDED
  - PROVISION FOR OTHER MODES
- DESIGN STANDARDS:
  - MAXIMUM CURVATURE
  - MAXIMUM GRADE
  - DESIGN SPEED
  - LANE WIDTHS
  - SHOULDER WIDTHS
  - MAXIMUM SIDESLOPE GRADES
  - MAXIMUM HEIGHT CLEARANCE
  - R.O.W. WIDTH
  - PAVING TYPE
  - EDGE TREATMENT
  - SPECIAL SURFACE CHARACTERISTICS
  - LANDSCAPING
- LOCATION:
  - NEW OR EXISTING R.O.W.
- ACCESS:
  - INTERCHANGE SPACING
  - TYPE OF ROAD CLOSED
  - TYPE OF ROAD CONNECTED WITH
  - AT-GRADE OR GRADE-SEPARATED INTERCHANGE
  - TURNING MOVEMENTS PROVIDED
  - ACCESS LIMITATIONS
  - RAMP METERING
  - TRAFFIC CONTROL
- REGULATIONS:
  - SPEED LIMIT
  - WEIGHT RESTRICTIONS
  - VEHICLE BAN
  - RESERVED LANE
  - PARKING
  - PRICING
- STAGING:
  - ORDER OF SEGMENT CONSTRUCTION
  - SUCCESSION OF STEPS TO OBTAIN THE ULTIMATELY PLANNED FACILITY
- FUNDING:
  - PRIMARY (IMMEDIATE SOURCE OF MONEY FOR HIGHWAY AGENCY'S SHARE (e.g., TRUST FUND, BOND ISSUE)
  - SECONDARY SOURCE (e.g., TOLLS, GAS TAX)
- JOINT DEVELOPMENT (ACTUAL OR INCLUDING PROVISIONS FOR):
  - JOINT RIGHTS-OF-WAY
    - OTHER MODES
    - UTILITIES
  - NON-TRANSPORTATION DEVELOPMENTS
    - AIR AND UNDER RIGHTS
    - OFF-SITE REPLACEMENT
      - HOUSING / COMMERCIAL / INDUSTRIAL, ETC.
    - CONSERVATION / RECREATION AREAS WITHIN R.O.W.
    - ROADSIDE DEVELOPMENT
  - TIMING
  - ROLE OF HIGHWAY AGENCY IN PLANNING AND IMPLEMENTATION OF THESE
- COMPENSATION:
  - TO DISPLACED RESIDENTS, BUSINESSES, INDUSTRIES AND INSTITUTIONS
  - TO REMAINING "NEIGHBORS" OF THE FACILITY

[1] ELEMENTS BEYOND THIS POINT REFER ONLY TO SPECIFYING HIGHWAY ALTERNATIVES. A SEPARATE LIST WOULD BE NEEDED FOR EACH OF THE OTHER MODES. A HIGHWAY AGENCY MIGHT FULLY OR PARTIALLY DEVELOP MULTI-MODAL ALTERNATIVES OR MERELY IDENTIFY WHERE SUCH ALTERNATIVES WOULD BE DESIRABLE, DEPENDING ON THE LIMITS OF THEIR AUTHORITY, AND WORK IN CONJUNCTION WITH THE APPROPRIATE PLANNING AGENCIES TO COMPLETE DEVELOPMENT OF NON-HIGHWAY ALTERNATIVES.

tween a Massachusetts Turnpike entrance and the destination of many oil and dangerous-cargo trucks. Because of air-rights use over the Massachusetts Turnpike (the Prudential Center and also some tunnels) Department of Public Utilities regulations require these trucks to get off the Turnpike and proceed through Cambridge to their final destination, which is closer to the port. We were looking for solutions to this problem in the form of modification of the physical street system. These were pursued, but there was a growing question: "Why can't the regulations be changed so that trucks can stay on the Turnpike and proceed around Cambridge on an already available freeway?" We initially said: "Well, these are the regulations, you know. When the highway is covered over for 600 feet or more, because of fire, trucks can't continue on the road." The community retort was: "Well, can't you protect the tunnel from fire? Why do we have to build something when there appear to be changes in regulations that could solve our problem and therefore relieve us of the impacts associated with a physical change in a very dense urban structure?" This issue has not yet been resolved and is still being worked on by our technical staff. We have made applications and have assisted the city of Cambridge in making applications for a relaxation of that particular regulation that was in part responsible for the problem.

Example: Century Freeway, I-105, Los Angeles, California (35).—The California Division of Highways initiated studies for I-105, the Century Freeway, in 1967. The Century Freeway runs in an east-west direction and is part of California's legislatively mandated freeway and expressway system. The corridor is approximately 10 miles south of central Los Angeles and passes through the area of the 1965 Watts riots. Watts is a low-income community within the city of Los Angeles. A portion of the population is very transient, with many migrants from rural areas of the South. For the community as a whole, however, 50 percent of the families live in homes they own. Twenty percent of the occupants are retired on fixed income.

It became clear early in the course of studies that provision of relocation housing was a key issue. Each of the eight alignment locations under consideration would displace approximately 2,600 families. Although the average value of the houses to be acquired was $13,000, the cost of comparable homes outside the area was then between $18,000 and $22,000. At that time the Division of Highways compensation was limited to fair market value of the property being acquired. Development of a more equitable relocation assistance and replacement housing program became a major design task. It was felt that no highway could be implemented if residents were asked to bear the burden of greater housing costs and higher mortgage payments.

The following program elements were developed:

1. Legislative action was initiated to empower the Division of Highways to develop a replacement housing program that would allow it to acquire vacant unoccupied property outside the highway right-of-way, and to contract with public and private entities for the financing, planning, development, construction, management, sale and exchange or lease of replacement housing. This program would provide replacement housing for low-income individuals and families who reside in economically depressed areas and who are displaced by freeways, and provision would be included allowing for expenditure of up to $5,000 above fair market value for each household to place them in the same mortgage equity position as prior to displacement. This action resulted in passage in 1968 of the Ralph Bill, California Assembly Bill 1072, which subsequently served as the model for the National Uniform Relocation Assistance and Real Property Acquisition Policies Act enacted by the U.S. Congress in 1970.

2. A community group, The Watts Labor Community Action Coalition, was designated as the state's agent in charge of providing replacement housing. This provided visible participation and control by the community along with a job training program coordinated with the production of replacement housing.

3. Sites were identified in the neighborhood to which the houses in the highway right-of-way could be moved.

4. Houses that could be rehabilitated and moved to meet the needs of the Watts community were acquired elsewhere in the metropolitan area through such means as acquisition for other freeways, and from expansion of Los Angeles Airport.

5. A relocation housing program was developed in which families who preferred to do so were relocated in single-family homes within the same area.

Designing to Minimize Impacts and Obtain Community Benefits

The achievement of as equitable a distribution of impacts as possible requires that adverse effects be eliminated or at least minimized and that, where feasible, steps be taken to permit the transportation improvement to act as a catalyst for other community benefits. A general strategy for accomplishing this objective is:

1. Review of impacts and evaluation:
   (a) For each alternative, review the impact and evaluation analysis. For which affected interests is there an improvement over the status quo? Which interests are affected negatively?
   (b) Identify the impacts that an interest finds unacceptable. Determine the elements of a course of action that affect each of these impacts, and examine the implications of changing each of these elements.
2. Design activities. Design options fall into five major groups:
   (a) Changes in the physical transportation elements. Consider how changes in such geometric aspects as alignment and profile, interchange or station location and design, superstructure and substructure design, width of right-of-way, number of lanes or tracks, may shift the impacts, especially seeking ways to minimize or ameliorate undesired impacts.
   (b) Changes in nonphysical transportation elements. Consider traffic management approaches, such as restricted parking or left turns, speed controls, and reserved lanes.
   (c) Changes in the nontransportation elements. Consider how joint development within the right-of-way or air rights, under rights, and off-site

construction might be used to shift impacts. Consider how land-use controls might be used to minimize adverse indirect effects.

(d) Changes in compensatory programs. Consider ways of modifying existing compensatory proposals to tailor them more to the needs of the impacted interests.

(e) Development of new alternatives. Consider significantly different courses of action, such as different modes or significantly different types of facility.

Comments from the public and other agencies can help to identify many of the necessary modifications. Suggestions for changes in specific elements of an alternative, comments identifying unacceptable impacts of an alternative, and identification of the most desirable features of each of the alternatives by the various interests will be of most use.

There are numerous examples of air-rights and joint development proposals in conjunction with major freeways in urban areas. Less well publicized but probably more effective are the opportunities that have been taken on a smaller scale and nonurban facilities to minimize impacts.

In the town of Falmouth, the Maine Department of Transportation proposed to widen a curve where there was an extremely high accident rate. Doing so required filling one edge of a pond on its deepest side. The owner was concerned that this would affect the habitat for trout, with which the pond was stocked. To minimize the effect, it was decided to place curbing along the roadway edge to prevent salt runoff from entering the pond and to use clean stone fill to permit using a steeper sideslope, thus reducing encroachment on the pond. The grade of the road was also lowered 2 ft, which improved the connection to an adjacent restaurant parking lot and further reduced encroachment on the pond (*187*).

Design should strive not only to minimize negative impacts but also to use transportation improvements to obtain additional benefits wherever possible, be they environmental, social, or economic. For example, in Montana the state highway department has been empowered to purchase on behalf of the Fish and Game Department land for use as wildlife refuges that otherwise would be isolated by highway construction (*193*).

Near Davenport, Iowa, an embankment for I-280 was used to dam Black Hawk Creek and form a 95-acre lake, which will serve as the focus of a 600-acre regional park (Fig. 8). This was accomplished through the joint efforts of the Iowa Highway Commission, the Scott County Board of Supervisors, and the Scott County Conservation Board. The design for I-280 needed to be altered to raise the embankment and incorporate the dam and spillway. The cost difference between the original and modified designs was paid by the Scott County Conservation Board (*185*).

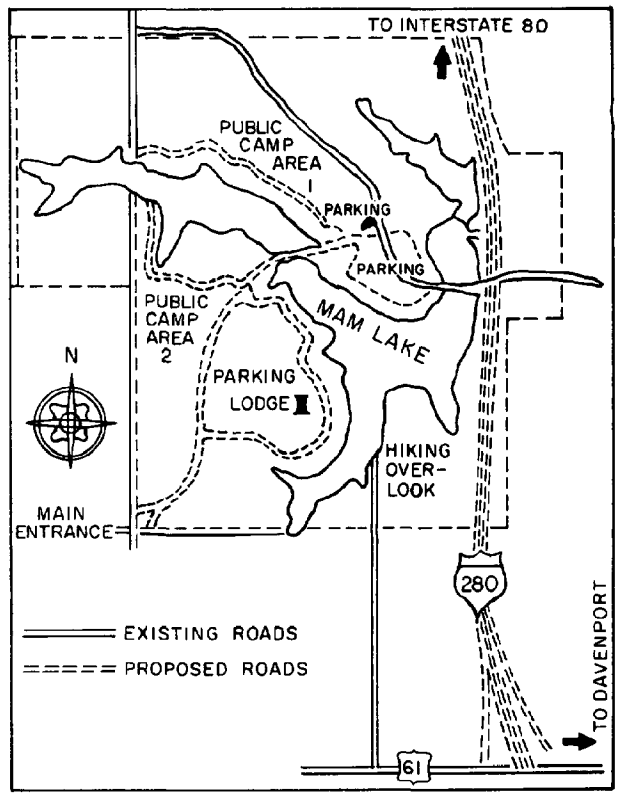


Figure 8. Designing to minimize impacts and obtain community benefits; Davenport, Iowa.

Techniques

Several techniques are available that can be used either independently or in combination to assist in the development or modification of alternative courses of action, as follows:

1. Sketch planning.
2. Environmental mapping.
3. Community interaction.
4. Alternative scales of action.
5. Variation in modal mix.
6. Variation in objective.

These techniques and other design aids can assist in generating an appropriate range of alternatives to be examined and in documenting the basis of these alternatives. There is, however, a danger that they will be misused if employed during evaluation as the basis of selecting the "best" alternative.

Sketch Planning

The use of sketch planning is important to achieving the kind of responsive and flexible process being recommended. This technique calls for a description of alternatives consisting of a rough sketch, both verbal and pictorial, that identifies the basic features of an alternative's location and design, as well as the basic nontransportation components of the action. Sketch plans normally include only enough detail to facilitate identification of the basic impact differences. Such a practice conserves agency resources and at the same time people frequently can relate more easily

to sketch plans than to more accurate geometric drawings. General specification of the nature of each proposal thereby permits community interests to formulate opinions on the basic nature rather than the details of an alternative and to give more fundamental guidance in the search for an acceptable course of action.

Some alternatives will be dropped as a result of sketch planning, some modified, and some added. As the number of alternatives being considered is reduced, more details can be added. Care should be taken, however, not to invest too much technical effort in any single action, as it is quite likely that none of the alternatives developed at a sketch planning stage will be the exact one finally chosen.

Example: West Side Highway Study, New York City.— The initial 6-month phase of the New York City West Side Highway Study was devoted to a sketch analysis of all suggested alternatives and to identification of issues of choice. During this phase, multimodal alternatives were developed to a low level of detail, as shown in Figure 9 (*160*). The range of alternatives examined included the do-nothing alternative, moderate reconstruction of the existing West Side Highway, tearing down the existing highway and building transit, and a variety of new highways, each including transit.

At the outset of studies, there was a potentially overwhelming number of options for the location of highway and transit facilities within the West Side corridor. In a horizontal direction, facilities could be located between the existing highway and the ends of the existing piers. In a vertical direction, the facilities could be tunneled, depressed, at-grade, or elevated. Further, the vertical and horizontal location could be different at different points along the corridor. Given this degree of choice, it was necessary to narrow the range of alternatives that should be developed, even to a sketch planning level of detail. To aid in accomplishing this task, the study staff prepared a series of matrices that showed the effects of possible options at selected points along the corridor (Fig. 10).

Each option was conceptualized as a box containing highway and transit facilities with a given horizontal and vertical location (called a Location Type Alternative, or LTA). Critical cross sections were identified at points along the corridor where existing or proposed land uses were felt to be particularly sensitive to the location of highway and transit facilities. Each entry in the matrix consisted of a preliminary evaluation of an LTA at a critical cross section. These matrices, together with design standards that determined feasible combinations of LTAs and rough estimates of the impacts on a broad range of interests, were applied to narrow the range of sketch plan alternatives (*161*).

At the conclusion of the initial 6-month planning phase the number of alternatives was reduced to a small number to be examined in more design detail. As a matter of policy, the alternatives involving no new highway were not deleted in the sketch planning phase, as that was felt to be too early in the project to so drastically limit choices.

Environmental Mapping

To present a meaningful choice of alternative locations, a designer should develop options that not only are physically different but also are different in terms of their impacts and the objectives to which they are oriented. For example, a road oriented toward the achievement of economic development may be very different in character from one oriented primarily toward environmental preservation. Techniques used in developing alternative locations should therefore be used in such a way as to present meaningful choices. One technique that lends itself to such use is mapping (*167, 189*).

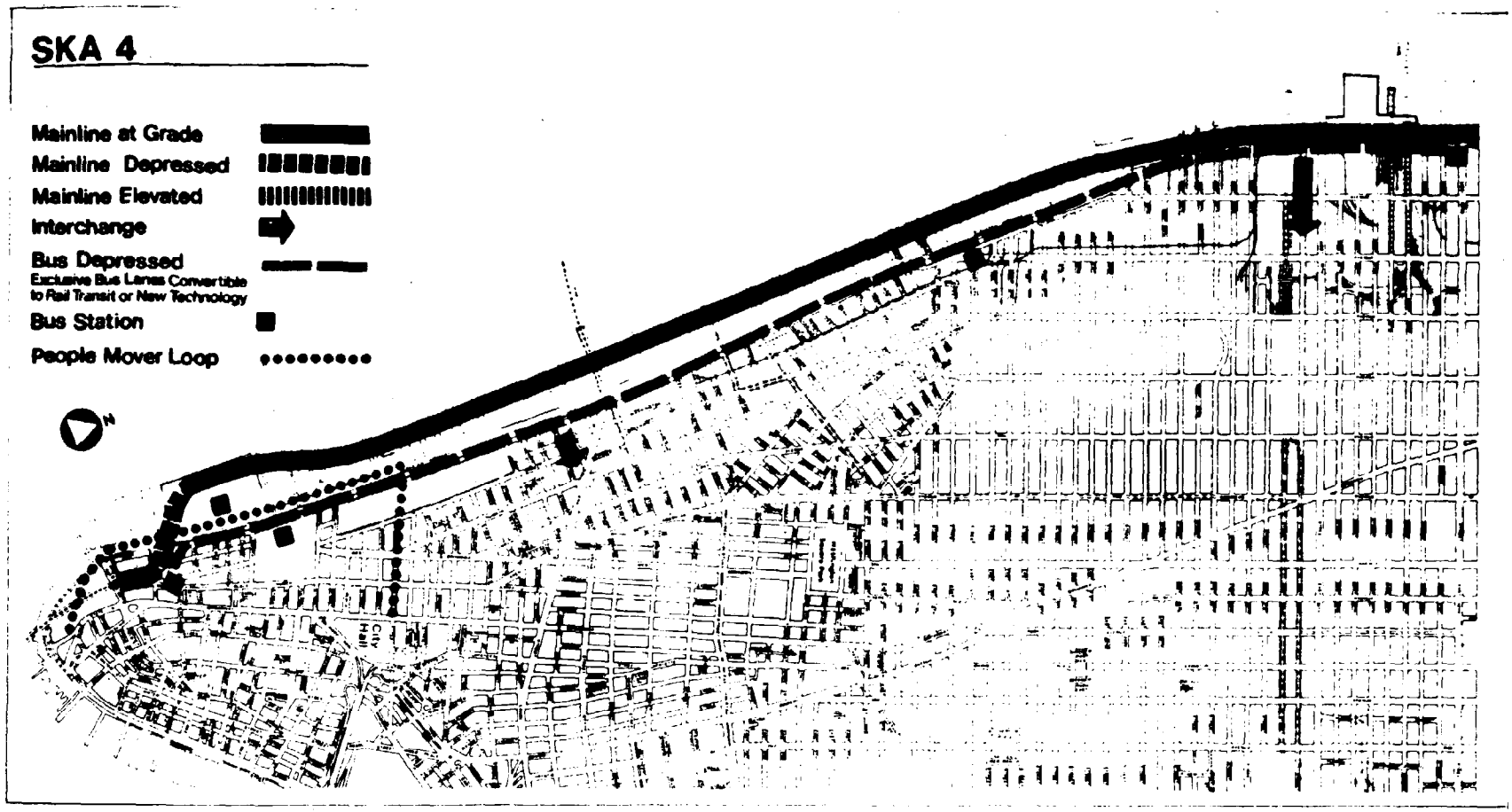
The information that is to be considered in selecting the location options can be displayed in the form of transparent overlay maps, with different features being mapped in separate overlays. The data to be mapped might include information on natural features of the land, vegetation and wildlife, human use of the land, and social characteristics (see the later section on "Identification of Impacts and Affected Interests").

The level of aggregation of the information being mapped normally will vary from one level of study to another. For example, at the corridor level it may be desirable to map environmental districts such as a lake district, whereas at the location/design level the actual bodies of water would be significant (Figs. 14, 15, 16).

Once the maps have been prepared, the designer can identify those features that should be avoided to illustrate each choice he or she wishes to display, and overlay the maps of these features to form a composite of areas to be avoided. For example, if the designer wishes to develop an option that would preserve unique areas, he might combine the maps of various physical features such as recreation areas, parks, conservation lands, historic areas, unique physical formations, scenic areas, streams, rivers, lakes and ponds, marshes and swamps, wildlife habitats, and forests. One or more routes that minimize infringement on the designated sites can then be traced across the composite map.

Computer techniques are available that are capable of assisting in the map overlay process. Care should be taken, however, to use such techniques to suggest possible routes rather than to identify one "best" route through an area. Community suggestions should be used to indicate modifications to these initial locations, as well as entirely new options.

Although there are presently several variations of these mapping techniques, most call for overlaying all of the mapped features to identify the least "total cost" route—the route that is best for engineering, social, and environmental values. Most authors recognize the undesirability of assigning relative weights to these different factors, but any process of combining individual feature maps implies some relative weights and these implied weights affect the resulting composite map. Also, this method is geared to identifying options that balance environmental damage and



SKA 4 and Transit Options #3, #1, and #2

The SKA 4 facility provides a 6 lane mainline for mixed traffic at grade and outboard past Battery Park City at which point it turns midboard and continues at grade to 23rd Street. Here the alignment moves inboard and goes elevated at 34th Street. Two depressed exclusive bus lanes begin in the 6 lane service road at the Battery Garage Terminal and continue in the service road median to grade at 38th Street east of the service road. North of 42nd Street, the exclusive bus lanes would operate in the Penn Central right-of-way and end at the highway approaches to the George Washington Bridge. On-line bus stations at intermediate points are provided in the service road at Battery Park City, World Trade Center, and 14th Street. These exclusive bus lanes can be converted at a future date to rail rapid transit, or the bus service can be augmented by a new technology transit system. The right-of-way of a proposed people mover loop is also provided for in Lower Manhattan.

Figure 9. Example sketch plan alternative; New York City West Side Highway Project.

	LTA 1 SKYWAY IN RIGHT OF WAY	LTA 2 NEW ELEVATED IN RIGHT OF WAY	LTA 3 AT GRADE IN RIGHT OF WAY	LTA 4 DEPRESSED IN RIGHT OF WAY	LTA 5 DOUBLE DECK RECONSTRUCTION	LTA 6 REHABILITATE EXISTING CONSTRUCT NEW SOUTHBOUND	LTA 7 DEPRESSED AT BULKHEAD	LTA 8 AT GRADE BULKHEAD	LTA 9 ELEVATED AT BULKHEAD	LTA 10 DEPRESSED AT PIERHEAD	LTA 11 AT GRADE AT PIERHEAD	LTA 12 ELEVATED AT PIERHEAD	LTA 13 TUNNEL AT BULKHEAD	LTA 14 TUNNEL AT PIERHEAD	LTA 15 REHABILITATE EXISTING HIGHWAY	LTA 16 LEAVE EXISTING HIGHWAY AS IS	LTA 17 REMOVE EXISTING HIGHWAY
16 CONSOLIDATED PASSENGER SHIP TERMINAL																	
15 PROPOSED CONVENTION CENTER																	
14 CIRCLE LINE PIER																	
13 LINCOLN TUNNEL																	
12 PIER 76																	
11 PENN CENTRAL RAIL YARDS																	
10 CHELSEA PIERS																	
9 GANSEVOORT - 14th ST. MEAT MARKET																	
8 DESTRUCTOR PLANT																	
7 WEST VILLAGE																	
6 MORTON STREET PIER AND PATH TUNNEL																	
5 PIER 40																	
4 HOLLAND TUNNEL																	
3 WASHINGTON STREET URBAN RENEWAL AREA																	
2 WORLD TRADE CENTER																	
1 BATTERY PARK GARAGE																	

Figure 10. Evaluation matrix for initial sketch alternatives; New York City West Side Highway Project.

construction costs (as well as other costs), but a more acceptable route to the public may favor environmental protection over minimum construction cost, or vice versa.

To overcome this objection, the product of a mapping effort should be a set of alternative locations, each emphasizing preservation of a different type of feature, rather than one "best" route which, by its basic nature, represents only one of the many possible options. For example, a route that would minimize environmental damage should be identified, as should one that would maximize economic growth. Maps are still being combined; the difference is that the number of features combined onto one composite map is greatly reduced and only similar features are combined. The problems caused by implicit or hidden relative weights are minimized because basically different issues are not combined, but maintained as separate displays.

Community Interaction

Community interaction should occur both prior to and during the time alternatives are being developed, gathering information on likes and needs and adjusting design activities to respond to community views. Local officials and agencies, interest groups, and the general public can contribute useful suggestions for alternatives to be considered. Using techniques such as workshops, design-ins, or mail requests, individuals can be encouraged to suggest new alternatives or modifications to existing alternatives. The representativeness of this selection of alternatives would then depend on the variety of interests contributing. Groups should be encouraged to specify more than one alternative to reduce the likelihood of an interest being in the position of defending one particular suggestion. Impact prediction is particularly important because it serves to help people

understand if the alternatives that they proposed actually accomplish what they intended. Accordingly, it may be possible in many cases to furnish sufficient background data to community groups so that they themselves can perform some approximate impact analyses.

Community responses to alternatives may serve as a basis for improving the plans; their comments may direct the designers' attention to local problems that can be solved by adding to an existing course of action. Especially important, effective community interaction may help to point out unacceptable alternatives before much time and effort has been expended on their development.

Community interaction is vital to a good design strategy. There are numerous examples where suggestions have been selected for implementation. Two cases from the Boston Transportation Planning Review are illustrative of general experience.

Example: Boston Transportation Planning Review.—Commenting on the contributions of community participants, Steve Lockwood of the BTPR staff reported (*119*):

> It was important to this process that it be understood by everybody involved, participants and technicians alike, that all the plans and technical memos were essentially drafts. This tended to lower the threshold of reactions to tentative solutions and made it possible to generate on the basis of less-detailed technical study a variety of alternatives at the outset, which could then be modified.
>
> As participants became accustomed to playing a role in shaping plans, they often took the initiative themselves rather than simply establishing a series of defensive postures to initiatives coming out of the technical process. The continued questioning and exposure to a variety of value positions on the part of the technical staff seemed to broaden out professionals' "conventional wisdom" about what constitutes what we call nonabsurd alternatives, or what feasibility really means. A number of solutions were resisted by the technical staff in the beginning, but as discussion forced us to reevaluate the basis of our intuitive reactions, some of these proved to be more feasible than we might have thought.

A specific example is found in the BTPR's Southwest Corridor Study as reported by Hansen (*119*):

> . . . in studying alternative transit systems for the southwest corridor, our findings, at least to us, kept indicating one particular course of action. There was one lady in our working committee who continually said, "But you haven't studied . . . But you haven't studied. . . ." And we went through the alternatives, and we got to a draft report, and she said: "But you didn't study this other alternative in the right context, and your results therefore are biased." We printed our final report, and she stuck right in there. Finally, one day she got me in the hall, and she said: "I don't think I am getting through to you. What I mean to say is that you haven't studied the right alternative. Therefore, although I believe your numbers, you haven't presented all the numbers you could." So we spent a couple of hours and lo and behold, we hadn't studied. As a result, the way our results were presented, they were in fact biased, not because we didn't like her solution, but because we hadn't looked at it in quite the right way—the way she was looking at it. We did a rerun and, fortunately, prior to public hearings and public meetings we were able to put out an addendum. Again, what the lady wanted us to study that we didn't look at in quite the right way—her way, so that we could fully see what she was talking about in terms of service to a particular area—has become a part of the recommended plan.

Alternative Scales of Action

Another basis on which to select a range of alternatives is the scale of the proposed action. The end points of this spectrum are familiar; that is, the no-build alternative and provision of a high-standard facility designed to satisfy unconstrained projected demand. There are, however, numerous solutions between these endpoints, and in many cases these intermediate scales of action may provide a viable alternative. Some of these intermediate scales of action might include:

1. Regulatory changes or traffic management without any new construction, such as area traffic control or signalization.
2. Spot improvements, such as adding turning lanes or changing intersections to interchanges.
3. Upgrading the existing facility by widening existing lanes and shoulders or by adding lanes.

To consider the full range of alternative scales of action, agencies need to be flexible regarding the map scale to be used during a particular study stage. A general standard such as 1 in. = 200 ft for location studies may not be sufficient. Different kinds of alternatives need to be mapped to different scales; urban projects require larger scales than rural projects.

The consideration of alternative scales of facility also implies a flexible application of design standards. Design standards, if used as rigid constraints rather than as flexible guides, may discourage the in-depth investigation of particular alternatives. In many cases, there may be an apparent safety-environment tradeoff. For example, a safety-conscious design might imply wide paved shoulders, flat constant slopes, and wide right-of-way with all trees and other hazards removed. An environmentally sensitive design may dictate the opposite.

Example: Relocation of Hypothetical Route 1000.—The existing US 1000 (Fig. 11) is a two-lane uncontrolled-access facility with 10-ft lanes and 5-ft shoulders passing through a small town. Within the town, 10-ft parking lanes are included. The existing road is on a 66-ft right-of-way. There are traffic lights at the intersections with State 103, US 2000, and State 22. The speed limits are 30 mph in the town and 50 mph elsewhere.

Traffic projections indicate that a four-lane limited-access facility will be required between State 22 and US 2000 in about 20 years. In addition, the existing facility has a high accident rate, particularly at the steep grade and sharp curve to the south of town and at the intersection with US 2000, with a slightly lower rate in the town center at State 103. The bituminous macadam pavement and stabilized-soil shoulders are potted and in need of repair; the side slopes are eroded. The set of alternatives to be considered might include:

Alternate 1—Do nothing. No action is taken other than routine maintenance.

Alternate 2—No build. Parking lanes within the town would be converted to travel lanes.

Alternate 3—Major maintenance. The route would be

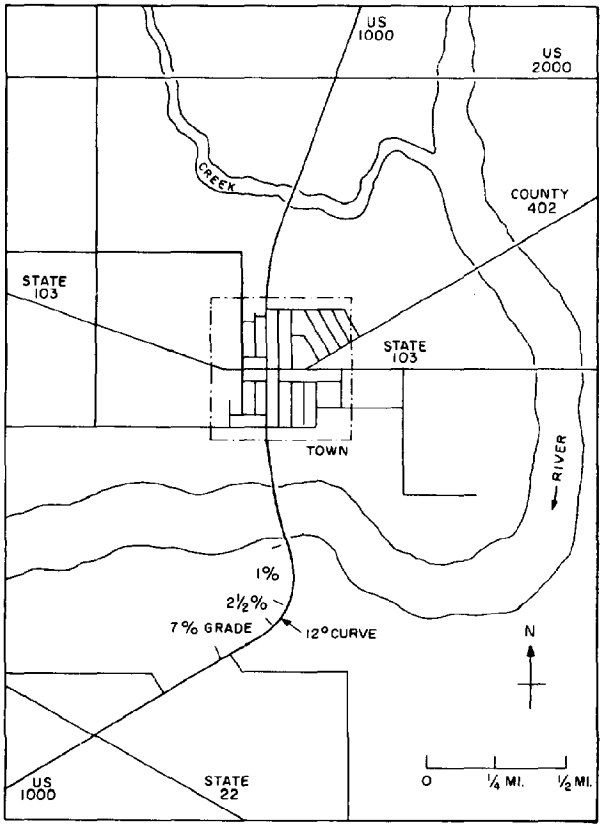


Figure 11. Example of alternative scales of action.

returned to its original condition, including major repairs to the pavement, shoulders, and side slopes.

Alternate 4—Minor spot improvements. Turning lanes would be added at US 2000, State 103, and State 22, utilizing the existing parking lanes near State 103 for that purpose. The 12° curve would have the lanes widened to 12 ft and the shoulders to 8 ft, and the superelevation would be adjusted to conform to current design standards.

Alternate 5—Minor upgrading on existing right-of-way. Travel lanes would be widened to 12 ft and shoulders to 8 ft. Travel and parking lanes in the town would be reduced to 8 ft, and repaved with bituminous macadam. Side slopes would be reduced from 1:1 to 1:3.

Alternate 6—Major spot improvements. A cloverleaf interchange would be constructed at US 2000 and a diamond interchange at State 22. The sharp curve south of town would be widened to 5° and the grade reduced to 3½ percent. A climbing lane would be added in the southbound direction.

Alternate 7—Major upgrading on existing right-of-way. The existing facility would be widened to four 12-ft lanes (10 ft in town) with 8-ft shoulders between US 2000 and State 22.

Alternate 8—Construction on new right-of-way. A new four-lane limited-access divided highway would be constructed on new right-of-way located between the town and the river from south of State 22 to north of US 2000, with interchanges at State 22, State 103, and US 2000. A new recreation area would be developed between the new highway and the river in the vicinity of State 103. The new highway would be built to Interstate design standards.

Variations in Modal Mix

Proposed highway improvements should be considered in the context of a multimodal transportation system. In a rural setting, this may involve the relationship between highways and railroads for the movement of intercity freight. In urban areas, highways are to be considered in relation to bus, rail, air, port, and other transit systems. Alternative courses of action can be developed that place a different emphasis on the different modes. A range of strategies could include all highways and no transit; a combination, such as highways with provisions for bus lanes or median rail rapid transit, or improved highway access to park-and-ride or kiss-and-ride facilities combined with line-haul transit improvements; and transit improvements with no additions to the supply of highways.

Example: Westside Transportation Evaluation, Atlanta, Georgia.—The draft Study Design for Atlanta's Westside Transportation Evaluation has adopted three strategies that illustrate the concept of various mixes of multimodal alternatives (*112*), as follows:

Strategy A—Meet the Atlanta Area Transportation Study (AATS) projected future demand. Handle most trips on freeways, from 4 to 8 lanes or larger. This strategy stresses highway mobility. It accepts the existing AATS plan. The Metropolitan Atlanta Rapid Transit Authority's planned system is also accepted.

Strategy B—Handle most trips on the existing street system. Make use of ramp metering to maintain smooth flow and increased volume on expressways. Utilize reserved lanes for buses, multiple-occupancy cars, and other special-purpose vehicles. Prohibit on-street parking. Divert automobile demand to transit for peak-period work trips.

Strategy C—Constrain automobile demand. Handle auto movement with major arterial improvements, signalization, one-way street operations, reversible lanes, and provision of new arterials. Transit changes might include construction of additional bus and rail rapid transit lines and/or the inclusion of new stops on approved MARTA lines; changing bus routes; implementing new systems, such as "dial-a-ride"; and providing park-and-ride facilities at points of congestion.

Variations in Objective

Inasmuch as transportation decisions can have a significant effect on the shape of a community's future, this relationship should be recognized and displayed as a point of choice. Alternatives should provide a choice of objectives for the future, as well as a choice of ways to reach these objectives. In doing this, the examination of alternatives will help to clarify the tradeoffs among alternative futures.

Alternative objectives can be identified through community interaction and can serve as the basis for an initial set of transportation alternatives. In this approach an alter-

native is developed such that it supports one particular identified objective, with different alternatives being oriented to the achievement of different objectives. Objectives are not necessarily compatible and, in fact, would be expected to be in conflict. The intent is to develop initially a wide range of alternatives to assist individual interests in better understanding the implications of their stated objectives. The alternatives would be expected to vary in mode and type of facility as well as in location. Compromise and the combining of individual features of particular alternatives would occur after this initial analysis.

Alternative objectives that may be appropriate to an urban area might include minimizing school takings, minimizing splitting of neighborhoods, minimizing job losses, maximizing taking of old and marginal schools that need relocation or replacement, and maximizing the quality of the perceptual sequence for the user. Even though the action ultimately decided on will almost certainly reflect a compromise among these initial objectives, the examination of such "extreme" conditions can better illustrate and identify issues.

Example: Michigan Route 31/131 Northwest Region Study.—This approach was used in the Northwest Michigan regional study, where alternative objectives similar to the following were identified as a result of public meetings and discussions with community leaders:

- Protection of the natural environment.
- Improve transportation service.
- Growth in industry.
- Growth in business.
- Growth in tourism.
- Growth in agriculture.
- No growth in industry.
- No growth in business.
- No growth in tourism.

One alternative was defined to achieve each alternative objective. Because some of the objectives are in direct conflict, one option was developed, for example, that would facilitate tourist visits whereas another choice was designed to explicitly act as a barrier to future growth in tourism and related industries.

The option selected for each element of an alternative is the one that best serves the objective to be addressed (Fig. 12). The options for each element are ranked against one another for their ability to produce the desired impact. The alternative for the objective, then, consists of the highest-ranked option for all of the elements. (In more complex cases, it may be necessary to further define an objective in terms of actual impacts. A summary ranking can then be made for all impacts under that objective.)

In the Michigan application, the number of lanes, access control, and general location were considered. The following alternatives were selected for initial consideration:

- Two-lane, free access, on existing right-of-way.
- Two-lane, limited access, on existing right-of-way.
- Four-lane with median, limited access, on new location near population centers.

	II IMPROVE TRANSPORTATION SERVICE	III IMPROVE THE QUALITY OF THE HUMAN ENVIRONMENT	V GROWTH IN INDUSTRY	VI GROWTH IN BUSINESS	VII GROWTH IN TOURISM	VIII GROWTH IN POPULATION	XIV NO GROWTH IN AGRICULTURE
MODE	MAJ	MIN	MAJ	MOD	MAJ	MAJ	MOD
DO NOTHING	4	4	4	4	4	4	4
IMPROVE AIR	3	3	3	3	3	3	3
RAIL	2	2	2	2	2	2	2
HIGHWAY	1	1	1	1	1	1	1
TYPE OF FACILITY							
NUMBER OF LANES	MOD	MIN	MOD	MOD	MOD	MOD	MOD
2	4	4	4	4	4	4	4
4 W/O MEDIAN	3	3	3	3	3	3	3
4 WITH MEDIAN	1	1	1	1	1	1	1
5	2	2	2	2	2	2	2
LOCATION	MOD	MOD	MIN	MOD	MIN	MOD	MOD
EXISTING R.O.W.	3	3	2	2	3	3	2
CLOSE TO POP CTRS	1	1	1	1	1	1	1
DIST FROM POP CTRS	2	2	2	2	2	2	2
ACCESS							
ACCESS	MOD	MIN	MIN	MOD	MIN	MIN	MIN
FREE	2	2	2	1	2	2	1
LIMITED	1	1	1	2	1	1	2
INTERSECTIONS	MOD	MIN	MIN	MIN	MIN	MIN	MIN
AT GRADE	2	2	2	2	2	2	2
GRADE SEPARATED	1	1	1	1	1	1	1

LEGEND

NO: NO SIGNIFICANT RELATIONSHIP
MIN: MINOR RELATIONSHIP
MOD: MODERATE RELATIONSHIP
MAJ: MAJOR RELATIONSHIP
1 INDICATES THE MOST DESIRABLE ALTERNATIVE

Figure 12. Example of summary impact element matrix.

- Four-lane with median, free access, on new location near population centers.
- Two-lane, limited access, on new location distant from population centers.
- Four-lane with median, limited access, on new location distant from population centers.

Corridors satisfying the foregoing characteristics were then laid out on previously developed environmental maps, using the mapping technique discussed earlier and in the following section.

A variation of the objective orientation approach is to address an alternative to meet the primary needs of a specific interest (such as summer residents) rather than to the accomplishment of a particular objective (economic growth). Through community interaction, an alternative can be selected that will best accomplish the interests' mix of objectives. Figure 13 shows an example of what an information matrix might look like if applied to the North-West Michigan Study.

	TOURISTS	BUSINESSES (SERVING TRAVELERS ON EXISTING ROUTES)	BUSINESSES (SERVING RESIDENTS)	INDUSTRY	RESIDENTS (IN LABOR POOL OR DEPENDENT ON SOMEONE WHO IS)	RESIDENTS (NOT IN LABOR POOL NOR DEPENDENT ON SOMEONE WHO IS)	SUMMER RESIDENTS
MODE	MAJ	MOD	MAJ	MAJ	MAJ	MAJ	MOD
DO NOTHING	4	2	4	4	4	1	3
IMPROVE AIR	3	3	3	3	3	2	1
RAIL	2	4	2	2	2	3	2
HIGHWAY	1	1	1	1	1	4	2
TYPE OF FACILITY							
NUMBER OF LANES	MAJ	MAJ	MAJ	MAJ	MAJ	MAJ	MOD
2	4	4	4	4	4	1	1
4 W/O MEDIAN	3	2	3	3	3	2	2
4 WITH MEDIAN	1	3	1	1	1	3	3
5	2	1	2	2	2	3	3
LOCATION	MIN	MAJ	MOD	MIN	MIN	MAJ	MAJ
EXISTING R.O.W.	3	1	2	2	2	1	1
CLOSE TO POP CTRS	1	2	1	1	1	2	2
DIST FROM POP CTRS	2	3	3	3	3	3	3
ACCESS							
ACCESS	MOD	MAJ	MOD	MOD	MOD	MOD	MOD
FREE	2	1	2	2	2	2	2
LIMITED	1	2	1	1	1	1	1
INTERSECTIONS	MOD	MIN	MIN	MOD	MOD	MIN	MIN
AT GRADE	2	1	2	2	2	1	1
GRADE SEPARATED	1	2	1	1	1	2	2

LEGEND

MIN: MINOR CONCERN TO INTEREST
MOD: MODERATE CONCERN TO INTEREST
MAJ: MAJOR CONCERN TO INTEREST
1 INDICATES THE MOST DESIRABLE ALTERNATIVE

Figure 13. Example of interest element matrix.

IDENTIFICATION OF IMPACTS AND AFFECTED INTERESTS

Impact prediction is the identification and estimation of the potential direct and indirect transportation, economic, environmental, and social effects of implementing a particular course of action. These effects include items such as changes in activity distribution patterns, travel demand, ecological relationships, and neighborhood character. Information on impacts is necessary so that decision-makers —whether a governor or a technician—are fully informed of the issues of choice. Impact information serves to guide designers in the development and refinement of alternatives, suggesting possible changes that will eliminate or minimize an adverse impact and identifying those areas where compensation of some form is desirable to achieve a more equitable solution.

Impacts are incident upon particular people or interests, with some benefiting, some adversely affected, and some affected both beneficially and adversely. Those individuals and businesses directly displaced by a transportation project, and the potential users of an improved facility, are obvious examples of specific interests affected. Other interests may include town and city governments (particularly impacts caused by tax base changes), school districts, ethnic groups, neighborhoods, low-income groups, handicapped persons, persons not owning automobiles, adjacent residents and institutions, area businesses and industries, and recreational facilities.

This section develops basic requirements for impact prediction and describes methods to assist in identifying and establishing priorities of impacts and in selecting which prediction techniques to use. The relationship of impact prediction to other functions, notably community interaction and the consideration of alternatives, is described, and a series of examples and impact typologies are included.

A comprehensive catalogue of technical impact prediction techniques and discussion of their use is not presented. Rather, the emphasis is on the requirements to be satisfied by such techniques and the process context in which such techniques are used. To demonstrate these requirements and to illustrate the interrelationships between various impacts, five impact types—air quality, community cohesion, network flows, accessibility, and mobility for special groups —are discussed in Appendix B.

Compensation for Adverse Effects

Increased attention in transportation planning is being given to issues of equity, recognizing that interests receiving undue burdens from implementation of a project should be compensated for these adverse effects. Compensatory programs should be developed in parallel with transportation-oriented components of a course of action, as they are one of several available mechanisms for eliminating or minimizing adverse effects.

Compensatory programs are generally aimed at a specific target or common interest. Thus, impact information cannot be examined in the aggregate, ignoring the fact that different interests are affected differently by different impacts; it is necessary to determine who would be affected and the nature and extent of impact.

The principal existing compensatory program on a national basis is the 1970 Uniform Relocation Assistance and Real Property Acquisition Act. The Act, directed at individuals actually displaced, was a major step toward more equitable compensatory practices in that it allows relocation assistance over and above "fair market value" in order to account for other costs incurred, extends relocation assistance to renters as well as owners, and requires the existence of decent, safe, and sanitary replacement housing prior to relocation.

Several states have developed their own unique compensatory programs that are directed at additional interests. For example, proposals either enacted by or proposed to the California state legislature include the following:

- Lease to a local agency for park purposes the remaining portion of land not needed for state highway purposes.
- Lease nonoperating right-of-way areas to municipalities or other local agencies for public purposes, and may

contribute toward the cost of developing local parks and other recreational facilities on such areas.

- Reimburse school districts for temporary loss of tax base revenue.
- Undertake noise abatement programs in schools where freeway traffic noise exceeds 50 decibels (A).

Attention also is being given to compensatory programs for those interests immediately adjacent to the highway right-of-way. As one example, proposals developed by the Secretary of State for the Environment in the United Kingdom (*203, 214*) and recently enacted by Parliament include provisions for installation of sound insulation where the predicted noise level at the outside of a dwelling would be above a specified level; and owners and occupiers of residential property, farms, and small business premises will be eligible for compensation for any significant depreciation in the value of their property where such depreciation is caused by nuisances, noise, or smell resulting from the use of the roadway. The costs of providing these measures is to be met by the public authorities responsible for the road-building.

Direct monetary payments and provision of new or replacement facilities are only two of the ways of ameliorating negative effects. Increased land-use control is another commonly proposed technique.

Although compensatory programs vary in their specifics, a common element is that each is aimed at a particular kind of interest, thereby implying that these interests be clearly identified as part of the impact prediction process.

Basic Impact Identification Strategy

Requirements

Information on impacts and affected interests should be keyed to satisfying several fundamental requirements. The requirements are applicable to any level of planning—system, corridor, or project. Successive planning phases should be able to employ many of the data gathered and generated during earlier phases and should be oriented to adding only that detailed information appropriate to a more micro-oriented analysis.

The primary requirement for impact information, as discussed in earlier sections, is that it:

1. *Indicate how particular interests are affected by transportation proposals.* Institutions, people, and matters of concern ranging from the economy to wildlife are affected in different ways by different transportation proposals. The impact prediction process must determine the manner and extent to which specific interests are beneficially or adversely affected and must maintain the information in disaggregate form so that the issues to be resolved are highlighted.

Within this broad requirement, the following seven additional requirements can be specified.

2. *Give as much importance to social, economic, and environmental impacts as to transportation impacts* throughout all phases of a planning/design process, especially early in system and project planning. In performing any study, even very small ones, the objective is to develop a course of action that is socially, economically, and environmentally sound as well as technically beneficial. Social, economic, and environmental effects must be identified as early as possible and treated as integral components of a transportation alternative. Predictions must be made as the alternative is being developed. Although there may be limitations in the state of the art in identifying and analyzing some social, economic, and environmental effects, particularly second-order effects, the limitations are not sufficient to justify ignoring these considerations during any portion of a planning and design process.

3. *Document-associated uncertainty.* Impact predictions are rarely precise measurements, but rather "best estimates" given a particular set of assumptions about community trends and a particular state of the art in prediction capability. Long project lead times, changes in community characteristics, and changes in participants can lead to much uncertainty about many predictions. Although community interaction, more data, and more precise prediction techniques can sometimes help to reduce this uncertainty, uncertainty should nevertheless be documented, possibly by giving an estimated range rather than a single value, because it could significantly alter the decisions that will be made.

4. *Deal with qualitative information.* Many social and environmental impacts can be described best by verbal description or visual illustration. The impact prediction process must take these impacts into account, as well as those that are quantifiable.

5. *Be sensitive to people's perceptions of impacts.* The very existence of certain impacts depends on people's perceptions. Even when people agree that a particular impact may exist, they may not concur on its implications for themselves or for the community as a whole. It therefore is important to determine people's perceptions of impacts, and to document differences in perceptions and interpretations of impacts.

6. *Address indirect impacts.* Transportation facilities frequently cause impacts that have ramifications beyond their primary consequences. To some extent, impacts operate in causal chains. That is, the primary impacts of a facility (dislocations, access change, noise, air pollution, visual disruption) may cause secondary consequences (such as land value and land-use changes and new patterns of commercial development). These, in turn, may cause a third round of consequences, such as reduced community satisfaction and tax changes. Efforts should be made to determine these indirect effects and make decision-makers aware of the possibility of their occurrence.

7. *Determine the time frame in which particular impacts are likely to occur.* A particular impact may differ in magnitude and incidence depending on the period of time under consideration. For example, noise and air quality problems during construction are likely to be very different from those during operation of the facility. Some psychological, physiological and social impacts, land-use changes, and economic effects require long periods of time to appear, whereas other impacts are short-term or one-time (e.g., housing removal). The impact prediction process should be geared to determine when particular impacts will occur

and how the magnitude and extent of an impact will change over time.

8. *Assign priorities to studies of particular impacts.* For most projects, the number of potential impacts is quite large. Although the objective should be to predict as many consequences of implementing a course of action as possible, full attainment of this goal is seldom possible. Some impacts, however, will be more significant, either legally or to the groups and individuals affected, and should be given a high priority in the prediction process. Work toward impact prediction should begin prior to the development of alternatives with the collection of a base of social, economic, environmental and transportation information. During an early sketch planning phase, impact prediction concentrates on developing quick and approximate predictions of many impacts for many alternatives. As the number of alternatives is reduced and as alternatives are developed in greater detail, emphasis shifts to more accurate predictions of those impacts that are determined to be especially sensitive to changes in the transportation system.

In summary, if a planning process is to be responsive to the needs and desires of all persons potentially affected, alternatives must be developed which enhance positive impacts and minimize negative ones. In order for this kind of flexible, responsive process to occur there must be a continuous flow of information between community and technical staff during the development of alternatives and impact prediction. This cannot occur if impacts are predicted in a "one shot" approach after all alternatives have been developed and selection is about to be made.

Information Collection

As soon as an area has been designated for study, an initial survey of the area can be made to gain an understanding of its character and needs, likely impacts, and potentially affected interests. The information gathered is used to identify significant issues in the study area. These, in turn, give direction to the rest of the prediction process. A centralized filing system, organized to facilitate easy retrieval, should be set up.

TABLE 8
AFFECTED INTEREST TYPOLOGY

1. DISPLACED INDIVIDUALS AND ORGANIZATIONS.
2. INDIVIDUALS AND ORGANIZATIONS LEFT ADJACENT TO THE HIGHWAY.
3. INDIVIDUALS AND ORGANIZATIONS WITHIN NEIGHBORHOODS AND AREAS CLOSE TO THE HIGHWAY.
4. INDIVIDUALS AND ORGANIZATIONS WITHIN MUNICIPALITIES CLOSE TO THE HIGHWAY.
5. INDIVIDUALS AND ORGANIZATIONS WITHIN PUBLIC SERVICE DISTRICTS AFFECTED BY THE HIGHWAY.
6. COUNTY-WIDE OR METROPOLITAN ORGANIZATIONS, THEIR CONSTITUENTS AND THE USERS OF THEIR FACILITIES.
7. STATE-AND REGION-WIDE ORGANIZATIONS.
8. NATIONAL ORGANIZATIONS.

An affected interest, as given in Table 8, can be defined as people (groups or unaffiliated individuals), institutions (including public agencies, governments, businesses, and private organizations), and resources (air quality, cultural and historic sites, wildlife, etc.) that may receive impacts, either beneficial or adverse. Thus, affected interests might include homeowners, renters, and businesses potentially displaced by, left adjacent to, or located near a proposed transportation facility; neighborhoods, public services districts, and local governments; indigenous flora and fauna, national and state parks, and so on.

Relevant data to be examined will vary with the nature of the interest affected: for communities or neighborhoods, these would include economic, demographic, land-use, and similar information; for a particular wildlife species, maps of habitats, life support requirements, etc. The information indicates any relevant expressions of attitudes, opinions, or concern about particular impacts. For interests like neighborhoods or institutions, this information would come from direct communication with residents or representatives, news articles, etc. For interests like wildlife, these concerns may be expressed by local residents, state agencies, or private organizations.

Generalized typologies of impacts (Table 9) can be useful as checklists, although care should be taken to use such lists flexibly. Different transportation proposals vary so greatly as to mode, location, scale, and other factors that they create substantially different sets of impacts and interests. For example, a highway in a rural area might impact a highly important outdoor recreation industry. Then, "effect on recreation industry" becomes an impact to be considered and "users of recreation facilities," etc., are interests affected. An expressway planned to pass through a low-income urban community, on the other hand, would not likely generate the same kinds of concern. Instead, significant impacts are likely to be "air pollution," "community disruption," "houses dislocated," and "access to employment," while interests such as "community residents," "suburban commuters" and "displaced homeowners" would have to be considered.

Information sources for the initial survey include federal, state, and local agencies; existing reports; fieldwork; aerial photography; public meetings; surveys; interviews with spokesmen for various interest groups, and other such activities. Interaction with community groups can often point out features that other sources may not uncover. Specific data that should be considered for collection, along with potential sources are given in Table 10. Examples of appropriate federal agencies are listed in CEQ guidelines for the preparation of Environmental Impact Statements. It is unlikely, however, that any individual study will require all of the information listed in this table.

Impact prediction activities should be closely coordinated with other public agencies. The earlier section on "Community Interaction" discusses sources of existing data and the kinds of information that may be available from these sources. Many of these agencies already may have gathered extensive environmental data (e.g., housing stock, community characteristics, land use, pollution). The A-95 Clearinghouse Review carried out at the initiation of proj-

TABLE 9
IMPACT TYPES

OPERATIONAL IMPACTS				
NETWORK	FACILITY	SERVICE BY MODE		
		ACCESSIBILITY	USER	GOODS
NETWORK INTEGRATION SYSTEM OPERATION EFFECT ON ARTERIAL AND LOCAL STREET SYSTEMS SAFETY	SHORT RUN OPERATING CONDITIONS LONG RUN OPERATING CONDITIONS RELATION TO FUTURE TECHNOLOGY PLANS AND DEVELOPMENT SAFETY *MODAL COORDINATION*	PUBLIC SERVICES JOBS RECREATION COMMERCIAL INDUSTRY CHURCHES MEDICAL SHOPPING CULTURAL FRIENDS RELATIVES SOCIAL SERVICES	TOTAL TRIP SPEED TRAVEL TIME TRIP LENGTH ACCIDENT RECORD OPERATING COST TRIP RELIABILITY COMFORT, CONVENIENCE, & OTHER QUALITATIVE FACTORS LEVEL OF SERVICE USAGE PARKING	GOODS DISTRIBUTION FREIGHT COSTS DELIVERY SERVICES TERMINAL LOCATION AND OPERATION

ACTIVITY DISTRIBUTION IMPACTS		
LAND USE	DEVELOPMENT TYPE	DEVELOPMENT OPPORTUNITIES
PARKLAND OPEN SPACE RESIDENTIAL COMMERCIAL INDUSTRIAL INSTITUTIONAL	POPULATION EMPLOYMENT INDUSTRY PRODUCTION MARKETS	JOINT DEVELOPMENT SHORT TERM LONG TERM REZONING CAPITAL PROGRAM

MONETARY IMPACTS				
AGENCY COSTS	USER COSTS	NEIGHBORHOOD COSTS	COMMUNITY COSTS	DISPLACEE COSTS
RIGHT-OF-WAY CONSTRUCTION AUXILIARY FACILITIES REPLACEMENT HOUSING REPLACEMENT OF FACILITIES MAINTENANCE REVENUE SOURCES RELOCATION SERVICES COST OF CAPITAL	OPERATING MAINTENANCE PARKING INSURANCE ACCIDENT TIME FARES	PROPERTY VALUES RENTS ASSESSMENTS TAXES POLLUTION BLIGHT ACCESSIBILITY	INCOME PRODUCTION VALUE JOBS ASSESSMENT, TAXES PROVISION OF SERVICES REGIONAL ECONOMY	REPLACEMENT COSTS MORTGAGES AND INVESTMENTS RENTS TITLE FEES MOVING EXPENSES CLIENTELE LOSS OR GAIN

SOCIAL IMPACTS				
COMMUNITY BOUNDARIES	*COMMUNITY CHARACTER*	*COMMUNITY FUNCTION*	*COMMUNITY ECONOMY*	*COMMUNITY ACCESSIBILITY*
RELIGIOUS SCHOOL *POLITICAL WARD* ETHNIC DISTRICT NEIGHBORHOOD	COHESION AND STABILITY STRUCTURE *IDENTITY* GOALS ATTITUDES POPULATION COMPOSITION	SAFETY HOUSING QUALITY *PUBLIC SERVICES* EMPLOYMENT LEVELS INDUSTRIAL AND FARMING PROCESSES PEDESTRIAN CIRCULATION	HOUSING SUPPLY EMPLOYMENT *LAND VALUES* ZONING	CHURCH SCHOOL *ENTERTAINMENT* FRIENDS RELATIVES SHOPPING RECREATION PARKS JOBS COMMUNITY SERVICES

ENVIRONMENTAL IMPACTS			
EFFECTS OF TRAFFIC		EFFECTS OF ROADWAY STRUCTURE	
AIR POLLUTION	NOISE	WATER	NATURAL RESOURCES
REAL ESTATE VALUES MATERIAL DETERIORATION POWER DEMANDS MENTAL DEPRESSION BALANCE OF NATURE DUST	PSYCHOLOGICAL EFFECTS ABILITY TO CONCENTRATE SLEEP NUISANCE	DRAINAGE DIVERSION EROSION ACCESS TO LIGHT	ANIMAL LIFE ANIMAL MIGRATORY PATHS PLANT LIFE CULTIVATED AREAS UNCULTIVATED AREAS ACCESS TO LIGHT GLARE *SOILS* ENERGY CONSUMPTION

ESTHETIC IMPACTS		
VIEW OF THE FACILITY	VIEW FROM THE FACILITY	NATURAL BEAUTY
LIGHTING DARK AREAS COLD LIGHT MONOTONY LOCATION OBSTRUCTION OF SUNLIGHT *CHANGE OF AIR CURRENTS* VISUAL BARRIER ARCHITECTURAL QUALITY IMAGE-ABILITY DIMENSIONAL BALANCE BEAUTY ORIENTATION PSYCHOLOGICAL BARRIER	LOCATION PERCEPTION SEQUENCE DESIGN RHYTHM SIGNING	OPEN SPACES GREENERY PARK SYSTEM BOULEVARDS OR GARDENS LAKES WILDLIFE HABITATS

INSTITUTIONAL IMPACTS			
ADMINISTRATIVE		COMMUNITY	
GOVERNMENTAL	PRIVATE	HISTORICAL SITES	CULTURAL SITES
BUDGETS REVENUES COMMITMENTS PRIORITIES LAWS ORDINANCES BY LAWS GOALS AND PROGRAMS (NATIONAL DEFENSE, CONSERVATION, RECREATION, ETC.) REGIONAL ACCESS	EDUCATIONAL RELIGIOUS MILITARY CORPORATE INDUSTRIAL		

TABLE 10
EXAMPLE OF DATA REQUIREMENTS AND DATA SOURCES

DATA	DATA SOURCES: EXISTING DATA							NEW DATA			
	FEDERAL GOV'T. AGENCIES	STATE GOV'T AGENCIES	LOCAL AND REGIONAL GOV'T AGENCIES	NATIONAL ORGANIZATIONS (IN A LOCAL SECTION)	LOCAL ORGANIZATIONS	PRIVATE BUSINESS AND INDUSTRY	NEWSPAPERS	AERIAL PHOTOGRAPHY	FIELD STUDIES	INTERVIEWS	SURVEYS
NATURAL ENVIRONMENT											
WILDLIFE: SPECIES, HABITATS, POPULATIONS, MIGRATORY ROUTES	X	X		X	X			X	X		
VEGETATION: SPECIES, EXTENT OF COVER, HEIGHT, DENSITY, HEALTH, UNIQUE PATTERNS	X	X		X	X			X	X		
WATER: SURFACE WATER BODIES, FLOWS, FLOODPLAINS, GROUNDWATER, WELLS, AQUIFERS, DRAINAGE PATTERNS, USES	X	X	X					X			
LANDFORM AND TOPOGRAPHY: LANDFORMS, TYPE AND SIZE; GEOLOGICAL BASE; SOILS, TYPES, DEPTH, DRAINAGE, SUSCEPTIBILITY TO EROSION, POTENTIAL USES; ELEVATION	X	X						X	X		
POLLUTION LEVELS: AIR, WATER AND NOISE		X	X						X		
CLIMATE AND MICROCLIMATE: SNOW RECORDS, STORM TRACKS, NUMBER OF DAYS OF SUNSHINE, SPECIAL WIND CONDITIONS	X	X	X							X	
GENERA ECOLOGICAL RELATIONSHIPS: FOOD CYCLES, PREY-PREDATOR RELATIONSHIPS, DEVELOPMENTAL STAGE	X	X		X	X						
COMMUNITY CHARACTERISTICS											
POPULATION: TOTAL, DENSITY, DISTRIBUTION, AGE, ETHNIC BACKGROUND, LENGTH OF RESIDENCE, INCOME, TRENDS	X	X	X						X	X	X
LAND USE: COMMERCIAL, INDUSTRIAL, RESIDENTIAL, AGRICULTURAL, PUBLIC PARKS AND RECREATIONAL, INSTITUTIONAL, GOVERNMENTAL, CEMETERIES, VACANT, ETC.			X					X	X		
INTENSITY OF LAND USE: DENSITY, PRODUCTIVITY, CAPACITY, EMPLOYMENT, ETC.		X	X					X	X	X	X
AREAS OF SPECIAL SIGNIFICANCE: SCENIC, HISTORICAL, UNIQUE ARCHITECTURE, SCHOOLS, CHURCHES, HOSPITALS, SERVICE CENTERS	X	X	X	X	X		X	X	X	X	X
HOUSING STOCK: VACANCY RATES, RENTS, CONDITION, OWNER/RENTER DISTRIBUTION	X	X	X			X			X	X	X
BOUNDARIES: MUNICIPAL, COUNTY, STATE, SCHOOL, POLICE, FIRE	X	X	X								
GOVERNMENT: LAWS, BUDGETS, REVENUES, TAX BASE, ESTABLISHED PRIORITIES, PLANS, GOALS, PROGRAMS AND PROCEDURES	X	X	X								
EMPLOYMENT: LOCATION, TYPE, LEVEL OF SKILL, WAGE LEVEL	X	X	X			X	X			X	X
ECONOMIC: MARKETS, MONEY FLOWS, LAND VALUES, TRENDS	X	X	X			X	X			X	X
TRANSPORTATION UTILITIES											
EXISTING FACILITIES: ROADS, RAILROADS, BUS LINES, AIRPORTS, WATERWAYS, TERMINAL FACILITIES, OTHER MODES	X	X	X			X		X	X		
SERVICE CHARACTERISTICS: SCHEDULES, FARES, CONVENIENCE, CONDITION, TRAFFIC VOLUME, ACCIDENT RATES AND LOCATIONS, TRIP PURPOSE	X	X	X			X	X		X	X	X
PEDESTRIAN MOBILITY: MAJOR PEDESTRIAN ROUTES			X		X	X	X		X	X	X
UTILITIES: TYPE, LOCATION, CAPACITY, PRESENT LOAD	X	X	X			X		X	X		

ect studies can be used to help develop this information. State and metropolitan clearinghouse members have recognized responsibilities in particular areas of expertise and as such will be concerned with at least some affected interests. Appropriate wording and questions contained in the project notification circulation can be used to obtain additional information on impacts and affected interests.

Also, state transportation agencies frequently have particularly close working relationships with two or three sister state agencies, often formalized via memoranda of understanding. In-depth contact with such agencies early in project studies is a good source of information on potential impacts, affected interests, and additional spokesmen or representatives. Agencies with designated environmental responsibilities also may have the capability to predict impacts for the transportation agency.

Environmental and conservation data can be briefly examined, as an example, to indicate the kinds of analyses

that can be performed prior to the development of alternatives. Typical data in a rural setting might include wildlife species, habitats, and migratory routes; water and air quality; and soil, vegetation, and geology data. Sources of these data would include the state department of natural resources, private conservation groups, fieldwork, and air photo interpretation. Once such data have been collected, the sensitivity of the various species and features to the provision of improved transportation facilities can be determined. One possible scheme to roughly classify areas as to degree of sensitivity is as follows:

1. Very sensitive to intrusion; avoid if at all possible.
2. Able to withstand a highway without significant damage.
3. Sensitivity depends on location and design decisions; more in-depth analysis is needed.
4. Subject to federal or state legislation (e.g., 4(f) areas). Such division, however, is only a guideline and each element must be considered in the context of tradeoffs with other positive and negative impacts.

From this kind of information, possible constraints on the location and design of a project can be determined, together with opportunities for planning the project to conform to other facets of the area.

Other data, as well, can be mapped. The locations of schools, religious institutions, fire stations, police stations, and public utilities, and routes they use, and the districts they serve, can be mapped as a means of displaying potentially sensitive areas. Accessibility measures may also be useful in displaying the service characteristics of some of these activities, indicating how a transportation project might be able to improve them.

Classifying areas in this manner and soliciting opinions from people will allow the planner to determine which factors are potential issues in the area and, if so, how critical they are.

Impact Prediction Techniques

An important decision to be made in planning and design studies is the choice of the specific set of prediction techniques to use. Important considerations include the level of study (system, corridor, or project); the resources available; and the accuracy desired (Fig. 14). Table 11 identifies currently available techniques for predicting environmental, economic, community, and transportation impacts, together with an assessment of resources required for use of a particular technique and the level of planning for which use of that technique may be most appropriate. This table is not intended to be definitive, but rather to indicate that real choices do exist and that different techniques are appropriate for different contexts. In choosing a set of techniques for any one study and for each relevant impact, it is important to examine the advantages and disadvantages of each available technique. The indications given in Table 11 are generalizations that may not be applicable to any one unique study. In addition, the state of the art of prediction techniques is changing rapidly and new techniques are continuously becoming available.

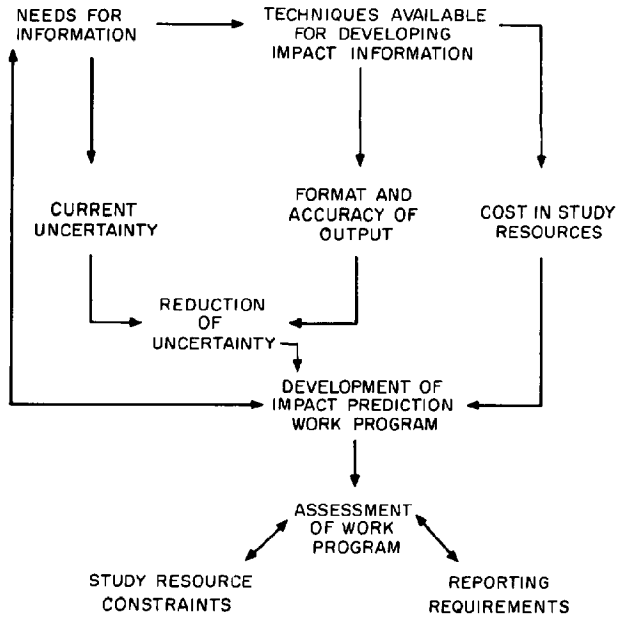


Figure 14. Factors in the choice of impact prediction techniques.

In predicting some impacts (for example, link travel times or pollutant emissions) it may be necessary to consider both average and peak-period levels to get a more accurate picture of the effect. The uncertainty of some impacts, especially at points early in the planning process, should be stressed in reporting impact results. For example, where there is significant uncertainty in a predicted impact, the likely range of values could be indicated.

To facilitate an examination of alternate techniques, an agency should maintain an up-to-date working catalogue of impact prediction techniques for use by agency personnel. The catalogue could be the responsibility of a headquarters environmental unit, with the assistance of state environmental agencies and of the U.S. Department of Transportation. For each impact type, the catalogue would contain a brief description of key definitions, issues, references, and summaries of available techniques. The operation of each technique should be described, together with input data requirements, data sources, outputs produced, resources required, level of planning for which the technique may be appropriate, advantages, disadvantages, and references.

An important consideration in deciding on prediction activities is the resources and capabilities available within the agency, from other state and local agencies, and from outside consultants and groups. In some cases the planner may decide to perform quick estimates of many impacts instead of taking a more in-depth look at a few. The results of these quick predictions can be used to indicate which impacts are most significant and, therefore, in need of more detailed study. This approach is especially appropriate at the system level when detailed plans have not been developed. It is difficult at the systems stage to predict impacts very accurately, so the use of approximate techniques is more justified. In deciding whether to use a more ac-

TABLE 11
CATALOG OF IMPACT PREDICTION TECHNIQUES

TECHNIQUE	LEVEL OF PLANNING[1]			RESOURCE REQUIREMENTS		
	SYSTEM	CORRIDOR	PROJECT	LOW	MODERATE	HIGH
A. ENVIROMENTAL AND CONSERVATION						
1. AIR POLLUTION						
a. EMISSION FACTOR MODELS	X	X			X	
b. DISPERSION MODELS	X	X	X		X	
c. APRAC-1A DIFFUSION MODEL	X	X	O			X
d ROLLBACK MODEL	X	X		X		
e. BOX MODEL	X	X		X		
2. NOISE POLLUTION						
a. COMPARATIVE STUDIES			X		X	
b. ESTIMATING EQUATIONS		O	X		X	
c. COMPUTER MODELS			X			X
d. NOISE-LAND USE SURVEYS	X	X	X		X	
e. PHYSICAL MODELS			X			X
f. NOMOGRAPHS		O	X	X		
3. ECOSYSTEM						
a. NATURAL RESOURCE INVENTORY	X	X	O	DEPENDS ON LEVEL OF DETAIL		
b. BIO ASSAYS		O	X		X	
c. ECOLOGICAL RELATIONSHIPS	O	O	X		X	
d. ECOLOGICAL MODELS	X	X	X			X
4. AESTHETICS						
a. INDEX OF VISUAL INTRUSION			X		X	
b. PHOTOGRAPHIC STUDIES			X		X	
c. PHYSICAL MODELS			X		X	
5. VIBRATION						
COMPARATIVE STUDIES			X		X	
6. WATER RESOURCES						
a. CHLORIDE ESTIMATES			X	X		
b. COMPARATIVE STUDIES		O	X		X	
c. METEOROLOGICAL DISPERSION MODELS		X	X		X	
7. HISTORIC PRESERVATION						
HISTORIC RESOURCE INVENTORY	X	X	X	DEPENDS ON LEVEL OF DETAIL		
B. INDUCED ECONOMIC						
1. EMPLOYMENT AND ECONOMIC ACTIVITY						
a. ECONOMIC BASE STUDIES	X	X	O		X	
b. CORRELATIVE STUDIES	X	X		X		
c. INPUT-OUTPUT MODELS	X					X
d. HIGHWAY USAGE INDICATORS	X	X		X		
e. ECONOMETRIC MODELS	X	X			X	
f. BUSINESS DISLOCATION STUDIES			X		X	
g. SIMULATION MODELS	X	O	O			X
2. TAX BASE CHANGE						
ROW ASSESSMENT	X	X	X		X	
C. COMMUNITY						
1. HOUSING DISLOCATION						
a. RESIDENTIAL DENSITY METHOD	X	X		X		
b. HOUSING STUDIES	X	X	X	DEPENDS ON LEVEL OF DETAIL		
2. EVIRONMENTAL CAPACITY						
ANNOYANCE INDEX	O	O	X		X	
3. COMMUNITY DISRUPTION						
a. NEIGHBORHOOD SOCIAL INTERACTION INDEX		X	X		X	
b. NEIGHBORHOOD INDEX	X	X	X		X	
c. PEDESTRIAN DEPENDENCE INDICATORS	O	X	X		X	
d. RESIDENTIAL LINKAGES		X	X			X
e. MOBILITY INDEX		X	X		X	
f. SOCIAL CAPACITY INDICATORS			X		X	
D. TRANSPORTATION SERVICE						
1. ACCESSIBILITY						
a. ACCESSIBILITY INDICES	X	X	O		X	
b. ACCESSIBILITY GRAPHS	X	X	O		X	
c. ISOCHRONAL MAPS	X	X	X		X	
2. MOBILITY FOR SPECIAL GROUPS	NO SPECIFIC TECHNIQUES EXIST					
3. PEDESTRIAN MOBILITY	NO SPECIFIC TECHNIQUES EXIST					
4. EXPOSURE TO CO						
CO MODEL	O	O	X		X	
5. VIEW FROM THE ROAD						
a. LAND		O	X		X	
b. VISUAL VALUES		X	X			X
E. ACTIVITY DISTRIBUTION						
1. LAND USE						
a. CORRELATIVE STUDIES	X	X	X		X	
b. INDEX OF DEVELOPMENT PRESSURE	X	X	X		X	
c. URBAN DEVELOPMENT MODELS	X	X	O			X
2. POPULATION						
a. ECONOMETRIC MODELS	X	X			X	
b. URBAN DEVELOPMENT MODELS	X	X	O			X

[1] X = BEST LEVEL OF PLANNING FOR USING TECHNIQUE.
O = OTHER LEVELS OF PLANNING FOR WHICH TECHNIQUE IS APPLICABLE.

curate technique, the question to be asked is whether more detailed information on an impact will clarify issues and make the final decision easier, and if so, if it is worth the cost.

Because of the vast number of potential impacts from a highway project, and the staff resource limitations that will probably exist, it is important to determine the most important impacts so as to obtain maximum effectiveness from available manpower, time, and money resources. When setting priorities the agency should list not only the important impacts, but also the amount of detail to which each should be predicted.

Grouping the impacts into high-, medium- and low-priority categories may be useful both as a bookkeeping and display technique, with the priority listings being displayed to and discussed with the public as a check on their validity. As the prediction process proceeds, these priorities can be reevaluated and adjusted based on further community inputs and the results of actual predictions.

For example, air pollution initially may be considered to be of high priority in the case of an urban expressway because the ambient air quality level is such that any significant increase in pollutants will be unsatisfactory and residents of the areas have expressed concern about the impact. However, if the use of a quick and approximate prediction technique during an early stage of the process indicates that the project will have no adverse effect on air quality, it can be reassigned to a lower priority. This should be done, however, only after displaying the results of the prediction to the public and conferring with them on the action.

The results of impact predictions should be monitored to see if the initial impact priorities were reasonable. Staff analysis and community feedback can be used in deciding whether a particular impact should be assigned a different priority or if it should be repredicted using a more accurate technique.

The significance of an impact will be influenced substantially by its incidence (e.g., the noise level in an industrial area is not as important as the noise level near a hospital). Therefore, in making these evaluations the distribution of impacts with respect to affected interests must be considered.

In developing a schedule for prediction activities, the relationships among the outputs of various techniques should be considered, because prediction of one impact may depend on the results of other predictions (cf. Appendix B). Examples are the dependence of pollutant emissions and noise levels on the results of network traffic flow analyses.

Other factors that may influence scheduling are:

1. Weather conditions. Some data gathering may be difficult or expensive during certain times of the year.

2. Deadlines for concurrent studies. Another agency or group may be performing a study that could provide inputs to the prediction work and would thus call for scheduling adjustments to take advantage of their output.

3. Pending legislation and/or court rulings. The manner in which impact prediction is performed may be influenced or even mandated by laws or court cases. Although changes in these factors are difficult to anticipate, it may be wise to delay or anticipate certain prediction activities if legal requirements are expected to change in the near future.

Relation to Community Interaction

The identification and prediction of impacts should include interaction with groups and individuals potentially affected, and all impact data should be readily available to interested citizens and other agencies. Many social and environmental impacts depend on an individual's perceptions, and cannot be accurately predicted by anyone else. Many impacts on a community may only have significance for the people who live there and possess knowledge and understanding of the community that no outsider has.

If the public is to participate actively with an agency, all interests must be informed. Understanding of potential impacts enables citizens to determine those they consider important; alternatives can then be developed that are responsive to these considerations.

To assist in making decisions about the various alternatives, information should be documented, summarized, and displayed as clearly as possible. The improved communications that can be achieved through the use of maps, charts, slides, films, models, and other display techniques will improve the public's understanding of data and issues of choice.

The decision on how to display each impact should consider the needs of the study, staff resources, and the audience for which the display is intended. Early in the study, when quick and approximate prediction techniques are being used to produce initial estimates of impacts, simple display techniques may be appropriate. However, the output of an in-depth study of a high-priority impact normally should be displayed in more detail.

The mechanisms used to display information will significantly affect the quality of citizen input. For this reason agency personnel should seek public feedback on the clarity and usefulness of their display devices.

Examples

Maine Department of Transportation Questionnaire

Several states in their Action Plans have described procedures for involving the public in the early stages of project studies to help identify potential impacts. As one example, the Maine Department of Transportation uses a short questionnaire-letter (Fig. 15) mailed to all residents within a study corridor. The purpose is to identify physical features that may not appear in other, more traditional, data sources. As such, the information obtained supplements that obtained from other state and local agencies and from in-house sources. The Maine experience is that nearly all of the questionnaires are returned, with about 10 percent containing new information.

STATE OF MAINE

DEPARTMENT OF TRANSPORTATION

STATE OFFICE BUILDING AUGUSTA, MAINE 04330

mdot

ROGER L. MALLAR
Commissioner

December 18, 1973

Project: Wells, F-01-1(39)

Questionnaire to Aid in Evaluating Highway Locations

1. Are you aware of any old cemeteries in the immediate area of this project?

2. Are you aware of any buildings or monuments of a cultural or historical significance?

3. To your knowledge, are there any public or private bird or wildlife refuges within the limits of this project?

4. Is there any land adjacent to this project that might contain artifacts of archeological significance?

5. Do you know of any private or public park lands on or near this project?

6. Are there any unique features about this area not listed above that you feel may have a bearing on the location of this highway project and are worthy of comment?

If you have any comments relating to the above, it would be appreciated if this information could be sent to me at your earliest convenience in the enclosed prestamped envelope. If you feel any information that you have to offer would require personal contact at this time, I or one of my staff would be pleased to meet with you at your convenience.

Thank you for taking an active interest in this project.

Very truly yours,

Richard A. Coleman
Deputy Chief Engineer
Project Development

Figure 15. Questionnaire to aid in evaluating highway locations; Maine Department of Transportation.

Environmental Mapping

Technical approaches can be used in parallel with community interaction activities to inventory existing environmental resources and to collect and display a base of impact-related information. In doing this, every effort should be made to maximize the use of existing data rather than expending scarce resources on the possibly redundant or low-priority collection of new information. As information is obtained, it should be processed and displayed in a manner that will facilitate its use. One approach is to include as many of the data as possible on the maps then being used both in developing location alternatives (see preceding section on "Consideration of Alternatives) and in assessing the probable impacts of alternative actions (*167, 189*).

The techniques used in mapping have varied widely. Such work has included paper maps and transparent plastic sheets. Designation of the different areas has been by shades of gray, cross hatching, different colors, and other symbols. Some maps are prepared with only a single type of information on each map; others contain many different features arranged in a series of overlays. The mapping technique selected should provide flexibility for use of these maps while not sacrificing the clarity of information. Another consideration is map reproducibility for reports to the public.

Some information, such as conservation lands, can be mapped directly without any additional interpretation (Fig. 16). Other information to be mapped may require some analysis before displays are possible or may require that several kinds of basic data be combined. The mapping of "environmental districts" as part of the Michigan Route 31/131 study is illustrative of such synthesized mapping (Fig. 17). (See the earlier section on "Consideration of Alternatives" for a more complete discussion of the dangers of such mapping approaches.)

In the Michigan study, environmental features were organized into four distinct categories:

1. Swamps and marshes.
2. Lakes and ponds.
3. Rivers and streams.
4. Extreme and moderately extreme topography.

In preparing the environmental districts map, these four features were then combined into three sensitivities:

- Extreme—containing all four features.
- Moderately extreme—containing any three features.
- Moderate—containing only two features.

Other physically related data mapped as part of the Michigan Route 31/131 study included public lands, Section 4(f) lands, white-tail deer yards, agricultural capability, forestry potential, mono-ecological elements, and accessibility.

Other transportation studies, as well, have made substantial use of sensitivity mapping as a means of displaying information and evaluating alternatives. For example, the Virginia Department of Highways in the study of an I-664 Hampton Roads third crossing mapped the Newport News and Portsmouth regions according to low, moderate, and high social cost.

The Boston Transportation Planning Review, as another example, combined data from a natural resource inventory and information on the social and economic characteristics of urbanized areas into one over-all sensitivity map (Fig. 18). This approach served the dual purposes of indicating those areas which would be most seriously harmed by the intrusion of a transportation facility and pointing out places where existing conditions were already unacceptable. The former includes the protection of water resources, for example, while the need to reduce ambient air and noise pollution levels by decreasing local traffic is indicative of the latter.

Incidence of Impacts

The typology of affected interests given in Table 8 is designed to guide the search for affected groups in terms of geographic location, based on the concept that impacts experienced by people change as the distance from a facility increases. This typology is based on work performed by Gruen Associates, Los Angeles, Calif., for the California Division of Highways (*170*). The distance is measured in this case in terms of increasingly larger "communities." The communities range from displaced individuals to national organizations.

It should be emphasized that this is only one possible typology, and not necessarily the best for a given situation. Any typology that can systematically stimulate the search for particular types of affected interests may be useful. For example, other possible interests include various classes of highway users (peak, off peak, origin-destination pairs), low-income residents, handicapped persons, pedestrians, and commodity movement.

The Michigan Route 31/131 regional transportation study provides a typical example of how different people are affected in different manners by the alternatives under consideration. The region of the lower peninsula is scenic and valued for its environmentally sensitive areas. At the same time, it is an agricultural center; a winter and summer recreational area for residents of Detroit, lower Michigan, Ohio, Indiana, and Illinois; and a potential site for business and industry desiring to move away from the Detroit metropolitan area. Affected interests then include the following groups, many of which could be further identified by particular town or area within the northwest region or by trip origin:

- Permanent residents.
- Short-term (summer) residents.
- Tourists/visitors.
- Business (consumer/tourist).
- Industry.
- Farmers, agriculturalists.
- Local government.
- Construction industry.
- Labor force.
- Displacees.
- The State of Michigan.

Table 12 gives summary impact reports for two of these

interests—tourists and industry. The reports are based on personal judgment rather than technical investigations, because such analyses have not yet been performed by the Michigan study team. The reports are also designed, at least in part, to demonstrate the environmental preservation/economic growth tradeoff that exists within the region.

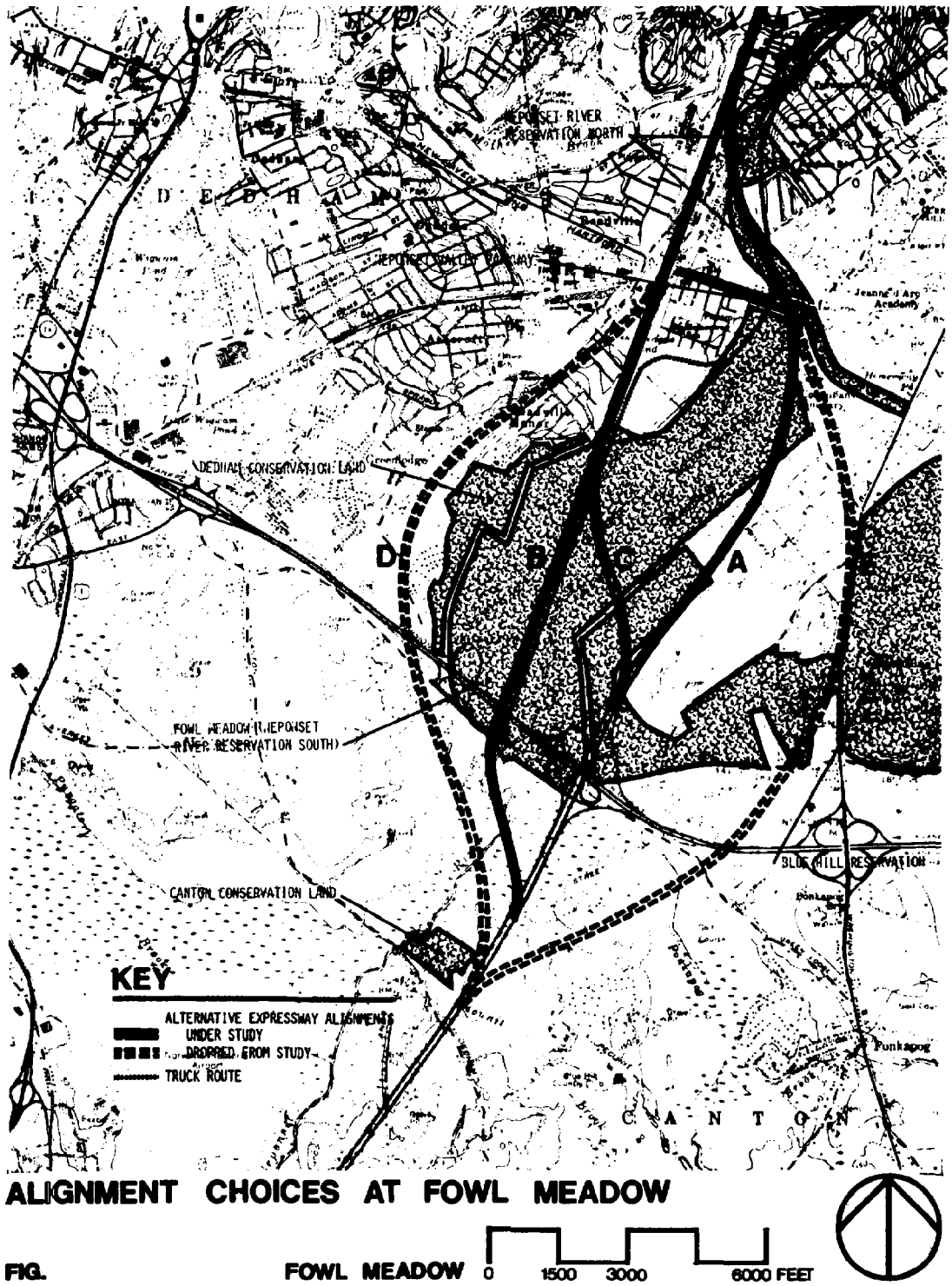


Figure 16. Environmental map of conservation lands; Boston Transportation Planning Review.

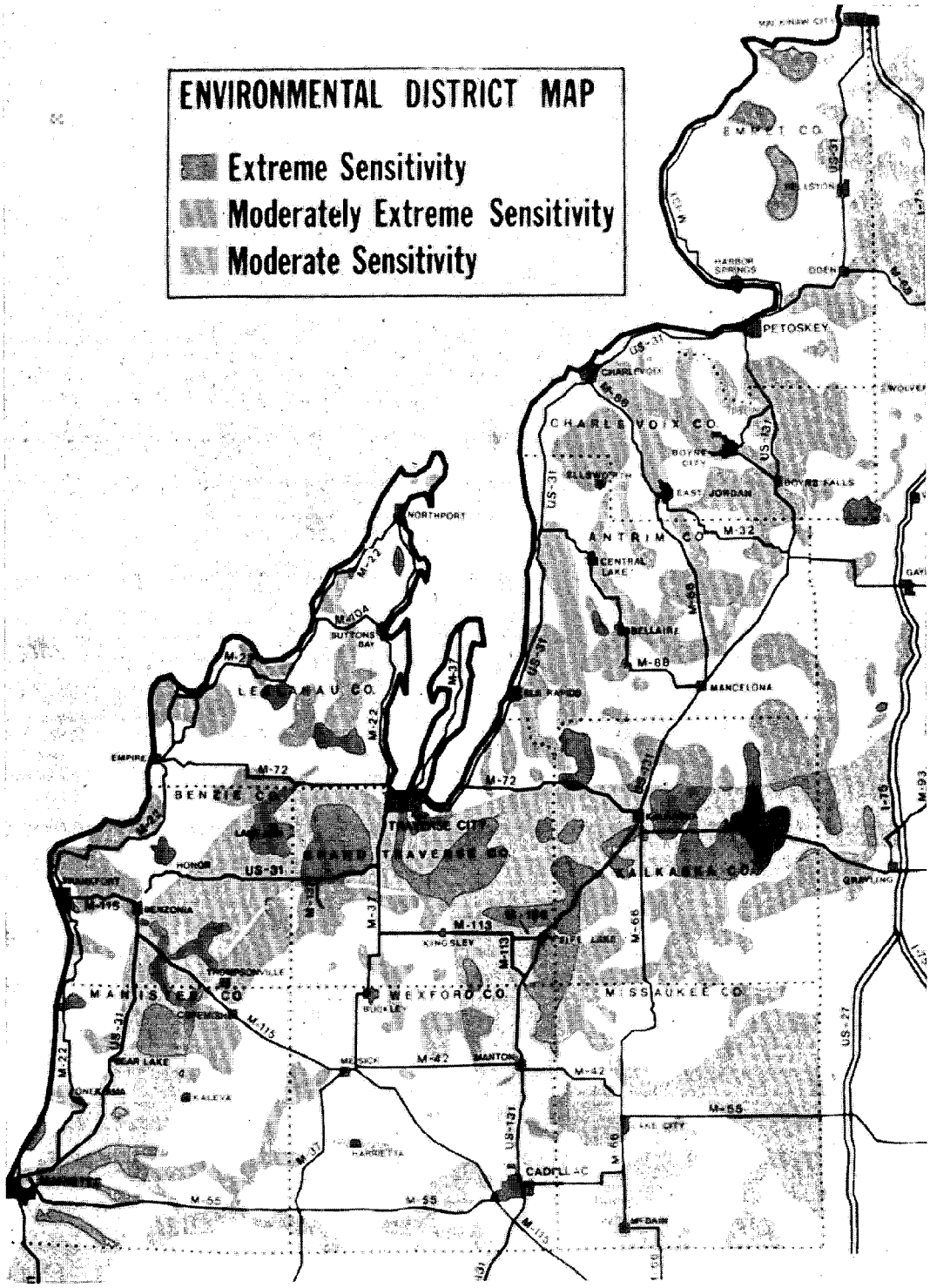
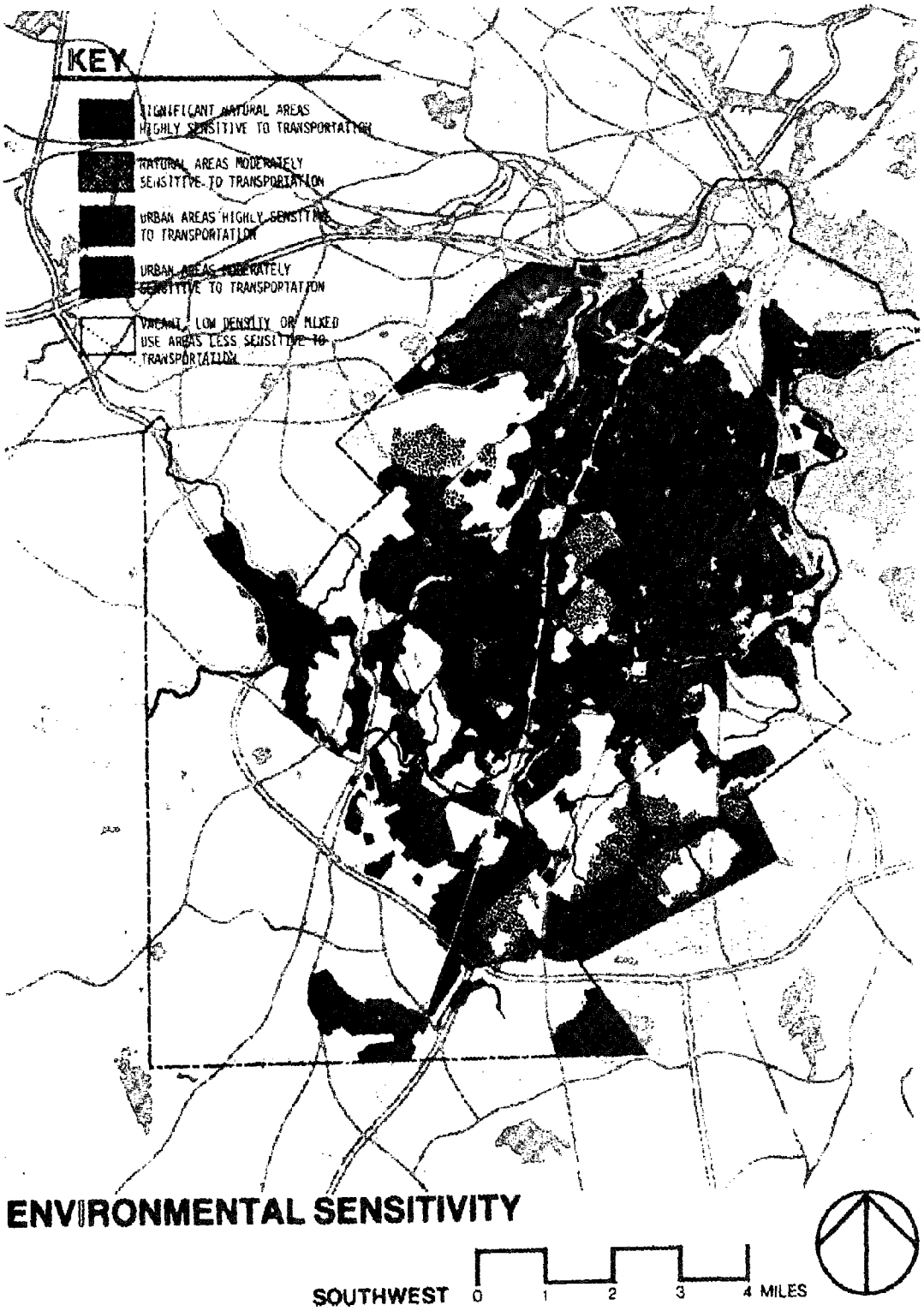


Figure 17. Environmental district map; Northwest Michigan Route 31/131 Regional Transportation Study.



Environmental sensitivity: Boston Transportation Planning Review.

TABLE 12
EXAMPLE IMPACT REPORTS BY INTEREST; NORTHWEST MICHIGAN ROUTE 31/131 REGIONAL TRANSPORTATION STUDY

INTEREST / ALTERNATIVE	TOURISTS	INDUSTRY
Do-Nothing	Of the three alternatives, the do-nothing does most to retain the existing quality of the environment of the region which is the major attraction to tourists. It discourages growth and urbanization but it also reduces the number of tourists who will be able to reach the region in a reasonable amount of time. As traffic continues to increase on the existing facility, travel times and costs will also rise and traveling will become more hazardous.	There is presently very little industry in the region and doing nothing with respect to transportation service will tend to perpetuate this situation.
Upgrade	The major benefit here is improved safety for the traveler. Capacity would increase slightly and, at least for a while, travel times would decrease. Growth and development in the region would increase slightly with the resultant reduction in the quality of the natural environment. Tourists would be able to travel to the region more easily.	This action will result in slightly lower travel times bringing manufacturers in the region closer to markets. Some additional increase in population of the region might be expected thus increasing the labor pool.
Construct Four-Lane Limited-Access Divided Highway on New ROW Close to Population Centers	This would open the region to a greatly expanded tourist market by significantly reducing the travel times from the southern part of the state and beyond. Unless land use controls were initiated or new recreation sites developed, the existing facilities would be over-crowded and would decrease in quality. The permanent population will also increase more rapidly causing urbanization of the region. Services for tourists will increase, displacing more natural areas.	The major reduction in travel (shipping) times and costs which would result from this action would encourage industry to locate in this part of the state. The population is also likely to expand more rapidly providing a larger, more diversified and more skilled labor pool.

CHAPTER FOUR

FINDINGS—MANAGEMENT AND POLICY GUIDELINES

PROCESS MANAGEMENT

Introduction

The four sections of this chapter examine community interaction, evaluation and reporting, consideration of alternatives, and identification of effects somewhat independently both of each other and of the organizational structure within which they are occurring. A key requirement, however, is to integrate these activities into a systematic planning process.

These four sections place emphasis on the organizational structure and policy framework within which the procedures and techniques described in Chapter Three are used. The concern is with both the internal structure of the transportation agency and the relationship of the transportation agency to other governmental agencies and officials at the local, state, and national levels.

This section discusses issues associated with management procedure, organizational structure, and project staff organization. The intent is not to provide a comprehensive discussion of organizational arrangements, personnel handling, incentive systems, and so on, but to present some

basic management techniques that may be useful to an agency in implementing the described procedural capabilities. It also describes a number of management procedures that proved to be useful during the various field applications, and, together with the later section on "Institutional Arrangements and Decision-Making," describes possible structural forms that may facilitate the consideration of environmental-related information.

Organizational Interrelationships

Planning procedures cannot be viewed, or changed, in isolation. Achievement of the Chapter Three procedural recommendations requires an understanding of all aspects of an organization.

An organization, be it a study group or an entire state transportation agency, can be viewed as a social system consisting of three interdependent parts (*236*):

- *Structure*—the set of roles and relations among members.
- *Theory*—the views held within the organization about its purpose, its operations, its environment, and its future.
- *Procedures*—the methodology, techniques, and modes of operation it uses.

These three dimensions all reflect and influence each other so that any change in one produces, in reaction, change in others. For example, a major change in study procedures (such as introduction of corridor or subarea studies) will likely result in changes in either the informal or formal structure of the organization, and may also lead to subsequent changes in agency policy (theory). Conversely, major organizational changes (such as formation of a statewide department of transportation) will almost certainly lead to major changes in study procedures as well.

The resulting modifications, however, may interfere with the operation of the initial change. Thus, when one of the dimensions—structure, theory, procedures—is to be modified, changes and adjustments to the other two should be carefully planned and implemented if the intended objectives of the change are to be fully achieved.

These organizational interrelationships were verified during the field cooperation with highway agencies, performed as a part of this research. In implementing and testing many of the procedural recommendations described earlier herein it became abundantly clear that the full intent of the procedural recommendations could not be achieved without parallel changes in both the policy and the structure of a transportation agency. Where such changes were made on either a permanent or a trial basis (California and Michigan), the operation of the procedures was significantly enhanced.

The Systematic Interdisciplinary Approach

A direct and far-reaching statutory requirement affecting the over-all management of a transportation planning process is contained in the National Environmental Policy Act of 1969 (NEPA). Section 102 (2) (A) of this act requires that agencies use a "systematic interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision-making which may have an impact on man's environment."

The three words, "systematic interdisciplinary approach," are of special importance. The first, "systematic," implies that it is not enough to bring the natural and social sciences and environmental design arts to bear on a piecemeal basis; their use must be methodical and integrated. This means that the appropriate disciplines must be chosen and utilized in a carefully planned and organized fashion. The second, "interdisciplinary," implies that the appropriately selected disciplines must work together in coordination to produce something greater than could result if they were used separately. Thus, the law recognizes the fuller understanding and broader perspective that may result when the special insights and skills of several disciplines interact in problem-solving. Finally, the word "approach" indicates that the over-all process must be both systematic and interdisciplinary. Although teams as such are not necessary to meet this requirement, the agency must insure that its procedures make methodical, integrated use of the natural and social sciences and environmental design arts throughout the planning and design stages.

It should be noted that the day-to-day work activities of a transportation agency, as well as final decision-making, have environmental impacts. Thus, a systematic interdisciplinary approach is required at all levels of an organization and throughout the planning and design stages—from system planning through the final design. Although the nature and extent of the approach may vary with the type and significance of the project or the geographic area, a systematic interdisciplinary approach is needed at all times, not just for special cases. Preparation of an environmental impact statement by an interdisciplinary group at one point in project studies, although it contributes to a systematic interdisciplinary approach, is not sufficient.

Management Requirements for a Flexible and Responsive Process

Flexibility is required in the conduct of system and project studies. New information will emerge as studies progress; conditions may change. In response, management must be able to allocate resources to new activities, adjust allocations to reflect changes in needs and priorities, and reshape the planning process to reflect these modifications.

At the same time, the planning process must be decisive; and, realistically, management will face certain constraints —in budget, in available manpower, in the amount of time that can be spent on a particular project. Thus there is a need for a timetable, a work program, and a personnel assignment plan.

The need for flexibility and responsiveness is not inconsistent with the need for decisiveness; but achieving both takes careful planning and managing. On one hand, one is often faced with situations where more information or more detail seems desirable; on the other, one is tempted to hold firm to a work program in order to stay within resource limitations and to achieve definite results. Balancing competing process needs is the job of management.

The four-stage strategy developed in Chapter Two pro-

vides an over-all framework to guide process management. Within this broad framework, detailed management and resource allocation decisions must be made. Several specific techniques are available that can help to satisfy these requirements.

Study Designs and Work Programs

Action Plans developed by each state highway agency in response to FHWA PPM 90-4 specify the general activities to be conducted for various types of system and project studies. For any particular study, however, the Action Plan requirements must be translated into a work program specifically oriented to the particular context of that study. A work program, in general, will be more specific than the Action Plan and will spell out the general scope of study and such specific items as the particular community interaction techniques to be employed, the initial list of alternatives to be investigated, the particular impacts to be examined and the prediction techniques to be used, and the points in time when particular decisions will be made. The work program should be agreed to, or at least understood, by local officials and interested community groups.

The process of developing a work program can be referred to as a study design. For minor projects, a study design will involve relatively little effort. On the other hand, projects involving construction on new right-of-way and having potentially significant social, economic, and environmental effects may justify a well-defined study design, possibly as long as several months in duration and involving interaction with many different community groups. The rationale of study designs is that unless agreement can be reached on what should be studied and how studies should be conducted, the possibility of conflict over proposals will be greater, and it will be correspondingly more difficult to reach agreement on a course of action to be implemented (Fig. 19).

The objective of the initial phase of the Westside Transportation Evaluation Study in Atlanta, for example, was to reach agreement on the nature of the studies to be conducted (*112*). This study design was scheduled as a five-month effort. Numerous meetings were held between representatives of the Georgia Department of Transportation and community and regional interest groups. In addition, a citizens committee met in a series of meetings to review the draft document and suggest revisions. It became clear as a result of these meetings that although there was considerable opposition to a proposed full freeway, there was widespread recognition of transportation problems within the region and agreement was reached that improvements to the arterial highway system and to the existing and proposed public transportation system should be considered as part of any transportation study. This agreement was reached without major investment in technical studies for the freeway.

Preparation for the Boston Transportation Planning Review involved a similar study design effort (*229*). The study design that was negotiated served both as a report to the Governor, who had assumed personal responsibility for all decisions, and as an application for federal funding. The

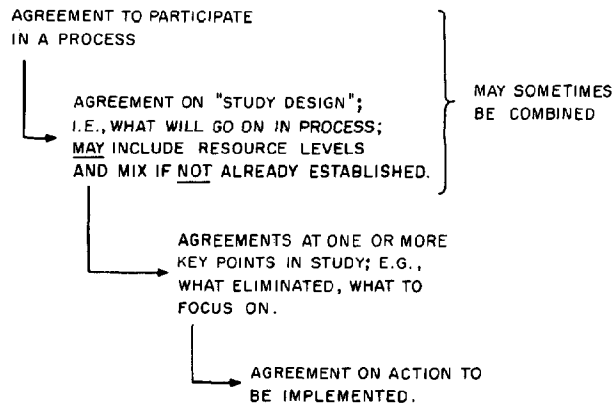


Figure 19. Levels of agreement.

study design document described an over-all planning process involving public participation, the specification of criteria for evaluating proposals, the development of a range of highway and transit alternatives, and the scope of technical studies to be performed. Thus, it is more economical of scarce study resources to bring out conflict as early in a study as possible, so that steps can be taken, where possible, to resolve differences without entering a potentially costly and lengthy process in which the polarization of positions becomes worse and worse.

In developing a work program with the participation of community interests, the following general steps might be followed:

1. Meet in small groups with local officials and interest groups to decide whether a study is needed, and if so, what kind of study. Robert Datel, State Highway Engineer, California Department of Transportation, Division of Highways, suggests a series of "listen and learn" sessions in which agency staff sit down with officials and community leaders in small groups, and attempt to talk out how these people view their community, what the needs are, and whether it is appropriate or how it would be appropriate to study transportation at that time (*71*). Careful and extensive minutes should be taken at all meetings and should be submitted to participants for their review. This helps to assure participants that the staff understands their concerns, or points up where there is not yet a mutual understanding.

2. Meet with local media people to review their files, if any, on transportation and related matters and to inform them of the initiation of a study and its probable characteristics. Inform them of activities or time periods in the study that may be potentially newsworthy, and, if they desire, arrange for regular meetings or briefings. As the study gets under way, agency and local officials may wish to be the source of major news stories.

3. Using the knowledge gained from interviews and meetings, agency staff should begin to develop drafts of a proposed study design, and should try to reach agreement on the wording of that study design. Such a study design document may go through several drafts, especially when the proposed study is in a complex or environmentally

sensitive area. Having everything written down as precisely as possible will serve to establish a common base of understanding of what the study will do and of what the major issues are likely to be. The same degree of common understanding cannot be achieved through verbal exchanges only. In some cases the agency may wish to establish a formal cooperative study agreement with other jurisdictions such as cities and towns. For example, as a standard part of their transportation corridor studies California develops cooperative agreements with local jurisdictions in order to promote common understanding of the course of studies and the responsibilities and resource commitments of each jurisdiction (*227*).

For those staff members who do not have extensive experience in community participation activities, a study design phase can provide important training in conducting meetings and in achieving effective face-to-face communications. Because it is likely to be easier to agree on what should be studied than on a final alternative, this initial phase of a study usually provides a simpler set of issues to resolve. Staff members can thus gain confidence and familiarity with community involvement activities.

Basic Process Cycle of Activities

The interrelationship of the basic process activities—consideration of alternatives, impact prediction, community interaction, and evaluation—is shown in Figure 20. A total process can be viewed as being composed of a number of cycles of this set of activities. Based on the present appraisal of the state of the process, management establishes objectives, tasks, and priorities for the next work period for community interaction, the alternatives to be investigated, and the impacts to be studied. For example, obtaining information from potentially displaced businesses on number of employees and employee residential location may be defined as one high-priority community interaction task because this information is needed to help determine the social impacts of one of the alternatives. The dotted arrows show numerous information feedbacks; as impacts are predicted and community responses obtained, new possibilities for alternatives are suggested and developed. Also, from community interaction, new information is acquired as to which impacts are important to particular groups, and insights are gained on how to predict impacts better. Further, the information about alternatives and their impacts is used in community interaction to obtain community responses and to help clarify objectives and issues. Finally, towards the end of a cycle, evaluation begins appraising the current status of the process and recommending priorities for activities to be conducted during the next cycle.

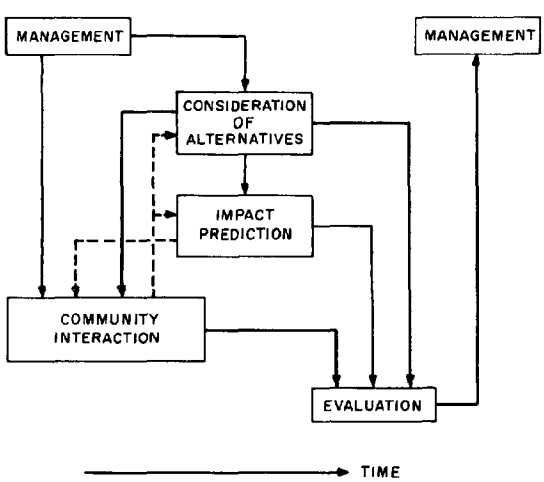


Figure 20. Basic process cycle of activities.

A cycle may be as short as a few weeks or as long as several months, depending on the nature of the study and other factors. For example, the Boston Transportation Planning Review was structured as three such cycles with the first stage constituting a formal study design. The second stage lasted six months and was oriented toward the examination of a wide range of suggested alternatives and a partial narrowing of choices. The third cycle, twelve months in length, was concerned with the more in-depth design and analysis of particular alternatives. Within each of these longer cycles, there were a number of more informal cycles of activities as well.

The Northwest Michigan Route 31/131 regional study is being conducted with a similar cycle of activities. Cycle one corresponds roughly to an initial survey with only general corridors sketched out for possible transportation improvements and one round of community meetings. Cycle two is analogous to the exploration of alternatives phase of the four-phase strategy described in Chapter Two, with many alternatives being examined; potential social, economic, and environmental impacts investigated; and two rounds of community meetings. The third cycle is oriented to the further development of a small number of particular alternatives that the results of the second cycle have shown to be most promising.

Some states' Action Plans have proposed holding a series of public meetings at a regular defined period during project development (for example, at the start of studies and at 25 percent intervals thereafter, resulting in a total of five rounds of meetings). Although this form of event milestone is not recommended in comparison to a more flexible and responsive scheduling of community interaction activities, it does have the effect of dividing a study into four separable cycles.

Management Decisions: Objectives, Tasks, and Techniques

The decisions to be made by management range from general decisions on over-all strategy to detailed decisions on what *tasks* to assign to personnel and what *techniques* to use. Many techniques are available that can be of use in a study; but it is neither feasible nor desirable to use all techniques, given time, dollar, and personnel constraints.

Field experience and general observation have indicated a frequent preoccupation with techniques, particularly in the practice of community interaction, but also in the pre-

diction of impacts. For example, a decision is made to open a field office, hold a meeting, or conduct a survey based primarily on a general perception that the field office, meeting, or survey is needed and will accomplish some good. Significant resources may be invested, with only marginally useful benefits or contributions being obtained. Although a general objective may exist (such as to inform the public), this is frequently not translated into more operational objectives (such as to solicit information on public transportation desires from low-income groups) that can then serve as a more specific management aid. In impact prediction there is often a desire to use a relatively time-consuming, expensive technique to obtain as accurate an estimate as possible, even though a more approximate estimate may be obtained faster and cheaper and may be more responsive to immediate study needs.

A study should be governed by well-defined and agreed-upon objectives, needs, and tasks, not by available techniques. A task may include use of one or more techniques; conversely, one technique may be used in accomplishing more than one task. The problem becomes how to decide what techniques will most effectively accomplish the defined objectives and tasks (Fig. 21).

The guidance of day-to-day work activities by specific, operational, and agreed-upon objectives for each major study activity is generally referred to as "Management by Objective," or MBO (*231, 235*). Management by objective has been used in the private sector since 1950 and has been instituted in many corporations with mixed results. Despite this mixed record, this management style probably can contribute to a process that is as complex as is transportation planning and design.

Frequently, objectives may be implicitly in the mind of the project manager. What is being recommended is that such objectives be explicity, carefully thought through and discussed, communicated to all staff members, and periodically reassessed.

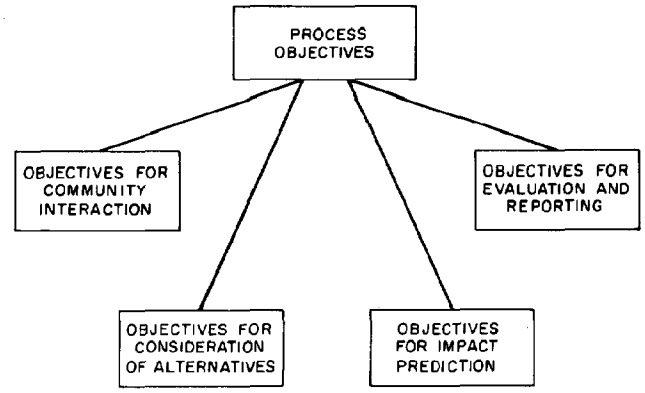


Figure 21. Objectives, tasks, and techniques.

Objectives that provide effective guidance have the following characteristics:

- Are output oriented.
- Allow the development of measures of effectiveness.
- Are within the limits of authority and control.
- Are instrumental in achieving the over-all process objective.
- Cover all important activities within each functional area.

As examples, Table 13 gives some possible objectives for various activity areas. The relative emphasis on particular objectives will change as the planning/design process proceeds. The listed objectives are illustrative only and are not necessarily definitive or exhaustive. Each study team should

TABLE 13
EXAMPLE ACTIVITY OBJECTIVES TO AID MANAGEMENT

COMMUNITY INTERACTION --
- TO ESTABLISH AND MAINTAIN AGENCY CREDIBILITY
- TO INFORM ALL POSSIBLE INTERESTS OF THE INITIATION OF PROJECT STUDIES
- TO COLLECT INFORMATION ON POTENTIAL IMPACTS
- TO IDENTIFY CURRENT COMMUNITY PROBLEMS
- TO EXPLORE VALUES OF DIFFERENT COMMUNITY GROUPS

CONSIDERATION OF ALTERNATIVES --
- TO PROVIDE A RANGE OF CHOICES, ORIENTED TO THE ACCOMPLISHMENT OF DIFFERENT OBJECTIVES; e.g., ECONOMIC DEVELOPMENT, ENVIRONMENTAL PRESERVATION
- TO DEVELOP DESIGNS JOINTLY WITH THE AFFECTED INTERESTS

IMPACT IDENTIFICATION --
- TO IDENTIFY THE INCIDENCE OF IMPACTS ON A PARTICULAR ETHNIC COMMUNITY
- TO INVOLVE AFFECTED INTERESTS IN THE PREDICTION OF IMPACTS IMPORTANT TO THEM

PROCESS MANAGEMENT --
- TO ACHIEVE (OR MAINTAIN) AGREEMENT ON THE OVERALL PLANNING/DESIGN PROCESS
- TO ACHIEVE AGREEMENT ON THE ALTERNATIVE COURSES OF ACTION TO BE INVESTIGATED
- TO IDENTIFY ISSUES AND TRADEOFFS AMONG ALTERNATIVES
- TO ACHIEVE SUBSTANTIAL EFFECTIVE AGREEMENT ON A COURSE OF ACTION WHICH IS FEASIBLE, EQUITABLE AND DESIRABLE

evolve its own version of operational and more specific objectives tailored to the specific problem under study.

Explicitly assessing objectives and needs has two advantages. First, it improves communication so that everyone understands what assumptions are built into the planning and design process. Internal understanding and agreement on desired measures can be very important for interdisciplinary teams where the members do not share the same biases. Second, explicitness also facilitates communication between the agency and the affected interests who may want to question the agency's perceptions of an existing situation.

MBO is a way of thinking. Before deciding to perform a new task or to implement a new technique, one should ask such questions as:

- What are we trying to accomplish with this task?
- Should we be trying to achieve something else?
- Can we achieve the same objective with other tasks?
- How will this task or technique affect other objectives?

Management by objective, the assessment of needs and effectiveness, and an orientation to tasks as opposed to techniques, all point to the need for a general work plan. This work plan can be developed either for the process as a whole or for individual functional activity areas, and can be generalized into six basic steps (Fig. 22). These steps complement the evaluation method described in Chapter Three under "Evaluation and Reporting" and are intended as a guide to agencies setting up their own work program for specific projects.

Organization and Assignment of Responsibility

Assignment of responsibility in this context refers to the chief administrative officer's designation of responsibility for handling those aspects of a process relating to the consideration of social, economic, and environmental factors to particular units or positions within the agency or to others. Typical questions facing an agency are: Should a separate environmental unit be formed within each primary division (e.g., planning, location and design)? Should a single unit with high-level authority be established to meet the needs of the entire agency? Should interdisciplinary staff be internalized within existing largely engineering-oriented units? Should responsibilities for air and noise studies be combined with responsibilities for regional economic and civil rights issues?

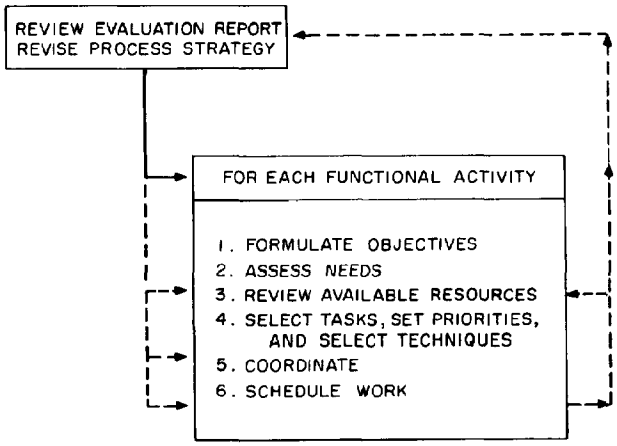


Figure 22. Developing activity work programs.

This discussion analyzes several means of organizing and staffing to meet the requirements of a systematic interdisciplinary approach. Each is discussed in terms of its advantages and disadvantages, its resource needs, the type of project, and the environmental conditions for which it is most suited. The discussion is not exhaustive, but only suggestive of the range of approaches that might be used.

Key Issues

In evaluating alternative ways of assigning environmental responsibilities, several important issues need to be addressed.

Relation to Decision-Making.—The systematic interdisciplinary approach requirement of the National Environmental Policy Act relates to decision-making as well as to the conduct of planning and other technical studies. Those bearing responsibility for decisions must be provided with all available data, alternatives, tradeoffs, and viewpoints so that their decisions are based on full information. Personnel from all disciplines must have direct access to decision-makers; at the same time, interdisciplinary personnel must be integral parts of a study team so that they can be involved continuously in all phases of studies.

Satisfying the interdisciplinary approach requirement is complicated by the fact that decisions normally are made throughout all levels of an agency. Many important decisions are made in the course of day-to-day activities regarding alternatives to investigate, impacts to predict, allocation of study resources, etc. Yet major go/no go, programming, and policy decisions are normally made only by the top level of an agency. This implies that all levels of a transportation agency must have interdisciplinary capabilities as well as direct and unfiltered access to environmental information.

Vertical Placement Within the Organization.—Assignment of responsibility in a government agency is frequently accomplished by formal delegations of authority. The chief administrative officer is usually vested with an array of legislative authority and charged with carrying out a number of administrative requirements. He or his deputies retain some of these responsibilities; others are delegated down the chain of command.

Responsibility for over-all policy-setting typically is maintained high enough in the organizational hierarchy to be responsive to the needs of elected officials (e.g., the governor and the state legislature. But the work that actually implements these policies is usually too detailed and complex for high-level control. These functions become line activities and the work is actually done or managed by first-line supervisors or project managers. The key to assignment of responsibility then actually lies in middle management, those individuals who coordinate several functions to assure that the policies and objectives of the agency are, in fact, achieved, and who directly supervise those charged

with doing the work. Although the chief administrative officer of a highway agency and the top deputies and assistants direct policy, middle managers are the implementors and coordinators who bear direct responsibility for making policy and associated administrative directives work.

Almost without exception, environmental responsibilities can be considered to be important functions that should remain within the purview of the chief administrative officer. Yet to achieve early consideration of environmental effects and their incorporation in the day-to-day decision-making process, environmental responsibilities also must be part of the routine work activity of both middle-level project management and the project staff.

Thus, it really is not sufficient to place environmental responsibilities at just one level of an organization; such capabilities must exist at all levels—policy, middle management, and study staff. If high-level policy decisions do not account for environmental considerations and environmental responsibilities are assigned to a lower level of the organization, middle management may lack a mandate for sound environmental work, may be unable to satisfy national legal responsibilities, and may be faced with conflicts between policy actions and actions relating to the consideration of environmental effects. Alternatively, if environmental activities remain at a high organizational level and lower organizational levels are not provided with environmental responsibilities and capabilities, good policy is likely to remain just that, with little actual effect on the work of the organization.

Span of Responsibility.—The assignment of environmental responsibilities is further clouded by the functional organization of most transportation agencies. Social, economic, and environmental effects must be investigated throughout all stages of planning from system planning through location and design, yet most agencies tend to separate these decisions and planning functions, particularly at the middle level of the organization. Where state DOTs have been created, these activities may be even further separated. Environmental capabilities, then, must be provided to separate and distinct line units.

Furthermore, different kinds of issues normally will be considered during different stages of planning. For example, assume that an agency is considering the improvement of transportation facilities that affect coastal redwoods:

1. At the system planning stage, environmental issues focus on the impact of improving access to recreational facilities and the impact of higher-density use of campgrounds and facilities in a fragile environment.
2. At the location stage, environmental issues focus on more specific impacts like the maintenance of particular redwood stands and groves, animal migration patterns, effects of noise, and scenic attractions for travelers.
3. At the design stage, environmental concerns are even more fine-grained (e.g., the effect of runoff on stream siltation and spawning, both during and after construction.

The problem is difficult because decisions at one stage assume that adverse environmental effects at subsequent stages can be satisfactorily resolved. Although it is especially difficult to perform detailed analysis at early "broad-brush" study stages, a system-level environmental assessment still should include, to the extent possible, a preliminary assessment of potential location and design-level issues. It may even be desirable in some cases to develop partial designs at the system stage in order to reduce the uncertainty of the estimated environmental impacts. For those environmental impacts that are important in making system or location-stage decisions and that cannot be determined until design details are made final, availability of design-stage environmental analysis frequently may be necessary to ensure that such effects are not ignored and undesirable commitments made.

The broader issues still need to be analyzed at later, more specific stages to check the continued validity of earlier assessments. No matter how sensitive a design section is to environmental matters, it is difficult for them to correct, other than by recycling or outright cancellation of a project, a failure in an earlier system or location study to give due consideration to potential environmental effects.

Placement of environmental responsibilities and capabilities at a relatively high level of the organization usually corresponds to a broad span of control; one unit may be responsible for performing environmental studies throughout all phases of system and project planning. The difficulty with this kind of arrangement is that competition for their services will probably be keen, and the setting of reasonable priorities in view of habitually limited staff will be critical. In fact, performance of some assigned responsibilities may be neglected altogether if resources are too limited.

Delegation of responsibility for coordinating social, economic, and environmental studies to the middle and lower levels of an organization would result in a narrower span of responsibility but would necessitate environmental expertise being located within system planning, again in location, and again in design—activities that are sometimes performed by different agencies. The existence of parallel environmental units also would likely result in some duplication of staff and may require greater personnel resources than the agency may have available, at least in the short term. Placement of a single environmental unit at a middle or low level (for example, within route planning) may imply that other parallel positions—system planning and design in this instance—may have very limited or even no direct environmental expertise.

Effect on Continuity of Studies.—An issue closely related to the span of environmental responsibilities is the effect on the continuity and over-all length of project studies. Changing personnel between system planning, location, and design tends to reduce responsiveness to the community and increase the length of project studies. Although there are advantages to the specialization resulting from the creation of separate environmental planning, location, and design capabilities, there are also certain costs.

For example, location studies typically are performed by one unit. When studies are completed, the job is then transferred to a design unit, frequently with a lapse of "shelf" time. It is likely that location personnel will have established good rapport and communications with most local and regional interests. Every time the project changes

units, the communication links have to be reestablished, taking additional time and agency resources.

Changing environmental responsibilities also may result in a loss of information. Even though all possible efforts may be made to document data, it is possible that important information, especially that which is nonquantifiable, may remain unrecorded. Specialists develop a "feel" for an area, and it is difficult to transmit this kind of understanding from one unit to another. As a result, studies may be undertaken on matters that had already been investigated and discarded in a previous stage.

Staffing

Sources of interdisciplinary personnel include:

- Core staff.
- Subcontracts to experts.
- Use of personnel from other agencies (local as well as state).

These personnel can in turn be organized on the basis of:

- Socio/economic/environmental units (as opposed to being internalized within other units).
- Interdisciplinary in-house project teams.
- Interdisciplinary consultant teams.

There is no one best way to organize for interdisciplinary system or project studies. Different organizational forms are appropriate to different situations. In determining the specific mix of personnel sources and organizational approaches to take in meeting the requirement of a systematic interdisciplinary approach, an agency must assess its resources, the types of projects it deals with, the types of effects it commonly faces, and the availability and reliability of help from outside sources (consultants, universities, other agencies).

Core Staff.—Essential to satisfying the requirement for a systematic interdisciplinary approach is to establish an in-house core staff to provide a basic capability for handling social, economic, and environmental effects. The core staff would have responsibility for ensuring that the appropriate natural and social sciences and environmental design arts are systematically used in the agency's planning and decision-making. The core staff may not be sufficient, however, to assume responsibilities for carrying out studies.

The skills represented would depend to a large extent on the kinds of economic, social, and environmental effects the highway agency faces regularly. Usually, however, a core staff still would not be large enough, due to resource constraints or merely to work loads in particular areas insufficient to justify full-time employees; to be knowledgeable of all the social, economic, and environmental problems that may arise.

To adequately satisfy the requirement for the application of the aforementioned skills in decision-making, core staff need to be in a position within the organization to make clear inputs to major decisions as well as to the day-to-day working decisions of the agency. Attention must be given to information flows, coordination, and integration of the core staff with other members of the agency.

Core staff might be organized in a variety of ways. Where only a small number of nonengineering disciplinary positions are available, they may constitute a small number of generalists reporting directly to a high-level executive. Where larger personnel resources are available, core staff may consist of specialists as well as generalists and be either internalized within other operating divisions or established into their own environmental unit. Further, an environmental unit may either assume direct and full responsibility for environmental studies or act as an umbrella service unit, lending staff on a consulting basis to engineering units.

Subcontracts to Experts.—Core staff cannot be assumed *a priori* to be a sufficient means of meeting the requirement for a systematic interdisciplinary approach. For especially sensitive projects or environmental effects not usually encountered, additional resources may be needed. One possibility is to subcontract specific tasks or responsibilities to independent experts, consultant firms, or universities.

If experts are to be hired, special attention should be given to questions of availability, coordination, and information flows, and the effects on over-all integration. There must be some confidence that personnel with requisite skills will be available when needed and that the procedures for obtaining the services of these personnel permit quick access to them. Also, it should be possible for these experts to make timely and meaningful input both to the day-to-day planning and decision-making and to major decisions, as well as to receive information and data from the transportation agency as needed in order to adequately perform their duties.

Experts can be hired on a long-term, "on call" basis or as needed. For small but regularly occurring tasks, a long-term agreement is preferable because it provides both continuity and accessibility.

The main problem in relying on outside experts is that coordination and communication of information easily can become unsatisfactory. It is not sufficient to have such experts working independently on their assigned tasks. There must be regular interaction and information exchange with all others working on the project.

An agency expecting to rely on outside experts should keep in mind that in-house core staff are still needed to oversee and evaluate subcontracted work and that it is not sufficient in meeting the requirement of a systematic interdisciplinary approach to call in experts only in the later stages of planning and design, except when specific problems are not apparent until those stages. Use of outside experts is appropriate to fill gaps in expertise that occur irregularly rather than to provide for a major ongoing need; it should not be relied on as the primary means of meeting the requirements of the National Environmental Policy Act.

Use of Personnel from Other Agencies.—This approach to interdisciplinary staffing is similar to the hiring of experts in many of its implications and its acceptability. Here, other agencies—be they state, regional, county, or municipal—provide the expertise for the study of certain social, economic, and environmental effects.

Other agencies may regularly carry out studies that are directly applicable, or at least relevant, to the transportation agency's studies, and so this method may help to avoid duplication of staffing and effort among state, federal, and

local agencies. However, the problems of information flows, coordination and integration discussed previously are just as real here, if not more serious. Other agencies almost always have their own resource and personnel limitations, and will give first priority to their own programs. Consequently, a realistic assessment must be made of the extent to which the desired expertise will be available when needed and the reliability with which other agencies can be expected to lend staff or devote time to highway agency problems before too much reliance is placed on their ability and willingness to help. Formal agreements are desirable in almost all cases, and reimbursement for services provided may be desirable in many states.

It has been suggested by some that the A-95 review process, combined with the process of circulating draft and final Environmental Impact Statements to other agencies and acting, as appropriate, on received comments, constitutes an acceptable systematic interdisciplinary approach. However, this is not sufficient, as it is not especially systematic, does not provide input throughout planning, and does not necessarily provide effective input to decision-making.

This is not to say that the review and comment mechanism is not useful. It can provide meaningful input if carefully done. Other state agencies should be brought in early in system or project studies, when it is far easier for them to provide useful data and guidance.

Experience in several state transportation agencies has shown that other agencies can provide a useful role in training by conducting formal courses for highway agency personnel, by loaning staff to the highway agency, or by permitting highway agency staff to work with the agency for periods of time, to enable highway people to view problems from a different perspective.

In summary, a transportation agency expecting to make use of other agencies in meeting the requirement for a systematic interdisciplinary approach must take special care that the result will indeed be systematic, not just a piecemeal and brief application of the views of other disciplines; and thorough, having an effect throughout planning and on decision-making. Emphasis must be given to integration of expertise, not merely to the circulation of materials and obtaining of comments.

Social/Economic/Environmental Units.—Many transportation agencies, as part of their Action Plans, are establishing special units to handle social, economic, and environmental effects. The unit is intended to assume primary responsibilities for performing environmental studies and is frequently located at a level of the organization equivalent to that of system, location, and design study units. It is at this level that such a unit can most effectively contribute to day-to-day decisions. For those agencies having highly decentralized operations (such as Florida and California), separate environmental units exist in each district office.

Those states with extensive experience in this area have found, however, that establishment of an environmental unit is only a small, though necessary, step; it is far more difficult to integrate effectively the inputs from these units into the day-to-day operation of project studies.

The establishment of a separate environmental unit raises several difficult questions. For example: In which types of projects does the unit become involved? When does the unit enter into the planning process? Who decides this? What is the relationship of the unit to the rest of the agency—is it a service unit or does it have final responsibility for the treatment of social, economic, and environmental effects? What final decision-making responsibility does the unit have, or, alternatively, what is its role *vis a vis* the decision-makers? What is its role in project management? How is the information developed by the unit fed into the appropriate places in the agency, and *vice versa?* All these questions must be answered to determine the sufficiency of the special unit in meeting the requirement for a systematic interdisciplinary approach.

As might be expected, serious efforts to integrate such units into the day-to-day operations of transportation agencies frequently have been accompanied by considerable internal conflict and problems of "territorial imperative." Where the unit is responsible only for preparing environmental impact statements on projects previously completed by engineering units, such conflict normally does not arise because the unit is seen as a service organization helping to implement previously made decisions. It should go without saying, then, that such "after the fact" units are not contributing to the achievement of a systematic interdisciplinary approach in the true intent of the law.

Design and location units traditionally have had primary responsibility for project development and either intentionally or unintentionally there is a natural tendency to try to limit the influence of a newer environmental unit. Each discipline is prone to mistrust the other because of a lack of understanding of the other's language, background, and values, and a tendency to question the other's judgment. Engineers generally are uncomfortable with information that is highly uncertain and is unquantifiable, whereas environmentalists, lacking a full understanding of the traffic flow and safety implications associated with various geometric proposals, may not trust engineers to make unbiased decisions based on all of the available information and consequently may feel that their input is being ignored.

Such conflict is not necessarily to be avoided if it can be constructively managed and a polarization of the respective units avoided. Bringing out conflict on a project-specific basis may help to identify relevant issues from the viewpoints of different interests.

Where personnel resources are limited, it is best to staff environmental units with generalists, individuals having a general capability in several disciplines. For example, Florida places emphasis on a generalist capability in the district environmental offices. These generalists have sufficient knowledge of environmental matters to be able to identify potential impacts needing specialized study. The generalists then can call on specialists from a headquarters environmental unit, other state agencies, or on an outside expert basis to perform the needed analyses (*72, 225*).

In-House Interdisciplinary Teams.—Interdisciplinary teams on either a project or an area basis can be established in-house to supplement environmental staff. In the past, such teams have been used primarily on especially large or sensitive projects, frequently as task forces established only after a study has become controversial. However, agencies

could establish a full-time interdisciplinary team for each major project. Small projects that would not warrant a single project team could continue to be handled by individual functional units as they are now, or several minor projects physically near each other could be grouped together so they could be studied by a single subarea team.

Each team could be responsible for all phases of a study (e.g., regional or subarea planning, corridor, location, and design studies might even coordinate right-of-way acquisition and clearance). The team would be staffed by personnel drawn from within the transportation agency, other state agencies, and possibly from local and regional agencies as well. Each study would need different disciplines, so the exact composition of a team cannot be pre-specified. Most teams, however, would likely contain full-time specialists from route location, design, right-of-way acquisition and appraisals, programming, system planning, traffic analysis, social sciences, environmental analysis, economics, and management. Because the activities of a team shift over time, the skills needed in the team also shift. For example, more regional economists and system planners might be part of the team during early studies, and more designers and right-of-way negotiators might be on the team near the end of studies.

Team members should be located in a single spatial location to facilitate intrateam communication. The various professionals, although retaining their association with their line or staff units, would be responsible to the team leader during the time they are a member of a team. Team members, in addition to having a working knowledge of their own area of specialty, should also be familiar with the entire planning process, other functional departments, other aspects of the agency's operation, and other proposed county and state transportation projects in the same general vicinity.

The team leader should be chosen primarily for leadership and interdisciplinary management skills, should be able to interact effectively with community interests, and should have authority, status, and credibility within the agency. The team leader also should play an important role in appraising a person's job performance for purposes of promotion and salary review.

A major question to be resolved is the team's role in decision-making. Are traditional decision-making mechanisms retained or are increased responsibilities in this area also delegated to the team?

The northwest Michigan Route 31/131 study is organized around the use of an in-house interdisciplinary team having many of the characteristics described. The team includes members from ten units within the state department of transportation plus members from a regional agency (the Northwest Economic Development District), and the state planning office. The team was formed on an experimental basis when it became clear that the proposed alternatives could not be investigated meaningfully without studying their interrelationships, effects on regional economic growth, local environmental effects, and transportation proposals affecting the region. Interdisciplinary team efforts are now being initiated in other regions of Michigan and have been incorporated into Michigan's Action Plan (*258*).

Establishment of a permanent basis for interdisciplinary teams normally would be accompanied by corresponding changes in organizational structure. One possible structure is shown in Figure 23. The major thrust of the organization is a shift from the traditional vertical structure to more of a matrix structure.

Use of teams may contribute a number of benefits to an agency. In addition to providing a systematic interdisciplinary approach and its resultant increased environmental sensitivity, the concentration of personnel on a single proj-

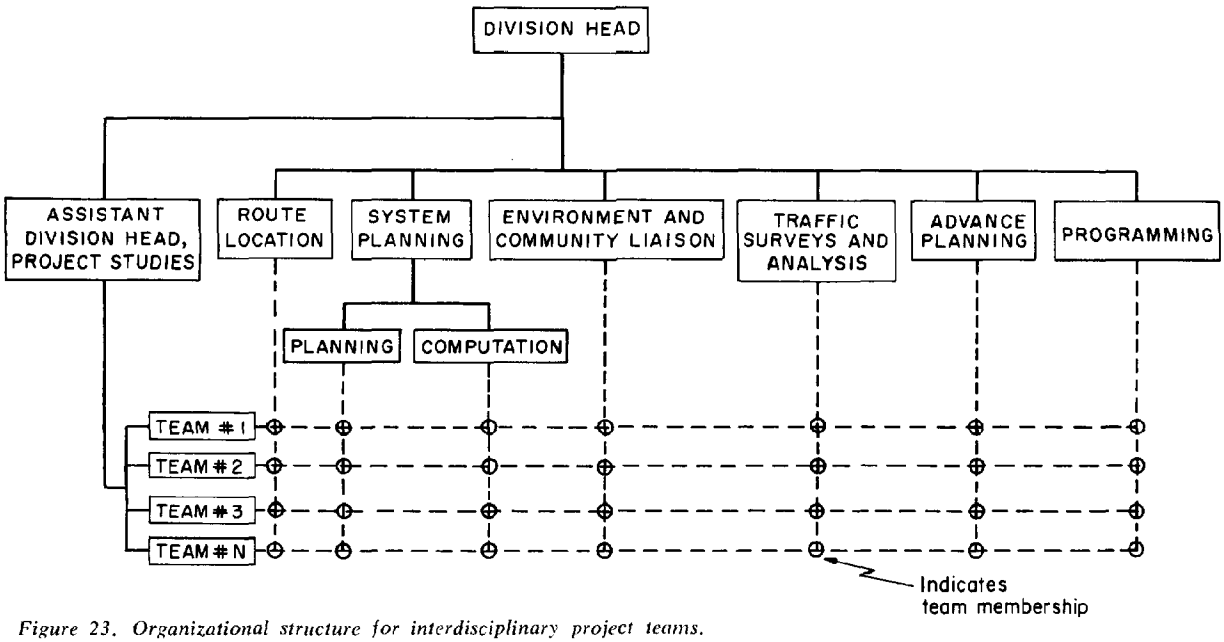


Figure 23. Organizational structure for interdisciplinary project teams.

ect, rather than allocating their efforts to several projects simultaneously, may shorten the length of project studies and provide increased process continuity. Interdisciplinary teams also provide a well-defined arena in which to resolve interdisciplinary conflicts, may help to maintain high employee commitment and morale, and should increase the agency's responsiveness to the needs of a community.

Potential disadvantages of an interdisciplinary team include establishment of a momentum and identity of its own, formation of an internal team policy that may be different from a previously determined agency-wide policy, and increased management requirements.

Interdisciplinary Consultant Teams.—A variation of the interdisciplinary team relies on one or more consultants in some form of contractual association. In this type of arrangement, the consultant team would assume complete or at least nearly complete production responsibility for a study, with agency core staff retaining policy-level supervision and control. Interdisciplinary consultant teams could be used on especially large or complex studies where the agency does not have sufficient in-house expertise, on sensitive or controversial projects where a consultant may provide higher credibility than an agency itself could achieve, or on studies that are funded by more than one governmental agency and where the lead agency may be unclear. An example of the latter is where independent highway and mass transit agencies jointly sponsor a multimodal corridor study.

It is not unusual on large projects for twelve or more firms to pool their resources into a single effort. Most such studies during the 1960's were constrained to focus almost exclusively on design issues and were referred to as "design concept teams." Examples, most of which have been written about extensively, include Baltimore, Boston Inner Belt, Chicago Crosstown, Seattle I-90, and the New Orleans Vieux Carre (*230, 237*). More recently, the scope of such studies has been significantly broadened with a lessening of the earlier orientation to final design and joint development opportunities. For example, both the Boston Transportation Planning Review and the New York City West Side Highway Project have included considerations of network effects and other modes in an effort to better relate system and project planning.

Analysis of both early and recent interdisciplinary consultant team efforts indicates four requirements that should be satisfied if such a team is going to have a high probability of success (these requirements are also pertinent to other forms of organizing an interdisciplinary approach, but are particularly essential to a consultant-based approach):

- Scope of study. Just as interdisciplinary staff must be involved throughout all phases of project development, an interdisciplinary consultant team should be free to investigate all aspects of a study—network, programming, demand, relationships among modes, location, and design features. For example, a team brought in for final design after a project may have become controversial cannot correct for possible previous planning or location deficiencies unless it has some authority to review earlier decisions and is given control over a broad enough range of variables.
- Reporting and decision-making. The client agency, or agencies, should retain an active and strong day-to-day involvement in an interdisciplinary consultant team. Responsibilities for supervision, control, and decision-making should remain with client agency staff and not be informally delegated to the consultant team. Involvement of agency personnel is especially important to maintain the morale of existing agencies, provide a continuity of effort when the consultant team has completed its assigned responsibilities, and ensure that the client fully understands all issues of choice.
- Coordination. Individual firms should be in close and continuous communication with each other and should adopt a work style that facilitates informal interaction among the various disciplines involved. Ideally, all member firms of a consultant-based team should work out of the same office space, in much the same manner as would an in-house interdisciplinary team. During the period of the study, firm differentiation and identity would become secondary to that of the study effort.
- Management. Expert management is crucial to the success of an interdisciplinary consultant team. The various efforts must be coordinated and the necessary information flows achieved. Schedules of individual efforts must be kept compatable, yet at the same time sufficient flexibility must be retained to achieve responsiveness to changing conditions and community inputs. The primary job of the team manager must remain management, and not design, environmental analysis, or some other function for which the lead firm also may have responsibility. One technique that has been successfully employed to help ensure that team management retains a management perspective, maintains a balance among the activities of all team firms, and remains unbiased toward any one discipline, firm, or activity, is to assign one firm only management responsibilities. This consultant would then constitute the lead or prime contractor but, in contrast to traditional practice, would not necessarily have the largest financial portion of the total contract.

INTERRELATION OF SYSTEM AND PROJECT PLANNING

Need for Environmental Considerations in System Planning

The initial response by most transportation agencies to the concern for social and environmental issues has been to examine a wider range of impacts and to include a broader segment of the public in the project planning process. Although these efforts aimed at the project level represent a major and positive step, a number of difficulties have been encountered with this predominantly project-oriented approach.

First, as described in the previous section, a great many of the effects implied by a system plan have regional impacts and so cannot be analyzed effectively on a project-by-project basis. Although system planning studies often have considered some regional effects (e.g., land use, the regional economy, and changes in traffic patterns), other factors that are of a regional nature (such as air quality, open-space conservation, and housing) commonly have not been investigated in any depth until project studies are under way. As a result, important system-level information

is not available to system studies. Analysis of all such area-wide impacts during system studies would strengthen the basis for system-level decisions and would allow such impacts to be assessed more effectively.

Second, when significant portions of community and environmental impact analysis are not undertaken until project studies are initiated, significant resources may be expended for the design of projects that later may be delayed, extensively revised, or even dropped from further study, due to the discovery of adverse effects not anticipated in system-level planning. Such changes in project concepts or schedules create the need to revise implementation programs and system plans. Although changes are never totally avoidable, anticipating project environmental impacts in system studies should result in fewer delays and disruptions to implementation programs.

Third, decisions made during system planning studies may establish some of the social, economic, and environmental effects of a proposed project. For example, the choices of mode, type of facility (e.g., freeway, primary), and approximate location often determine the general range of effects such as noise levels, air quality, and housing displacements. It would be desirable to be able to modify such choices in order to mitigate adverse effects or simply to be more responsive to new conditions. However, there is a tendency to view system-level decisions as fixed because it is assumed that system planning determined the "need" for the specified facility. Staffs responsible for project studies therefore may be constrained in their ability to take actions to alleviate or avoid potentially serious adverse effects because of previous system planning decisions, even though project studies may develop information on possible adverse effects or sources of increased costs that call the system-level decisions into question. This points to the need for more flexibility in project studies and greater feedback between project and system planning, so that the range of alternatives is not prematurely narrowed.

These three factors suggest that for the most effective use of resources social and environmental impacts must be anticipated early in system planning and that more continuity is needed in addressing these issues throughout the entire planning process, from system planning through detailed project design. Most transportation agencies have begun to recognize and to address these issues. Further steps, however, can and should be taken. Any strategy and techniques for integrating system and project planning must recognize the need to address both area-wide and local issues throughout the process and specifically to deal with identified environmental issues at both the system and project planning levels.

This section discusses how system and project planning can be integrated to more systematically include community and environmental concerns. The section (a) identifies problems in the current relationship of system and project planning, (b) describes a strategy for integrating the activities of these different levels of planning, and (c) presents several techniques for more effectively interrelating system and project decisions.

Issues in Interrelating System and Project Planning

The Gap Between System and Project Planning

A traditional view has been that system planning analyzes the transportation needs of 20 to 30 years in the future and develops a general network (or "master plan") for an urban area, a regional planning district, or even a whole state. Project studies then prepare the detailed designs necessary to implement a particular link (Fig. 24). Thus, the two activities have been treated as sequential. As a result the gap developed in the institutions, staff, and procedures used in system and project planning impedes the consideration of social and environmental effects.

To overcome this "cultural gap" between system and project planning, a number of issues must be resolved (*246*), as follows:

1. *Only limited impact prediction occurs during system planning.* There are four general reasons for this: First, the period for which the prediction is desired often is 10 to 30 years hence, and there is a great deal of uncertainty associated with such long-term predictions. Second, many system impacts are diffused over wide areas; further, it is difficult to develop good estimates of their nature and magnitude because they are not fixed until project planning has developed a specific location and sometimes even a design of a proposed facility. For example, air pollution and housing displacements both are highly dependent on facility location and design, yet have system-wide implications. Third, many system impacts are indirect, and there is a lack of understanding of their complex cause-and-effect relationships. The best example might be the long-disputed relationship between transportation and land-use patterns. Finally, some impacts are localized (noise levels, for instance) and therefore are difficult to handle on a system-wide basis; yet these impacts may be crucial in determining project acceptability.

The result is that system planning often examines a different set of impacts for a different time period and at a different level of detail than is the case during project studies. Yet the impacts at both planning levels are highly interdependent.

2. *The full range of multi-modal alternatives has not been considered in most system planning studies* (*238, 240*). Most have looked primarily at construction options; policy- and regulatory-oriented alternatives (fare structures,

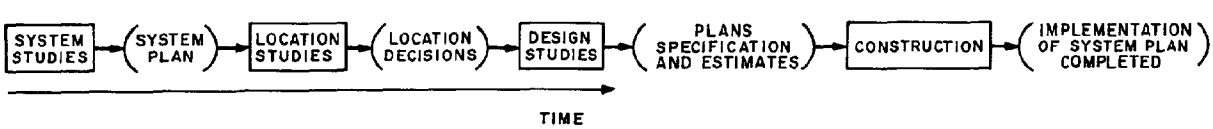


Figure 24. Traditional view of the planning process.

flow metering, etc.) have not been considered. In addition, funding constraints have limited the consideration of certain alternatives by making funds available only for particular modal solutions or even for particular classes of highways.

As project studies progress, questions often are raised about these options. A general relaxation of funding constraints is occurring with the current change in the use of the Highway Trust Fund and with increased mass transit funding, thereby making the examination of a range of transportation alternatives more meaningful. Yet, because system planning studies did not investigate the implications of these alternatives, project study personnel find it difficult to respond. In fact, the technical procedures used in system planning tend to impede the examination of many alternatives. (Cf. Appendix B and Ref. *62*). For example, functional classification and needs studies generally assume a "desired" or "minimum tolerable" level of service. However, once a level of service has been assumed, the appropriate design standard of a facility is set. By examining service characteristics alone in making preliminary decisions on the types of facilities needed or desired, system planning is ignoring critical social and environmental issues as well as prematurely limiting the range of alternatives that should be considered.

3. *Evaluation techniques have tended to emphasize average area-wide benefits, with little examination of the incidence of impacts and the specific requirements of subareas and subgroups* (*165*). Such aggregate measures tend to conceal the distribution of benefits and costs among different user groups (local versus through traffic, various income groups, etc.) or between users and nonusers. Many communities contain a diversity of views about transportation, and public involvement is useful in obtaining the views of these different interests as to what impacts are important. However, effective public involvement has been difficult to achieve in system planning studies because of the remoteness of most system planning decisions (in that they concern actions to be implemented ten or more years in the future) and the lack of information about localized impacts. Evaluation criteria appropriate to system considerations often do not address the local issues of most concern to many groups. For example, the benefits for peak-period through traffic might be the major justification given for a project, whereas the issues of concern for the local community are effects on local traffic patterns or off-peak accessibility to shopping and recreational centers.

4. *System plan revision is not seen as a viable option.* Project delays or cancellation often do not result in a review and revision of system plans or at the very least make such a review a cumbersome task. Dropping a small and isolated project from further study might have few system implications and not warrant revising the system plan. However, when a large project or a number of projects are delayed or dropped, there is a need to reexamine the allocation of resources to other projects in a program and to determine whether a revision in the system plan or program is desirable.

Part of the problem has been that system plans have been advisory in nature, with little influence over programming decisions. Thus, when a project was delayed or cancelled an inventory or "shelf project" might be substituted into the program without the issue of system revision ever arising. In fact, given the revenues expected over the planning horizon, system plans often have represented unrealistic target networks. Frequently system connectivity and completion of the master plan are used to partially justify particular projects even when completion of the network (or especially completion on schedule) seems unlikely due to resource or community considerations. Many states are now recognizing that they may never complete their master plans or meet their currently defined "needs" (*259*).

5. *Independence of projects in programming is often assumed.* In some cases, different segments of the same route are studied separately. As a result, project designs implicitly assume completion of the target network by the specified horizon year, with little consideration given to interim improvements or other design scales. In many cases, this is an extremely inappropriate and costly assumption. If the target network cannot be completed, or cannot be completed on schedule, better area-wide service often could be achieved with a different mix of projects. Allowing variations in project scale makes the possibility of meeting social and environmental standards more likely.

Often, rural projects are treated on a project-by-project basis. Many states view system planning as primarily an urban activity with the "3C" process serving as the legal impetus for developing a structured urban system planning process. The need for integration of system and project planning is a rural as well as an urban problem. In rural areas there is a definite need to coordinate all project studies in a strategy for improving the rural transportation system and to solicit the involvement of interested groups early in the planning process. Furthermore, on a statewide basis there is a need to coordinate all funding and programming decisions. Treating urban and rural projects separately may not result in the most effective allocation of funds and improvements to the statewide transportation system.

6. *Uncertainties in predicted revenues, demand, impacts, or community acceptability have not been considered explicitly.* Often, the nature and magnitude of these uncertainties have not become apparent until a strong commitment has already been made to particular components of the plan. For example, the patterns of land-use and economic activity assumed during system studies may be very different from those existing when a particular project is ready for construction (*244*). Similarly, developments in new technologies and new funding patterns may allow new modes or different mixes of modes. System plans may have to be revised significantly to take advantage of such new opportunities or information.

7. *The personnel involved in system and project planning typically have very different perspectives on transportation problems.* At the system level, area-wide and long-range issues are addressed and the planning profession is predominant. At the project level, more detailed design work is emphasized and traditional engineering skills play a much larger role. Even more important than the difference in disciplines is the fact that system and project

studies are generally carried on in different units within an agency, or even different agencies (and possibly different buildings), with resulting problems in communication caused by physical separation. This is particularly true in the case of highway and transit planning. Often, one agency is responsible for multi-modal system planning; but project planning and implementation invariably occur in different agencies. In most cases, the state is responsible for highway implementation and local or regional operators are responsible for transit.

Implementation Strategies, Not Master Plans

The issues discussed in the foregoing have arisen largely as a result of treating system and project planning as sequential activities. As mentioned previously, this traditional view has been that system planning developed a set of "needs" or a "master plan," and that project planning developed the detailed design or projects necessary to implement the approved "plan." Although the master plan may give a precise picture of what the future transportation system *might* be in some target year (e.g., 1995), in many cases the master plan has not been tied explicitly to the programming activities that determine how projects will be scheduled toward implementation. The master plan rarely includes details of the implementation program that will be followed in bringing about the master plan. Thus, a master plan often represents an unrealistic goal because it does not take into account the problems and uncertainties in implementing the system on a step-by-step basis. Because completion of the plan (or completion on time) is assumed, year-by-year decisions on specific projects are distorted; if a more realistic perspective on completion of the system were taken, different project decisions would be taken in many cases. For example, the California Department of Transportation is currently revising planning programs as a result of a careful examination of expected revenues over the next 10 to 20 years.

More importantly, by focusing on only one future system, the master planning approach loses flexibility to revise plans. The implementation program is geared toward construction of one plan for one target year. Because it is assumed that all projects will be built eventually, projects may be selected that will operate effectively only when other interdependent projects are completed. Then, if community and environmental impacts discovered during project studies bring into question the desirability of one project or several links in the system, it is both technically and psychologically difficult to respond positively by considering new projects or system concepts. Because no provision has been made in system studies for a range of project designs, or the potential deletion of a particular link, a large amount of resources is required to revise the plan later.

Uncertainties in funding, community preferences, and the impacts of a particular action place severe limitations on a master plan approach. Transportation options must be developed with the knowledge that today's decisions are based on an imperfect understanding of the future of a region. Unforeseen changes may require new responses and adaptations that are impossible to fully anticipate.

The important decisions are the near-term programming choices—the annual decisions on how to spend money next year. These are the only decisions that irrevocably commit resources to projects and studies. In system planning it is neither desirable nor necessary to make a choice of one target system for some future year. The choice of a system master plan is alterable and in fact is likely to be altered many times before the target date arrives. By leaving future decisions open until more information is obtained, system planning can take into account possible future options and events and help to select the most flexible direction for present programming decisions.

An examination of many transportation controversies leads to the conclusion that many of the problems are directly related to the inability of the present system planning process to explicitly deal with uncertainty and to effectively relate near-term programming decisions to longer-range system plans. System planning must focus not only on desirable master plans but also on implementation strategies.

An Approach to Integrating System and Project Planning

To address social and environmental factors throughout the planning process requires both new technical procedures (such as those described in the succeeding section) and new planning approaches or strategies in which these procedures can be used. The strategy proposed for improving the integration of system and project planning views the planning process in terms of a series of implementation decisions (*267, 272*).

System plans are all the facility, operating, and policy changes proposed over time for all modes of a transportation system for a state, a region, or a municipality. Plans for different governmental (or geographic) levels will be overlapping and highly interdependent, and consistency among the different transportation system levels must be an objective of the over-all planning process. This definition of a system plan is obviously more than a map displaying proposed capital improvements. The usefulness of this definition for integrating project and system decisions is discussed in more detail in the next section.

The system planning process encompasses all those elements and activities necessary for producing area-wide transportation plans, including those activities necessary to relate transportation planning to more general planning encompassing energy, land use, housing, industrial development, open space, etc. This definition of the process includes the institutional structure and decision-making process for transportation (including the various interest groups involved), the process for generating and allocating funds, and the modeling and analysis procedures used. Defined in this manner, system planning encompasses a broad range of components and provides a framework within which project-related decisions can be made in a coordinated manner.

Project planning then involves those activities which prepare some component of the system plan (whether a highway link, transit link, or traffic operations scheme) for de-

tailed design and implementation, explicitly recognizing the relationship between a particular component or "project" and the entire system plan.

These definitions imply that system planning should be viewed not as a phase of planning preceding project studies, but rather as a framework within which project decisions can be made, serving to coordinate ongoing project studies (Fig. 25). System planning thus would periodically assign resources and priorities among the ongoing subarea studies and project planning activities. Inasmuch as project studies influence system planning, they must be coordinated with system planning in an ongoing way. It is fair to say that traditional practice has not integrated project and system planning within the sort of time sequencing of activities proposed here, although some states and many urban areas are certainly taking steps in this direction. (California and Pennsylvania, in particular, are implementing major changes in this direction.)

Such an approach explicitly recognizes that transportation plans are not implemented in "one shot," but rather in a series of stages. Thus, system planning ought to examine a range of different implementation strategies. For example, a 20-year time horizon might be divided into 5-year stages. Each stage of a particular implementation strategy might include construction of a number of highway links, operating and pricing changes, as well as transit improvements, demonstration projects, and planning studies. No particular "end state" need be identified initially as a target system. Each action taken during a stage should be beneficial (rather than being dependent on as yet unimplemented steps), may fit into a variety of possible "end state" future systems, and is evaluated with a perspective of keeping future options open (Fig. 26). During implementation of the first stage, the subsequent stages in a strategy could be revised or updated in light of new information or changes that have occurred (*242, 261*). The same future system may be reached by any of several paths; for example, in Figure 26 both paths A and B reach system X.

This approach recognizes that many significant decisions affecting a system plan may be postponed until project environmental impact, corridor, and initial route studies are under way or completed. The service level, specific alignment, and indeed even the existence of a particular facility may not be finally determined until later phases of planning. System plans should account for the possibility of a number of outcomes from these later studies.

By developing different sequences of actions on facility improvements, emphasis is placed on what choices are available over the planning time horizon, and how present decisions affect the range of choices available in the future. The different sequences can explicitly recognize uncertainty by evaluating the impacts of a number of potential outcomes from project negotiations or impact studies. Thus, implementation strategies provide a convenient framework for relating system and project planning by focusing on both short-term decisions and longer-range plans.

Although the resources available for system planning will restrict the number of sequences and uncertainties that can be considered, attention need not be limited to one sequence. Implementation strategies cannot be developed for

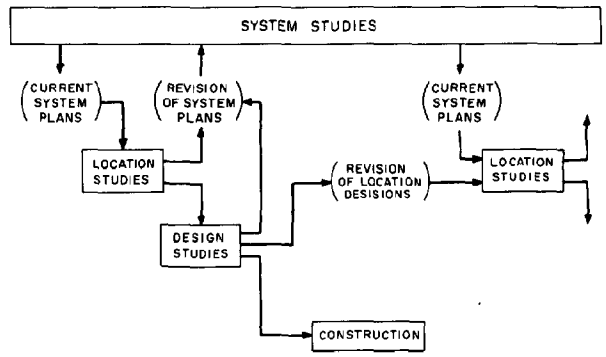


Figure 25. Suggested view of the planning process.

every possible event that may occur in the future, but they can be developed to explore what appear today to be the major choices facing the decision-making process.

The role of system planning in the context of alternative implementation programs is to anticipate the choice issues that must be resolved as planning continues, and to devise tentative sequences of improvements based on potential outcomes of these choices. As new information is gathered, new options will be added and others will be dropped from consideration.

In summary, system and project planning must be integrated so that a decision to implement or not to implement a particular project or design will not affect the ability to

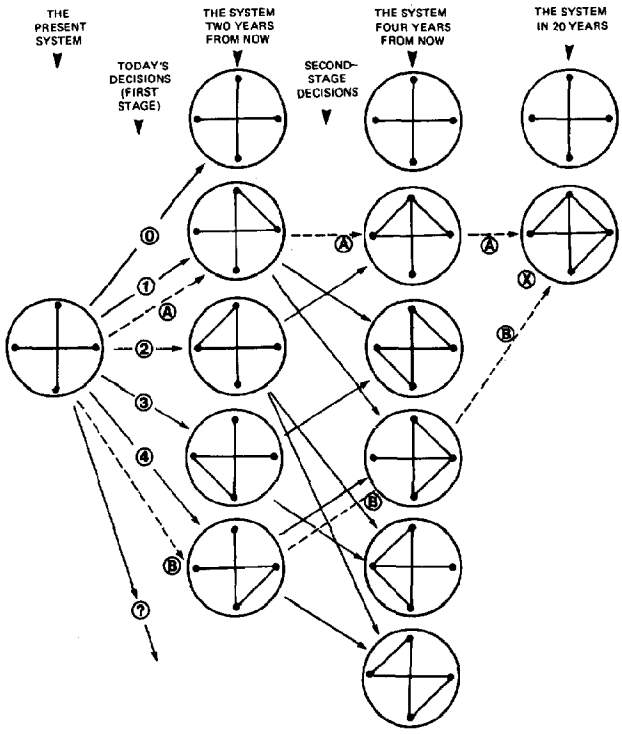


Figure 26. An implementation strategy approach to system planning.

allocate funds smoothly to other high-priority projects. Focusing on implementation strategies (rather than master plans) will allow and encourage a transportation agency to anticipate modifications so that when they occur they do not result in lost time. Only with ongoing integration can this problem of a great deal of lost time be avoided when something doesn't go according to schedule in the development of particular projects.

Naturally, both the master plan and a plan based on implementation strategies can be altered in future periods in response to changes. Neither irrevocably commits a region to one sequence of implementations. The two essential differences between the approaches are how initial decisions are made and the flexibility provided to revise the plan over time. Initial decisions with the master plan aim at a one-target-year system. Although the master plan can be revised, many alternatives may be foreclosed prematurely by focusing on one target network. The implementation strategy approach considers uncertainty and a number of improvement sequences when initial decisions are made. By anticipating the changes that may occur and a range of the choices available in the future, this approach explicitly requires periodic evaluations and revisions and ongoing coordination with project studies. (Cf. Refs. *62* and *73* for a more in-depth treatment of the issues discussed in this section.)

Techniques for Integration

The proposed approach for the improved integration of system and project planning suggests possible changes to many aspects of the current planning process, including the institutional relationships among levels of government and the process for allocating funds, as well as the procedures used for needs and sufficiency studies, network flow modeling, and priority setting and programming.

This section presents three specific techniques that can serve as initial steps toward achieving close and continuous integration:

- System Plan Format and Content.
- System Environmental Report.
- Corridor and Subarea Studies.

System Plan Format and Content

One of the best opportunities for more effectively integrating system and project planning lies in strengthening programming as a decision-making activity. Programming is the key for a number of reasons. First, the programming process is the focus for important decisions and negotiations concerning the commitment of money and manpower to various projects and studies. Second, programming provides an appropriate forum for consideration of both long-run and short-run actions aimed toward implementation of a system plan. Finally, programming is a periodic activity (often with yearly budgeting cycles) and thus is a convenient checkpoint to review the status of ongoing project studies and to revise the system plan in light of current project development activities.

Traditionally, the link between system planning and programming has been weak. System planning, primarily through functional classification and needs studies, provides lists of projects that are then assigned priorities in some manner. Programming then chooses projects until the budget is exhausted, subject to geographic and other constraints. One way to strengthen this linkage is to require a system plan format that encourages discussion and documentation of both system and project activities and provides for stronger and different kinds of system inputs. The basic planning document should be a multi-year program package that combines both short-term and longer-run improvements while explicitly recognizing the resource and other constraints facing transportation plans. Such a document would represent an extension of the current multi-year implementation programs developed by many agencies to cover the entire planning period.

Typically a target-year plan for 20 to 30 years in the future is developed along with a short-range (up to 5 years) implementation program. The recommendation here is to combine the requirements for the target-year transportation plan and the implementation program into one multi-modal planning program package that reflects reasonable resource assumptions and illustrates all the actions on transportation anticipated for an area over the entire planning horizon. Thus, the proposed planning document would contain all capital and service improvement projects (large and small), including maintenance, operating and policy changes, and planning studies for all modes within a region. In addition, the planning program should identify all sources of revenues and the implementing or operating agency responsible for each action contained in the program. An example of such a program is shown in Figure 27. (It is recognized that such a document, given existing federal and state funding programs and constraints, might involve programming projects in some categories somewhat separately and then combining these "subprograms" into a single integrated final plan.) The key planning document thus would not be simply a series of maps, though maps might serve as supplementary information illustrating planned improvements for some categories of projects.

For urban areas such a document would extend the U.S. Department of Transportation requirement for a Unified Work Program to include project implementation (such as capital and service improvements) as well as planning activities. (At present, the U.S. Department of Transportation is developing a requirement for annual submission of a program of projects that would include all capital and service improvement projects). Moreover, it is recommended that the planning program format be adopted for both urban and rural areas.

In many cases, the list of projects to be given priority ratings should include a number of design options for the same project because each option for a particular facility has a different cost as well as a different set of impacts on the community. The effect of a budget constraint alone can alter the choice of both the set of projects and the design option for a particular project (*252*). For example, it may be desirable to select something smaller than the largest of all options for each location if the budget is tight and overall network coverage and equalized mobility is an objective. By providing multiple alternatives, the cost of studies may

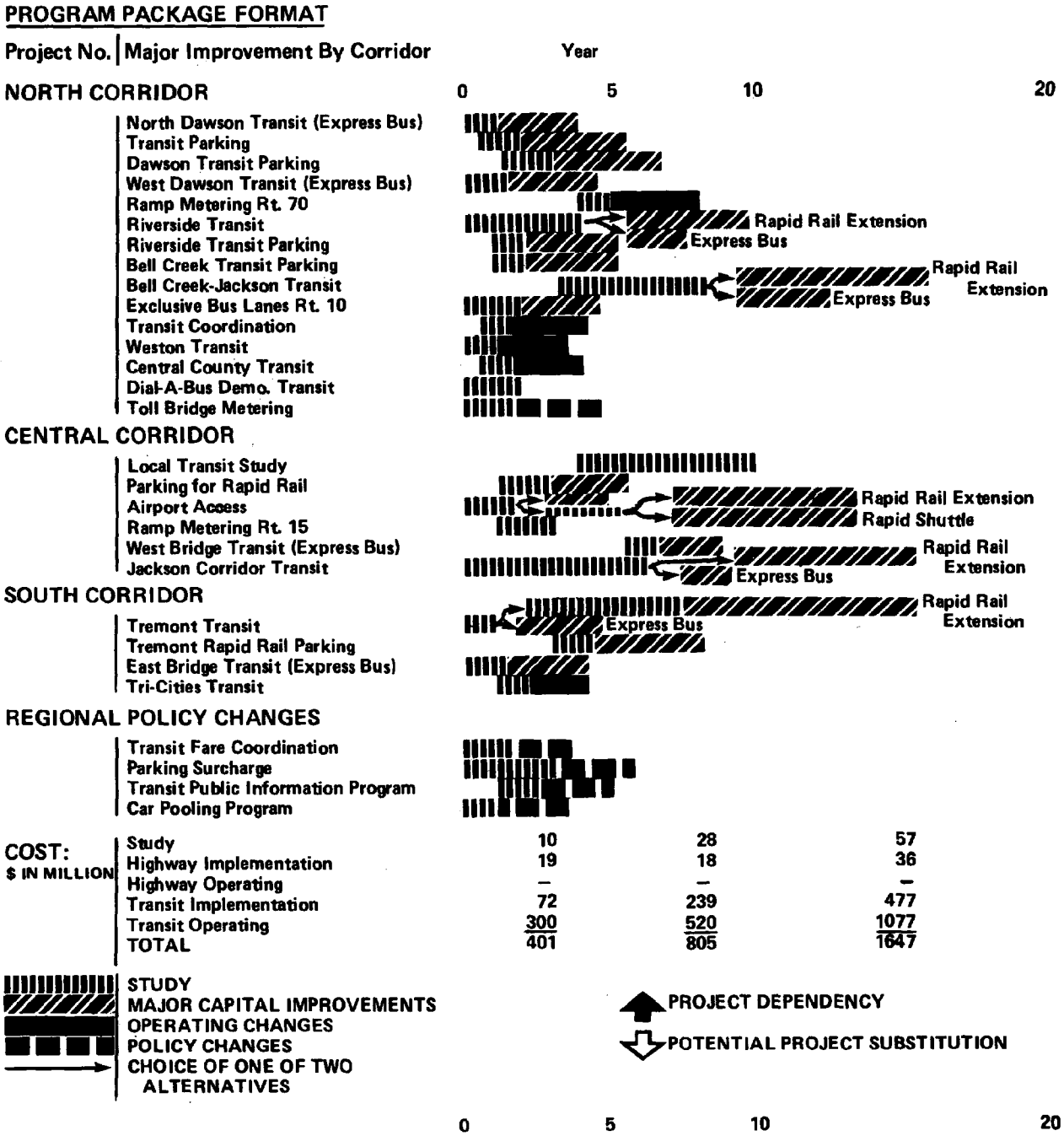


Figure 27. Example program package format.

be increased, but the flexibility for change in later periods also will have been increased.

There are a number of advantages to defining the basic planning document as a multi-year planning program rather than a target-year plan. Developing a planning program encourages the planning agency (or agencies) to focus on resource and other constraints early in the planning process. The result will be a plan that represents a proposal with a realistic potential for implementation and, hence, a better guide for transportation decision-making. Although the content of the plan can be expected to change, at any point in time the plan should reflect as realistically as possible existing and anticipated constraints on transportation decisions (i.e., resource, environmental, etc.) for at least the near-term portion.

Combining short-run and long-range improvements in a program package also increases the potential for the effective involvement of a wide range of different interest groups,

particularly in system planning. Program packages define both immediately implementable steps (such as flow metering, priority bus lanes, dial-a-ride, and pricing policies) and the longer-range improvements (such as major new facilities and broad policy changes like funding, compensatory programs, peripheral parking schemes, or even new studies). Because the lead time for major transportation projects can be as long as ten years, program packages show interest groups how their concerns can be addressed in the near future as well as giving all participants a realistic sense of the time required for more major improvements. A number of states have recognized this already, and are incorporating corresponding changes in their system planning process. The California Department of Transportation is considering use of the plan format shown in Figure 27 as the basis for their legislatively required 1976 statewide plan. The Connecticut DOT has adopted a similar format and uses regional plan summaries as the basis for conducting public meetings in each planning region of the state (*241*).

The public should not be involved simply in deciding on the studies and projects to be included in the plan, but should also be involved in deciding on the relative priority of those studies and projects. The proposed plan format focuses explicitly on the scheduling of projects and planning activities.

To define the plan as suggested here will make ongoing coordination of system and project planning easier. Because the desirability of some projects in a region, or their timing, may depend on other projects in the plan due to traffic or resource considerations, the program package can explicitly identify these interdependencies and indicate when or how changes ought to be made to the program package if the status of a particular project changes (*251*). In programming and project development, a project often is considered to be independent, for the most part, from other projects under study. Using a planning program format will facilitate inclusion of system considerations in project development decisions. Also, combining plans and programs for all modes will encourage cooperation among agencies doing system planning and those responsible for implementation.

Contingency plans may provide additional flexibility within the basic planning program format, particularly in areas where a number of controversial issues are unresolved or for major projects with significant lead times. In these cases, in order to facilitate the orderly allocation of resources, it may be desirable to develop alternative tentative implementation strategies for a range of potential future decisions. For example, if a major freeway has a 15-year lead time but no assurance of its acceptability can be made that far in advance, it may be wise to examine and plan a contingency program for smaller-scale facilities and traffic operation improvements in the corridor in case at some point in project development the freeway concept is dropped. By anticipating such occurrences, the agency can provide for an orderly implementation program rather than reacting to crises only after they occur. At the same time, the agency can provide the community with more than a "freeway or no improvement" choice.

Although development of contingency plans may require more resources for planning, it provides for a more realistic range of network and project choices when there is significant uncertainty in funding levels, community acceptability, the predicted impacts of proposed projects, and external events with implications for transportation (land-use control, air quality regulations, etc.). In the long run, contingency plans may result in a more efficient use of resources by providing flexibility and keeping options open.

The California Department of Transportation, for example, has developed alternative programs in a number of cases when the public acceptability for large projects has been uncertain. The alternatives have been developed to minimize the disruption to the schedules of other projects, as well as to ensure compliance with legislatively defined highway planning district and county funding minima. In one case a proposed southern crossing for the San Francisco Bay was faced with significant opposition and a public referendum to decide the issue. In the interim the state prepared two planning programs for the region; one program assumed construction of the southern crossing, the other assumed the bridge would not be built.

Although alternative plans can be displayed particularly for the medium to long run, the first one to two years of the planning program should be decisive and represent what actually will be budgeted and implemented or studied during that period. By making the first few years of the program decisive, but explicitly recognizing the range of choices available in subsequent time periods, the planning document can support and indeed encourage a periodic decision-making process. Every one or two years a new budget is prepared and the entire planning program is updated and documented. The proposed format then encourages a planning process whose periodic output is a new budget reflecting the fiscal flows anticipated in the planning program.

It may be useful to establish a joint system and project programming team to ensure that programming decisions address all appropriate issues, and to further facilitate programming, by serving as an effective bridge between system and project studies. In Michigan, the team conducting the Northwest regional study was concerned that their recommendations might not be reflected in programming decisions when such things as funding availability and balanced work loads were considered. Subsequently, a representative of the programming unit was assigned to the ad hoc regional study team to help anticipate potential conflicts. In the Pennsylvania Department of Transportation this same kind of coordination is obtained through the department's organizational structure. There the Deputy Secretary of Planning is responsible for long-range planning, short-range programming, and budgeting, and has authority for the design staff to initiate corridor studies with subsequent review over corridor study results to assure consistency with plans and programs.

In developing an implementation program, a programming team should discuss the interrelationships among various projects, major unresolved issues at both the system and project level, and potential revisions to system plans or project concepts. A major focus should be identification of

the dependencies of upcoming decisions on all ongoing studies. These project dependencies would determine which decisions can be detached from over-all system consideration, and identify which study efforts must be coordinated and with whom.

System Environmental Report

One mechanism for obtaining more systematic consideration of social and environmental impacts in system as well as project plans is to encourage explicit documentation through preparation of a system environmental report. The California State Transportation Board has recently developed guidelines for the preparation of regional plans that require such a document (*240*). Pennsylvania's Action Plan also calls for an "environmental overview statement" during system planning, as do several other state Action Plans (*264*).

A system environmental report (SER) should neither approach the detail currently found in project environmental impact statements nor simply summarize the current status of project environmental analysis. Rather, the SER should present a summary of the plan's area-wide implications for, and impacts on, the environment as well as provide a framework within which later and more detailed project environmental analyses can occur.

Specifically, the SER might contain the following:

1. Identification (and possibly map overlays) of environmentally sensitive areas, land-use assumptions, prevailing air and noise pollution contours, and general topography. Also included would be basic demographic data and projections on population, income levels, and employment, and the range of uncertainty associated with these projections.
2. A summary of aggregate area-wide social and environmental effects implied by each of the system plan alternatives under consideration. Such a summary would estimate such things as the total open space and farm land likely to be taken or subsequently developed, the effect on the housing market of displacements from all projects, and compensation programs required to minimize adverse effects.
3. Identification of unresolved issues or further studies required in order to estimate the system-wide social and environmental effects.
4. Identification of the status of environmental studies for each project, including major unresolved issues, network implications (i.e., interdependencies with other projects) for projects currently being seriously questioned, and the current status of the project EIS (under way, completed, approved, etc.).

The SER should be produced as a natural by-product of the planning process and the reporting that has occurred to date. Given the magnitude and complexity of the issues to be addressed in a SER, it is extremely important that its production not entail a massive after-the-fact documentation exercise. Rather, the SER should be designed to merely summarize or compile the results of ongoing analyses, thereby avoiding the criticism frequently leveled at project environmental impact statements that documentation often doesn't occur early enough in project development to affect the study, in addition to being a burdensome and time-consuming task.

The documentation of system environmental concerns ought to be integrated with the documentation of the system plan itself. Thus, if the plan takes the form of a multi-year implementation strategy as recommended, the SER sections of that plan ought to discuss the anticipated impacts of alternative sequences of improvements and which sequences are left open or foreclosed by the first-period budget decisions. As the transportation elements of the system plan are periodically reviewed and updated, the SER component of the plan also should be reviewed and revised. (The importance of a system environmental report may increase dramatically as a result of a pending law suit in Atlanta. There, a citizens' coalition is contesting the validity of the region's system plan in the absence of an environmental impact statement (*248*).)

Corridor and Subarea Studies

The use of an intermediate level of planning—between area-wide system planning and detailed project planning—as a technique for interrelating system and project decisions has been receiving increasingly more attention. Introduction of a new level of planning prior to committing a large amount of resources to the detailed design of one or more options provides a mechanism for a more thorough assessment of issues, alternatives, and impacts than is possible during system planning.

Subarea or corridor studies, as this intermediate planning level is called here, might be used between statewide, regional, or urban area system planning and project planning. Thus, a statewide system plan can be divided into subareas or regions, with each receiving more detailed studies. Similarly, within an urban area several corridors or subareas might be identified. (The similarity among these statewide, regional, or urban corridor subarea studies is not the geographic type of area under study, but rather in the nature of the planning activities occurring. In every case, such a study would be examining in more depth both system and project options prior to committing major funds to develop and design alternatives in detail.)

Such studies might not precede every project or group of projects but might be reserved for areas undergoing rapid change or with potentially sensitive social and environmental qualities, areas in which a number of related projects are proposed, or areas where high-priority but controversial improvements are proposed. In Atlanta, the route selection studies for the Westside Freeway were redefined and broadened to be a subarea study, including a thorough evaluation of nonhighway alternatives, when it became clear that many areawide issues were unresolved (*112*). The Michigan northwest regional or subarea study was initiated because the state believed that the potential for increased development encouraged by transportation improvements in this predominantly rural and recreational area warranted a more detailed study prior to any project development activity (*257*). Michigan intends to initiate similar studies in other regions; and a number of other states, including California and Pennsylvania, have adopted formal corridor or subarea study policies (*239, 264*).

Subarea studies can provide a forum for the evaluation of multi-modal alternatives. For example, California is using the corridor study to examine multi-modal alternatives in interregional corridors as well as to reexamine controversial intraregional projects. Pennsylvania's subarea policy is intended to look at different parts of an urban area too large and complex to be examined as part of a single system planning study.

Subarea studies should include analysis of both short-term and long-term transportation improvements in a corridor. This will have the advantage of seeking some short-run benefits for each corridor from interim or low-cost improvements. As mentioned previously, it will also serve an important role in stimulating involvement and interest. If some actions might take place within a few years instead of in 10 or 20 years, the time frame is more meaningful to people. Interest groups can then see the connection between near-term improvements and longer-run plans.

Particular attention should be given to defining a broad enough study area so as not to exclude any areas that may be directly impacted by the alternatives under study. The definition of a corridor should not be fixed, but should be subject to change depending on the alternatives being considered. A wide range of alternatives might be specified initially and narrowed down as the study proceeds.

Corridor or subarea studies facilitate a recycle or restudy of projects around which agreement has not coalesced. System plans can be reevaluated with regard to their community acceptability, and better estimates can be made within the corridor study of the community, environmental, and transportation service impacts of alternative actions. Similarly, a corridor study provides opportunity for early identification of "questionable" projects, and allows for revision of planning programs with a minimum of study investment or effort on detailed project development.

The goals for a subarea or corridor study should be to determine the range of alternatives for project studies, identify issues, and, if possible, reach agreement on a course of further studies. Outputs from subarea studies might include:

1. The range of alternatives for which detailed study and design is appropriate.
2. Agreement on the course of studies, including:
   (a) Procedures for and levels of involvement of agencies, officials, and citizens.
   (b) Design criteria or performance standards for project alternatives.
   (c) Tentative timing of future studies and of implementation.
   (d) Identification of impacts that must be given further study.
   (e) Development of programs to overcome adverse community and environmental impacts.
3. Revisions to the alternative sequences of improvements being considered at the system level, if options are deleted during the corridor study.

Changes in certain institutional arrangements and technical capabilities may be desirable in some states in order to realize the full potential of a subarea or corridor study. Constraints exist at both the state and federal levels on the types of studies, as well as projects, that can be funded. States and the modal administrations within the U.S. Department of Transportation should work together to arrange for more comprehensive and more flexible funding packages.

In addition, effective subarea studies require the use of staff from system and project planning as well as from the environmental and other units within an agency. Such skill requirements may necessitate shared personnel and new staffing policies, as discussed in the earlier section on "Process Management," to achieve the objectives of subarea studies.

Finally, the available analysis tools should permit a broad range of alternatives to be examined relatively quickly and without the extensive data requirements of existing urban transportation planning approaches.

INSTITUTIONAL ARRANGEMENTS AND DECISION-MAKING

The Context of Transportation Decision-Making

This section is concerned with the ways in which the multiple and sometimes competing or conflicting viewpoints of national, statewide, regional, and local interests are resolved through the decision-making process of transportation organizations. Both the procedures for making decisions and the institutional or structural responsibility for decisions are examined.

The orientation of the discussion is toward formal decisions; for example, the decision on the type of transportation project to be planned or on a particular location for a facility. This is not intended to either ignore or downplay the importance of the numerous informal decisions, however. Although major formal decisions may be made officially by a chief administrative officer (or in some cases by an elected official), such decisions are based on input from project staff. In the course of their day-to-day work activities, project staff also make an enormous number of important decisions that in large part determine the nature of the project or program ultimately proposed. The thrust of the recommendations is to increase and explicitly recognize the decision-making authority of those involved in and affected by transportation studies.

Institutions at all levels of government are experiencing major changes in the manner in which transportation decisions are reached. Most large metropolitan areas have made progress toward development of comprehensive planning and decision-making institutions. Many states, both urban and rural, have moved toward creation of regional planning councils, in some instances blanketing the whole state. Federal laws and regulations have had numerous major effects on state and local institutional arrangements, from changing the amount of funding available for various types of planning and projects to modifying the locus of decision-making responsibility in some endeavors. Changes also are occurring in response to changing needs and priorities regarding transportation and the allocation of resources, and as part of a natural evolution of both national and local political traditions.

Institutional restructuring is most evident in the highly urbanized states, and it is there where it seems most needed in order to give fuller recognition to the complexity of interests at all levels of government. But major institutional change often is slow in coming and almost always is controversial. It also should be recognized that such major changes do not always have the desired effects; modest procedural changes may accomplish significant (and sometimes better) results.

Given the size and complexity of the United States, diversity in institutional arrangements is to be expected; but three general trends are clear. First, responsibility for transportation is being redistributed, with regional and local levels of government having increased responsibility for over-all transportation planning and decision-making and with the state level assuming a larger role in transit decisions (formerly a predominantly local function). Second, interests outside the immediate domain of transportation (for example, a state department of natural resources) are being given larger roles in transportation planning. Third, elected political officials, and even the judicial branch, are playing increasingly strong decision-making roles. Thus, many more officials, agencies, and interests now have some either formal or informal decision-making responsibility. Unfortunately, the result of these changes too frequently is a decision process that is complex, confusing, and even indecisive.

It is well recognized that all levels of government have a legitimate interest in transportation decisions. The difficulty is in determining the appropriate mix of local, regional, state, and national responsibilities in decision-making. For example, although there are practical reasons for placing responsibility for regional and local area transportation planning with institutions at the corresponding levels of government, there are legitimate state and national interests that need to be taken into account in making decisions. This is because the effects of transportation projects, especially major projects, rarely are limited to their immediate geographic boundaries. For example, the economic benefits of a major facility may be felt throughout the state; similarly, adverse effects (such as air pollution) may have regional implications.

The challenge is to reach an appropriate balance between national, statewide, and regional concerns and the objectives of the affected subcommunities. These subcommunities cannot be viewed merely as parts of a broader community; quite commonly, the interests of the larger community and of individual subcommunities are in fact inconsistent. A common situation finds the statewide or regional community concerned with a transportation facility's potential for increasing mobility, encouraging and aiding economic development, or providing access to some area of interest. To the smaller community through which such a facility may pass these broad objectives may be of relatively little concern in comparison with more local objectives, such as preservation of the viability of neighborhoods or maintenance of customary amenities. As another example, local interests may find a proposed facility to be of great benefit because of the economic development that is likely to ensue, whereas regional groups may wish to preserve existing land uses. This situation has arisen, for instance, where the proposal in question would lead to commercial development of rural or wilderness areas. A third situation that occurs with some regularity is competition among interests over whose favored projects will be implemented, and when.

It is fully recognized that different political cultures require different decision-making procedures and institutional arrangements. Even so, three broad needs can and should be met, as follows:

1. The need for clarity of decision-making authority. Often, what institution has this authority depends on the type of project being considered and on what effects are expected. In some cases, authority is shared by several institutions. All concerned must understand who has authority for decisions, when, and under what circumstances.
2. The need for timely public access to decision-makers and the decision-making process. The points of access should be clear, and should be readily available to all concerned. In addition, equality of access is crucial; people must see that they have as much access to decision-makers, and that their input receives as much consideration, as anyone else's.
3. The need for a clearly defined process of appeal of transportation decisions. Appeals may be made, of course, through political channels to higher authority and through legal channels to the courts. Of primary concern here, however, is the process through which parties may request and set into motion review and evaluation of decisions within the organization or set of organizations that made the original choices.

Institutional Arrangements

This section examines some of the problems in institutional arrangements and discusses several changes that may increase the social and environmental capabilities in transportation planning and decision making.

Evolution of Transportation Institutions

It is instructive to review the evolution of transportation institutional relationships at the state, regional, and local levels, because many of the issues of concern in this section stem from these relationships.

It has been only a few decades since state highway departments were concerned almost exclusively with rural, intercity roads; it was there that the needs were greatest. Indeed, in the early years of federal aid to highways, federal funds could be used only in rural and low-density areas. Urban roads were the responsibility of local jurisdictions; transit was privately owned and operated.

In the 1920's and 1930's, and again following World War II, private transit firms in a number of areas went bankrupt. Because there was no tradition of federal or state responsibility, or any apparent interest in transit, there were but two outcomes: either transit service ceased, or the local communities assumed ownership. In the latter instances, transit operations characteristically were placed under metropolitan authorities. In many areas, of course, private transit com-

panies maintained their viability, sometimes with local government subsidies.

With the passage of the several post-war federal-aid highway acts, and in particular with the creation of the Interstate System in 1956, the states and federal government assumed responsibility for major urban highways. The authority of local governments and agencies varied from state to state, primarily depending on state laws and traditions.

In the 1960's, federal legislation strengthened the local role in highway planning, particularly through the requirement that highway projects in metropolitan areas be based on a continuing comprehensive transportation planning process carried on cooperatively by states and local communities. Requirements for citizen participation also expanded during this period.

Meanwhile, because of increasing fiscal problems, transit operations succeeded in getting federal and in some cases state support. Some states have created departments of transportation with comprehensive multi-modal responsibilities; in other states, transit planning functions remain at the local level, with some state responsibility for pass-through funding. Recent federal regulations calling for annual unified work programs for highway, mass transit, and airport intermodal planning in metropolitan areas, and permitting funds originally designated for Interstate construction to be switched to transit, complete the picture. Thus, today the typical institutional structure for transportation gives some authority, or at least influence, over transportation decisions to each level of government. Often, however, this makes it difficult to carry out coordinated, multi-modal planning, because responsibilities for different modes and for different stages of planning or different types of decisions for one mode rest with separate institutions at different levels of government. For example, in some urban areas a local authority is responsible for transit, a 3-C agency is responsible for system-level highway decisions, and a state highway commission is responsible for highway project decisions.

Fragmentation of responsibility also can make it difficult for interest groups to understand who makes decisions, where the points of access are (how to make input), and how to appeal decisions. It is not unusual, for example, for people to direct transit questions to a state agency with little or no authority to consider transit. Too often, confusion over who has what responsibilities works against public confidence in the transportation planning process.

Similarly, for the transportation planner the apparent simplicity of the system within which he or she operates—e.g., in a state highway agency with what appears to be clear authority—turns out to be illusory. The seemingly clear lines of authority lead to decision-makers who often do not have the capacity to make their decisions stick due to the intervention of numerous other political actors at the state and local levels who share in the real authority. Thus, planning takes place in a context without adequate guidelines, with unknown ultimate processes of decision-making, and with a resultant lack of confidence that the proposals made by staff in good conscience can be carried out.

It seems clear that it is beneficial to both the community within which planning is taking place and the staff that is conducting the planning to clarify the processes through which decisions are made and to provide clear guidelines for the planning process itself. The planning process must be defined as not only a technical process but also a process of interactions with all the relevant parties who have legitimate interest in that process. Only through such a clarification can planning have any political reality.

Current Changes in Transportation Institutional Relationships

Over the past decade, a number of states have made major changes in their transportation institutions. The two most common of these changes—the creation of state departments of transportation and the strengthening of regional planning authorities—are discussed in the following.

1. Many states have created *departments of transportation* with multi-modal perspective. However, there is a great deal of variation among the states in the extent to which the state DOT plans and implements nonhighway modes. For example, some state DOTs have transit responsibility; others have it in some communities but not in others (usually the larger cities) where long-established transit authorities retain primary planning and implementing responsibilities; still others act primarily as a coordinating and funding channel.

Regardless of their precise responsibilities, state DOTs can make coordination among modes and consideration of a wider range of alternatives easier. There have been problems, however. Often, the DOT acts as an umbrella organization under which previously independent modal agencies have been placed, and project planning is still carried out within these modal agencies just as before, with many of the same constraints on reconsideration of decisions and investigation of options involving other modes. A number of states are attempting to overcome the resulting difficulties through procedural changes, such as setting up study teams with personnel from the different groups.

2. Many states have placed increased responsibility for transportation planning with *regional planning agencies and councils of government.* Because these institutions usually have land-use planning responsibilities, they often are better able to coordinate transportation and other developments and services than the state level, where land-use and general area-wide planning traditionally has been limited. A few states have addressed this need from the opposite direction, establishing state-level planning agencies with responsibilities for evaluating the compatibility of proposed actions with a state development plan, which usually is based on a compilation of regional plans.

Regional and metropolitan agencies not infrequently are rather weak and ineffective, however. There are a number of reasons for this: neither the states nor the municipalities and counties are eager to turn over to regional or metropolitan organizations responsibilities that they have formerly shared, nor are they eager to strengthen these agencies so that they may become a threat to state and local authority; municipalities often feel that they can achieve their objectives better by direct relations with the "known quantity" of the state, rather than with the unknown potential of the re-

gional institution; and private interests often fear metropolitan institutions because they may impose restrictions on their freedom of action, particularly with respect to land development.

In those states with state-level planning agencies confusion has sometimes arisen over the scope of jurisdiction and decision authority of the general planning agency and program-oriented agencies (i.e., transportation, housing, and economic development agencies). In particular, there has been uncertainty over which agency has the final say when disagreements arise. Again, clarification of procedural arrangements seems to be the solution to these difficulties, rather than further institutional change.

It can be seen that changing institutional arrangements, whether by developing new institutions or by broadening or spreading about the authority of existing institutions, will not necessarily improve decision-making clarity, responsiveness, or effectiveness unless there are clear boundaries of authority, guidelines for operation, and procedures for the resolution of conflict. Merely piling up new institutions on top of old ones without, for the most part, redistributing authority is unlikely to bring about the desired results. Institutional change must be accompanied by a thorough analysis of procedures.

Decision-Making Process

The previous section looked at the question of what institutions have transportation responsibilities and how those institutions are structured. This section examines what decision-making responsibilities are assigned to these institutions and how assignments of responsibility affect the clarity of, and accessibility to, the decision-making process and the availability of channels for appeal of decisions.

The availability of professional expertise is a factor that to a considerable extent will govern the allocation of responsibilities for transportation planning and decision-making. In states with no major metropolitan areas, the state may be the sole source of expertise in the disciplines needed for transportation planning and implementation. Thus, the state must assume most of the responsibility for studies. When expertise is available at the metropolitan or regional level, the state may share or delegate significant areas of responsibility. Very large urban areas may well have more personnel resources than the state, in which case the state may choose to delegate major responsibility to the urban or metropolitan area.

Of course, another approach may be taken: rather than allocating responsibility with resource availability treated as a given, the state might determine where it wishes to place responsibility and then ensure that the requisite resources are provided.

The key objective is to assign decision-making responsibilities so that there are adequate forums for consideration of local, regional, state, and national interests, with a means of resolving differences so that conclusive decisions can result. Creating a decisive process that at the same time allows for ready access by all interests requires careful balancing.

Clarifying Points of Access to Decision-Making

The complexity of governments and agencies involved in transportation planning almost automatically leads to multiple access points to the decision-making process. In many ways this is desirable, because it tends to ensure that all interests will be able to have a meaningful influence on transportation plans. However, it is not uncommon for multiple access points to create ambiguity about who the decision-makers are and in turn for this ambiguity to lead to confusion and hard feelings. For example, it is not uncommon for people to direct questions about local streets to the state highway department, when that responsibility rests with local jurisdictions; or to ask project staff members to make firm commitments, when only the head of the agency can do so. When people do not understand where to make their inputs and misdirect their inquiries and requests, or ask for actions that are beyond the agency's authority, rightfully or not they may lose confidence in the agency. Thus, clarifying points of access both prevents loss of information and wasted time and helps maintain the agency's credibility.

The solution is not to reduce the number of access points, but to develop clear and orderly procedures through which interested parties can have input into decisions. The foremost need is for the agency to make very clear, throughout the planning process, what it can and cannot do and how people can get involved.

Where responsibility for decisions is assigned has a major effect on the accessibility of the decision process. Two models are discussed in the following.

Local or Regional Responsibility.—One procedure for clarifying points of access to decision-makers is to assign decision-making responsibilities to the lowest appropriate level of government (Fig. 28). For example, if the effects of a project under consideration are generally confined to a particular local jurisdiction (municipal, metropolitan, or regional) the state might designate local officials to make the decisions on the project and to handle inputs. The state might lay down certain "ground rules" or limitations on the local jurisdiction's scope of authority, to insure that statewide and national interests are given due recognition and that minority rights are safeguarded.

The state would not totally relinquish its decision-making authority. Indeed, by exercising its authority to lay down guidelines for decisions the state would have a significant influence; and it still would have the final formal decision. In most cases, however, it would accept the decision reached at the lower level of government.

Assignment of responsibility to the lowest appropriate level of government, with limitations designed to protect other interests, increases accessibility to decision-makers in several ways. Most simply, the local governments and agencies are closer to the people affected; geographic distances are reduced, making contact easier, and in most cases local decision-makers will be more familiar with issues and problems of the area. In addition, the number of decision-makers is reduced, so it is easier to make clear who is making what decisions.

The local responsibility model for citizen access has sev-

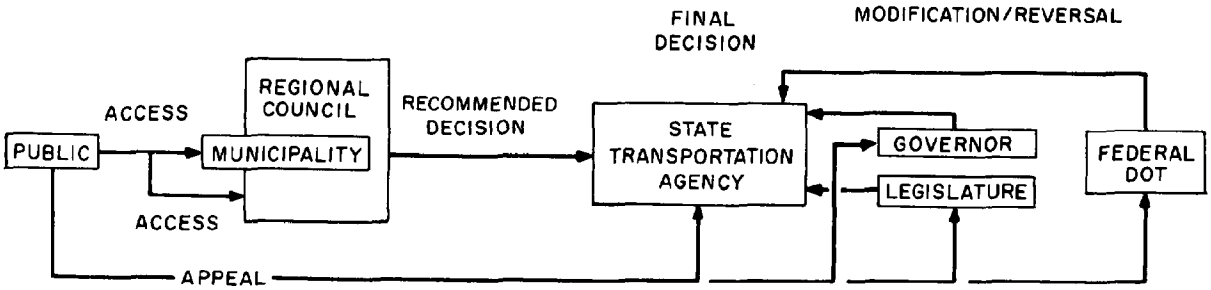


Figure 28. Access patterns with local or regional responsibility.

eral built-in "appeals" channels. Groups that are dissatisfied with the decision made at the local level still may appeal to the state, which ordinarily will have the final formal decision. Further, because state agency decision is not necessarily "final" in a political sense, appeals may also be made above to the governor and to the legislature, and even to the federal government (FHWA, DOT, Congress) or the courts.

In several states current procedures are quite compatible with this model. For instance, in some states a local veto power exists by law. Also, in several states, both urban and rural, regional planning authorities have major transportation decision-making responsibilities. The major difference between most of these current procedures and the model proposed herein is that the latter explicitly recognizes the local levels as the basic access point.

Availability of resources for transportation planning at the local levels is a major determinant of the feasibility of the local responsibility model. In general, the local levels have neither the expertise nor the funding to carry out comprehensive transportation planning at the present time. The alternatives are for the state to fund local-level planning efforts (including the hiring of needed personnel at those levels) or for the state to carry out the studies itself, while allowing decisions to be made at the local levels.

State Responsibility.—Most transportation agencies have retained decision-making responsibilities at the state level. A major difference among these agencies is whether planning functions are carried out in a central headquarters or in district offices. There is a tradeoff here: district offices are closer to the project site, and thus to many of the affected interests, than are centralized offices, and so there is greater access to the day-to-day planning activities. But because the final decisions are usually made in the state offices, the district office organization has more potential points of access than the centralized planning organization and requires a more complicated decision process. Placing responsibility at the district level also necessitates making a wide range of expertise available at each district office.

Under either organizational form, the state agency can do much to increase the clarity of its decision-making process and to ensure equality of access. A number of states have taken steps to overcome the problem of geographic distances; some have set up telephone "hot lines" where comments and inquiries can be directed; others are expanding district maintenance offices to handle citizen requests.

Strong state authority over transportation decisions is not incompatible with strengthening local institutions. In fact, in many of the states where strong metropolitan and regional institutions are evolving there appears to be a complementary growth in state capabilities and in state sensitivity to urban and regional issues, and a constructive partnership among state and local agencies is developing.

State agencies that retain decision-making responsibilities may take advantage of the points of access to municipal and regional institutions in conducting studies. For example, participation programs might be set up under the auspices of the local institutions, or in cooperation with them, even perhaps using their facilities as the study field office. This does not mean that participation is limited to, or channeled through, local officials, but that the existing communications channels at the local levels are utilized and enhanced.

State agencies need to give careful attention to the issue of equality of access. In a number of highway controversies, some elements of the public have felt that they in effect were denied access to the decision-makers with the formal power to approve a proposed facility (the state highway commission). In some cases, the formal decision-maker did not recognize concerns about nontransportation aspects of a proposal, or even suggestions for alternative transportation plans, as "legitimate" interests. In others the formal decision-maker was too far away to be accessible and in still others simply did not have the necessary communications apparatus to be adequately informed of the seriousness of the opposition. Given these circumstances, it is no wonder that these groups turned to decision-makers to whom they did have access: local officials, the governor, or the legislature. Although those officials usually did not have the power to actually approve a freeway, they did have either the formal or the informal political power to prevent its approval. Clearly, the situation where certain interests believe they have less access to decision-makers than other interests is to be avoided.

Someone in the agency who is viewed as representing environmental interests must be directly accessible and clearly influential in decision-making. An obvious candidate is the social and environmental unit.

Another potential location, though outside the state transportation agency, would be a state planning agency, environmental agency, or a department of community affairs. To be the key access point, representatives of such agencies

should either be authorized to be in charge of community involvement or at least participate actively to stand guard over the interests of public groups. They must have the resources available to handle these increased responsibilities and, in addition, must be provided with day-to-day participation in all levels of decision-making.

Appeals Procedures

Appeals procedures allow concerned parties to initiate a reconsideration of decisions. All transportation decision processes allow for formal or informal appeals, but often the procedures for appeal are unclear or are not publicized. In some cases, problems or disagreements that could have been resolved through agency appeals have developed into controversies, with appeals made to political authorities, in part because the appeals procedure within the agency was unduly constrained or unclear. It is recommended that all agencies develop explicit procedures for reconsideration of decisions and make these procedures readily accessible.

In some other societies, the right of appeal within the regular political system has been institutionalized more fully than in the United States. For example, the "ombudsman" idea has captured the fancy of some nations. In Ontario, Canada, a body known as the Ontario Municipal Board has been in existence for many years and has evolved into a sort of administrative court to which citizens may appeal. The Board's decisions are subject to reversal only by the Ontario government cabinet, which is viewed as the last appeal within the political system, other than the courts. Also, the constitutional separation of powers, as in the United States, would be difficult to duplicate.

In some states the existence of a local veto power over highway decisions may result in an informal appeals process. In others, citizens have the right to appeal to a state highway commission (e.g., California) in an effort to reverse or modify the actions of the highway agency. Although this has provided a needed option in many cases, it is limited by the fact that the highway commission's perspective is still usually restricted to highway concerns. In contrast, the Ontario Municipal Board has the power to deal with a wide range of issues, including essentially all types of public works questions involving the taking of private property by condemnation and planning decisions affecting private property.

One possible appeal procedure is to establish an agency with over-all state responsibility (i.e., dealing with all state agencies) to which appeals might be made. This would seem more appropriate within the executive than the legislative branch of government, and would provide an additional input to the governor to consider along with the official position of the relevant agency or agencies.

Case Examples

Several states and metropolitan areas throughout the country are moving in the direction of the recommended institutional arrangements. This section examines several specific situations in more depth. Primary attention is devoted to Atlanta, Ga., and the relationship between the Atlanta Regional Commission and the Georgia Department of Transportation, a typical situation that illustrates many of the points discussed in the foregoing. To provide a perspective for the Atlanta discussion, four other areas are then examined more briefly: California; Miami-Dade County, Fla.; Minneapolis-St. Paul, Minn.; and Baltimore, Md.

Atlanta, Georgia

Institutional structure.—The Atlanta Regional Commission (ARC) is governed by a 31-member board. Sixteen represent the seven member counties and the City of Atlanta; these 16 choose the other 15 members from districts that are not coincident with municipal or county boundaries.

The ARC is charged with development of a metropolitan land-use plan, but it is not an implementing agency. Other agencies are required to submit their plans to ARC for its review. The ARC determines whether the plans are consistent with its "development guide" and may recommend changes. The ARC also has the A-95 review powers for federal agencies.

ARC's comments and recommendations must be submitted with applications to federal and state agencies. Thus, any negative ARC comments may act as a constraint; positive comments may provide an impetus. However, there is no "ultimate authority" to resolve disagreements between ARC and one of its constituent jurisdictions or an independent regional operating agency.

Transportation Decision-Making.—The ARC has transportation planning powers that operate through a committee system involving ARC, the Georgia Department of Transportation, and the Metropolitan Atlanta Rapid Transit Authority (MARTA) (Fig. 29). Although authority for regional planning resides with the ARC, Georgia DOT has legal authority to develop

> . . . in conjunction with affected local governmental bodies, regional planning agencies, and other appropriate State and Federal agencies. . .
> (A) A comprehensive, statewide, 20-year transportation plan;
> (B) A comprehensive transportation plan for all standard metropolitan areas and those areas which the department determines, based upon population projections, will become a standard metropolitan area within 20 years, such plan to supplement and be compatible with the statewide transportation plan; and
> (C) Comprehensive plans for regions and urban areas as such plans are deemed necessary by the department. . .

A transportation planning division is located under the Department of Community Development Planning (DCDP), the ARC staff unit responsible for community planning, housing, economic development, and transportation planning. The DCDP has an overseeing committee of ARC commissioners known as the Community Development Liaison Committee. This overseeing committee, in turn, has under it the Atlanta Regional Transportation Planning Program (ARTPP). The ARTPP has three advisory subcommittees. The first, the Transportation Policy Subcommittee, consists of the chairmen of seven counties' commissions, the mayor of the City of Atlanta, the chairmen of the Boards of ARC and MARTA, and a member

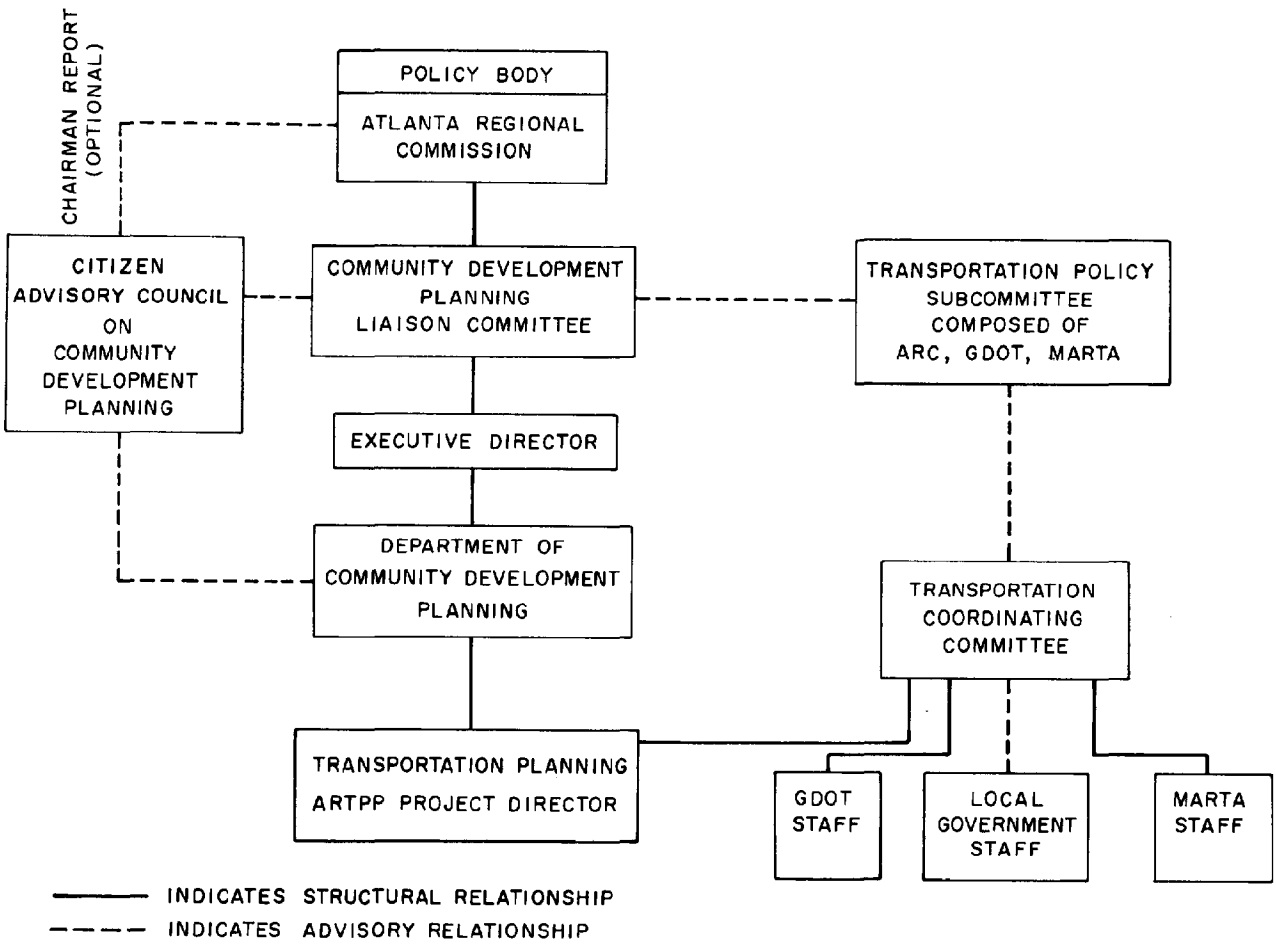


Figure 29. Organizational chart for Atlanta Regional Commission transportation planning program.

from the DOT Commission representing the Atlanta area. The second subcommittee is the Transportation Coordinating Committee, consisting of the Chief Transportation Planner of the ARC, the Director of Planning for MARTA, and the Chief of the Georgia DOT Atlanta Area Transportation Planning Branch. The third subcommittee is the Citizen Advisory Council on Community Development Planning.

Most policy questions are first discussed in the Policy Sub-Committee then submitted to the Advisory Council on Community Development Planning and in turn to the ARC itself for final determination.

It should be evident that this is an especially complex institutional structure. Although ARC has the formal power to make transportation planning decisions, implementation requires at least "no opposition," and usually consensus, among the three agencies and affected jurisdictions.

ARC can plan, but can't implement. On the other hand, Georgia DOT and MARTA would be constrained from implementing without ARC approval. No significant conflicts have yet arisen among these three agencies; therefore, it is difficult to say what, in fact, the real powers of the ARC are *vis-a-vis* these other agencies.

Access.—In their observation of Atlanta's West Side corridor study, the researchers found that the institutional complexity resulted in some confusion on the part of the public as to how to gain access to and influence that process. The early "study design" phase was almost wholly in the hands of the Technical Coordinating Committee. Principal leadership was assumed by Georgia DOT, which assigned a full-time staff to the study; ARC participated quite actively through two of its transportation staff members; MARTA assigned one staff member. Atlanta University staff also were part of the core group, which was augmented by representatives from the cities in which the corridor is located—Atlanta, College Park, and East Point.

Under the structure devised by the responsible agencies, public access might occur in several ways. The way chosen by the agencies was through the Technical Coordinating Committee (Fig. 30). A second alternative would have been to revitalize the Citizen's Transportation Advisory Task Force, established to provide citizen input into transit planning but largely defunct since the MARTA plan was approved by the voters. (This task force has since been replaced by a Citizen's Advisory Council.) Another alternative might have been to work through the municipality.

An Atlanta city councilman presumably could be contacted and, if persuaded, could use his influence on the Atlanta ARC representatives who, if responsive, could then influence discussions being held at the staff level. However, such an approach is rather remote, given the way planning is handled within the ARC structure.

Operation.—One problem that arose at neighborhood public meetings was that it was difficult for the technical staff to answer questions involving future policies that had not yet been confronted by agency heads themselves. This suggests a lack of clarity in the planning process between staff work and policy-making and points out the importance of a continuous flow of information and policy guidance between the staff and policy levels. There is a similar need for continued interaction between the metropolitan policy-makers and the responsible elected municipal officials.

Four Interests.—The Atlanta situation illustrates the institutional questions very well. Three levels of government have a direct interest and concern with the planning of the Westside area. The transportation corridor is largely within the city of Atlanta and, given the potential impact of possible new facilities, the study is obviously a matter of great interest to the city. Also, the city of Atlanta has most of the existing authority to obtain federal funds for any community programs that may be developed in association with a new transportation facility. To the extent that any government is responsible for social action and redevelopment programs in this area, it is the city.

The Atlanta Regional Commission is concerned because any major transportation facilities constructed in this large subarea will affect not only transportation movement throughout the urban area but also land use, economic development, the housing market, and so on. The city obviously shares these concerns.

The Metropolitan Atlanta Rapid Transit Authority concern is that the outcome of the study might well emphasize transit or at least affect transit use. MARTA can probably be responsive to bus transit, but if additional rapid transit extensions are suggested, MARTA would be placed in a difficult financial situation because it is fully occupied with its present long-range plans, for which financing is already available and committed to specific facilities.

Georgia DOT's interest grows out of the fact that it has statutory responsibility to develop comprehensive transportation plans and in conjunction with the ARC and MARTA participates in long-range transportation planning.

None of these four interests can be solely responsible for the kind of program that is envisioned in the Westside area; indeed, all of them must participate cooperatively to achieve a meaningful, coordinated program. Each level of government might be said to have an effective veto power. Further, no interest has a monopoly of qualified staff which, were it the case, might force a distribution of authority for purely practical reasons. Georgia DOT staff for urban system planning in the Atlanta area is relatively small (three or four professionals), making it equivalent to that of ARC and the city.

Given these facts, and despite the constitutional authority of Georgia DOT with respect to transportation planning, it may be desirable to turn more of the transportation system policy responsibility over to ARC, with the full participation of the City of Atlanta. When a freeway project reaches the location and design phase, the DOT should be called on to participate through its technical staff, providing services to the regional and city policy makers.

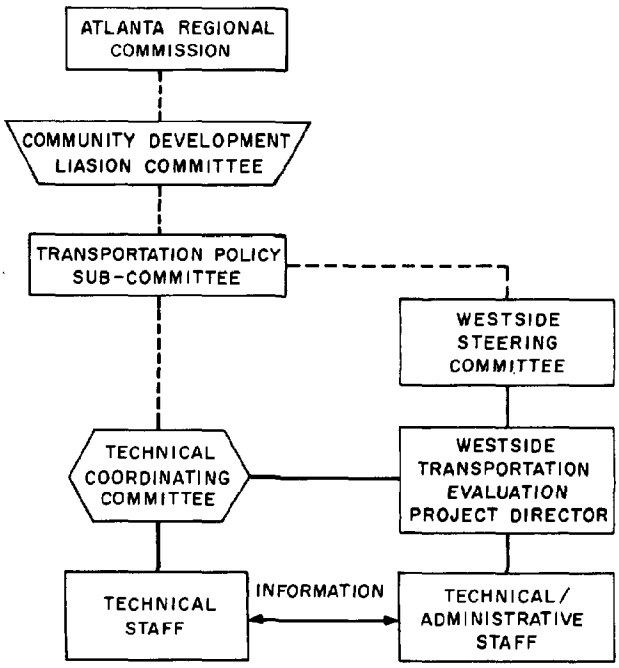


Figure 30. Relationship of Atlanta Westside transportation evaluation organization to the Atlanta Regional Commission.

California

Under the mandate of a recent California law (Assembly Bill 69) creating the California Department of Transportation, a new set of institutional arrangements and procedures for state and regional transportation planning is emerging. A primary goal of the changes is delegation of transportation decision-making to the regional level to increase responsiveness to local interests. To accomplish this, the law mandates development of regional planning processes to be tied into development of a state plan by 1976. As a result, the California Department of Transportation is moving to establish closer working relationships with the regions. Three examples of the emerging institutional arrangements and procedures are described briefly in the following.

The State Transportation Board.—The State Transportation Board consists of 9 members, 7 governor-appointed public members and one each from the state senate and assembly (the latter are nonvoting). In theory, the Board with its own small staff is independent of the Department of Transportation; in fact, however, it relies heavily on the Department's staff for much information. Its two primary roles involve allocation of funds to regional planning agencies from a newly created State Transportation Planning and Research Account and adoption and revision of the state transportation plan, including review of annual capi-

tal budgets for consistency with the state plan. In line with this latter role, the Board has approved comprehensive guidelines for development of regional plans by the regional agencies.

The Department of Transportation is responsible for monitoring development of regional plans and pulling them together, intact whenever possible, into a state plan to be presented to the Board. The Department will identify issues of statewide significance (e.g., provision for interregional travel or the preservation of Class A farmland) in order that they may have a major impact on regional plans at an early stage. Where statewide issues are not addressed, the Department may develop alternatives to the regional plans and present both the regional plans and state alternative to the State Transportation Board for a decision.

The Board must resolve conflicts between state and regional interests and approve a state plan that is consistent with the state transportation goals and objectives adopted by the legislature. Prior to approving a plan the Board must hold public hearings, providing an opportunity for discussions with various interest groups throughout the state. Although the precise role played by the Board in resolving these conflicts has not been completely defined, the Board provides a forum for consideration of local, regional, and state interests in approval of the state transportation plan.

The Regional Planning Process.—Assembly Bill 69 delegates responsibility for development of regional transportation plans to regional agencies. In some cases, however, those agencies have specifically requested that the corresponding state transportation district office perform the staff work to develop the plans. Generally, these agencies take the form of Councils of Governments (COG's) or local Transportation Commissions (LTC's; committees of local political representatives and transportation operating agencies). Both the COG's and LTC's include Transportation Policy Committees and Technical Coordinating Committees similar to those in Atlanta.

Plans developed by the regional agencies are to be multimodal and responsive to the range of the region's needs and desires. Regional plans are to incorporate, to the extent possible, local transportation plans and are to be developed in an open participatory process. Once adopted by a COG or LTC and the State Transportation Board, regional plans are to be adhered to by the California Highway Commission in setting priorities for highway improvement. Although not explicitly mandated by state legislation, it is expected that federal regulations and the inclusion of local and regional transit agencies in the plan development process will encourage the transit implementation agencies to adhere to the plan as well. Various proposals that would require conformance to the plan during implementation are now under consideration by the state legislature.

In addition to the COG's and LTC's, the state legislature has created two statutory regional agencies, the Metropolitan Transportation Commission (MTC) in the San Francisco Bay area and the Tahoe Area Regional Planning Agency (TARPA). The MTC has strong powers over transportation planning and implementation decisions of all agencies involved in the process, including the California Department of Transportation. Agreements have been worked out with the Department's district office and the Association of Bay Area Governments (ABAG) confirming these powers; in addition, it has been agreed that the MTC will carry out its duties in accord with the long-range land-use development plans of the ABAG. Although one might question the desirability of having a separate agency dealing with transportation alone, the arrangements with the other agencies in the region and the relative strength of the MTC (as compared to a COG or LTC) offer opportunities for close coordination of transportation planning and implementation in all modes. TARPA, unlike MTC, is a multipurpose and bistate (Nevada and California) planning agency with a mandate to guide the future development of the Lake Tahoe Basin. TARPA will develop the regional transportation plan for the basin in conjunction with the rest of their planning efforts.

The Revised Highway Priority-Setting Process.—Ultimately, priorities for state highway improvements will be guided by the adopted regional plans, with each regional agency having strong inputs (if not final decision authority) concerning what priorities are actually set. Prior to adoption of those plans, officials in the State Department of Transportation, Division of Highways, have initiated a cooperative priority-setting process that attempts to bring the COG's more directly into the decision-making process. The key elements of the process are: (1) a *technical priority list* is developed by the district from a list of projects generally thought to be "buildable" and based on user benefit criteria such as time and accident savings; (2) this list is *modified for specific environmental and community preference factors* by the COG's and the districts; and (3) this "ideal" list is then *adjusted for financial constraints* (geographic minimums, funding categories, etc.) by the district. Although not fully delegating decision-making to the regional agencies, the new priority-setting process represents a first step toward careful coordination of important implementation decisions with the regions. Naturally, the actual process is not carried out in a strict sequence of steps but the activities listed are cycled through a number of times as an agreed upon set of priorities is negotiated.

Miami-Dade County, Florida

Miami-Dade County is almost a metropolitan government. The county has home rule authority, and certain duties (including responsibility for transportation and traffic) have been transferred to it from the municipalities. Except for repairs and maintenance of local streets, the municipalities play no significant role in transportation planning and programs. Transit responsibilities, for instance, are fully within the powers of the county. Thus, the county is a primary focus for multimodal transportation planning.

The state of Florida has not relinquished its powers over highway planning and programs, though as a practical matter highways are planned jointly by the state and county and each has an effective veto over the other.

A limitation on effective regional planning is that Dade County does not encompass the entire urban area and the institutions and processes available for planning of the total

three-county urban area are extremely weak and ineffective. Furthermore, Dade County has little effective control over local development.

Minneapolis-St. Paul, Minnesota

The Minneapolis-St. Paul "Twin Cities" have evolved important new institutions to deal with regional problems. The Metro Council, established in 1971, has members appointed by the governor from districts unrelated to municipal boundaries.

Although the Council has rather strong powers over transportation planning and programs, it still has some severe limitations. Highways remain a responsibility of the state and plans are jointly developed between the state and the urban area.

The present situation with respect to transit planning is ambiguous; both the Council and the Metropolitan Transit Authority have been given long-range planning powers over other regional agencies, but not veto power. Each has developed its own independent transportation plans: the MTA plan calls for rail rapid transit; the Council plan emphasizes exclusive busways. The two agencies have been unable to iron out their differences and the question is now before the legislature for settlement. It is hoped that the legislature will settle not only the substantive dispute, but also the ambiguities in the legislation.

The Metro Council has relatively little power over land use in the municipalities. The Council has the A-95 review powers and also the power to review all new zoning ordinances and subdivision plans of the municipalities, but it cannot exercise effective land-use controls. Thus, as in Miami, there is a reasonably effective capability to assure that transportation plans are consistent with land-use plans, but there is little capacity to actually effectuate those land-use plans.

Baltimore, Maryland

The formal arrangement of institutions in the Baltimore area is very different from Atlanta, California, Miami, or Minneapolis-St. Paul. Here, all the major transportation organizations have been lifted to the state level and placed in the Maryland Department of Transportation. Both highways and transit for the Baltimore region are planned and administered by Maryland DOT. Baltimore does have a Regional Planning Council with broad planning authority but, as usual, with a lack of authority to implement those plans. The RPC and the state DOT appear to have worked rather well together in the development of the Baltimore area rapid transit plan and in freeway planning as well, though the seeds of controversy still exist.

The logic of state control over transportation in Maryland derives from the small size of the state and the dominant role that the Baltimore area plays within the state. Therefore, this is not a model that easily can be translated to most other states.

CHAPTER FIVE

IMPLEMENTATION AND APPLICATION EXPERIENCE

IMPLEMENTATION

The Accomplishment of Change

This report presents procedures, techniques, and organizational forms for increasing transportation agencies' effectiveness in dealing with social and environmental factors. A number of these methods can be adopted with little difficulty and, in fact, are the current practice in several states. However, the over-all approach to transportation planning recommended in this report may require major changes in policies, work styles, and institutional arrangements. Such changes necessarily are complex, and their implementation requires careful planning; a coordinated sequence of changes in training, policy, and practice executed over a period of time is needed. Indeed, the process of implementing changes may be as important as the changes themselves.

Determining that a particular change is desirable may be considerably easier than determining how to bring about that change. Especially when a major change is proposed, there usually will be far-reaching consequences that must be identified and planned for. Even with careful planning, any major change may raise issues that were not readily foreseeable at the beginning of the implementation process. Thus, there is a need for periodic evaluation of the change strategy and of the change itself, with revision as necessary. When implementation is complete, monitoring may be desirable both to assess the change and to see whether it has had the expected results.

The experience of a number of states in implementing the requirement for a systematic interdisciplinary approach is instructive. Although there is a general consensus that agencies need personnel from the natural and social science disciplines in addition to engineering personnel, many states have discovered that meeting this requirement involves a number of modifications to existing circumstances and that many complex and difficult choices must be made. Some

have found, for example, that state civil service regulations for employment in their agencies unduly limit salaries and promotional opportunities for professionals without engineering degrees. Other states have faced difficult questions of where in their organization interdisciplinary personnel should be placed to maximize their effectiveness—for instance, how to distribute personnel among district and headquarters offices and 3C organizations. Similarly, the states have had to choose among a number of options for providing interdisciplinary capabilities, from hiring new personnel to training existing staffs to utilizing the expertise of other agencies or consulting firms. And all states have had to contend with the issue of what role interdisciplinary staff should play in the decision-making process.

A number of lessons can be drawn from the states' experiences. First, major changes cannot be implemented instantaneously. It is important to analyze the interrelationships among different parts of an organization and among different policies and practices in order to develop a workable strategy for implementing change, and this takes time. Second, the strategy for change is heavily dependent on the organizations to be affected, and so must be developed for each target of change and for each change to be brought about. Third, the implementation of change is a learning process that is most likely to be effective when some flexibility and room for experiment is available.

Another factor that should be taken into consideration is the inherent tendency of organizations to limit, slow, or resist change. Indeed, the need for thorough assessment of the organization's inner workings stems largely from the necessity of identifying potential sources of resistance. Introduction of change can upset the equilibrium of the organization, and one of the objectives in developing an effective change strategy is to develop a new stability that incorporates the desired end.

Resistance to change is often beneficial, because it tends to bring out the full consequences of the proposed change and thus may protect the integrity of the organization. It is important, however, that resistance to change be identified explicitly, not only to aid the evaluation of proposed changes and to develop a strategy for change implementation, but also so that unfounded fears of the consequences of change can be laid to rest and reactions that might reduce the effectiveness of change can be avoided.

This shows the importance of broad-based participation in the development of change policies and strategies. Participation in designing organizational changes encourages the identification of potential problems, provides a better understanding of the short- and long-term benefits and costs of changing, and helps insure that the solution to the problem identified is practical. Another important benefit of participation in the development of change is that the people who will carry out the change will have a clear understanding of why the change is occurring and what it is intended to accomplish.

Simultaneous implementation of a number of changes introduces considerations in addition to those invoked by each individual change. Long-established policies and procedures provide stability and continuity and allow people in an organization to measure their achievements against precedent. When only one or two changes are introduced at a time, the general pattern of activity within the organization is relatively undisturbed. Thus, changes are more easily assimilated, and monitoring and controlling the change process is easier. However, introduction of a number of changes may so change the "rules" that uncertainty and confusion will ensue; not only is this disruptive, but also under such circumstances strong resistance is likely.

This is not to say that several changes cannot be implemented at the same time; in fact, some changes will be most effective when implemented together. Even so, simultaneous implementation of all of the recommendations of this report is not expected nor is it necessarily desirable.

Barriers to Change

A number of organizational and procedural barriers exist that work against change in general and, in particular, the introduction of increased environmental sensitivity within transportation agencies. These barriers must be overcome in implementing a new approach if the desired changes in attitudes and work styles are to be accomplished. Where the changes are fundamental, acceptance may be slow, indicating the real depth to which efforts must go to successfully bring about change within an agency.

There are attitudes and constraints within any organization which tend to inhibit innovation and experimentation and to encourage patterns that have worked well in the past, even in the face of signs that those patterns may not work well at present. The barriers to change identified are intended to be exemplary and are by no means comprehensive.

Inherent in Transportation Agency

Several characteristics of transportation agencies and of a transportation program itself may work against successful introduction of the kinds of changes proposed.

Assumptions That Decisions Are Final.—Procedures for review and reconsideration of earlier decisions are an integral component of the recommended approach. Although most highway agencies have learned through controversies that no decision is final until a project is actually constructed, in practice personnel often operate under the assumption that earlier decisions are fixed. The fact that a different unit, or even a different agency, may have made the earlier decisions makes this reluctance to reopen the issues understandable, as does the fact that the earlier decisions in all likelihood were the result of years of effort. The problem is that if such attitudes toward earlier decisions are maintained, any procedural requirements for reconsideration of earlier decisions will not be treated seriously and reconsideration will be perfunctory.

There is a great deal of ego involvement in any plan or design, and transportation personnel are not alone in measuring the success of their work by the amount of it that is adopted or put into effect. It is natural, then, that many individuals see their goal as getting plans accepted and projects built. However, in a process in which a large number of alternatives are considered with emphasis on social, economic, and environmental effects, and on the views of

the public, it is likely that questions about particular plans will be raised and that requests to reevaluate earlier decisions will be made, especially for those "pipeline" projects developed under a less environmentally sensitive process. These requests for further work or reconsideration of decisions should be viewed as a means of improving one's work rather than as criticisms of one's abilities and judgment.

If personnel assume that earlier decisions are not open to change, the range of alternatives to be considered will necessarily be limited. Furthermore, if requests for reevaluation are viewed as attacks on the competence of the planner, designer, or decision-maker, resistance to such requests will be likely. This could have the further effect of antagonizing those who made the request.

Existence of Adversary Roles.—Adversary roles can develop, or may already exist, between a transportation agency and other agencies or groups, or between personnel within a transportation agency. The existence of such roles works against the systematic consideration of social, economic, and environmental effects.

Adversary roles between an agency and outside groups may develop in the course of interaction or in many instances may already be in existence. If personnel feel threatened or under attack when outsiders criticize their procedures or work, they may develop elaborate defense mechanisms such as denigrating their "opposition," disregarding outsiders' comments, or avoiding interaction altogether. In turn, the outside groups may be highly suspicious of the agency's motives and may tend to be overly critical.

Adversary roles also may exist within an agency, in particular when individuals from different disciplines work together, such as planners and designers or engineers and environmentalists. The problems may arise because (a) members of one discipline act as "police" on the work of members of other disciplines; (b) members of certain disciplines are regarded as "support staff" and as being less important to the work than others; (c) members of one discipline understand neither the nature of the problems faced nor the terminology of other disciplines.

In the case of outside groups, an attitude of openness must be built up so that agency staff are less likely to react negatively to outside suggestions. Training sessions on topics such as dealing with the public or learning to handle harsh criticism may be helpful.

Reward Structure, Career Patterns.—Reward systems include opportunities for internal advancement, starting wage and salary structure, opportunities to learn, job security, opportunities to direct one's own work activity, responsibility, recognition by superiors and fellow employees, opportunities for being creative, and recognition by outside professionals.

The reward structure is critically related to the success of planning procedures. Highway agencies, for example, traditionally have been viewed as engineering agencies. In some states, an engineer may receive higher pay or be eligible for overtime, whereas a nonengineer with corresponding responsibilities may be working for lower pay and not be able to be compensated for evening meetings. Requirements for supervisory and management positions have traditionally included provisions that the person have either an engineering degree or professional registration as a prerequisite, automatically excluding those persons with a background in management, social science, or environmental skills unless they happen to also have an engineering degree. Nonengineers frequently have limited opportunities for advancement. Thus, presently, it is not uncommon for the environmental personnel of a highway agency to be young, junior staff, and to view their current position as an initial stepping-stone toward a more responsible position elsewhere. If an agency is to develop a truly interdisciplinary approach, civil service and other personnel policies must be such as to enable nonengineering disciplines to be rewarded with positions of increasing responsibility, including positions of top-level management.

Consideration of No-Build Option.—A transportation agency may have a mandate from its state legislature to construct either an entire system or a particular project, and this mandate is cited as a reason for not considering the option of no new construction as a feasible alternative. Further, the legislative directive may state the particular kind of facility to be constructed, thereby again narrowing the range of alternatives that may be considered.

Two points are relevant. First, the original source of the request to the state legislature may have been the agency itself. In this case, it is certainly within the prerogative of the agency to go back to the legislature and request a modification to the original mandate.

Second, the National Environmental Policy Act and its associated implementing guidelines require consideration of alternatives to the proposed action. These alternatives are to include, where relevant, the option of not building a facility at all, even though the facility may be part of a state or nationally mandated system.

Continuity of Project Studies.—The traditional approach to the development of highway projects, as discussed in Chapter Four under "Interrelation of System and Project Planning," can be characterized as linear and production-oriented—system planning followed by location, in turn leading to design, resulting in construction. The organizational structure of highway agencies reflects this traditional sequence with separate and independent units or departments responsible for different phases of project development.

This has several effects, all tending to work against the systematic consideration of social and environmental effects. First, different groups of people are responsible for different phases of project development. It is difficult to communicate all relevant information developed by one group to another group. Second, different groups, by the nature of their differing responsibilities, tend to work with different community interests and officials, leading to a lack of comprehensiveness and continuity. Third, lapses of time frequently exist between major phases of project development, thereby further increasing an already long lead time.

The thrust of the recommended process, and particularly that for a systematic interdisciplinary approach, runs counter to this traditional sequential approach and resulting organization structure. Major studies are likely to combine

elements of system planning, location, design, and possibly even programming. Individuals from these backgrounds should continuously interact with each other on a direct and face-to-face basis and project development should progress with a minimum of management and staff turnover.

Combining the traditionally sequential planning stages also may help reduce currently long project lead times and the resulting problems relating to environmental effects. Long lead time makes it difficult to establish meaningful community interaction and contributes to the difficulty of identifying direct and indirect impacts, those that may be beneficial as well as those that are likely to be adverse. Communities are continually changing as residential and economic development patterns shift. Political officials change with new elections and as community attitudes and beliefs are modified. The result is that it is difficult to allocate resourecs in ways that support the development of an effective transportation system that can keep pace with faster changing communities.

Lack of Disciplinary Skills.—A satisfactory process requires sufficient personnel resources representing the social and environmental sciences as well as civil engineering. Although most states have made laudable progress in broadening their interdisciplinary staff capabilities, the need for management capabilities for interdisciplinary staffing is less well recognized.

Project managers typically have been selected based on demonstrated engineering skills or technical performance on former projects. Hence they are often more qualified as engineers than those who work for them. Frequently their interest and ability in engineering are strong and there is a tendency to continue to make detailed technical decisions and to pay less attention to administration or to motivating people. In the past, this practice was acceptable because the decision process emphasized these technical factors and management decisions based on precedent were satisfactory. However, the increasing inclusion of environmental factors in the decision process, the availability of a broader range of alternatives, service options, and transportation technology, and the growing participation of the public and other agencies has made management by precedent less workable.

Demands on project managers have increased significantly in recent years. They must manage interdisciplinary staff without favoring any one discipline over another. They have to understand the technical jargon of each discipline so that they can resolve misunderstandings among staff. They also have to be accustomed to working with uncertainty. Because many more factors must be considered and many more specialists will be involved in studies, managers are not able to monitor all activity, but are having to give more autonomy to the professionals they work with. Administration and personnel coordination take more time, so there is less time for making decisions as a specialist.

In a truly interdisciplinary approach the managers' primary responsibilities are to mediate among the many disciplines and to motivate the specialists to work with the community and each other. Candidates for managerial promotion should be judged on their management and administrative skills, specifically their ability to work with community interests and with diverse professional specialties, as well as on their ability to motivate others and to manage conflict.

General Dangers

There are, in addition, dangers generic to all bureaucracies that can hamper implementation of new approaches to the consideration of environmental matters. These are personal resistance, standardization of response, and multiplication of requirements.

Personal Resistance.—Most of the internal structure and arrangement of any organization is designed to preserve the status quo as much as possible and thus to discourage or resist change. Change disrupts the normal order of things and causes uncertainty, which endangers feelings of security. Resistance to change may be open and direct, passive and hidden, or unintentional, as in the case of a person slipping back into former procedures. In any case, overcoming resistance entails a thorough study of its nature and the reasons for it.

A certain amount of resistance to change is inevitable in all people; and resistance can be of benefit in identifying unanticipated consequences of change. The new roles and procedures being recommended will require new styles of work. Their assimilation will be made easier if those who have to change fully understand what the changes are, why they are being asked to make them, and are included in determining the specific changes to be made. Care should be taken to reduce either the perceived or actual threats to such things as job security, status, and promotional opportunities whenever possible.

When resistance to change is found, open discussion of the problem should be encouraged. Resisters must be reassured and persuaded, if possible, without threatening, stiffening resistance, or causing lasting impairments in personal relations.

Standardization of Response.—Another tendency of governmental organizations is to standardize response; that is, to routinize and simplify the way in which problems are handled in an attempt to avoid major blunders. Standardization of response often occurs when the problems to be faced are difficult or ambiguous, or when the organization is operating under time constraints or resource limitations.

Routinized responses to the problems of identifying social, economic and environmental effects, interdisciplinary staffing, dealing with the public, and so on, will probably lack the necessary flexibility and responsiveness to be truly effective. Agency personnel must be able to operate in a complex, ambiguous environment. The danger is that they will devise standard responses to problems rather than try to operate in the face of high uncertainty, and that such responses will not be adequate.

Multiplication of Requirements.—This problem is related to the standardization of response, the prime difference being that whereas response standardization occurs within a particular level of an organization as a means of dealing with that level's problems and is often unintentional, the multiplication of requirements occurs when upper levels of the organization impose requirements on lower levels as a

way of ensuring their compliance. (This may be a headquarters office/district office phenomenon or a federal/local phenomenon.) The danger is that the increased "red tape" and paperwork that usually result may not in any way assure, and may even work against, adequate consideration of social, economic, and environmental effects.

One way to counteract the tendency to multiply requirements is to make sure that the lower levels of an organization participate in the development of the changes being implemented and that they understand what is required of them; if the personnel of the upper levels of the organization feel that their subordinates understand and accept what they are supposed to be doing, they are less likely to perceive a need to "force" compliance.

Developing an Implementation Strategy

A variety of methods are available for implementing change within an organization, and in most cases a number of methods will be used simultaneously rather than depending on a single change method. The particular mix of methods will be dependent on the particular change or set of changes being implemented, the nature of the organization in which the change is being implemented, the resources available, whether the change is being introduced from within or from outside an organization, and if from within, the level of the organization from which the change is being introduced.

The standard and most obvious change strategy is a top-down approach where the chief administrative officer announces a change, generally of a major policy nature, and then the new policy is incrementally introduced by successively lower levels of the organization following the standard and formal vertical structure. Experience has shown, however, that such an approach may require years rather than weeks and may be modified significantly by the time it reaches the lower or working levels of the organization.

An alternative strategy, which is more compatible with the identified principles and which can be successfully combined with a top-down approach, is to systematically utilize influential people scattered throughout an organization. Key people are identified at all levels and brought together as a kind of informal task force having its own direct communications mechanisms. This involves a broader diversity of interests and introduces a change simultaneously at several different organizational levels, thus helping to identify areas where a change may be resisted and the reasons for the resistance, and leading to both more realistic policy and a more realistic implementation strategy.

Some states followed this kind of approach in development of their Action Plans. Key people were identified from several different levels and departments and brought together into an ad hoc Action Plan group for a period of several months. These individuals brought with them a familiarity with many different facets of the agency and were generally chosen because they were respected by their peers within the agency so the Action Plan would more likely be accepted and implemented, and because they had an ability to think in process, as opposed to technical study, terms. The corresponding top-down approach would have been for the chief administrative officer to assign Action Plan responsibility to a single unit (for example, an environmental unit) within the transportation planning group. Where this occurred, this unit frequently found itself isolated from other agency activities, particularly engineering and design. The result may have been a good Action Plan, but one not widely accepted within the agency.

A typology of change strategies developed by Benne and Chin is given in Table 14. The "rational-empirical" strategies assume a change will be accepted if rationally justified. Examples are the publication of research results and the holding of extension and other types of training courses. These kinds of techniques are likely to be useful in exposing people to changes and helping to gain acknowledgment of a problem, but in most cases will not be entirely sufficient by themselves to fully accomplish implementation.

The "normative re-educative" strategies are based on the behavioral sciences and shared experiences. They are more

TABLE 14
TYPOLOGY OF ORGANIZATIONAL CHANGE STRATEGIES [1]

RATIONAL-EMPIRICAL	NORMATIVE-RE-EDUCATIVE	POWER-COERCIVE
1. BASIC RESEARCH AND DISSEMINATION OF KNOWLEDGE THROUGH GENERAL EDUCATION	1. RELEASING AND FOSTERING GROWTH IN INDIVIDUALS	1. PROTEST
2. PERSONNEL SELECTION AND REPLACEMENT	2. IMPROVING PROBLEM SOLVING CAPABILITIES OF ORGANIZATIONS, LEARNING SYSTEMS	2. ECONOMIC SANCTIONS
3. SYSTEMS ANALYSTS AS STAFF CONSULTANTS		3. USE OF POLITICAL INSTITUTIONS TO LEGITIMIZE CHANGE
4. APPLIED RESEARCH AND TRAINING, DIFFUSION OF RESULTS		4. RECOMPOSITION AND MANIPULATION OF POWER ELITES
5. UTOPIAN THINKING		
ASSUMPTION: CHANGE WILL BE ACCEPTED IF RATIONALLY JUSTIFIED.	USE OF BEHAVIOR SCIENCES, PSYCHOLOGICAL AND SOCIAL ASPECTS.	FEATURES POLITICAL, PHYSICAL, ECONOMIC, AND MORAL SANCTIONS.
	CONCERN WITH VALUES, ATTITUDES.	MODIFY OR MANIPULATE ENVIRONMENTAL CONSTRAINTS ON ORGANIZATION.
	GENERALLY MORE PERSONAL THAN OTHER METHODS.	

[1] KENNETH BENNE AND ROBERT CHIN IN THE PLANNING OF CHANGE, BY BENNIS, BENNE AND CHIN, HOLT, RINEHART AND WINSTON, 1969.

personal in approach and involve working with people on an individual or small group basis. An example of such a strategy would be the introduction of a new study procedure, such as a subarea study, through a series of pilot or demonstration applications. These would be highly visible throughout the agency and the results would be documented and communicated to other agency personnel undertaking similar studies.

Finally, "power-coercive" strategies feature the use of political, physical, economic, or moral sanctions. These could include changes brought about through protest, court injunctions, and withholding of funding or project approvals. A specific example is the withholding of project approvals within an urban area if that area's 3-C study has not received its annual certification as a mechanism of forcing the implementation of particular changes.

These change methods normally assume an incremental introduction of change where acknowledgment of a problem leads to changes in attitude that in turn lead to changes in behavior. This strict sequence, however, need not always be followed. For example, although people cannot be forced for a long period of time to do things in which they do not believe, some behavioral changes frequently may be possible before corresponding attitudes are changed. Field applications of the research showed this to be particularly true in the area of community interaction. Limited community interaction tasks could be initiated even though those responsible for the interaction did not have a full understanding of the objectives or of the use of particular techniques. In most cases, application experience helped to achieve the increased understanding and the desired changes in attitude.

Recommendations for Implementation

The following recommendations should be applicable to most transportation agencies—mass transportation as well as highway—and should serve as a basis for an agency to develop its own more specific implementation strategy. Inherent in the recommendations is an approach based on learning by doing.

Responsibility for Implementation.—The responsibility for implementation encompasses several tasks, as follows:

- To develop and implement both a strategy and a schedule for implementation, with an ongoing assessment of what changes are needed.
- To check that resources are sufficient to meet the implementation schedule and to carry out the activities planned.
- To make sure that other agency activities are consistent with the implementation plan or to revise the plan accordingly.

Other tasks that might be handled as part of this responsibility include development of proposals for changes to laws, directives, and operating procedures, and assessment of the agency's over-all operation with respect to environmental affairs, with recommendations for improvements.

Because of the importance of the responsibility for implementation, chief administrative officers probably should keep over-all control within their purview. However, it is likely that they will choose to delegate some responsibility for implementing particular tasks. Implementation could be monitored by a task force, possibly including representatives from other state agencies, or by assigning responsibilities for implementation to each level or department of the organization. Implementation also could be a continuing activity of the group that wrote the state's Action Plan, inasmuch as these individuals would already be familiar with the implications of a process approach and would already have thought through many of the procedural and organizational issues involved in implementation.

Involvement with Implementation.—Top management of the agency should fully understand, be committed to, and actively support the planned change. Many of the changes will likely involve, or at least question, basic agency policy; it is important that top-level executives be continuously informed and involved so they can facilitate these changes where appropriate.

Key personnel, including but not limited to middle agency and functional unit managers, should be identified who will be thoroughly versed in the approach and who will be committed to its implementation. These persons could coordinate research findings with their counterparts in other states and with federal personnel and could act as catalysts for change within their departments. These individuals also could help to identify personnel problems (insecurity, jealousy, and so on) that might arise and to take steps to avoid or at least minimize such problems.

Pilot Studies.—Implementation should be achieved incrementally, gradually introducing changes throughout an agency. A component of such a strategy should be the use of pilot application studies to gradually introduce new approaches and procedures. Such studies act as a learning opportunity, permitting adjustments to be made before a procedure is introduced on an agency-wide basis; a training workshop, where agency staff from all levels can be selectively introduced to new approaches and gain "hands on" experience; and as a control mechanism enabling those responsible for implementation to maintain more direct involvement in implementation.

The initial application should be undertaken in one region or city for a particular study phase (e.g., corridor studies). Subsequent applications can be gradually extended to other geographic areas and study phases, including design, system planning, and partially completed projects.

In applying the approach recommended, this report should be used as an aid or guide, and not as a "cookbook." There is sometimes a tendency to follow guidelines on a word-by-word basis; it is much more important that the spirit and intent be followed, and that the ideas be adapted to each unique situation.

A pilot application should be reviewed and evaluated periodically by top-level executives as well as by functional department heads. Major process decisions and activities should be documented so that experiences can be more readily transferred to other agency personnel.

When selecting personnel for a pilot application, several options are open. The teams can be composed of carefully selected, highly qualified personnel, possibly including the direct participation of agency executives—i.e., put the best available people on the project. The most capable people would then be in the position of teaching the process to their coworkers, and would either already be in or would likely move into positions of major responsibility.

A second option, and the one used in the field cooperation phase of this project, is to utilize a staff composed of normal line personnel. This kind of team gives a more accurate reflection of the skills currently available in an organization.

In either case, the selection of a study leader or manager is particularly crucial. The study manager must be committed to and understand the process and should have interdisciplinary and management skills, and the ability to work comfortably and effectively with community groups. Most important, the manager should be respected and have status within the agency if the results of the pilot application are to be credible, acceptable, and transferable.

"Pipeline" Projects.—Application of new approaches to "pipeline" projects poses special problems because extraordinary resources would be required to recycle the numerous projects of this nature using a new study process. It is instead recommended that pipeline projects be transitioned from the existing process to a new process at the time of a major decision point (such as is prescribed by the "Process Guidelines," FHWA PPM 90-4) or that when a pipeline project is recycled for any of a variety of reasons, studies be restarted using the new process instead of the former procedures. Recycling will probably be necessary on projects of major importance even though they have been under study for a long time.

Training Programs.—A program of training should be undertaken for all agency personnel in the areas of impact identification, community interaction, evaluation, consideration of alternatives, and process management. This training should provide the personnel working on various projects the opportunity to evaluate the effects of the new procedures and exchange information about their application. In addition, workshops on system planning should be conducted so that personnel can reassess existing statewide and metropolitan area planning processes, become familiar with their limitations, and start to develop changes in these processes.

Institutional Arrangements and Organizational Structure.—Changes to the existing institutional arrangements and organizational structure, as described in Chapter Four, should be accomplished in parallel with implementation of new study procedures. This will increase the incentives for agency personnel to adopt these procedures.

Federal Highway Administration Action Plan.—This report has been written to be compatible with FHWA PPM 90-4, the "Process Guidelines," implementing Section 109 (h) of Title 23, U.S.C. An Action Plan describes the organization to be used, including specific assignments of responsibility, and the processes to be followed in the development of highway projects from system planning through location and design. This report addresses these same topics and can serve, in essence, as a set of examples or candidate material to be incorporated into an Action Plan. An Action Plan can thus be used as a policy-level stimulus and as one element of a planned change strategy to assist in the implementation of these recommendations.

APPLICATION EXPERIENCE

Detailed findings from the various field applications are incorporated in Chapters Three and Four and the preceding section of this chapter as part of the in-depth discussions of particular topics. In addition, other states and private consultants have used the results of the September 1971 interim "Procedural Guide" as a basis for project studies. The following sections present certain basic observations from this experience.

Observations from Field Tests

Elements of the proposed approach have been applied in recent years to numerous system, location, and design studies. Each of the major proposed activities—evaluation, consideration of alternatives, identification of impacts and affected interests, and community interaction—has been used in the field applications, although the majority of attention has been devoted to the introduction of community interaction activities. Primary conclusions are that the approach, and the procedures and techniques discussed and illustrated in the preceding chapters, are feasible and contribute to an increased awareness of and sensitivity to social and environmental considerations, though some degree of training may be required and some modest addition to or reallocation of existing resources is desirable. The approach gradually has been accepted by the professionals with whom the researchers have worked. However, implementation does take time; full and successful application is not immediately achieved.

The approach in its fullest extent involves more than just the introduction of one or two new techniques or procedures. Full implementation has implications for personal attitudes, management capabilities, staffing, agency policy, organizational structure, institutional relationships, and the manner in which decisions are reached. Personnel from all levels and all departments of an organization need to be involved; implementation cannot be the sole responsibility of a single unit, such as the environmental staff.

For some individuals the shift to a process approach is difficult; the traditional concern in most agencies has been with the development and implementation of specific, well-defined "products," and less concern has been devoted to the process by which these "products" are developed. Adaptation to a process approach may take several months.

Objections to the Approach

In working with highway personnel, five potential objections have frequently been raised to the proposed approach: (a) The process may take longer than the time now allocated for studies; (b) the study itself may be more

expensive and may result in a project that costs much more; (c) the process may result in a project's never being built at all; (d) the approach implies that decision-making authority legally vested in the highway agency is delegated to the community; and (e) the process is based on community participation, yet the majority of the public may not be sufficiently interested to participate. These objections have been considered carefully and a response to them follows.

Time Requirements

It may be true that some additional time and money will be required. But the length of time between initiation of planning studies and initiation of construction has increased significantly in recent years, sometimes becoming infinite when controversy leads to mobilization of political power to block the project. For uncontroversial or relatively insensitive projects, the increased time required by the proposed approach is minimal. For controversial studies, however, the proposed approach may significantly reduce the length of time between initiation of studies and the start of actual construction by reducing the probability that positions will become so polarized that the project is blocked. In all situations, the quality of the final "solution" may be improved as a result of the community interaction and other activities undertaken.

Increased Costs

When it comes to cost, again a true baseline for comparison must be established. Given the present high annual rate of increase in construction costs, the project cost estimate of today may be much lower than the cost actually incurred when the project is built. Even if controversy delays a project only four or five years, there may be an increase in costs by perhaps as much as 50 percent. If controversy can be avoided by gaining community acceptance of the need for a route and its location and design features at an early point, the additional resources invested may save other longer-run costs.

Prospects of "No-Build"

The perceived "danger" that a project may never be built at all needs to be examined carefully. Presently, a highway or transportation agency may see itself as having the mission of constructing or upgrading particular highway or transportation facilities for which the need and desirability has been clearly established, reflecting the best available knowledge at some point in time and the preferences of that time. As the particular study proceeds, more realistic and accurate estimates can be made of costs, of traffic service provided, of the impacts on various communities and groups, and of the costs necessary to compensate for those impacts which are negative. These estimates may indicate costs and other effects of this project that are substantially less desirable than those estimated when the initial decision to proceed was made. If as a result a particular project is seen as undesirable and is eliminated, this is not a catastrophe: it is simply the inevitable result of the changing world we live in. Thus, the recommended process can be viewed as an opportunity to reexamine earlier system decisions, either to validate those decisions or to revise them.

Change in Decision-Making Authority

Although the proposed approach has implications for change in the decision-making process, public participation does not of itself imply a right for citizen groups to assume any part of the formal decision-making responsibility legally vested in a transportation agency. The objective is to provide as good a basis as possible for those individuals with authority to make a choice, by fully informing them of all relevant issues and tradeoffs. Community interaction is necessary to develop this information. Input from the public will contribute to an improved understanding of the potential social and environmental effects of proposed actions, will provide information on community preferences and objectives, and will in almost all cases influence decisions. This need not, however, involve either formal or informal delegation of authority.

Community Indifference

Some personnel measure the success of a community interaction program by the number of people participating. Low attendance at agency-initiated special-purpose meetings may be interpreted as apathy on the part of the general public. A process based on citizen participation, therefore, is viewed as requiring significant additional effort and providing only marginal returns. But maximization of the number of participants is not, by itself, a desirable objective of community interaction; there are reasons other than lack of interest for low meeting attendance. An agency's prime responsibility is to provide full and equal opportunity for citizens and interest groups to be informed and to become involved in transportation decision-making, recognizing fully that different levels of effort and different techniques may be required to inform and involve different publics. There can be no denying that effective community interaction will require significant effort on the part of an agency, but the actual decision to participate must always be made by the individual citizen or interest group. There are two basic determinants of successful community interaction: First, have viewpoints on all relevant issues of choice been obtained? This implies a representativeness of different views, and is not necessarily achieved just by obtaining a large number of participants. Second, have the issues of choice been clarified for the public as well as for the agency? This does not mean that full consensus has been obtained or even that individual preferences or positions change during the course of a process, but only that an increased understanding has been obtained of the alternatives available, their impacts, and the positions of other interests.

From the point of view of the public, successful participation is achieved when they perceive that their contributions are truly desired and influential, and are not being solicited just to fulfill a legal requirement or administrative directive. Where positive conditions have existed, experience has shown that effective participation has resulted.

In summary, introduction of any significant new approach will result in a natural resistance to the change. Although the very real concerns reflected by the objections that have been raised are fully understood, it is believed that the problems faced are not necessarily inherent in the proposed approach.

CHAPTER SIX

CONCLUSIONS AND SUGGESTED RESEARCH

APPLICABILITY TO PUBLIC POLICY DECISIONS

The approach described has been developed specifically for highway decisions at both the system and the project levels. Although the research initially was oriented to construction of freeway-type facilities in urban areas, subsequent phases have examined smaller-scale projects such as secondary road upgradings, rural settings such as are typical in many states, and a variety of political cultures found in the different geographic regions of the country. The result is that the findings and recommendations should be applicable to the operations of all national, state, and metropolitan highway organizations and to the full range of potential service improvements.

The approach also should be directly applicable, with few or no modifications, to other transportation modes: transit route (or station) location and design; operation, parking, scheduling, and other regulatory policies; bus routing; airport location and design; and rail line abandonments and network rationalizations.

The concepts underlying this approach, and the approach itself, also should be applicable to fields other than transportation: for power plant and refinery siting, urban development, flood control projects, and similar public works decisions. Moreover, the basic principles should be valid in a wide spectrum of public policy problems. The issues of "the environment" cannot be handled by simply hiring a few architects or ecologists; neither can issues of equity be resolved simply by a program of citizen participation. Decision and planning processes must be structured so that the inevitable conflicts among competing interests can be resolved with a full understanding of the choices made. It is firmly believed that the approach described is essential if governmental agencies are to retain the confidence of the public.

NEXT STEPS: IMPLEMENTATION

Major advances have been made in the understanding and development of methods for incorporating social and environmental considerations in transportation decision-making. Even so, and although research needs still exist, routine operations of most transportation agencies lag behind current state-of-the-art understandings. Priority emphasis should be given to implementation at all levels of government—national, state, regional, and local—and to all modes—highway, urban public transportation, rail, and air—of already existing research results.

Although many transportation organizations agree with this priority and recognize the desirability of a planning process that more effectively incorporates means of considering social, economic, and environmental factors, there are several factors that retard implementation. The major need, then, is for development of a means to aid the implementation of improved procedures. Among the important items requiring careful consideration are:

1. Staffing. Many transportation agencies lack sufficient personnel with expertise in nonengineering disciplines and are hard pressed to obtain the authority necessary to hire them. Salary scales and advancement opportunities for nonengineers often are relatively unattractive, making it difficult to find and keep qualified people. Arrangements with other agencies for the lending of specialists may be limited or nonexistent.

Because it is important to have an adequate in-house staff of social, economic, and environmental specialists, needs exist for (a) ways of authorizing and funding nonengineering personnel, (b) appropriate salary scales and career opportunities for nonengineers, and (c) means of obtaining the services of experts available in other governmental agencies.

2. Training programs. Both engineers and professionals in other disciplines need training that updates their capabilities in their own disciplines and increases their understanding of, and capacity to work wth, other disciplines. Development of methods and programs for on-the-job training and of opportunities for further formal education are essential.

3. Funding. Fiscal constraints that may inhibit the freedom to take a truly multi-modal and service-oriented approach to transportation should be removed. Funding

should be available on an equal basis for the construction, operation, maintenance, and planning of all modes and services; and for compensation of persons beyond the immediate transport right-of-way for adverse social, economic, or environmental effects that may be directly incident upon them.

4. Research tools. Further work is needed in developing and improving techniques for predicting direct and indirect transportation-related impacts, and especially to disaggregate the results of current prediction models to better indicate the manner in which specific interests and groups may be affected. In addition, means for disseminating state-of-the-art information on available methods should be improved. For example, regularly updated catalogs of impact prediction techniques and community interaction techniques would be of service to transportation professionals.

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APPENDIX A

LEGAL REQUIREMENTS

This appendix provides short discussions of selected federal laws and directives affecting the consideration of social and environmental effects in the highway planning and decision-making process. There is no attempt to be comprehensive in these summaries; the intent is to show how the proposed approach incorporates the major federal requirements. Each state, of course, has its own additional statutes and directives to which it must adhere.

COMMUNITY INTERACTION

A few of the more important statutory and administrative requirements for interaction with other agencies, officials, and the public are included in the following.

1. *Federal-Aid Highway Act of 1962,* Section 134(a), provides that highway projects in urban areas with populations of more than 50,000 must be "based on a continuing comprehensive transportation planning process carried on

cooperatively by States and local communities in conformance with the objectives stated in this section." *Policy and Procedure Memorandum 50-9*, which implements 134(a), states:

> 1. The planning process includes the operational procedures and working arrangements by which short- and long-range highway and transportation plans are soundly conceived and developed, and continuously evaluated in a manner that will:
>
> (a) Assist governing bodies and official agencies in determining courses of action and in formulating attainable capital improvement programs in anticipation of community needs.
>
> (b) Guide private individuals and groups in their planning decisions which can be important factors in the pattern of future development and redevelopment.
>
> * * *
>
> 3. The planning process should be closely coordinated with policy making and program administration and should be organized with the objective of achieving agreement on interrelated action programs founded on factual information.

2. *Executive Order 11514, "Protection and Enhancement of Environmental Quality,"* Section 2(b), directs federal agencies to:

> Develop procedures to ensure the fullest practicable provisions of timely public information and understanding of federal plans and programs with environmental impact in order to obtain the views of interested parties. These procedures shall include, whenever appropriate, provision for public hearings, and shall provide the public with relevant information, including information on alternative courses of action. Federal agencies shall also encourage state and local agencies to adopt similar procedures for informing the public concerning their activities affecting the quality of the environment.

3. *The Federal-Aid Highway Act of 1968.* This act emphasizes public participation and the consideration of community goals and objectives, social and economic effects, and environmental impacts in highway planning. The law states:

> Any state highway department which submits plans for a Federal-aid highway project involving the bypassing of, or going through, any city, town, or village, either incorporated or unincorporated, shall certify to the Secretary [of Transportation] that it has had public hearings, and has considered the economic and social effects of such a location, its impact on the environment, and its consistency with the goals and objectives of such urban planning as has been promulgated by the community . . . (23 U.S.C. 128).

4. *Federal-Aid Highway Act of 1970 as implemented by FHWA Policy and Procedure Memorandum 90-4*

Section 11, Involvement of Other Agencies and the Public, states:

> b. The Action Plan should identify the assignment of responsibility and procedures to be followed:
>
> (1) to ensure that information is made available to other agencies and the public throughout the duration of project studies, and that such information is as clear and comprehensible as practicable concerning:
>
> (a) The alternatives being considered.
>
> (b) The effects of alternatives, both beneficial and adverse, and the manner and extent to which specific groups are affected.
>
> (c) Right-of-way and relocation assistance programs, including major points of public interest.
>
> (2) To clearly indicate the organizational unit or units within the Highway Agency to which the public can go for information outlined in paragraph 11b (1), and for assistance to clarify or interpret the information.
>
> (3) To ensure that interested parties, including local governments and metropolitan, regional, State and Federal agencies, and the public have an opportunity to participate in an open exchange of views throughout the stages of project development.
>
> (4) To select and coordinate procedures, in addition to formal public hearings, to be used to inform and involve the public.
>
> (5) To utilize appropriate agencies with area-wide responsibilities to assist in the coordination of viewpoints during project development.
>
> (6) To involve appropriately the organization which is officially established in urbanized areas of over 50,000 population to conduct continuing, comprehensive, cooperative transportation planning (consistent with PPM 50-9 and IM 50-3-71).

EVALUATION

The evaluation method is designed to produce periodic reports documenting the planning process. These reports can serve as the basis for the environmental impact statement (EIS) called for by Section 102(2)(C) of the National Environmental Policy Act of 1969, which requires that before decisions are made on major federal actions, a statement be circulated describing

> (i) The environmental impact of the proposed action,
>
> (ii) Any adverse environmental effects which cannot be avoided should the proposal be implemented,
>
> (iii) Alternatives to the proposed action,
>
> (iv) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
>
> (v) Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

The environmental impact statement must satisfy two conflicting but essential considerations. It must serve as a public disclosure mechanism, making information on the proposed project readily available to interested parties; and it must demonstrate that the responsible agency has performed careful investigations of the potential consequences of its proposed actions. To inform people, an impact statement should be brief and readable, and people should not have to wade through hundreds of pages to extract the information of interest to them. Yet for many large projects demonstrating that a thorough analysis has been carried out may require a massive statement.

The way out of this dilemma may be to have one part of an environmental impact statement provide a cogent summary with other sections filling in details. An evaluation report as described in Chapter Three could serve as the summary, presenting the most important issues. The rest of the statement would add the detailed descriptions required by Section 102(2)(C) and its implementing guidelines.*

* Council on Environmental Quality, "Guidelines for Federal Agencies Under the National Environmental Policy Act." Issued August 1, 1973. Also, Federal Highway Administration, Policy and Procedure Memorandum 90-1, August 24, 1971, as revised September 7, 1972.

ALTERNATIVES

Principal among federal requirements for the process of investigating alternative courses of action are the following:

1. *National Environmental Policy Act of 1969*, Section 102(2)(C)(iii), requires a discussion of "alternatives to the proposed action" in every environmental impact statement. Section 102(2)(D) requires that agencies:

> Study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources.

Experience shows that such conflicts exist on the majority of projects; therefore, this section may be applicable even though a formal environmental impact statement may not be required.

2. *Department of Transportation Act of 1966 as amended by the Federal-Aid Highway Act of 1968* Section 4(f) states:

> The Secretary [of Transportation] shall not approve any program or project which requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state or local significance as determined by the Federal, State, or local officials having jurisdiction thereof, or any land from an historic site of national, state, or local significance as so determined by such officials unless (1) there is no prudent and feasible alternative to the use of such land, and (2) such program includes all possible planning to minimize harm to such park, recreation area, wildlife, and waterfowl refuge or historic site resulting from such use.

The words "no prudent and feasible alternative" form a "negative performance standard" that can be satisfied only by investigating all possible alternatives and demonstrating that none is in fact prudent and feasible. Court rulings have provided guidance on the interpretation of "prudent and feasible." In the leading case *Citizens to Preserve Overton Park, Inc. v. Volpe,* 401 U.S. 402 (1971), the Supreme Court held that an alternative route is "feasible within the meaning of this provision unless its use would be contrary to sound engineering," 401 U.S. 402, 411. It further stated that an alternative route is "prudent" within the meaning of this provision unless its use involved "truly unusual factors" or "cost or community disruption . . . [of] extraordinary magnitudes." (401 U.S. 402, 413). [Comment on this aspect of opinion can be found in the Supreme Court, 1970 Term, 85 HARVARD LAW REV. 315, 322-325 (1971).]

3. *Federal-Aid Highway Act of 1970, as implemented by FHWA Policy and Procedure Memorandum 90-4,* Section 10, requires highway agencies to follow procedures to ensure that:

> (1) The consequences of the no-highway improvement option are set forth, with data of a level of completeness and of detail consistent with that developed for other alternatives.
> (2) A range of alternatives appropriate to the stage is considered at each stage from system studies through final design.
> (3) The development of new transportation modes or the improvement of other modes are adequately considered, where appropriate.
> (4) Non-transportation components, such as replacement housing, joint development, multiple use of rights-of-way, etc., are in coordination with transportation components.
> (5) Suggestions from outside the Agency are given careful consideration.

4. *Federal-Aid Highway Act of 1973* increases flexibility in exploring a wide range of transportation options by expanding the funds available to transit and by allowing more serious consideration to be given to the option of not building an expressway-level facility.

The act establishes urban and rural systems, both funded by the Highway Trust Fund, and allows funds to be used, starting in fiscal 1975, for the purchase of buses and capital expenses for highway traffic control devices, bus passenger loading areas, and auto parking facilities to serve mass transit passengers. Beginning in fiscal 1976, these monies also may be used for rail transit facility construction, reconstruction, and improvements, and for rail transit rolling stock.

A second provision allows urbanized areas of over 50,000 population to trade funds from unwanted Interstate segments for an equal amount of mass transit aid from general funds. Thus, a decision not to build an expressway-level facility does not automatically mean forfeit of transportation aid.

IMPACTS

Federal legislation and administrative directives define a basic set of requirements to be satisfied by impact prediction activities, as follows:

1. *National Environmental Policy Act of 1969* defines a national policy for the environment. Objectives of this policy are stated in Section 101(b):

> (1) Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
> (2) Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
> (3) Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
> (4) Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;
> (5) Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
> (6) Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Section 102(2)(B) states that all agencies of the Federal Government shall:

> (B) identify and develop methods and procedures, in consultation with the Council on Environmental Quality . . . which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic and technical considerations.

2. *FHWA Policy and Procedure Memorandum 20-8 (Public Hearings and Location Approval), as modified by Instructional Memorandum 20-4-72.* The following effects are required to be discussed, to the extent applicable, by a state highway agency in requesting federal location and design approvals:

(1) *Regional And Community Growth* including general plans and proposed land use, total transportation requirements, and status of the planning process.

(2) *Conservation and Preservation* including soil erosion and sedimentation, the general ecology of the area as well as man-made and other natural resources, such as: park and recreational facilities, wildlife and waterfowl areas, historic and natural landmarks.

(3) *Public Facilities and Services* including religious, health and educational facilities; public utilities, fire protection and other emergency services.

(4) *Community Cohesion* including residential and neighborhood character and stability, highway impacts on minority and other specific groups and interests, and effects on local tax base and property values.

(5) *Displacement of People, Businesses, and Farms* including relocation assistance, availability of adequate replacement housing, economic activity (employment gains and losses, etc.).

(6) *Air, Noise, and Water Pollution* including consistency with approved air quality implementation plans, FHWA noise level standards (as required under PPM 90-2), and any relevant Federal or State water quality standards.

(7) *Aesthetic and Other Values* including visual quality, such as: "view of the road" and "view from the road," and the joint development and multiple use of space.

3. *Federal-Aid Highway Act of 1970, as implemented by FHWA Policy and Procedure Memorandum 90-4* Section 9, calls for Action Plans to discuss the assignment of responsibility and procedures relating to the identification of social, economic, and environmental effects. Information to be provided includes control of the technical quality of impact studies and monitoring the effects of completed projects and of the general state-of-the-art to ensure that agency procedures are as current as possible.

An Action Plan must also describe the procedures to be followed to ensure that environmentally related information:

(a) Is developed in parallel with alternatives and related engineering data, so that the development and selection of alternatives and other elements of technical studies can be influenced appropriately.

(b) Indicates the manner and extent to which specific groups and interests are beneficially and/or adversely affected by alternative proposed highway improvements.

(c) Is made available to other agencies and to the public early in studies.

(d) Is developed with participation of staffs of local agencies and interested citizens.

(e) Is developed sufficiently to allow for the estimation of costs, financial or otherwise, of eliminating or minimizing identified adverse effects.

4. A number of federal laws are directed at specific types of impacts. Among these are:

- Department of Transportation Act, Section 4(f).
- Civil Rights Acts of 1964 and 1968.
- Clean Air Act of 1970.
- National Historic Preservation Act.

For example, Chapter II of Volume 3 of FHWA's Civil Rights-Equal Opportunity Manual provides interim guidelines for (a) implementation of Title VI provisions of the Civil Rights Act of 1964 (42 U.S.C. 2000d-d4) and (b) conduct of Title VI compliance reviews. Compliance for local studies in urban areas is based on the extent to which a state complies and displays certain information, including:

(a) The major racial populations in that portion of the urban area through which alternate locations pass.

(b) The character of each area through which the corridor passes.

(c) The estimated number of persons and families in the corridor by race that would be either displaced by the road or located in areas directly adjoining the road.

(d) The location of each business enterprise located within the corridor, the estimated number of employees by race, and the race of the owner.

5. *The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970* has removed nearly all the statutory barriers to the equitable financial treatment of displaced households. It provides that homeowners may be reimbursed up to $15,000 above "fair market value," to be applied to the purchase of comparable decent, safe, and sanitary housing. This enables the household to be left in a similar equity position, having the same assets and liabilities as before displacement. However, this legislation merely enables administrators to be fair; it does not require such compensation.

For renters, the act provides a rental supplement for displacees of up to $1,000 per year for four years, recognizing that they also may face an extremely tight housing market and face other unreimbursed costs during relocation. In addition, to encourage former renters to become homeowners, they can elect instead to receive $2,000 toward a down payment plus up to $2,000 more as a "matching share" for whatever down payment the former tenant himself provides.

The 1970 Act was preceded by the *1968 Federal Aid Highway Act* in many of its recommendations, although with somewhat lower limits on the payments.

The remaining financial issues in housing displacement are not so much statutory ones, but administrative. Those responsible for administering relocation and replacement programs must understand the housing market and conscientiously and fairly apply the law to achieve the objective of equity for those displaced.

PROCESS MANAGEMENT

Federal legislation and administrative directives define a basic set of requirements to be satisfied by process management activities, as follows:

1. *National Environmental Policy Act of 1969,* Section 102(2)(A), contains the most direct and far-reaching statutory requirement affecting the over-all management of a transportation planning process. This section requires that agencies use a "systematic interdisciplinary approach which will insure the integrated use of the natural and

social sciences and the environmental design arts in planning and in decision-making which may have an impact on man's environment." Because an agency's day-to-day work activities, as well as its final decision-making, have environmental impacts, a systematic interdisciplinary approach is required at all levels of the organization and throughout the planning and design stages. Although the nature and extent of the approach may vary with the type and significance of the project or the geographic area, a systematic interdisciplinary approach is needed at all times, not just for special cases. A one time application (e.g., preparation of an environmental impact statement by an interdisciplinary group) is not sufficient.

2. *Federal-Aid Highway Act of 1970, as implemented by FHWA Policy and Procedure Memorandum 90-4,* requires that each state highway agency demonstrate compliance with the NEPA requirement for a systematic interdisciplinary approach. Action Plans are to

> . . . indicate procedural arrangements and assignments of responsibilities which will be necessary to meet this requirement, including:
>
> (1) the organization and staffing of project groups which are systematic and interdisciplinary in approach, including the possible use of consultants and representatives of other State or local agencies;
> (2) recruitment and training of personnel with skills which are appropriate to add on a full-time basis, and the development of appropriate career patterns, including management opportunities;
> (3) additional training for present personnel to enhance their capabilities to work effectively in an interdisciplinary environment.

SYSTEM PLANNING

Federal legal requirements affecting the integration of system and project planning include the following:

1. *Federal-Aid Highway Act of 1962* was the first legislation that explicitly recognized the need for special attention to be paid to transportation planning in urban areas. Section 134(a) resulted in creation of what has come to be known as the 3-C (continuing, comprehensive, and coordinated) planning process by stating:

> It is declared to be in the national interest to encourage and promote the development of transportation systems, embracing various modes of transport in a manner that will serve the States and local communities efficiently and effectively. To accomplish this objective the Secretary shall cooperate with the States . . . in the development of long-range highway plans and programs which are properly coordinated with plans for improvements in other affected forms of transportation and which are formulated with due consideration to their probable effect on the future development of urban areas of more than fifty thousand population. . .

Satisfaction of the full intent of the stated "coordination" and "consideration" can only be accomplished if project studies are effectively integrated with system planning.

2. *Federal-Aid Highway Act of 1970 as implemented by FHWA Policy and Procedure Memorandum 90-4.* The Process Guidelines contained in the PPM are applicable "from initial system planning through design," including statewide planning as well as urban area transportation planning conducted under the Section 134 "3-C" process.

Section 14 of the Guidelines is directly concerned with the interrelation of system and project decisions. The Action Plans called for by the PPM are to identify:

> (1) Procedures to be followed to:
> (a) ensure that potential social, economic, and environmental effects are identified insofar as practicable in system planning studies as well as in later stages of location and design;
> (b) provide for reconsideration of earlier decisions which may be occasioned by results of further study, the availability of additional information, or the passage of time between decisions.
> (2) Assignment of responsibility for ensuring that project studies are effectively coordinated with system planning on a continuing basis.

3. *Federal-Aid Highway Act of 1973.* A major feature of this act is that portions of the Highway Trust Fund allocated to the federal-aid urban system and to primary and secondary roads are annually apportioned to the states. Within a state, urban system funds are further apportioned to urbanized areas of more than 200,000 population. This can have a profound implication for the planning and decision-making process at state and local levels. In the past, federal funds for all urban and rural facilities (other than those included in the secondary road program) were allocated to specific projects receiving federal approval. Therefore, planning, location, and design studies were oriented around a sequential process in which the need for a project was tentatively established in system planning, and not building the project became less and less a realistic option as the project progressed through location and design studies because of the fear of losing the federal funds for that project.

With apportionment, concern is shifted from project approvals to the management of a flow of funds. This means that from the point of view of the implementing agency, there can be greater flexibility in responding to changes in community preferences as to which specific actions citizens and local officials wish to implement in the next period. Thus, there can be an annual programming process in which decisions are made as to which projects should advance toward implementation. If, for example, corridor studies produce information on previously unanticipated adverse consequences of a proposed project, that project can be deferred from implementation and alternative projects can be advanced with no fear of losing federal funds.

Another provision of the 1973 Highway Act requires that establishment of routes and schedules for public mass transportation systems in urban areas be based on the 3-C planning process. This implies that the comprehensive area-wide planning process should be concerned not only with long-term area-wide plans but also with the near-term changes in public transportation systems, and by implication with other short-range program elements as well. In other words, the act implies that the annual programming process should focus on all modes and on short-range capital and service improvements as well as long-range area-wide plans. This, combined with the increased funding

flexibility, creates the institutional context in which the programming process can become a meaningful focus for constructive citizen participation on an annual basis.

INSTITUTIONAL ARRANGEMENTS AND DECISION-MAKING

Among the federal laws exerting significant influence on institutional arrangements are:

1. *Federal-Aid Highway Act of 1962, Section 134(a), as implemented by FHWA Policy and Procedure Memorandum 50-9, Instructional Memoranda 50-4-68 and 50-3-71, and Notice HP-21.* Section 134(a) requires that highway projects in urban areas of more than 50,000 population be "based on a continuing comprehensive transportation planning process carried on cooperatively by states and local communities. . . ." This has had the major institutional effect of stimulating establishment of metropolitan transportation planning agencies and processes separate from those of the state highway agency. Many come under councils of (local) governments (COGs). The 3-C provision also placed an obligation on state highway agencies to work closely with these agencies in the development of urban transportation plans. Thus, a more explicit state-local (metropolitan) working relationship has been forged.

2. *Demonstration Cities and Metropolitan Development Act of 1966 (Section 204) and Intergovernmental Cooperation Act of 1968 (Title IV, Sec. 401(b)), as implemented by Office of Management and the Budget Circular A-95.* Circular A-95 requires that highway projects be accompanied by an area-wide comprehensive planning agency's comments on the relationship of the proposed project to the planned development of the area to avoid conflict and duplication in expenditure of government funds. These statutes and regulations further strengthen metropolitan institutions *vis-à-vis* both municipalities and state agencies operating in metropolitan areas, have brought about a greater degree of cooperation and coordination, and have enabled federal financing agencies to be better informed of local area attitudes.

3. *DOT Order 1130.2 (Unified Work Program)*, issued in 1973, establishes the requirement for annual unified work programs (UWP) for highway (FHWA), mass transit (UMTA), and airport (FAA) intermodal planning in metropolitan areas. The UWP is

> . . . designed to afford increased flexibility to States and localities . . . [in order] to reflect local priorities. Where more than one metropolitan agency is involved in transportation planning, it is local prerogative to determine which agency shall initiate development of the UWP . . . The UWP should not just be a compilation of existing work programs for each funding source. Instead, it should be an integrated program describing the coming year's transportation planning process and delineating major tasks including products.

Although the DOT order does not directly address either institutional arrangements or decision-making, meeting the full intent of the order would require multi-modal institutional arrangements and a unified decision-making procedure. (Cf. discussion of 1973 Federal-Aid Highway Act).

4. *Federal-Aid Highway Act of 1970, Sections 105(d) and 109(h) of Title 23, U.S.C., as implemented by FHWA Policy and Procedure Memorandum 90-4, Process Guidelines.* Section 134(a) of the 1962 Highway Act influences the decision-making process in 3-C urban areas with the requirement that "responsible public officials of such an urban area . . . have been consulted and their views considered with respect to the corridor, the location and the design of the project." For federal-aid projects on the urban system, this wording is strengthened by Section 105(d), which states that such projects ". . . be selected by the appropriate local officials and the state highway department in cooperation with each other." The emphasis is on a local voice in the selection of projects as opposed to only consultation and involvement. (Cf. discussion of 1973 Federal-Aid Highway Act).

Section 109(h) further defines the decision-making process with the words ". . . the final decisions on the project [shall be] made in the best over-all public interest, taking into consideration the need for fast, safe and efficient transportation, public services, and the costs of eliminating or minimizing . . . adverse effects. . . ." Project decisions cannot be based solely on transportation and public service considerations, but must include the cost that would be incurred in eliminating or minimizing adverse social, economic, and environmental effects.

Action Plans developed under PPM 90-4 are required to identify decision-making processes. Specifically:

> (1) The processes through which other State and local agencies, government officials, and private groups may contribute to reaching decisions, and the authority, if any, which other agencies or government officials can exercise over decisions.
> (2) Different decision processes, if any, for various categories of projects (e.g., Interstate, Primary, Secondary, TOPICS) and for various geographic regions of the State (e.g., in various urban and rural regions) to reflect local differences in the nature of potential environmental effects or in the structure of local governments and institutions.
> (3) The processes to be used to obtain participation in decisions by officials of appropriate agencies in other States for those situations in which the potential social, economic, and environmental effects are of interstate concern.

5. *Federal-Aid Highway Act of 1973,* Section 109, provides in part that in approving programs for projects on the federal-aid urban system, the Secretary of Transportation shall require that such projects be selected by the appropriate local officials with the concurrence of the state highway department and in accordance with the 3-C planning process. This places even greater responsibility for assessing transportation needs on local officials and represents yet another step toward the strengthening of metropolitan (3-C) agencies.

In implementing the 1973 Highway Act, the Federal Highway and Urban Mass Transportation Administrations have emphasized their intent to unify the planning and decision-making processes for highway and transit projects. The governor in each state has been asked to designate a

single agency in each urbanized area to be the recipient of FHWA and UMTA planning funds, thereby reinforcing the requirement in DOT Order 1130.2 for an annual unified work program covering all modal planning. A next step would be to combine this unified planning program with the program of capital and service improvements and with preliminary engineering funds into a single program to be reviewed and updated on an annual basis.

APPENDIX B

IMPACT AND DESIGN INTERRELATIONSHIPS

There is a tendency to treat social, economic, and environmental impacts as being relatively independent of one another. Increasing concern, however, is now being given to the long-range, indirect, secondary and tertiary effects of transportation development. Increased air pollution and noise levels, as an example, can result not only from increases in traffic but also from changes in activity patterns. Further, many adverse social and environmental effects may be related more to actual traffic volumes than to the physical characteristics of a roadway. Studies have shown that neighborhood disruption is greater with a heavily travelled one-way arterial than if the same street carries a lighter volume of two-way traffic (*40*).*

To predict social, economic, and environmental effects, impact prediction models must be sensitive to changes in traffic volumes, activity distribution, and operating policies and must recognize the two-way interaction between land use or, more generally, activity systems and a transportation system; first the effect of transportation supply or service changes on activity system characteristics and, second, the effect of activity system changes on transportation demand characteristics (*1*). The impact that a transportation facility has on the environmental quality, social characteristics, and economic activity of an area also influences the kind of activities that will locate there. These dynamic interactions are shown schematically in Figure B-1.

Recent modeling efforts have attempted to include explicitly these demand shift relationships with some degree of success. Although this area of modeling is not yet well developed, it offers much promise for future application. Such models specifically incorporate the influence of the type, scale, and location of transportation investments on future transportation demand. The notion that a fixed set of future demands will occur independent of the quality of service, taken over time, is specifically avoided.

In the following, five particular impacts are addressed in more depth, illustrating the interrelationships between impact and design variables.

* Numbers in italics are to a special list of references at the end of this appendix.

AIR QUALITY

The relationship between air quality and highway traffic has been the topic of much recent attention and controversy. The Clean Air Act of 1970 resulted in national ambient air quality standards and transportation control plans in major metropolitan areas that are aimed at achieving these standards. These plans frequently involve changes in modal emphasis, pricing, and operating policies. Inherent in some plans is the decision to accept current levels of traffic congestion rather than attempt to improve highway levels of service. Other means proposed to reduce pollution from transportation sources include vehicle strategies, such as emission controls and auto check-up programs, and system strategies that control and improve traffic flow. Land-use planning that reduces the need for transportation and decreases congestion can also be used as part of a broad-based air quality program.

Transportation analyses of these clean air plans, as well as of any new transport facility, require techniques to predict the impact on air quality. Various pollutants are emitted by vehicles due to the incomplete combustion of fuel. The most important of these are carbon monoxide (CO), hydrocarbons, and nitrogen oxides (NO_x). Sulfur oxides and suspended particulates are also released, but in small quantities compared to other sources. Transportation systems also affect air quality through their influence on land-use patterns. Thus, a rail line that reduces emissions by decreasing automobile travel may attract enough industry and other new developments to result in a net emissions gain in an area.

The impact of air pollution on health is the most often cited reason for concern with air quality. However, it also can affect the aesthetic quality of an area due to soot and smells, erode structures through chemical action, injure crops, soil clothing, and affect people's physiological performance. The incidence is generally worst on those who live and work near areas of concentrated auto use. People living in congested city centers are most severely affected because of the traffic flow patterns in the areas and the presence of other pollution sources nearby. In all areas it is the elderly and the sick who suffer most from air pollution.

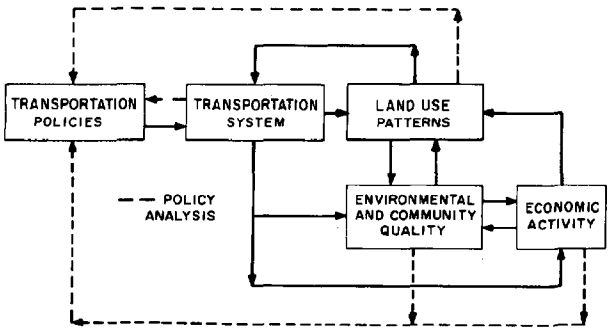

Figure B-1. Interrelationship of transportation policies and land use.

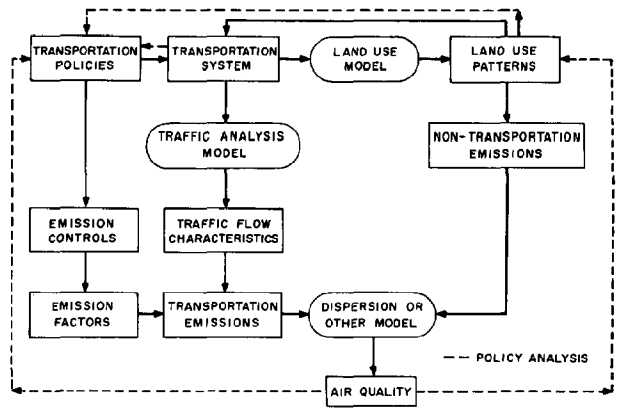

Figure B-2. Interrelationship of transportation and air quality.

The general factors in predicting the air quality impact of a transportation project are shown schematically in Figure B-2. Although a variety of techniques exist that vary in the resources required and the accuracy of the results (Table 11), four basic steps can be outlined:

1. Based on traffic flow data and emission factors, calculate the automotive emissions in the zone or zones being studied.
2. From land-use projections, estimate the total emissions from nontransportation sources.
3. Using either a dispersion model or some simplifying assumption, translate the emissions into a measure of air quality.
4. Where possible, evaluate the impact with respect to its incidence (i.e., which groups and activities will be impacted and how sensitive are they to air quality changes) and with regard to established criteria.

Generally, the measure used in the analysis of air quality is the concentration of each pollutant at a particular point (or zone). This allows the pollutants to be handled individually because their effects and characteristics vary. Basic emission factors for CO, hydrocarbons, and NO_x for motor vehicles of different model years have been compiled by the Federal Environmental Protection Agency. Adjustments to these factors can then be made to account for type of operation, vehicle speed, and trip length. The point in time for which a prediction is being made also should be specified in order to account for changes in land use, emission controls, and traffic volumes. The estimated air quality and emission levels must then be compared with appropriate national, state, and local standards.

COMMUNITY COHESION

One of the more difficult impacts to estimate is the change in neighborhood and community character that would be caused by implementation of a transportation proposal. For the residents of an area in which a project is contemplated, key questions are "Will my house be taken?" and "How will my neighborhood be changed?" Not only should potential physical effects be predicted, but estimates also need to be made as to how individuals and communities will react to these effects.

In general, two affected groups exist when a highway is built through a community—those residents who are dislocated and those who remain. Their problems and reactions are different and must be considered separately (Fig. B-3).

The community first feels the effect of a project during the system or corridor planning stage. Experience has shown that at this point uncertainty as to a road's actual location may result in an unwillingness among residents to invest in home improvements and may make it difficult to sell property in the area. Speculators may move in, buying up property cheaply in hopes of making a profit from resale if the highway isn't built.

How seriously a particular neighborhood will be harmed by this uncertainty is difficult to predict. However, it is reasonable to assume that the discomfort created will be related both to the length of time it takes to decide on an alignment and the strength of residents' ties to their homes. More cohesiveness in a neighborhood would most likely mean a higher level of anxiety and psychological discomfort, whereas in a less stable area the impact from reduced maintenance and speculator activity would be more significant.

The severity with which a displaced person or family is impacted depends on two factors—the psychological feelings created (which are a function of the feelings that initially exist toward the neighborhood) and the ability to relocate satisfactorily. Fried's study of urban renewal displacees (*29*) describes the "psychological costs of relocation" and notes that their severity is a function of prior orientation to the area (i.e., familiarity, commitment) and of social and emotional ties to the area. He sugegsts that "either spatial identity or group identity may be a critical focus of loss of continuity and thereby lead to severe grief: but if both bases for the sense of continuity are localized within the residential area, the disruption of continuity is greater, and the proportions of marked grief correspondingly higher." Furthermore, Fried notes that "apart from local interpersonal and social relationships and local spatial orientations and use (and variables which are closely re-

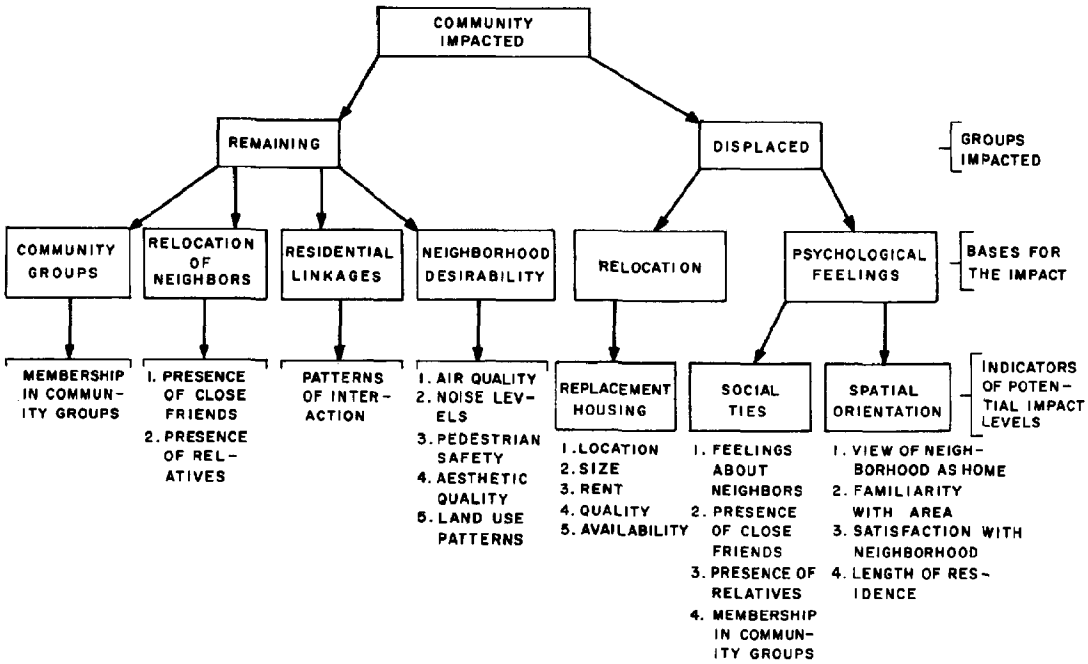

Figure B-3. Community disruption factors.

lated to these), there are few other social or personal factors in the pre-location situation which are related to depth of grief."

Factors that are indicative of spatial orientation include the extent to which the neighborhood is viewed as "home," familiarity with the area, satisfaction with living there, and, to a lesser degree, length of residence. The strength of social ties can be estimated by the individual's feelings about his or her neighbors and the presence of close friends in the community. Prediction of potential grief levels, then, depends on gathering the information described in the foregoing for a particular area and combining it with an estimate of how many households would be displaced. The output of this kind of analysis would be a qualitative estimate of how the community (using average values of data and responses from individuals) would react.

The manner in which a family is relocated also influences their reaction to displacement. If replacement housing can be found in or near the community, adverse psychological reactions may be minimized due to the maintenance of ties to family, friends, schools, stores, etc. As Fellman's (*27*) work pointed out, lower-income people (who have frequently been the victims of relocation) tend to have many friends and relatives within walking distance of their homes. Coupled with the lack of a second family auto, relocating these people even a few miles from their former neighborhoods may result in the severing of many important relationships. Furthermore, it is often impossible to find equivalent housing for comparable prices, especially when the existing home has had extensive improvements made on it.

The impact felt by those "remaining" after the road is built through a community may be considered as three factors—friends and relatives lost through relocation, community groups weakened through loss of members, and residential linkages broken or altered. A fourth factor, the change in neighborhood desirability due to increased air, noise, and visual pollution, decreased pedestrian safety, and changes in land-use patterns may also affect the stability of the community.

Studies of linkages to the neighborhood—the close proximity of friends and relatives; ties to churches, social clubs, and neighborhood organizations; and use of neighborhood facilities such as shopping and recreation areas—give indicators of the effects displacements will have on those left behind as well as dislocated residents (*25*). Membership and use surveys may indicate the severity impact displacements will have on organizations and businesses.

Several efforts have been made to systematically define communities where strong psychological reactions to a highway are likely to occur. The basic approach of these methods is to organize data that describe the social ties and spatial orientation of residents into quantifiable forms. Although this provides an index and/or sensitivity map that is appealing to analysts who have despaired of adequately delineating communities by qualitative means, too great reliance on any one technique will most likely oversimplify and obscure the issues. The best approach seems to call for gathering as many potentially useful data as feasible and analyzing them with respect to the ideas presented here.

NETWORK FLOWS

The magnitude and pattern of traffic flows on a multimodal transportation network are directly and indirectly related to a wide range of community and environmental effects. It is important, then, for network analyses to recognize the

relationship between traffic flows and other impacts (Fig. B-4).

To make network flow predictions sensitive to the full range of alternatives to be investigated, three "ideal" requirements can be stated toward which the development of network modeling tools should move.

First, the network model system should be oriented toward multimodal analysis. Such a system should account for the ways in which the service provided by and the demand for different modes are interrelated. Mode split models alone are insufficient to fully evaluate interrelationships among modes; multimodal analysis should extend from trip generation to assignment.

Second, network models should be sensitive to a wide range of policy variables, including facility and vehicle options as well as operating and pricing changes. Models should be able to handle explicitly a variety of level-of-service characteristics, including travel time (access and line-haul), frequency of service, and trip costs (including fares, tolls, and parking charges). The demand for transportation is a function of both the activity system (population, income, etc.) and the level of service (Fig. B-5). For a model to be policy sensitive, it must be based on the causal relationships that influence individual choices rather than on associative or correlative relationships. Existing techniques often assume that total demand is independent of the existing level of service or the level of service to be supplied in the future. Often, no capacity limitations are assumed in assigning trips to links. Such techniques are unrealistic and tend to bias an evaluation toward favoring more and larger facilities.

Finally, network analyses should recognize the incidence of impacts and produce results that are as disaggregate as possible. Rather than predicting average daily volumes, attention should be focused on the implications of transportation service changes on different income groups and subareas within a region. For example, the origins and destinations of the principal users of a proposed facility could be identified, such as through select link analysis or extensions of such procedures. Both local and through traffic and peak/off-peak periods could be analyzed.

The Urban Transportation Model System

Most urban transportation studies are based on a planning methodology developed in the 1950's that predicts demand for travel in an urban region based on growth in population, employment, and income and attempts to predict the distribution of this travel over the future transportation system (*53*). The basic sequence of activity is to proceed through separate stages of trip generation, trip distribution, modal split, and network assignment. This same general approach is now being used in a variety of forms for most statewide transportation studies (*48*).

The approach, as normally applied, suffers from four serious weaknesses:

1. The predicted volume and distribution of travel are not determined as a function of the expected level of service and as a result do not correspond, in general, to equilibrium flows.

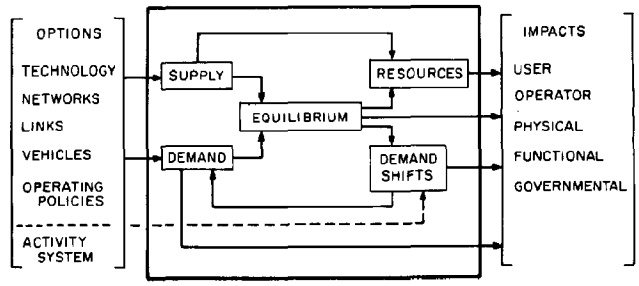

Figure B-4. Basic prediction models.

2. The model is biased toward increased highway needs because effects of congestion are not considered in the trip generation and modal split stages.

3. The system considers only highway travel (except for the modal split, which considers two modes of private vehicle and public transportation).

4. The approach does not encourage evaluation of a wide range of alternatives, because of extensive requirements for base-year calibration data.

Although these weaknesses limit the usefulness of the typical urban transportation model package, modifications can be made in applying the approach to make the network analyses more policy sensitive. For example, on the West Side Highway Project in New York City, preliminary assumptions of unrestrained vehicular demand resulted in predicted volumes that far exceeded the parking capacity in different parts of Manhattan (*59*), and also did not take into account the effect of increased congestion. The trip generation and the distribution predictions were then scaled down to be consistent with practical limitations on parking supply and the revised inputs were reassigned to the network to yield more consistent volumes.

In the Michigan Route 31/131 study, a version of the urban modeling package adapted for statewide use is being used. Again, to increase the sensitivity of traffic analysis to level-of-service variables, a number of modifications and

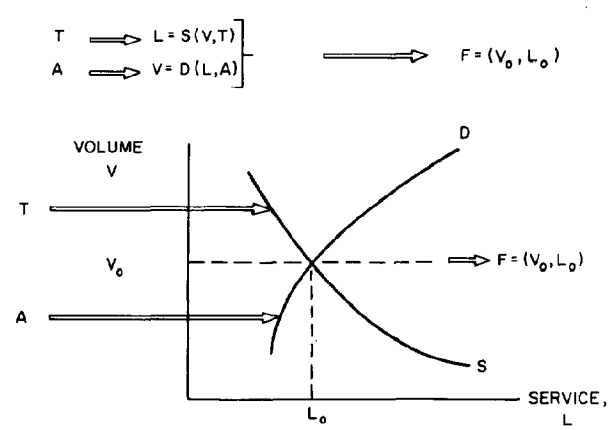

Figure B-5. Simple equilibrium of transportation supply-demand.

supplementary activities are being considered. In recognition of the difficulty and expense in actually modifying the models or in analyzing numerous alternatives, it is recommended that:

1. The level of service implied by the assignment of trips to links be checked for consistency with the level of service assumed for those links in the models. If assumed levels of service exceed those which could be reasonably expected, adjustments can be made to either the models or the assignment itself by:
   (a) Lowering the assumed level of service in the models and testing the alternative again.
   (b) Introducing capacity restraints and testing the alternative again.
   (c) For routes with high volumes (and in some cases, physically impossible volumes) comparing the level of service on alternate routes and diverting by hand some percentage of the traffic.
2. At least one two-lane alternative be run to test how trip generation rates and the assignment change (the Michigan model is sensitive to travel time to some extent in trip generation). Other two-lane routes might then be assumed to have approximately the same relative effect compared to a corresponding four-lane alternative in the same corridor.
3. The traffic analysis unit assigned to the region should attempt to augment the assignments with their knowledge of local effects. Particularly in the more populated and popular areas like Traverse City and Sleeping Bear National Park, the large zones used in the model may underestimate local traffic.
4. Plots from permanent traffic recorders in the region be used to get a feel for the summer recreational peaking problem. Also, placement of temporary recorders at strategic points in the region should be considered.
5. Although design-hour volume/capacity plots may be useful to the study team in identifying trouble spots, they will probably not be meaningful to the public. Other display formats should be explored, including pictures of the traffic conditions likely to prevail on the major arterials during summer peak and off-peak periods.

These two examples are cited to illustrate the types of modifications that can be made to traditional traffic analysis models and to their outputs to increase the usefulness of the results. It is particularly important in the evaluation of the "no-build" option not to assume that volume is independent of level of service (as is assumed by most trip generation equations). Such an assumption often leads to the prediction of unreasonable or even physically impossible volumes on the existing system. Both the analysts and the public know this will not occur. Attention should be focused on presenting a realistic appraisal of the transportation service impacts explicitly recognizing that congested conditions are as valid an option as new facilities.

Direct Demand and Disaggregate Behavioral Models

Concern with the limitations of the traditional urban transportation planning process led to development of direct demand models. In its most general form, the direct demand model predicts the volume of travel from a single zone to another zone by each mode as a function of the activity system in the origin and destination zones and the level of service between the origin and destination zones by the selected mode and by all other modes (*49*). The activity system variables most commonly used include population, employment, income, auto ownership, and indices of commercial and industrial activity. The level-of-service variables most commonly used are travel time, waiting time, transfer time, line-haul cost, and access cost.

The approach combines trip generation, trip distribution, and mode split into one direct step and thus eliminates some of the weaknesses of the traditional urban transportation planning approach. Most notably, total trips, distribution by zone, and mode split are functions of level of service, a broader concept of level of service is included, and fewer data are required for model calibration.

A second alternative approach to transportation system modeling is disaggregate (based on the individual traveler) and behavioral (models the causal relationship by observing the individual's trip-making behavior) (*60*). This approach initially concentrated on binary choice modal split but recently has been extended to include the entire sequence of trip-making decisions of generation, distribution, and modal split (*45*). Use of disaggregate data not only reveals relationships that are suppressed by zonal aggregation but also eliminates the need for uniform area sample O-D surveys with resultant major savings in the cost of data acquisition and analysis. The behavioral emphasis also offers increased hope for understanding the basis of trip-making decisions and, thus, for the transferability of models among areas.

ACCESSIBILITY

Accessibility is a measure of the resources (principally time and money) required to reach various opportunities (jobs, stores, etc.). Although travel times and costs have usually been used as surrogates for accessibility, it is desirable to disaggregate accessibility changes with respect to different groups of users and different kinds of opportunities to permit an assessment of differential incidence.

Changes in accessibility have both a direct and an indirect impact (*68*). The direct effect relates to the ability of people to reach desired destinations as an end in itself. The indirect effect is the impact of access patterns on land use, economic development, and population distribution and, in turn, their impact on environmental quality. Furthermore, the increases in land values that are often attributed to transportation improvements are due, for the most part, to accessibility changes.

Differential impacts can be evaluated through the use of indices, graphs, and isochronal maps if the data from traffic analysis models are disaggregated in an appropriate manner. In some cases, two or more of these techniques may be used in unison because they illustrate different dimensions of accessibility. An example of the desirable disaggregation would be to look at the impact of a highway on the travel time from low-income residential areas to an industrial park where unskilled and semi-skilled jobs are available.

MOBILITY FOR SPECIAL GROUPS

In any community, there are certain groups—the elderly, the young, the poor, and the handicapped—whose transportation needs differ from those of the general population. Normal transportation facilities either are of no use, due to the unavailability of a particular mode (especially auto), or actually impede travel by these groups due to vehicle design, physical barriers, and operating policies. Because these people have limited flexibility in making their travel plans, their problems should receive special attention. In addition, the unique requirements of pedestrians and bicyclists are receiving increasing interest.

A general methodology to accomplish special mobility studies is as follows:

1. Identify groups in the affected area that may have distinct or special mobility needs and problems.
2. Determine which measures and techniques are appropriate for evaluating the mobility of each particular group.
3. Assess the impact of the proposed facility (or policy) on each group based on their special needs.
4. Determine ways in which the mobility of these groups can be best improved.

In carrying out this methodology it is desirable to interact with individuals and representatives of concerned organizations in order to identify the special problems that exist in the study area. For example, it might be discovered that a community has many retired persons who would be unable to use overpasses in crossing a proposed highway. This can then be taken into account in planning the facility's location and design.

Once the accessibility changes for each group have been computed, they must be checked against the special characteristics of each group in order to determine the magnitude of each impact. Thus, a project that will enable children to more easily reach a playground or handicapped people to get to a medical center will benefit these groups and satisfy some of the latent demand for transportation that they possess. Alternatively, a highway or transit line that cuts off a low-income neighborhood from jobs and recreation centers creates a negative impact.

Evaluation of the expected impacts should include proposals by which the mobility of the special groups can be improved. Possibilities include transit service and vehicles tailored to the needs of the handicapped, loan programs to encourage auto ownership among low-income groups, etc. Finally, the results of this analysis should be combined with the over-all accessibility evaluation in providing a broader view of the impact on mobility.

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