Improving Decision-Making For Major Urban Transit Investments
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JOSEPH R. STOWERS, ARLEE T. RENO, and V. WESLEY BOYAR
System Design Concepts, Inc.
Washington, D.C.

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Administrators, engineers, and many others in the transit industry are faced with a multitude of complex problems that range between local, regional, and national in their prevalence. How they might be solved is open to a variety of approaches; however, it is an established fact that a highly effective approach to problems of widespread commonality is one in which operating agencies join cooperatively to support, both in financial and other participatory respects, systematic research that is well designed, practically oriented, and carried out by highly competent researchers. As problems grow rapidly in number and escalate in complexity, the value of an orderly, high-quality cooperative endeavor likewise escalates.

Recognizing this in light of the many needs of the transit industry at large, the Urban Mass Transportation Administration, U.S. Department of Transportation, got under way in 1980 the National Cooperative Transit Research & Development Program (NCTRP). This is an objective national program that provides a mechanism by which UMTA’s principal client groups across the nation can join cooperatively in an attempt to solve near-term public transportation problems through applied research, development, test, and evaluation. The client groups thereby have a channel through which they can directly influence a portion of UMTA’s annual activities in transit technology development and deployment. Although present funding of the NCTRP is entirely from UMTA’s Section 6 funds, the planning leading to inception of the Program envisioned that UMTA’s client groups would join ultimately in providing additional support, thereby enabling the Program to address a large number of problems each year.

The NCTRP operates by means of agreements between UMTA as the sponsor and (1) the National Academy of Sciences, a private, nonprofit institution, as the Primary Technical Contractor (PTC) responsible for administrative and technical services, (2) the American Public Transit Association, responsible for operation of a Technical Steering Group (TSG) comprised of representatives of transit operators, local government officials, State DOT officials, and officials from UMTA’s Office of Technology Development and Deployment, and (3) the Urban Consortium for Technology Initiatives/Public Technology, Inc., responsible for providing the local government officials for the Technical Steering Group.

Research Programs for the NCTRP are developed annually by the Technical Steering Group, which identifies key problems, ranks them in order of priority, and establishes programs of projects for UMTA approval. Once approved, they are referred to the National Academy of Sciences for acceptance and administration through the Transportation Research Board.

Research projects addressing the problems referred from UMTA are defined by panels of experts established by the Board to provide technical guidance and counsel in the problem areas. The projects are advertised widely for proposals, and qualified agencies are selected on the basis of research plans offering the greatest probabilities of success. The research is carried out by these agencies under contract to the Academy, and administration and surveillance of the contract work are the responsibilities of the Academy and Board.

The needs for transit research are many, and the National Cooperative Transit Research & Development Program is a mechanism for deriving timely solutions for transportation problems of mutual concern to many responsible groups. In doing so, the Program operates complementary to, rather than as a substitute for or duplicate of, other transit research programs.
This report will provide guidance to all transit professionals involved in ongoing and future analysis of transit/highway alternatives for urban areas. State and local officials who must make transit investment decisions will find practical information on appropriate organizational structures for conducting major transit studies including guidance on coordination with officials at all levels of government, and guidance on communicating issues to staff and other parties involved at the various stages of the Alternative Analysis process as called for by the Urban Mass Transportation Administration (UMTA), U. S. Department of Transportation. Federal officials, who must determine policies for investment in mass transit, will find recommendations on simplification or integration of federal regulations, changes in UMTA's review and approval procedures, and other actions such as training or technical assistance that could improve practice. Transportation professionals in agencies responsible for conducting major transit studies will find planning guidelines, approaches to involving decision-makers at each stage of the process, and lessons from other areas on how to assure successful completion of each phase. State and federal professionals who review Alternatives Analyses will find an assessment of various approaches used in urban areas with differing institutional arrangements, and the identification of guidance needs of those who are undertaking Alternative Analyses. Researchers who develop methodology will find useful information on experience in various technical aspects of major transit studies and the identification of the more important needs for further research.

Since 1975, the Urban Mass Transportation Administration (UMTA) has required, as a condition for federal funding support, a structured process, termed “Alternatives Analysis,” for proposed major investments in urban mass transit facilities. This process is used to identify priority corridors for possible major investments and to assess the cost-effectiveness of these investments in comparison to less costly transit improvements. Information generated in the process is used both by federal officials in administering a discretionary capital grant program and by state and local officials in determining priorities and identifying needed improvements in mass transportation services.

Since the advent of the alternatives analysis requirements, a significant number of urban areas has been involved in some aspect of the process. Concerns have been expressed with the process, particularly regarding the extensiveness of the study requirements, the delays caused in implementing transit improvements, the role that UMTA staff has played in managing the studies, and the use of the study results in UMTA’s decision-making process. This project was initiated because of a recognized need to evaluate past experience with alternatives and to recommend improvements in the process that will result in more effective local, state, and federal decision-making.

The research results contained in this report are derived from an assessment of federal, state, and local decision-making processes for major urban mass transportation investments by evaluating recent alternative analysis experiences. The assessment has identified potential improvements in policy, procedures, and use of technical information, and has produced recommendations on planning procedures for use by federal, state, and local agencies.
CONTENTS

1 SUMMARY

PART I

10 CHAPTER ONE Introduction and Research Approach
   Problem Statement
   Original and Expanded Scope of Study
   Research Approach

15 CHAPTER TWO Findings
   Technical Analysis
   Structure of Study Phases and Decision-Making
   Organizational Structure for the Studies

31 CHAPTER THREE Recommendations for Improvements in the
   Transit Decision-Making Process
   Recommendations for Current Practice
   Recommendations for Federal Programs

40 CHAPTER FOUR Recommendations for Research and Synthesis
   of Practice
   Costs of Major Transit Studies
   Travel Demand Data
   Travel Demand Modeling
   Preliminary Engineering
   Transit Operations Planning
   Transit Route Length Evaluation
   Overall Evaluation
   Research, Development, and Demonstration Planning
   within the Context of Alternative Analysis
   Evaluation of Possible Structural Changes in Urban
   Transportation Grant Programs
   Involvement of Experts in Research Program Management

PART II

44 APPENDIX A Chronology of Selected Federal Actions Related
   to Urban Transportation Planning

47 APPENDIX B Bibliography
NCTRP TECHNICAL STEERING GROUP
Annual research programs for the NCTRP are recommended to UMTA by the NCTRP Technical Steering Group (TSG). Under contract to UMTA, the American Public Transit Association, supported by the Urban Consortium for Technology Initiatives/Public Technology, Inc., is responsible for operation of the TSG, the membership of which is as follows.

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EDITH PAGE, Senior Research Associate, Public Technology, Inc. (Alternate)

TRB Liaison
KREIGER W. HENDERSON, JR., Director, Cooperative Research Programs, Transportation Research Board

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Since 1975, the Urban Mass Transportation Administration (UMTA) has required, as a condition for federal funding support, a structured process, termed "alternatives analysis," for proposed major investments in urban mass transit facilities. This process is used to identify priority corridors for possible major investments and to assess the cost-effectiveness of these investments in comparison to less costly transit improvements. Information generated in the process is used both by federal officials in administering a discretionary capital grant program and by state and local officials in determining priorities and identifying needed improvements in mass transportation services.

Since the advent of the alternatives analysis requirements, a significant number of urban areas have been involved in some aspect of the process. Concerns have been expressed with the process, particularly regarding the extensiveness of the study requirements, the delays caused in implementing transit improvements, the role that UMTA staff has played in managing the studies, and the use of the study results in UMTA's decision-making process. NCTRP Project 36-1 was initiated because of a recognized need to evaluate past experience with alternatives analysis and to recommend improvements in the process that will result in more effective local, state, and federal decision-making. As the project progressed in its early phase, its scope was expanded to include a broader review of alternatives analyses within the context of the entire process of major transit investment decision-making. More case studies were added, including several involving no UMTA funding, and more attention was directed at system planning processes and at federal policy and procedures.

The general objective of this research has been to assess the federal, state, and local decision-making process for major urban mass transportation investments by evaluating recent alternatives analysis and related study experiences. The purpose of the assessment has been to identify potential improvements in policy, procedures, and use of technical information, and to formulate recommendations on planning procedures for use by federal, state, and local agencies.

The original scope of work included case studies of the planning process for major transit investments in eight urban areas: Baltimore, Houston, Milwaukee, Pittsburgh, Portland, San Diego, San Jose, and Toronto. All of these except San Diego and Toronto involved UMTA-funded alternatives analyses. The two non-UMTA-funded urban areas were included to provide a basis for comparisons to attempt to identify the influence of federal funding and associated regulations on the process.

While the initial case studies were being conducted, the NCTRP project panel decided to enlarge the scope to include additional case studies and to expand the assessment of the alternatives analysis program to include a series of interviews with current and former federal staff and officials. The case study urban areas added were: Boston, Calgary, Chicago, Cleveland, Denver, Edmonton, Madison, and St. Louis.

The expanded list of 16 case study areas included 41 major transit studies that were conducted since the beginning of the alternatives analysis program in the mid-
1970s. Of these, 20 were UMTA-funded and 21 were non-UMTA-funded, including several locally funded light rail transit (LRT) feasibility and corridor studies in the same areas which also conducted UMTA-funded alternatives analyses (San Jose, Denver, and St. Louis), in addition to the several studies in San Diego and the three Canadian cities.

A major product of this project has been a set of case study reports that have been separately bound and reviewed by most of those persons interviewed in the case study urban areas (copies of all case study reports are available on a loan basis or may be purchased in microfiche from the Publications Office of the Transportation Research Board). These reports include a history of the recent transit planning process, an evaluation of the major studies based on a common set of review criteria, and conclusions on lessons for other urban areas.

Three additional products of this project have been produced:

1. An inventory of regulations and requirements, a task report which included the chronology of UMTA actions in this field and is contained in Appendix A of this report.
2. A review of relevant literature, a task report which included an annotation of the bibliography contained in Appendix B of this report.
3. A technical memorandum on the case study methodology and selection of case study cities, which is summarized in Chapter One of this report.

Chapter Two of this report contains the study findings based on the individual case studies and the comparative assessments of planning processes in these urban areas.

**Technical Analysis**

The first part of the findings deals with the quality of the various components of the technical work programs with emphasis on their role in the decision-making process. Both the state of the art and general practice in the field have improved enormously over the last several years. The relative levels of adequacy, however, differ significantly among the specific technical elements of the process:

1. Demand analysis methods have been highly refined and the quality of work in actual practice has improved greatly, due in substantial part to the role of UMTA staff.
2. Input data for demand analysis, on the other hand, are frequently inadequate and no standards or guidelines have been developed. However, only small scale data collection efforts can be justified as part of alternatives analyses.
3. Preliminary engineering (P.E.) work was originally considered by UMTA to be performed only after completion of alternatives analysis work and selection of a preferred alternative. However, several of the recent alternatives analyses have included "conceptual engineering," and some P.E. work has been performed in most of the non-UMTA-funded studies before local formal commitments were made. No guidelines exist, however.
4. Transit operations planning is often a very weak element of the planning process, but should receive far more attention based on the case study experience. Sometimes the most valuable immediate products of studies are transit operations improvements. UMTA staff have emphasized the importance of this work but no guidelines are available.
5. Analysis of varying lengths of guideway systems is another weak technical element of the process. Very little work has been done in the studies and no guidelines are available.
6. Environmental impact studies have improved substantially in quality, but the environmental impact issues associated with the transit alternatives are seldom important issues in the decision-making process. More work is being done than is necessary in this area; however, caution is advised in reducing attention to environmental issues.

7. The same conclusions apply to analysis of historic site impacts, parklands, and energy consumption.

8. Overall evaluation of alternatives (i.e., benefit-cost analysis, cost-effectiveness analysis, etc.) remains one of the weaker technical aspects of many of the studies, and the available guidelines are often not being used.

9. Consideration of new technology has been a very weak element of all the case studies. Only a very few of the studies have given significant attention to new technology and no examples were found that can be considered exemplary for current practice.

Structure of Study Phases and Decision-making

The overall structure of the planning and decision-making process as defined in UMTA's guidelines makes sense in general and in an abstract rational process. However, no case study urban area has gone through the process without some modification of UMTA's idealized model, and this review leads to a conclusion that none should be required to conform with UMTA's model unless that process truly fits the local decision-making context. Some of the case study urban areas have been forced to comply with this standard process to a greater extent than they wanted to, and to a greater extent than appears justified in retrospect.

Phase I system planning studies can be eliminated if urban areas can provide a well-supported basis for determining priorities among corridors. If urban areas wish to program studies involving combinations of Phase I and Phase II technical work and decision-making, UMTA should be receptive to such proposals under appropriate conditions. To avoid disruption to staff efforts, the process of transitioning between the two phases should be facilitated by rapid reviews and approvals, and by greater emphasis on a shared local and federal process, avoiding protracted negotiations over work programs.

The local decision on a preferred alternative should be followed as closely as possible by funding agreements, if any are to be reached by all responsible parties including UMTA. This will normally require that some preliminary engineering (P.E.) work be performed as part of the Phase II alternatives analyses. In order to avoid the waste of performing substantial amounts of P.E. work on several alternatives, Phase II studies that involve complex engineering problems on several alternatives should provide for narrowing down of the number of alternatives during the study to reduce the amount of P.E. work required to obtain good cost estimates. Preliminary engineering work necessary to establish technical feasibility, approximate alignment and grade, station locations, and cost estimates accurate enough to reach financial agreements for the preferred alternative should be included in the Phase II work programs. In complex studies, some P.E. work may be justified on more than one alternative if the cost of such work is justified by the time savings involved.

Since most Phase II studies leave some issues unresolved among local, state, or federal officials, funds should be programmed at the start for Phase III special study activities to aid in resolving such issues—to be authorized on a contingency basis as Phase II work is being completed. Additional P.E. work will usually be necessary after basic commitments are made to refine the cost estimates, and the funding agreements should therefore provide for some adjustments in funding.
UMTA's incremental development policy has been successful in forcing local officials to be far more realistic and to come to grips with the difficult process of establishing priorities for regions. However, the policy has had the effect of diminishing attention to the development of long range transit plans to an undesirable extent based on experience in the case studies. Greater attention to long range planning is needed because of interrelationships among transit corridors and because of the importance of land development considerations within corridors. Emphasis should shift somewhat to greater attention to long range transit system planning, as distinct from setting priority among corridors based primarily on demand measures, which has been overemphasized in some previous system planning studies.

The draft and final environmental impact statement (E.I.S.) processes are logically related to the alternatives analysis process in terms of timing, but the analysis work being done in most UMTA-funded studies is far in excess of what is required for environmentally responsible transit development. Phase I studies should continue to address environmental issues only to the extent that such issues are raised in the "scoping" process for these studies. Phase II studies should be reoriented to provide much greater attention to overall evaluation, and allow the actual balance among specific local real world issues to determine the relative emphasis on environmental issues vs. other issues such as transit operating costs, capital costs, land development policy, traffic conditions, etc. Some of the problem might be alleviated if the responsibility for the E.I.S. work program development and execution were to be shared more equitably by UMTA rather than left primarily to the local agency.

Organizational Structure for the Studies

The case study urban areas had a surprisingly wide variety of study organizational forms, particularly in light of the fact that U.S. urban areas share so many of the same general characteristics of governmental structure as relates to transportation programs, and in light of the influence that the U.S. Federal government has had in standardizing organizational structure for other programs. Only in the instance of the two Alberta case studies was there any pair of urban areas which had precisely the same organizational structure in terms of which types of agencies were responsible for transit system planning and which types of agencies were responsible for corridor studies. Transit operating agencies and metropolitan planning organizations (MPOs) were the most common types of lead agencies, but state and provincial transportation departments, counties, and cities have all been lead agencies in one or more case study areas.

Most of the case studies involved changing organizational structure both in terms of shifts in lead agency responsibility over time, and in terms of shifts as work progressed from system planning to corridor studies. A frequent shift was from MPO to a transit operating agency or local government.

Most of the studies involved substantial participation from several agencies, often as many as five or more. Some involved the creation of ad hoc groups or formally constituted multiagency committees, and one (San Diego) involved the creation of an agency specifically for guideway transit development, as distinct from transit operations. The specific roles assigned to each type of agency involved in the process have also varied widely, although some fairly common roles have been identified for each type of agency.

Consultants also played a wide variety of roles in the studies. In about half the urban areas, consultants conducted the majority of the technical work. Problems that existed in some of the early studies due to lack of effective management of consultants'
work have largely disappeared in recent years as the responsible agencies have developed substantial experience. Nonetheless, when all, or almost all of the technical work is performed by consultants, the responsible agency must have very competent and experienced managers to assure proper policy direction.

UMTA-funded studies have involved more comprehensive, costly studies (almost three times the others) which often have required more extraordinary efforts of the agencies involved, and have more often required the use of consultants in major technical roles. The UMTA-funded studies have often involved more effort than appears justified, although this was more true in the past than in recent studies. The non-UMTA-funded studies have involved fewer alternatives and have concentrated on the most important technical issues—they have focused more on preliminary engineering and capital cost estimating, and less on environmental impacts. Some of the non-UMTA-funded studies have given too little attention to lower cost bus alternatives, to demand analysis, and to overall evaluation of alternatives. The Canadian consultant contracts have often been small scale supplementary efforts, in specialized areas, as parts of ongoing agency planning programs. Canadians have placed more emphasis on the use of consultant contracts as part of a learning process to build up in-house expertise for future studies.

The cost of major transit studies is more strongly influenced by the complexity of the alternatives being evaluated and the complexity of the impacts involved, rather than by such factors as the phase of the study, the size of the urban area, or the need to involve a consultant. Furthermore, study costs are affected by a variety of aspects of complexity:

1. Number of potential technologies.
2. Alignment complexities.
3. Grade level complexities.
4. Extensiveness of alternatives.
5. Environmental impact issues.

LRT feasibility and corridor studies have been particularly inexpensive by comparison with other studies, partly because of lack of federal involvement (and therefore federal study requirements) in many of them, but also because of the emphasis on lower cost surface operations, use of existing rights-of-way, the sharing of experience (particularly in Canada and the West), and the absence of significant environmental issues.

Recommendations for Current Practice

A wide variety of forms of organizational structure may be appropriate for the conduct of major transit investment studies. Ideally, all responsibility for technical work, coordination, and managing the participation process should be placed in a single agency—the agency best prepared in terms of staff expertise, makeup of its governing board, and its responsibilities.

Very often, however, more than one agency must be involved, for various reasons. If the principal reason is lack of available staff expertise in a single agency, the most efficient arrangement is for the agencies involved to enter into an agreement whereby key staff members needed will be loaned to the lead agency under appropriate conditions and time commitments.

Coordinated multiagency work programs can be carried out successfully if properly managed, if roles are clearly defined for managing work elements and participation in decision-making processes, if mechanisms are established for periodic progress
review, and if a lead agency has sufficient authority and competence. Co-equal joint responsibility for study management should be avoided if possible.

If the MPO is designated the lead agency, the danger can exist of having lack of sufficient expertise in some important technical areas, such as transit operations, engineering feasibility, cost estimating, and economic feasibility analysis. Overemphasis on land use planning and travel forecasting at the expense of these other important study elements can result unless such studies are properly balanced with competent borrowed staff expertise or through consultant contracts.

Consultant contracts should be effectively managed by competent agency staff, particularly if consultants are to conduct most or all of the technical work. Consultants can be used effectively in a wide variety of technical roles, from providing specialized technical expertise, to augmenting general staff efforts, to evaluation of alternatives, and even making recommendations on preferred alternatives. Regardless of the roles assigned, however, all final decisions should rest with the responsible agency and its governing board. The greater the role given to consultants, the greater should be the agency's attention in assuring that top agency managers and decision-makers are actively involved.

Local study managers should develop a clear definition of what level of effort is needed in new work programs for an effective local decision-making process. This will aid them in negotiating study agreements with UMTA and/or other funding agencies. Contingencies should be built into funding agreements to provide opportunities to conduct special studies within the framework of the alternatives analysis process or its equivalent. Unforeseen problems arise in almost all complex studies, and they usually require special study and staff attention to resolve them. This staff assistance can be particularly important as agreements on preferred alternatives and funding are being developed.

**Recommendations for Federal Programs**

Recommendations are made in three categories: (1) changes in the alternatives analysis and related regulations, (2) administration of the program, and (3) possible changes in the grant program.

The need for immediate change in regulations is minimal. The existing policy statements and regulations are flexible enough to permit accomplishment of most, but not all of the recommendations without change.

UMTA's regulations should not arbitrarily force the decision-making process to be drawn out into the standard four-phase model (system planning, corridor study, preliminary engineering, and final design). Experience in the case studies shows that the standard four-phase model can unnecessarily lengthen the process and confuse participants, often without real benefit to any interested party. Some formal clarification of this policy is desirable to reduce the likelihood of future problems.

UMTA should clarify its policy regarding its own decision-making process and the way in which the results of alternatives analyses are used in this process. This should involve more clearly defined guidelines for overall evaluation, including the manner in which economic investment evaluation measures, benefit-cost ratios, or cost-effectiveness measures are developed. It should also involve a commitment by UMTA to state the basis on which its decisions are made in each grant application case.

Consideration should be given to the development of a policy statement that would place greater emphasis on long range transit system planning issues that might be important in alternatives analyses, including such factors as:
1. Operational plans for areawide transit systems.
2. Impacts of the transit development program on future operating costs and subsidy requirements.
3. Land development impacts.
4. Commitments of local officials to land development policies to enhance the transit-orientation of corridors.
5. Commitments of the private sector to major development projects in corridors in accord with policies adopted by local officials.
6. Areawide bus service needs and deficit implications.
7. Need for, and location of, maintenance facilities and other major systemwide considerations that may have different solutions when seen from an areawide basis as compared to the corridor level.

Consideration should also be given to a program of encouraging localities to participate in a national process of technology development. U.S. policy in this area has been managed very ineffectively over the long term compared to many other industrialized nations. Emphasis on particular technological solutions has shifted too quickly, too often, and too completely toward single types of technology. Technology development programs have too frequently shifted from emphasis on the long range to emphasis on immediate implementation of unproven technology. These problems might be overcome by the establishment of a strong advisory group to insulate the program from short term pressures and to draw upon the best talents of the transit industry, manufacturers, state and local government, and transportation planning professionals.

Legislation may be required in order to achieve the maximum benefits of such a program. However, within the framework of existing statutes, a great deal of the potential benefits of such a program could be realized through development of a policy statement or regulations which would encourage urban areas and industry to work more effectively with U.S. DOT on an evolutionary program of this type. Consideration should be given to encouraging selected urban areas to seriously evaluate evolving technologies within the framework of major transit studies. U.S. DOT should consider contributing technical staff resources and funds to work with carefully selected state and local agencies in evaluating new systems, and effectively setting up programs for testing of prototypes after they have been proven in test track environments. Such efforts should be part of a logical, continuing national program rather than one-shot promotional efforts.

In terms of administration of the alternatives analysis program, greater effort should be devoted to achieving common FHWA and UMTA administration of major corridor studies. Far more could be done to train field staff to have common understanding of regulations and policy, and to be prepared to represent U.S. DOT as a whole.

UMTA staff should be very flexible in enforcing existing policy regarding the staging of the alternatives analysis decision-making process. Local judgments as to the proper staging of the process should be given careful consideration by UMTA and accepted in most cases in reaching agreement through a cooperative negotiating process.

The quality of the technical planning work has been improved enormously over the last few years, and a large part of this improvement is attributable to the competence and diligence of UMTA staff. Several specific further improvements in the process should be fostered by UMTA staff.

The study has resulted in some conclusions which raise questions about the basic structure of U.S. DOT's urban transportation grant programs: Is it feasible to avoid major distortions in decision-making in favor of capital-intensive transit so long as the program continues as a large scale discretionary program? Can the alternatives
analysis process really be expected to force a rational decision-making process based on cost-effectiveness criteria within the framework of a discretionary program? Can the highway and transit programs be sufficiently integrated within urban areas to avoid continuing major distortions in local decision-making so long as the basic structures of the two grant programs are so dissimilar?

If the preceding recommendations are carried out, some of the problems that give rise to the foregoing questions would be mitigated. Yet the inherent incentive for local officials to select high capital cost alternatives would remain unless UMTA could limit the amount of the discretionary grant to the estimated capital cost of the most cost-effective alternative based on more specific criteria defined and applied by UMTA using local study results. This would be extremely difficult for UMTA to administer unless UMTA was required by law to impose such a limit. Furthermore, such a policy (whether required by law or regulation) would tend to force a contest over the merits of technical work and have a very undesirable effect on the basic nature of the alternatives analysis process. Under the current discretionary program there will always be some degree of contest between UMTA staff and local officials and study managers, with the latter group seeking to justify rail systems and UMTA staff seeking to encourage more serious attention to lower cost alternatives.

Another structural change in the grant programs that would address this and other problems identified is to combine urban highway and transit capital grant programs into a single formula grant program. This would allow local and state decision-makers to make trade-offs between highway development and transit development to an extent that cannot occur under current programs. However, a major problem in achieving such a restructuring of urban transportation programs is that the basic highway program is administered by the states; whereas the transit program is administered by various types of agencies (e.g., transit operating agencies, MPOs, and local governments), primarily at the local rather than at the state level.

Another structural change in the grant programs which would achieve essentially the same objective while recognizing states' prerogatives is to establish separate urban highway and transit formula grant programs, but to provide relatively easy trade-in provisions for both programs (within some limits), following the precedents of the Interstate and Federal-Aid Urban System programs.

Restructuring of this type would avoid the problems discussed above and could also address the problems in coordination of the highway and transit program. Such a restructuring would give state and local officials far more incentive to coordinate their programming processes for highways and transit and to give joint consideration to trade-offs between them. Major rail investments could only be implemented by delaying major highway investments, and vice versa, and these difficult, but logical decisions, would fall primarily to those officials who should be most responsible. A restructured program of this type could facilitate reducing the federal paperwork burden for minor capital investments, such as most TSM activities, and thereby create an incentive which has been difficult to achieve under current program structures.

These alternatives for restructuring of urban transportation programs should be given more comprehensive consideration in light of the findings of this study.

Recommendations for Research and Synthesis of Practice

A program of research and synthesis of practice has been developed in support of the foregoing findings and recommendations. Nine projects are recommended:
1. A detailed analysis of the actual labor, costs, and budgets of alternatives analyses and related studies to provide an improved basis for planning new studies and work programs by local officials, study managers, and funding agencies.

2. Development of guidelines for collection and processing of data on ridership and travel demand, based on synthesis of work in carefully selected areas, and based on demonstration of procedures in two or three urban areas.

3. Development of a set of guidelines for travel demand modeling in major transit studies based on the best practice in selected areas, including areas with different types of transit system alternatives and areas which use basically different approaches.

4. Preparation of a reference document for P.E. work in major transit studies, including statistics on actual costs, guidelines for cost estimating, and examples of levels of detail appropriate for P.E. work in these studies.

5. Development of guidelines for transit operations planning within major transit investment studies, drawing upon related work that has been done in other contexts for transit agencies, and including operating cost estimating methods, procedures for evaluating the location of maintenance garages, guidelines for planning of timed transfer operations and transit centers, and procedures for evaluating transit operating options within the context of complex traffic conditions.

6. Development of guidelines for evaluating transit route lengths, taking into account the approximate effects of varying terminal locations on such factors as vehicle requirements, capital costs, convenience of transfer, number of transfers required, speed, and ridership.

7. Preparation of guidelines for overall technical evaluation of alternatives by study managers, drawing upon experience in the few studies which have performed quality work in this area, and upon the experience of guidelines available for closely related types of work.

8. An evaluation of the U.S. DOT's transit technology research, development, demonstration, and deployment program and an evaluation of the recommendation of involving urban areas in a program of planning and implementing evolutionary technology under the general guidance of a strong advisory group composed of the best talents of the transit industry, manufacturers, state and local government, local planners, environmentalists, academia, and transportation planning professionals.

9. An evaluation of possible major changes in urban transportation grant programs to alleviate the problems discussed at the end of the preceding section.

The U.S. DOT and the Transportation Research Board should consider convening a conference soon to critically evaluate these findings and recommendations. Furthermore, the Transportation Research Board should consider establishing a committee or subcommittee on alternatives analysis that would provide guidance on research topics such as the above-recommended list, and provide a continuing forum for sharing research experience on these topics.

Despite the many criticisms and recommendations for improvements, the project team's overall assessment is that the basic alternatives analysis policy has been well conceived and administered. The field as a whole has had truly impressive accomplishments in a short history in moving from essentially a new program to a rather mature, but still quite dynamic program with high standards compared with the planning and decision-making processes for other modes of transportation.
CHAPTER ONE

INTRODUCTION AND RESEARCH APPROACH

PROBLEM STATEMENT

Since 1975, the Urban Mass Transportation Administration (UMTA) has required, as a condition for federal funding support, a structured process, termed “alternatives analysis,” for proposed major investments in urban mass transit facilities. This process is used to identify priority corridors for possible major investments and to assess the cost-effectiveness of these investments in comparison to less costly transit improvements. Information generated in the process is used both by federal officials in administering a discretionary capital grant program and by state and local officials in determining priorities and identifying needed improvements in mass transportation services. Three important decision points occur within the UMTA major transit investment planning process. First, appropriate local officials identify the corridor(s) where major investments appear to be most needed. Second, local and federal officials agree on a small set of investment alternatives that encompass a reasonably broad range of options. Finally, local, state, and federal officials agree on one (or more) of these alternatives for advancement into preliminary engineering.

Since the advent of the alternatives analysis requirements, a significant number of urban areas have been involved in some aspect of the process. Concerns have been expressed with the process. For example, there is uncertainty regarding both the effect on the timing of transit investment decisions and the use of information in the federal review process and in local decision-making. Although adjustments to the process have been made to enhance its usefulness in local, state, and federal decision-making, no comprehensive assessment has been made of the degree to which the analytical requirements have provided appropriate information at key decision points.

NCTRP Project 36-1 was initiated because of a recognized need to evaluate past experience with alternatives analysis and to recommend improvements in the process that will result in more effective local, state, and federal decision-making. Such an assessment would be useful, for example, in identifying points where decision-makers have not had complete information, where the process has constrained appropriate decisions, or where significant efforts are invested in the development of information that is not used in decision-making. Although, when the project began, it was unclear what direction federal policy would take in regard to alternatives analysis, it was clear that the need for some form of alternatives analysis for such investments would continue. Since the initiation of the project, its scope has been expanded to include a broader review of alternatives analysis within the context of the entire process of transit investment decision-making.

The general objective of this research has been to assess the federal, state, and local decision-making process for major urban mass transportation investments by evaluating recent alternatives analysis and related study experiences. The purpose of the assessment has been to identify potential improvements in policy, procedures, and use of technical information, and to formulate planning procedures recommendations for use by federal, state, and local agencies. Such improvements would be in terms of time, cost, scale, presentation of information, role of participants, and the like. The assessment is not intended to prescribe specific analytical techniques or to judge the appropriateness of previous major urban transit decisions.

As indicated in the initial NCTRP project statement, “the environment for transportation planning and investment decisions is in a period of dramatic change.” At the beginning of this project, the Executive Branch of the Federal government had announced a policy of “no new rail starts” and had proposed substantial reductions in capital grants and an end to operating subsidies. Since then Congress has enacted an earmarked fuel tax commitment to transit; however, the overall level of federal funding for transit has been a matter of continuing debate among all interested parties. The fact that this debate is continuing increases the importance of a planning and analysis process which examines major transit alternatives and allows decision-makers critical information on the cost-effectiveness and efficiency of investment decisions. The proposed changes in policy direction have been so significant that many transit professionals interviewed as part of this study have questioned whether the alternatives analysis process will be reviewed as a method for encouraging sound planning or whether it will be used as a means of constraining capital development, slowing the process of capital funding by the Federal government, or reducing the extent of application for federal funds. This emerging concern will be addressed in the body of this report.

Among the problems identified in the initial NCTRP project statement were:

1. Uncertainty regarding the effect of the timing of the transit investment decisions.
2. Use of information developed in alternatives analysis in the federal review process and in local decision-making.
3. The extent to which the analytical requirements have provided appropriate information at key decision points.
4. Whether the alternatives analysis process has constrained or facilitated appropriate decisions.
5. Whether or not significant efforts are invested in the development of information that is not used in decision-making.

In response to the general statement of the problem faced, the project team described additional issues affecting the alternatives analysis process and stated them in the proposed research plan. The major points raised included:
1. Uncertainty regarding funding and the future existence of a federally supported alternatives analysis process.
2. The financing and managerial demands occasioned by the enormous sums of money involved in implementing transit projects.
3. The need for clear decision criteria for federal investments so that planners can respond to increasing demands for analysis of intangible and nonmonetary costs and benefits of transit investments.
4. The relationship between the variety of institutional structures in urban areas throughout the country and the use of a single "federal model" of metropolitan structure in alternatives analyses which must address the particular decision-making requirements of each urban area.
5. The informational requirements among levels of government, as well as among the states, which are increasingly involved in transit decisions.
6. The perspectives of many transit operators in response to shifts from a growth environment to one of fine tuning or retrenchment and the ways in which this impacts their approach to alternatives analysis.
7. Skepticism of decision-makers regarding cost estimates and the economic and technical assumptions made in analyses.
8. Erroneous evaluations of particular alternatives or particular corridors as a result of poor technical analysis.
9. The impact of political decisions made prior to bringing on technical staff or consultants to analyze potential alternatives.
10. The effectiveness of public involvement in terms of the appropriate time in the analytical process for soliciting such input.

All of the issues listed above were indicated as potentially affecting the accuracy and usefulness of alternatives analyses. Subsequent to initiation of this project, but prior to completion of the case studies and development of evaluation criteria, project staff had occasion to meet with transit professionals from all areas of the country and found that there were a number of additional concerns which helped refine the framework for case study evaluations. Further, many of the issues initially raised by the study team were confirmed by professionals possessing operating responsibility and by leading academicians and researchers. Among the additional issues raised, or the initial notions confirmed, are the following:

1. Maintenance and rehabilitation rather than building and expansion are increasingly the focus of many transit agencies.
2. The institutions which have been delivering transit services are often outdated and new delivery systems must evolve regardless of the difficulties involved.
3. New roles for transit agencies and the private sector are emerging and these should be considered in the alternatives analysis process.
4. Changes and uncertainties in federal policy have created many difficulties for local officials trying to set directions for transit development and commit funding sources for major capital improvements.
5. There appears to be a tendency on the part of the federal programs to link local transit planning to the federal process and thereby separate it from other closely related local planning functions.
6. The transit industry as a whole is seeing management problems develop as a result of the lack of "new blood" at various levels.
7. Many professionals believed that during the 1970s the transit program experienced "paralysis by analysis" as a result of the increasing and changing regulations surrounding federal financial participation in transit, notably those affecting alternatives analyses as formulated in 1976, 1978, and 1980.
8. Despite the "no new rail starts" policy, there has been a host of new alternatives analyses either suggested or initiated as a result of direct congressional action and this is taking place in an environment of uncertainty regarding federal policy.

Since these issues relate to policy decisions at various levels of government, the research addressed the range of issues from local implementation of specific planning processes to broad national concerns which could eventuate legislative changes by the U.S. Congress.

ORIGINAL AND EXPANDED SCOPE OF THE STUDY

The scope of work for this project is described in the content of each of the six major tasks identified in the NCTRP 36-1 project statement. The six tasks were:

- Task 1—Inventory all applicable regulations and requirements concerning the evaluation of proposed major urban mass transportation investments.
- Task 2—Review relevant literature on alternatives analysis and transit decision-making.
- Task 3—Prepare methodologies for (a) the analysis and assessment of recent alternatives analysis decision-making experiences and (b) the selection of case studies.
- Task 4—Select and conduct case studies, including those undertaken pursuant to the 1976 guidelines as well as other cases.
- Task 5—Evaluate the usefulness of information developed in alternatives analyses for decision-making at each level of government.
- Task 6—Formulate recommendations to Federal DOT and to state and local agencies.

Early in the project, the review of the Task 3 report by the project panel members resulted in requests for additional information. The requests were in two categories and can be summarized as follows:

1. Some panel members expressed a desire to include more case studies in the project. This reflected the view of many members that the case studies are a critical aspect of the project's success, and that it may be difficult to generalize from only eight case studies.
2. Panel members also expressed a desire for more in-depth evaluation of the issues which surrounded the development of the alternatives analysis program, and the impact these may have on the success of the process. This evaluation entailed conducting interviews with knowledgeable current and former federal staff and officials.

As a result, the scope of work was expanded, and a total of 16 case studies were conducted. Further, the criteria for evaluating the planning and decision-making process were refined and were used uniformly in all of the later case studies.
The many issues that were addressed in each case study produced information which allowed for discussion of the following points:

1. The key decisions involved in the case study area and the technical information used in these decisions.
2. The public and private organizations and individuals involved in the alternatives analysis process and their respective roles.
3. The types of technical planning used to develop information for decision-making.
4. Desired information that was not available to decision-makers, not available in sufficient quality.
5. The role of federal requirements in the organizational, decision-making, and technical planning activities.

RESEARCH APPROACH

The research approach discussed in the following is based on the tasks specified in the project statement and expanded during the early part of the study.

Task 1—Inventory of Regulations and Requirements

Materials were assembled and reviewed which reflected the evolution and current state of federal and state guidelines regarding the alternatives analysis process. Data requirements, review and coordination activities, and decision points were specifically isolated. In the process of completing this task a comprehensive summary of all federal actions related to the process was prepared—from the 1962 Federal-Aid Highway Act to the most recent statements from UMTA regarding requirements for alternatives analyses. (The chronology was appended to the Task 1 report should be helpful to the reader interested in following the progression of federal rulemaking which deals with transportation planning.)

The subtopic study requirements for Task 1 included:

1. Urban transportation planning.
2. Federal financial assistance.
3. Developing UMTA policy on major transportation investments.
4. UMTA policy statements.
5. Efforts to integrate highway and transit investment policies.
7. Sequence of procedures for approval of major transit investments.

Through this approach the inventory of regulations and requirements presented a synthesis of some 22 related documents and highlighted some 35 specific legislative or regulatory actions that ultimately evolved into the current structure for alternatives analysis. The background information and the legislative/regulatory insights provided by the conduct of this task acquainted all individuals working on this project with the political, administrative, and technical reasoning behind the evolution of the process.

Expansion of the scope of study to encompass interviews of federal officials who were involved in the evaluation of policy regulations enabled the research team to gain a better understanding of the factors involved in this evolution.

Task 2—Review of Relevant Literature

The literature review included about 20 rapid transit planning studies in two categories: (1) case studies and assessments of transit planning experiences; and (2) guidelines and methodologies for conducted transit planning.

The case studies reviewed covered 23 cities and were conducted by six authors. In all, 45 separate cases were reviewed and summarized. Views of authors were compared as part of the reviews.

The format for review of individual studies and reports included specification of the type of publication (e.g., book, study, article, legislative report, etc.), the author's approach (e.g., theoretical, empirical), the geographic context (e.g., national, state, regional, specific city), and the planning issues addressed (e.g., political influences, government institutions, financing, forecasting, development of alternatives, evaluation techniques, etc.). Use of this approach allows the reader of the Task 2 report to briefly cover many major studies in a consistent manner.

Task 3—Case Studies of Alternatives Analysis: Methodology and Selection of Case Study Cities

Subsequent to the completion of the first two tasks, which respectively reported the results of an inventory of regulations and requirements pertaining to the alternatives analysis process, and a review of the relevant literature on the subject, the Task 3 report, entitled Methodology and Selection of Case Study Cities, was prepared and submitted.

The Task 3 report set forth the criteria for selecting case study cities. These included:

1. A preliminary assessment of the alternatives analysis process in each city, based on a review of UMTA documents, in terms of quality of technical analysis, from a relationship to decision-making, and key local characteristics.
2. The roles of various agencies in candidate cities in order to ensure coverage of the span of decision-making arrangements.
3. Geographical diversity and transportation orientation (e.g., historical use of transit in Northeastern cities vs. auto-orientation of newer cities in other areas of the country).
4. The range of socioeconomic and demographic characteristics of the various candidate cities.
5. Measures of transit ridership and operating characteristics.

The application of these criteria resulted in the recommendation that eight cities be studied in detail including Baltimore, Houston, Milwaukee, Pittsburgh, Portland, San Diego, San Jose, Santa Clara County, and Toronto. Nine additional candidate cities that were initially considered but deemed less desirable were also reviewed in the report.

Analysis of the following characteristics for each of the candidate metropolitan areas provided the basis for selection of appropriate cities for detailed analysis and on-site visits.

1. Geographic location.
2. Population of the urbanized area.
3. Density of the urbanized area.
Table 1. Selected characteristics of case study cities.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Baltimore Northeast</td>
<td>1.8</td>
<td>3,357</td>
<td>9,793</td>
<td>49%</td>
<td>107,040,084</td>
<td>823</td>
</tr>
<tr>
<td>Boston Northeast</td>
<td>2.7</td>
<td>3,157</td>
<td>11,928</td>
<td>37%</td>
<td>274,670,249</td>
<td>1,187</td>
</tr>
<tr>
<td>Calgary/Canada</td>
<td>0.5</td>
<td>2,296</td>
<td>2,906</td>
<td>NA</td>
<td>24,071,000</td>
<td>494</td>
</tr>
<tr>
<td>Chicago Midwest</td>
<td>6.2</td>
<td>4,876</td>
<td>13,174</td>
<td>53%</td>
<td>666,740,000</td>
<td>NA</td>
</tr>
<tr>
<td>Cleveland Northeast</td>
<td>1.8</td>
<td>2,297</td>
<td>7,264</td>
<td>53%</td>
<td>117,980,000</td>
<td>754</td>
</tr>
<tr>
<td>Denver West</td>
<td>1.3</td>
<td>3,080</td>
<td>4,443</td>
<td>59%</td>
<td>46,943,000</td>
<td>506</td>
</tr>
<tr>
<td>Edmonton/Canada</td>
<td>0.5</td>
<td>3,105</td>
<td>3,805</td>
<td>NA</td>
<td>86,550,150</td>
<td>554</td>
</tr>
<tr>
<td>Houston Southwest</td>
<td>2.4</td>
<td>2,300</td>
<td>2,865</td>
<td>74%</td>
<td>39,962,082</td>
<td>355</td>
</tr>
<tr>
<td>Madison Midwest</td>
<td>0.2</td>
<td>2,749</td>
<td>3,165</td>
<td>77%</td>
<td>13,960,000</td>
<td>140</td>
</tr>
<tr>
<td>Milwaukee Midwest</td>
<td>1.2</td>
<td>2,624</td>
<td>6,645</td>
<td>55%</td>
<td>87,120,000</td>
<td>475</td>
</tr>
<tr>
<td>Pittsburgh Northeast</td>
<td>1.8</td>
<td>2,538</td>
<td>7,652</td>
<td>55%</td>
<td>103,639,727</td>
<td>833</td>
</tr>
<tr>
<td>Portland Northwest</td>
<td>1.0</td>
<td>2,030</td>
<td>3,547</td>
<td>55%</td>
<td>40,561,998</td>
<td>434</td>
</tr>
<tr>
<td>San Diego West Coast</td>
<td>1.7</td>
<td>2,790</td>
<td>2,736</td>
<td>60%</td>
<td>28,131,832</td>
<td>235</td>
</tr>
<tr>
<td>San Jose West Coast</td>
<td>1.2</td>
<td>3,014</td>
<td>4,029</td>
<td>32%</td>
<td>36,000,000</td>
<td>400</td>
</tr>
<tr>
<td>St. Louis/Midwest</td>
<td>1.8</td>
<td>3,099</td>
<td>7,379</td>
<td>42%</td>
<td>76,416,674</td>
<td>784</td>
</tr>
<tr>
<td>Toronto/Canada</td>
<td>2.6</td>
<td>6,924</td>
<td>16,608</td>
<td>NA</td>
<td>553,075,000</td>
<td>1,843</td>
</tr>
</tbody>
</table>

2/ Calculated from population (urbanized area) and land area from the U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population.
3/ Calculated from population (central city) and land area data from the U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population.
6/ Data on Canadian population and density are 1981 census data obtained from the Canadian Embassy.

4. Density of the central city.
5. Employment in the central city.
6. Transit passenger trips.
7. Vehicles in peak hour.
8. Status of the alternatives analysis.
10. Types of alternatives evaluated.
11. Local preferences.

Selected characteristics of the 16 case study cities which relate to transit are presented in Table 1.

Task 4—Select and Conduct Case Studies

Once the expanded list of case study cities was agreed on, the study team undertook extensive preparation for case study trips. This included reviewing UMTA and other working papers for the specific area, contacting UMTA, APTA, and other Washington-based individuals knowledgeable of the particular case, specifying the major issues that needed to be addressed in the visits, preparing a list of local interviewees, and preparing a comprehensive interview guide that could be used with all interviewees regardless of their role in the particular project.

The site visits typically required three days and most often involved the efforts of two project team members. Upon completion of the site visits, the extensive written material from each alternatives analysis was reviewed by project staff. Draft case study reports were prepared which addressed both the history of transit planning in the relevant areas and an evaluation of the planning process. The criteria used for evaluation and for structuring a major portion of each report are presented in Table 2.

In most instances, drafts of the case studies were sent to the various interviewees for review. It was found in the process of conducting the case studies that individuals were often more forthcoming if they knew that they would have the opportunity to review the draft report prior to the documents being made public.

Tasks 5 and 6

Task 5 required the evaluation of the usefulness of information developed in alternatives analyses for decision-making at each level of government. Task 6 required the formulation of recommendations to the U.S. DOT and to state and local agencies. Preparation of this material required comprehensive review of all previous tasks, of the various case studies, and of a series of interviews on the evolution of federal policy. These two tasks together constitute the major portion of this report.

Organization of the Report

The remainder of this report consists of three chapters and two appendixes. Chapter Two includes the findings of the project. It is structured to present information on the technical analyses and their strengths and weaknesses, on how the technical studies should be organized in relation to the phases of the decision-making process, and on the organizational structure for the various alternatives analyses.

Chapter Three presents recommendations for improvements in the transit decision-making process. It has two major components: recommendations for current practice, and recommendations for federal programs. The first component specifically
Table 2. Criteria for evaluation of the planning and decision-making process.

<table>
<thead>
<tr>
<th>Evaluation Category</th>
<th>Specific Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organizational Structure for the Studies</strong></td>
<td></td>
</tr>
<tr>
<td>- Extent of opportunity for participation by the public and selected agencies at each stage of the process</td>
<td></td>
</tr>
<tr>
<td>- Involvement of decision-makers and representatives of responsible agencies in technical analyses which address the issues</td>
<td></td>
</tr>
<tr>
<td>- Identification of controversial issues at the beginning of the process, or as they arise</td>
<td></td>
</tr>
<tr>
<td>- Lead agency management of consultants' technical analyses required to address issues</td>
<td></td>
</tr>
<tr>
<td><strong>Technical Analyses</strong></td>
<td></td>
</tr>
<tr>
<td>- Procedures and assumptions reflected in the technical analyses</td>
<td></td>
</tr>
<tr>
<td>- Attention to alternative transit modes, alignments, and service levels and the operational characteristics of each</td>
<td></td>
</tr>
<tr>
<td>- The technical detail used at each stage of the analysis relative to the decision(s) required</td>
<td></td>
</tr>
<tr>
<td>- Objectivity of the data on the impacts of each alternative</td>
<td></td>
</tr>
<tr>
<td><strong>Use of Technical Analysis in Decision-Making</strong></td>
<td></td>
</tr>
<tr>
<td>- Availability of analyses and technical data to decision-makers in advance of major decision points</td>
<td></td>
</tr>
<tr>
<td>- Presentation of data in light of the needs and level of technical sophistication of the decision-makers</td>
<td></td>
</tr>
<tr>
<td>- Prioritizing of issues by technical staff in relation to concerns of decision-makers</td>
<td></td>
</tr>
<tr>
<td>- The mechanisms for communication among decision-makers, technical staff and other parties</td>
<td></td>
</tr>
<tr>
<td><strong>Role of Federal Government</strong></td>
<td></td>
</tr>
<tr>
<td>- How federal guidelines and assistance regarding technical analyses promote the use of appropriate techniques for differing circumstances</td>
<td></td>
</tr>
<tr>
<td>- Provision of relevant materials and case studies by federal representatives</td>
<td></td>
</tr>
<tr>
<td><strong>Role of Federal Government (continued)</strong></td>
<td></td>
</tr>
<tr>
<td>- Understanding by local officials of federal policy and the federal decision-making process</td>
<td></td>
</tr>
<tr>
<td>- Extent to which federal participation does or does not dictate analytical methodology</td>
<td></td>
</tr>
<tr>
<td>- Bias in the federal funding process for or against any particular technology</td>
<td></td>
</tr>
</tbody>
</table>

This chapter addresses organization of alternatives analysis studies and technical work programs. The second component addresses changes in the alternatives analysis and related regulations, administration of the program, and changes in the grant programs.

The final chapter provides recommendations for research and synthesis of practice. The projects recommended fall into the following categories:

1. Costs of major transit studies.
2. Travel demand data.
3. Travel demand modeling.
4. Preliminary engineering.
5. Transit operations planning.
6. Transitway route length evaluation.
7. Overall evaluation.
8. Research, development, and demonstration planning within the context of alternatives analysis.

The two appendixes provide a chronology of selected federal actions related to urban transportation planning from 1962 to the present, and a bibliography of references of general importance to this project. The specific references for the case studies are listed in bibliographies appended to each separate case study report. Copies of all case study reports are available on a loan basis or may be purchased in microfiche form from the Publications Office of the Transportation Research Board.
CHAPTER TWO

FINDINGS

The findings of this review are presented under three headings: (1) Technical Analysis, (2) Structure of Study Phases and Decision-Making, and (3) Organizational Structure for the Studies. This chapter summarizes the important findings from the case studies and other sources regarding the trends, strengths, and weaknesses of current practice in alternatives analysis and related planning and decision-making at all levels of government. The chapter points toward the recommendations for improvements in current practice and federal regulations and decision-making in Chapter Three.

TECHNICAL ANALYSIS

Overall Scope and Scale of Studies

The scope and scale of the studies has varied. At a very general level, the scope and scale of the studies can be related to five major factors: (1) availability of federal funding; (2) phase of study — e.g., system planning vs. corridor studies; (3) size of the urban area; (4) consultant involvement, and (5) complexity of the alternatives.

Not surprisingly, the UMTA-funded studies have generally been broader in scope and more costly than others. The evidence of this difference in scope will be presented and discussed before consideration of the merit for broader scope.

Table 3 provides a summary comparison of the approximate cost and length of time required for the UMTA-funded vs. non-UMTA-funded studies. The second-to-last row of the table shows that, when all studies are compared without regard to phase, the UMTA-funded studies have averaged almost three times the cost of non-UMTA-funded studies and have required about two-thirds more time to complete. The first two rows of the table show that the same general relationship holds for both the Phase I or system planning studies and the Phase II or corridor studies. UMTA-funded Phase I or system planning studies have cost more than twice the non-UMTA-funded studies and have required twice as long to complete. UMTA-funded Phase II or corridor studies cost about three times the cost of the non-UMTA-funded studies and require over one and a half times as long to complete. (The distinction used here and elsewhere in the text in identifying Phase I as system planning and Phase II as corridor studies is not a rigid distinction in many of the urban areas, particularly in Canada. Even several of the UMTA-funded alternatives analyses included significant elements of corridor planning level of detail in Phase I and important preliminary engineering work in Phase II studies, as will be discussed further in the last section of this chapter. More recently, since the completion of the case studies, UMTA has attempted to avoid use of the Phase I and Phase II terminology, to substitute the term “system planning” for Phase I alternatives analysis, and to reserve the term “alternatives analysis” for (Phase II) corridor studies.

Table 3 also provides a summary comparison of the cost and length of time required for Phase I vs. Phase II studies. The system planning studies on the average required roughly similar amounts of time and money as the corridor studies. The table shows that this generalization is approximately true for both UMTA-funded and non-UMTA-funded studies, suggesting that UMTA’s requirements have had the effect of enlarging the scope and extending the decision-making process in the Phase I or system planning process about as much as in Phase II or corridor studies (although, as previously noted, the UMTA-funded Phase I studies have required a somewhat higher ratio of time to complete compared to the non-UMTA-funded studies, and the UMTA-funded Phase II studies have required a somewhat...
higher ratio of cost compared to the non-UMTA-funded studies).

The cost and time requirements summarized in Table 3 and in the tables which follow are subject to considerable qualification and should be viewed as very approximate. The data were obtained during interviews and telephone calls and in many cases are based on interviewees' memory rather than review of actual contract documents. Some cost values are estimates based on person months of staff time and average salaries including fringe benefits. In several cases, the amounts of consultant contracts were not available, but are included in the total costs. In a few cases some minor proportion of the total costs has been omitted because no records were available for some of the older, smaller consultant contracts, and none of the persons interviewed would venture to offer estimates.

All costs have been converted into 1983 dollars using the Consumer Price Index; however, these conversions are based on the mid-point of the study period rather than on year-by-year expenditures.

Finally, the data must be considered very approximate because of problems of definition as to what should be included. In some cases, special studies were conducted outside of the framework of the major study but contributed importantly to the overall effort. For example, in Portland, Tri-Met hired consultants using non-UMTA funds to perform a cost comparison of a multicity LRT system and the results of this became a key factor for adding an LRT alternative to the UMTA-funded Banfield corridor alternatives analysis. However, the costs of these special studies are excluded from the major study cost estimates because they were not part of the alternatives analysis budget, work program, or organization structure for the study.

As the UMTA-funded alternatives analysis program has evolved, the definition of what is included has also changed, as will be discussed in a subsequent section.

Nonetheless, despite all these problems and qualifications, the summary conclusions from Table 3 provide approximate quantitative documentation that goes beyond the general conclusions from the interviews of the fact that UMTA has required or encouraged localities to undertake study scopes substantially greater than what would otherwise have occurred. The most dramatic example of this is Milwaukee, where the key decision-makers insisted on an expansion of scope which resulted in a lengthy, expensive study report. Overall study completion dates are based on major decisions by principal governing boards or committees, regardless of source of funding. The greater intensity of staff effort in the consultant studies and the greater incentive to meet deadlines inherent in consultant contracts.

The fifth and final factor listed above as being related to the scope and scale of the studies is the complexity of the alternatives. Complexity of the alternatives is probably the single most important characteristic affecting cost and time required. Several more specific characteristics of the alternatives are important aspects of this complexity: number of potential technologies, alignment complexities, grade level complexities, extensiveness of alternatives, and environmental impact issues. Because complexity of the specific alternatives involved is such an important determinant of cost and time required, and because there are so many important characteristics involved in determining complexity, each alternatives analysis project is almost a unique case.

The wide range of costs and times required among the individual studies can be seen in Table 5. Contract costs in this table are the sum of all contract amounts under a single major planning project, including contract amendments. Total costs include contract costs plus budgeted amounts for in-house work, regardless of source of funding. In general these costs include labor, fringe benefits, and direct expenses, but do not include complete agency overhead. Time required for technical studies begins when a contract is signed for major consultant studies or when funding is approved and technical work begins for in-house studies. Completion dates for technical studies are based on actual submission of major draft reports—e.g., system planning report, draft environmental impact statement (E.I.S.), or a feasibility study report. Overall study completion dates are based on major decisions by principal governing boards or completion of preferred alternative report—whichever event marks the completion of major staff activity for the project including
Table 5. Cost and length of time required to complete major transit studies.

<table>
<thead>
<tr>
<th>URBAN AREA AND STUDY</th>
<th>ESTIMATED COSTS (in thousands of 1983 dollars)</th>
<th>ESTIMATED MONTHS REQUIRED</th>
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<td>- Accelerated Rapid Transit Study</td>
<td>$377</td>
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</table>

1/ Not UMTA-funded.
efforts needed to resolve major differences among agencies or principal governing boards.

Denver's alternatives analysis stands out as the highest cost study of all 41 covered in the case studies ($9,230,000 in 1983 dollars). It was well underway (begun in February 1974) before UMTA had begun to develop its original guidelines. (UMTA published its Preliminary Guidelines and Background Analysis in February 1975 and its Proposed Policy on Major Urban Mass Transportation Investments in August 1975.) Because of this, Denver's alternatives analysis had more in common with the very large metropolitan area rail rapid transit system planning studies conducted during the 1960s and early 1970s. (U.S. Congress, Office of Technology Assessment. *An Assessment of Community Planning for Mass Transit: Volume 1: Summary*, February 1976.) The scope included an areawide evaluation of several types of new system technologies and a major emphasis on land use planning in relation to the transportation system planning. The preliminary engineering work performed as part of the study involved far more detail than was later considered to be warranted in system planning studies. In fact, no distinction had yet been made between Phase I and Phase II studies by UMTA; nor had UMTA yet required the more detailed corridor planning to be focused on a single priority corridor. By commonly accepted standards today, Denver's alternatives analysis and most of the early rail system planning studies had excessive scopes of work.

The second most expensive study was Portland's Banfield transitway project ($5,160,000 in 1983 dollars), which was complicated because it involved several highway improvement alternatives including a busway, HOV lanes, and a widening option, as well as several LRT system options. Local officials believe the project was unnecessarily costly and protracted because of the need to satisfy the separate requirements of both UMTA and FHWA and to get approvals from twice as many people. This also resulted in more coordination demands at the local level because of the greater number of state and local agencies involved in the funding and approval processes. The project was further complicated by several changes in federal requirements during the study, and by the fact that UMTA played a particularly strong role in shaping the work program, including having a strong voice in specification of alternatives and specific analytical activities. The Banfield project was also one of the earliest alternatives analyses, thus having some of the same historical influences and uncertainties as the Denver alternatives analysis. It was also the first of the UMTA-funded case studies to lead to an LRT project — resulting in the need to break new ground for approval of this technology.

The San Diego Guideway Planning Project was the third most expensive study among the case studies ($4,850,000 in 1983 dollars) and second most intensive ($269,000/month of study). (Cost estimates were not available by phase for the Guideway Planning Project; the overall Project cost has been apportioned by duration of each phase in Table 5.) This Project was conducted without UMTA funding, but was planned and managed to meet UMTA's requirements, at least in general terms. However, the Project went well beyond UMTA's standard practice in the amount of preliminary engineering work performed as part of the Phase II corridor planning work. The Metropolitan Transit Development Board (MTDB) benefited from this in that the Project's cost estimates eventually proved to be quite accurate and the San Diego Trolley was able to be put in operation within the original time and cost budget.

Phase I of the Project was rather complicated in terms of the number of corridors, right-of-ways, modes, and lengths of route in corridors that were studied and evaluated. Phase II was complicated by the fact that the railroad operating in the selected corridor filed for abandonment during the early part of the study, causing a shift in study emphasis to the special problems associated with negotiations with the railroad and consideration of joint transit-freight operations on the same tracks. At-grade operation of the trolley on downtown streets also became a special issue, forcing special study of traffic operations and access to parking facilities and buildings.

Baltimore's study of the overall regional transit system was the fourth most expensive among the case studies — $3,096,000 in 1983 dollars. (This study was called the Baltimore Region Phase II Transit Study, but it was not similar to a Phase II study as defined by UMTA.) As with Denver, this study (begun in July 1974) was underway before UMTA developed its original alternatives analysis guidelines. The Baltimore study was also similar in scope to the Denver study and to the other large metropolitan area rail rapid transit system planning studies conducted during the 1960s and early 1970s in that the level of effort devoted to many activities was far greater than would now be permitted in systems planning studies. A large number of corridors and system configurations were subjected to more detailed analysis, such as had been done in the several recent past heavy rail systems studies, because the study was oriented toward implementation of an entire system. The discipline of UMTA's staged decision-making process had not yet been imposed.

Boston's North Shore Corridor AA/EIS project was the fifth most expensive study reviewed ($2,597,000 in 1983 dollars). The North Shore Transit Improvements Project (NSTIP) was going on at the same time as much more expensive design studies were occurring in other corridors in Boston, and included consideration of commuter rail, rapid transit, highway access roads, and express bus improvements. The NSTIP also included an intensive public involvement effort which was at least partly necessitated by the perception of the local North Shore communities that even though the North Shore has been promised major transit improvements, projects in other corridors were moving towards implementation much more rapidly and were likely to use up all available funding before the North Shore planning was completed.

The Metropolitan Toronto Transportation Plan Review was the sixth most expensive study reviewed (2,480,000 in 1983 dollars), and was one of the most comprehensive transportation studies ever conducted in North America. The project differed from all other case studies in that it involved a review of all types of proposed urban transportation improvements and alternatives to them — major highway projects and a variety of transportation system management options, as well as transit investments and operational improvements. The Plan Review led directly to a wide variety of decisions in addition to the Scarborough LRT Feasibility Study, including a decision to eliminate a major expressway from the master plan and to proceed with the implementation of a major rail rapid transit extension.

Three rather costly studies were complicated by major highway alternatives within the same corridor as the major transit alternatives:
1. Portland's Banfield Transitway DEIS project (described above).

2. Portland's Westside Corridor AA/DEIS project (the eighth most expensive study reviewed at $1,782,000), involving several types of possible highway improvements along the major route and along alternative parallel and connecting routes, two major transit centers, corridor-wise TSM options, as well as several bus and LRT alternatives.

3. The Guadalupe Corridor AA/DEIS study (tied for eighth most expensive with the above study), involving a full freeway option, a more limited expressway design, busway, HOV lanes, an LRT system, and a bikeway system, in a wide variety of combinations of alternatives.

The last of the list of costly, complex joint highway-transit corridor studies was preceded by an even more costly Phase I study, the Santa Clara Valley Corridor Evaluation (seventh most expensive at $2,400,000 in 1983 dollars), which resulted in very similar conclusions and recommendations. The combination of these two projects is among the most expansive studies ever conducted in an effort to implement a single transit corridor project—particularly expensive in relation to the limited transit orientation of the area. The Phase I study was complicated by the fact that a rather large number of potential transit corridors was evaluated. However, many of the area's leaders, particularly the supporters of the current Guadalupe Corridor LRT project, believe that a large portion of these study expenses was wasted; they argue that the necessary technical support and a substantial degree of consensus for this LRT project already existed among both state and local officials based on the preceding studies. What appears to have been lacking, after the earlier studies, is UMTA's conviction as to the merits of the project. However, rather than turn the project down, UMTA required another major study which was seen as highly duplicative of the previous study by most local people interviewed. Ultimately, UMTA accepted the local consensus, but not until after the process had become more of a lobbying effort than a cooperative decision-making process. More than any other case study, the Santa Clara Valley experience calls into question the level of detail of study required to satisfy UMTA's requirements.

To a significant extent, the work program and reports of these projects seem to reflect routine analysis performed primarily to satisfy external requirements, as distinct from analysis performed primarily to aid local decision-makers in resolving issues. The work programs for the Santa Clara Valley studies were prepared locally, in what appears to have been almost an overreaction to satisfy UMTA's requirements. Neither party appears to have made a substantial effort to negotiate a reduction in the cost or scope of the studies to meet the real requirements of the actual decision-making process.

At the other end of the scale, a large number of light rail feasibility studies and alternatives analysis focusing on light rail (both system planning and corridor studies) have been conducted for rather modest budgets on the order of half a million dollars or substantially less. Many of these have kept costs down for several reasons:

1. Limitation on the number of technologies and alignments studied (sometimes only one basic LRT alignment).
2. Emphasis on surface operations.

4. Considerable sharing of experience from study to study, particularly in the West.
5. Reduced need for environmental analyses.
6. Lack of federal involvement in dictating detailed study requirements.

As will be described in more depth in the following section, the cost savings achieved by the non-UMTA-funded studies can be substantially supported in retrospect, but not in all cases or for all aspects of the technical work elements which were eliminated or reduced. Nonetheless, it would be inaccurate to conclude that all of the differences in costs of UMTA-funded and non-UMTA-funded studies are due to unnecessary UMTA study requirements. Most of the non-UMTA-funded studies took place in environments conducive to lower cost studies (e.g., lower densities suitable for at-grade systems with available rights-of-way), and most of them gave less attention to bus alternatives than would be warranted based on independent objective review of the conditions, although this judgment is admittedly highly debatable. What is less debatable, however, is that some of the UMTA-funded studies clearly contained alternatives and technical study elements that were unwarranted based on retrospective judgments by most participants and observers about the relevance of the work in the actual decision-making processes at all levels of government.

Strengths and Weaknesses of Technical Elements

Both the state of the art and general practice in the field have improved enormously over the last several years. The relative levels of adequacy, however, differ significantly among the specific technical elements of the process, as discussed in the following on a subject-by-subject basis.

Demand analysis methods have been highly refined and the quality of work in actual practice has improved enormously in the last few years. UMTA staff have played an important role in this process through technical assistance and dissemination of reports. If anything, work in this area has probably been overemphasized by professionals at UMTA, local agencies, and in consulting firms because of the extensive problems encountered in the past. A few years ago many patronage forecasts were highly suspect. They were often developed using methods and assumptions that were poorly documented, if at all. Several of the earlier transit studies included high demand forecasts that could be traced to specific factors that appear to be exaggerated in favor of transit, such as high projections of CBD employment or dramatic increases in corridor population density. Examples exist where forecasts of some factors, such as passengers per vehicle-mile, were projected to increase when all relevant trends and forecasts suggested that the opposite would occur. However, almost all recent studies, particularly the UMTA-funded studies, are being performed using more rational methods and more realistic assumptions. Non-UMTA-funded studies have generally given far less attention to demand analyses, and some of them gave far too little attention to such work. Nonetheless, professional standards in the field have improved considerably in the last few years, in large part due to the competence and diligence of UMTA staff.

On the other hand, travel demand data, input to the demand analysis, are frequently inadequate. Comprehensive origin-des-
tination studies were conducted in most urban areas during the 1960s, but few have been conducted in the last ten years. No major demand data collection efforts can be justified solely for alternatives analysis purposes, although many urban areas may find that modest scale surveys can be justified if they are designed to serve several transportation planning purposes and are designed to complement the variety of other available data. For example, journey-to-work data are available from the decennial census, but these data provide no information on nonwork travel and provide only minimal information on typical work travel, as work travel, as distinct from actual trip data. On-board transit ridership surveys also provide limited data because they provide no data on travel by other modes, and they must be limited to a very few simple questions because of the environment in which the questions are asked. Special small sample telephone surveys have been conducted in a few areas. If properly conducted these can provide adequate data for calibration of demand models, but no standards or guidelines have been developed to assist planners in properly planning and conducting such surveys.

In the earlier studies, preliminary engineering work was considered by UMTA to be performed only after the alternatives analysis work was completed. In some of the more recent studies, however, some preliminary engineering (P.E.) work has been approved during Phase II alternatives analyses. The term "conceptual engineering" was applied to the P.E. work performed in the Guadalupe Corridor study. Some Canadian studies have used the term "functional planning" to describe the combination of P.E. and planning activities required prior to local formal commitments to implement transmit systems or routes. The San Diego studies, particularly the first of the two, included substantial amounts of P.E. work as part of the corridor planning work. The amount of P.E. work required was left fairly flexible in the original work program, to be determined by the requirements of technical problems encountered in the studies. Experience indicates that some P.E. work has been very useful in providing more reliable cost estimates and in resolving many issues. Many of the case studies led to the conclusion that some P.E. work was needed in Phase II corridor studies where complex engineering issues needed to be studied in order to improve the alternatives analysis evaluation. Unfortunately, however, little in the way of guidelines is available to assist other urban areas.

The case studies show that when the alternatives analysis involves evaluation of several competing major capital investments, the costs of performing all P.E. work before a preferred alternative is selected would be too costly. P.E. work in such cases should be limited to that necessary to make the basic decisions on the choice of alternative and the important parameters that affect that choice (e.g., alignment, station locations, grade, solutions to major engineering problems, and other factors that may have major cost consequences). On the other hand, the case studies show that many simpler corridor studies can include all P.E. work prior to major decisions on the preferred alternative, without substantial cost or delay. The clearest examples are LRT extensions or systems at grade within available rights-of-way.

Many studies, however, fall in the middle ground where much of the P.E. work should be delayed until after a choice of preferred alternative, but sufficient P.E. work should be completed during the studies to provide necessary information for all major decisions that should be made at that time, including reasonably accurate cost estimates. In at least one of the case studies (Houston), P.E. work was performed on more than one alternative in order to achieve this objective. However, in order to avoid the waste of performing substantial amounts of P.E. work on several alternatives, Phase II studies that involve complex engineering problems on several alternatives should provide for narrowing down the number of alternatives during the study to reduce the amount of P.E. work required to obtain good cost estimates.

Transit operations planning is often a very weak element of the planning process. Many studies made early assumptions about frequency of service and running times and never bothered to refine or evaluate them when better data became available on ridership, boarding estimates, peaking conditions, and traffic conditions. In some studies, these characteristics turned out to have substantial impacts on frequency of service, running times, and other operating factors. Experience in implementing the two light rail systems in systems in terms of operating characteristics—an obviously wasteful approach that failed to recognize the unique flexibility of bus systems.

On the other hand, some studies have performed excellent work on transit operations planning as part of, or in conjunction with, corridor studies. The most noteworthy example is Baltimore's operations planning, which developed operations plans appropriate for the characteristics of each mode, and which was done at three levels, each appropriate at different times during the alternatives analysis. At the first level, enough was defined about the alternative in terms of hours during which operations occur and service frequencies so that the kind of service offered by the alternative could be understood by decision-makers. For the second level, enough information was developed about the operations so that all necessary parameters for the patronage modeling were available (e.g., travel times, frequencies, and routes). At the third level, the operations plans were refined so as to be balanced with the patronage estimates, considering the capacities and average loads per vehicle for each alternative.

Another excellent example of operations planning occurred in the development of timed transfer operations around transit centers which may become LRT stations in the future on Portland's West Side. Tri-Met has followed through by implementing a first phase reorganization of the bus system and has experienced substantial increases in ridership as a result.

UMTA staff have been emphasizing the importance of greater attention to operations planning, but no federal guidelines are
available and the subject lacks the force of congressional attention such as exists for other technical subject areas (e.g., the environment, energy, historic sites, and parkland impacts).

Analysis of varying lengths of guideway systems is often a very weak technical element of the process. UMTA's original guidelines stressed the need for this type of analysis, and it received considerable attention in the discussion of the proposed policy because it was so much in contrast to prior practice at the time. Most of the prior major rail planning studies had involved multiple corridor systems with little, if any, attention to priority corridors or varying lengths of systems. Several of the case study cities have gone through a systematic process of evaluating alternative system lengths, including San Diego and Portland. More commonly, however, the rail alternatives are of a fixed length for each corridor throughout the studies. In some cases, such as San Diego's border terminal and Cleveland's CBD and University Circle "Dual Hubs," the logical terminals for routes are obvious and do not require analysis of alternative lengths of routes. More commonly, however, the terminals are not obvious, but are determined more by political criteria. More technical evaluation should be performed to confirm or challenge these judgments in light of the substantial costs involved.

Environmental impact studies have improved substantially in quality over the period covered. At the beginning of the period, very few professionals had much experience in performing such studies in the transit field, and methods for performing air quality, noise, and other impact analyses were still under rapid development. Many of the earlier studies involved weak technical analysis, and the reports were typically filled with almost endless detail that had little, if any, relevance to the decision-making process. More recent environmental analyses and reports at least have improved technical content, but the environmental impact issues associated with the transit alternatives (as distinct from highway or land development options which may also be involved) are seldom important issues in the decision-making process. Occasionally air quality or other environmental benefits are cited by proponents as important arguments in favor of major transit investments, but the environmental impact differences among transit alternatives have not been significant enough in any of the case studies to be cited as important arguments either in favor of, or in opposition to, particular transit alternatives, with the possible exception of Baltimore's North Corridor and St. Louis' Clayton Corridor.

The lack of relevance of these environmental impact studies stands out when the level of effort devoted to them in the UMTA-funded studies is contrasted with non-UMTA-funded studies. Some of the non-UMTA-funded studies gave attention to particular environmental issues that may have arisen, but most of them involved no environmental analysis unless specific issues were identified by the decision-makers or study managers.

In the notice of proposed rulemaking of August 1, 1983 (Federal Register, Vol. 48, No. 148, pp. 34894-34907, August 1, 1983), the lack of relevance of many E.I.S. efforts associated with transit alternatives has been recognized. Specifically, the proposed rules eliminate the automatic E.I.S. requirement for exclusive busways on or alongside an existing highway facility, for administrative planning and design work, and for minor expansion of existing facilities. Further, bus transfer facilities (except in residential neighborhoods) would be exempt from the automatic E.I.S. requirements. The need for an E.I.S. for an urban redevelopment-related transit project would be determined by UMTA on a case-by-case basis. In cases where an E.I.S. would no longer automatically be required, an environmental assessment (E.A.) still may be required if the action is one that specifically is not listed as a categorical exclusion or where UMTA determines the E.A. would assist in determining the need for an E.I.S. (Federal Register, Vol. 48, No. 148, paragraph 771.113 for specific listing of Class I (E.I.S. required), Class II (categorical exclusions), and Class III (E.A.) actions.) Generally these rules streamline the process for UMTA and provide increased decision-making authority to agency field offices.

Impacts on historic sites, energy consumption, and parklands are all subjects involving very similar experiences as environmental impact studies. The quality of work has tended to improve, but the amount of attention devoted to these impacts is generally far greater for the UMTA-funded studies than for the others. UMTA, of course, must satisfy the legislative requirements in all these areas; the primary issue, however, is the extent to which UMTA will assume responsibility for minimizing burdens through cooperative efforts in working with local agencies to document the lack of impacts, as distinct from forcing local agencies to conduct time-consuming and costly studies and provide excessive documentation.

No examples were discovered in any of the non-UMTA-funded case studies where failure to perform more analysis in any of the environmental and related subject areas later proved to be a significant problem in the decision-making process. Nor is there any example in the UMTA-funded studies where early attention to such impact studies as required by UMTA under its interpretation of the law and regulations in any of these subject areas later resulted in resolution of an important issue which might not have been uncovered in a timely manner in absence of UMTA's requirements.

Public involvement has been adequate to exemplary in all of the cases studied, in terms of both public information and opportunities to express opinions on alternatives or on the process of studies. The degree of involvement has been generally determined by the local political culture. In Boston, public involvement in transit planning has been very intensive, reflecting the interest of the local officials and interest groups in all levels of decisions from system studies to detailed design. Over 120 separate meetings of various kinds were held with the public and local officials as part of the North Shore alternatives analysis, and newsletters were mailed regularly to thousands of persons. In Chicago, by contrast, three meetings were held to solicit public responses during the Southwest corridor alternatives analysis. In each case, however, the responsible agencies appear to have afforded adequate opportunities for involvement, and met the aspirations of the communities for the level of involvement they desired. The necessity of public involvement in decisions about major urban transit investments now seems to be ingrained in the styles and philosophies of agencies conducting transit studies.

Overall evaluation of alternatives (i.e., benefit-cost analysis, cost-effectiveness analysis, etc.) remains one of the weaker technical aspects of many of the studies, including even some of the more recent studies. Shortcomings include the following:

1. The guidelines for investment analysis for all federally aided projects as specified in OMB Circular A-94 are not followed or even recognized in most case studies.

3. Costs are often not converted to a common year, particularly in estimating cost-effectiveness measures.

4. Discount rates are often too low (e.g., 4 to 8 percent), tending to overstimate the attractiveness of high capital alternatives and to overstate the importance of projected growth in demand and user benefits.

5. Benefits are sometimes double counted—e.g., adding together user benefits and gains in land value in the corridor which result primarily from the advantage of travel in the corridor; or adding together the transit user benefits for all projected transit riders and reductions in cost of travel for auto users projected to switch to transit.

6. Benefit-cost ratios are sometimes not properly calculated, e.g., by improperly accounting for differences in the timing of future costs and their discounted values, or by failing to calculate the incremental benefit-cost ratios among various alternatives (i.e., calculating only the benefit-cost ratio of each alternative with respect to the base case or “do nothing” alternative).

One of the major reasons for inadequate overall evaluation processes is undoubtedly the fact that the basic structure of the discretionary capital grant process creates a strong incentive for selection of higher capital cost alternatives than can be justified by objective rational investment criteria. This is reinforced in many of the case study urban areas (but not in all of them) by the image of rail transit as being inherently more desirable and attractive regardless of what is shown by demand analyses and overall evaluation results. For these reasons, some studies have resisted performing an adequate overall evaluation process.

In some urban areas, there has been adequate attention to the issues in conducting evaluation. Boston’s North Shore alternatives analysis included informal evaluations throughout the course of the study, as did all other cases, but also presented a formal evaluation at the end which properly applied discount rates, illuminated the important differences among the alternatives, and highlighted the trade-offs involved in the choice among the alternatives. It should be noted that although this was one of the more technically sound evaluations conducted in an alternatives analysis, it did not make it easier for political decision-makers to choose among the options. Faced with local support for several alternatives, including a rapid transit extension and a major upgrade of commuter rail, local officials and the responsible agencies included major elements of both commuter rail and rapid transit in their locally preferred alternative, thus avoiding saying no to local advocates of any of the alternatives. While the technical evaluation had included a “Do Nothing” alternative, it had not included the “Do Everything” alternative which eventually emerged as the locally preferred option.

Consideration of new technology has been a very weak element of all the case studies. Only a very few of the studies have given significant attention to new technology and no examples were found that can be considered exemplary for current practice. During the early part of the period covered by this review two cities attempted to adopt new technologies without performing adequate technical assessments, and subsequently were forced to adopt more conventional technologies:

1. Pittsburgh sought to implement the “Skybus” system without giving sufficient attention to security considerations and other factors.

2. Denver adopted “Personal Rapid Transit” as a preferred alternative for an areawide network before that technology had been developed, tested, or even analyzed to the extent of demonstrating that the assumed costs and performance specifications could be met.

New technologies have been encouraged in other cities by UMTA (e.g., downtown people-movers) and by the Province of Ontario (i.e., automated intermediate capacity transit with linear induction motors). However, this encouragement has taken place without the benefit of the careful comparison of alternative technologies such as is done within the context of UMTA-funded alternatives analyses. Thus it appears that the major technology development programs in North America are proceeding without the benefit of real world comparative assessments within urban areas, and that alternatives analysis studies are proceeding without the opportunity to carefully consider these emerging technologies with the direct assistance of the agencies responsible for the technology development programs.

**STRUCTURE OF STUDY PHASES AND DECISION-MAKING**

One of the basic issues in this review has been how the technical studies should be organized in relation to the phases of the decision-making process. Table 6 provides a summary of the four phased decision-making process according to UMTA’s current policies based on UMTA’s perception of the decisions that must be made and on the technical information needed by the decision-makers. Five basic questions have been raised regarding the appropriateness of this process.

1. Do the separate decision-points and technical phases make sense? Is the technical work in each phase different from preceding and following phases?

2. Under what, if any, conditions can a Phase I or equivalent study be eliminated and the urban area proceed directly to Phase II?

3. Under what, if any conditions could two of the decision-points be combined and the intervening technical phase be eliminated?

4. Are there conditions under which distortions in the process are caused by UMTA’s “incremental development” policy which requires that planning and development proceed one corridor at a time?

5. Is the environmental process integrated with the alternatives analysis process in a logical way?

Each of these questions is addressed in the paragraphs that follow.

This review of 41 studies in 16 urban areas provides a very qualified positive response to the first question. The sequence of decisions does make sense in general, at least in an abstract rational process, and the technical work that should be done in support of each phase of decision-making does differ to a substantial extent. However, the qualifications on this positive re-
response are judged to be more important than the simple answer itself.

No case study urban area has gone through this process without some modification to the idealized sequence of Table 6, and this review leads to a conclusion that no urban area should be forced to do so without adequate justification based on the merits of the circumstances. Some of the case study urban areas have been forced to comply with this standard process to a greater extent than they wanted to, and to a greater extent than appears to be justified in retrospect (e.g., San Jose and Portland). Almost every locality has had some history of transit system planning, or at least some specific transportation studies that provide a basis for narrowing down priorities among corridors and transit technologies and a basis for judging cost-effectiveness to a significant extent. Several of the case study urban areas had a substantial basis for selecting a priority corridor at the start of the period covered by this review. The most obvious examples are Portland, Chicago, and Pittsburgh. UMTA accepted the prior history and particular circumstances in each of these areas as sufficient justification for proceeding with Phase II corridor studies without requiring prior conduct of a Phase I multiple corridor alternatives analysis (although Phase I studies were later conducted in Portland and Pittsburgh to determine priorities in other corridors).

This finding is, of course, more true today after another decade of transit planning history. Very few urban areas, if any, will have a real need in the foreseeable future for entirely new Phase I multiple corridor alternatives analyses, as defined in UMTA's guidelines.

The need for future Phase I studies according to the UMTA model should not be completely ruled out, however. Cleveland provides an example of an exception which could occur elsewhere. The area has a fairly extensive history of transit planning, has constructed major light and heavy rail lines, and recently has completely rehabilitated its LRT system. Yet an early 1970s regional transit study, a classical big system study of the type then being funded by UMTA throughout the country, left the decision-makers of the area without any real consensus on priorities among corridors and transit technologies and a basis for judging cost-effectiveness to a significant extent. Several of the case study urban areas had a substantial basis for selecting a priority corridor at the start of the period covered by this review. The most obvious examples are Portland, Chicago, and Pittsburgh. UMTA accepted the prior history and particular circumstances in each of these areas as sufficient justification for proceeding with Phase II corridor studies without requiring prior conduct of a Phase I multiple corridor alternatives analysis (although Phase I studies were later conducted in Portland and Pittsburgh to determine priorities in other corridors).

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Cleveland is one of the best examples of the difficulties that can be encountered in choosing a priority corridor, and an almost ideal example of the use of a sound technical process to support the decision. An important lesson from the Cleveland study, however, is that the participants had great trouble understanding why their decision-making should be so limited by UMTA's guidelines. They wanted to move on directly to the decisions UMTA insisted on reserving for future phases. However, the Phase I technical studies did not provide a proper basis for preparing either UMTA or local decision-makers to make these decisions because they were too limited in depth. Nonetheless, this limitation of the Phase I technical work was not appreciated by most people involved in the study, despite a highly intensive participation process.

In summary, Cleveland provides an excellent example of how to conduct a Phase I evaluation of multiple corridor candidates and to select a priority corridor. However, it also provides an example of the need to provide greater continuity between such studies and subsequent corridor alternatives analyses in order to avoid waste effort and to avoid frustrating the local decision-making process.

In Madison, Wisconsin, the Phase I effort served a very worthwhile function. Prior transportation planning had resulted in specific goals being set for transit. Yet, the approach to meeting the ridership goals had not been analyzed. Further, community interest in commuter rail needed to be addressed as one alternative among the possibilities for achieving the goals. The Phase I study allowed the MPO the opportunity to take a fresh look at options in the area and define how goals could be met.

One finding from this experience is that consideration should be given in planning Phase I study work program to provide contingencies for moving directly into subsequent Phase II technical work and decision-making processes without the long delays that almost always separate the phases under current practice.

This analysis provides an answer to question number two above: Phase I studies can be eliminated if urban areas provide a well-supported basis for determining priorities among corridors. If urban areas wish to program studies involving combinations of Phase I and Phase II technical work and decision-making, UMTA should be receptive to such proposals under appropriate conditions, while reserving approval to proceed with Phase II work based on meeting agreed upon criteria for successful completion and local agreements in Phase I. The appropriate conditions necessary to justify the planning of a combined Phase I and Phase II effort of this type include consideration of such factors as:

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<th>Table 6. Phases of transit investment decision-making process based on current UMTA policies.</th>
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<td><strong>Phase I/</strong></td>
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<td>Preliminary Engineering</td>
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<td>Final Design</td>
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1/ Since this review has been completed, UMTA has been attempting to avoid use of the Phase I and Phase II terminology, to substitute the term "system planning" for Phase I alternatives analysis, and to reserve the term "alternatives analysis" for (Phase II) corridor studies.

2/ Recommendations of this review presented in Chapter Three would combine part or all of the P.E. work with the alternatives analysis phase, depending on the complexity of the alternatives, and would have funding commitments negotiated as soon as practicable after decisions on preferred alternatives, subject to possible modifications upon completion of P.E. and refined cost estimates.

3/ Prior to October 1980, an FEIS was required to be produced in the alternatives analysis and another FEIS in the P.E. phase.
1. Reasonable presumption as to the justification for a major transit investment based on past studies and favorable preconditions.

2. Local consensus at the start on the desirability of a major transit investment and willingness to commit to increased support of transit.

3. Conditions which narrow the range of reasonable alternatives, such as the existence of a rail system or the virtual consensus on the priority corridor.

When combined Phase I and II alternatives analyses are planned, UMTA would still logically retain review and approval authority for the second phase. However, this review and approval process must be planned so as to avoid disruption and delay to the continuing combined Phase I and Phase II study process, to the extent feasible. This can be achieved if greater effort is devoted to planning these studies as more of a shared local and federal decision-making process.

The most important problem with UMTA's decision-making model, however, is not the unnatural separation between the Phase II decision on the "preferred alternative" and the decisions by UMTA and others to commit to implementation of the preferred alternative—decisions which are isolated from each other in the UMTA process by the separately funded preliminary engineering (P.E.) phase.

More logically, the case studies suggest that the local decision on a preferred alternative be followed as closely as possible by funding agreements, if any such agreements can be reached, by all responsible parties including UMTA. All P.E. work necessary to establish technical feasibility, approximate alignment and grade, station locations, and cost estimates accurate enough to reach financial agreements should logically be included in the Phase II work programs. Otherwise, local decision-makers are being asked to make preferred alternatives decisions on the basis of weak information that may later prove inaccurate enough to invalidate their decisions.

The original UMTA model which was used for all except the most recent of the UMTA-funded case studies tended to place local officials in a somewhat risky political position because they were asked to go on record in favor of a preferred alternative before sufficient P.E. work had been performed to provide reliable cost and other important data, and more expensive, long before UMTA made a decision. (This potential problem has been reduced somewhat by UMTA's decision in several recent studies to permit a portion of P.E. work to be performed during Phase II studies.) The long passage of time can easily allow a local consensus to become unreacted if it has been difficult to develop during the alternatives analysis process, as was often true in these case studies. More importantly, the cost estimates in most of the studies were made without the benefit of any P.E. work, and therefore later proved to be inaccurate.

Although this analysis leads to the finding that some P.E. work should logically be incorporated in Phase II studies and that funding agreements should be reached as soon as feasible after a decision on a locally preferred alternative, this analysis does not lead to the finding that no technical study should be programmed between these decision points. Ideally, under the simplest of circumstances, no special technical studies may be required. But the reality is that even very well planned Phase II studies have left some issues unresolved as a result of reviews by UMTA and others, and these should logically be resolved by special studies. To best facilitate this process, the need for a Phase III study should be recognized at the start of the alternatives analysis process to provide a contingency budget for staff work to assist in resolving any possible conflicts among local and state officials and to perform any special studies that may be required as a result of review of the Phase II work and preferred alternative report. As discussed in the preceding section, it will not be reasonable to complete all P.E. work during many of the more complex alternatives analyses. P.E. work not completed before a decision on funding commitments can be performed while remaining conflicts are being resolved, and final cost estimates can then be used to modify the funding commitments made at the end of Phase II alternatives analysis.

To summarize the last few points, this analysis leads to an answer to question three above: Only under rather ideal, simple conditions is it logical to completely combine the decision-points. However, the first decision-point (priority corridor selection, etc.) can often be reached without further technical study because satisfactory justification is now usually available, and the third decision-point (funding agreement) should usually be reached shortly after the second decision-point (preferred alternative), separated only by whatever special studies are required to assist in resolving local differences or to resolve issues raised in the review of Phase II work and decision-making process. Local officials in a number of cities noted the difficulties in retaining community support for a preferred alternative when faced with lengthy delays in information regarding potential funding. Funding agreements reached after the second decision-point (preferred alternative) should provide for refinements to be made after completion of P.E. work when more accurate cost estimates are available.

The fourth question asked above (regarding UMTA's "incremental development" policy) does not lend itself to a very clear answer based on experience in the case study urban areas.

The overall effect of the incremental policy has been positive by comparison with the preceding UMTA policy, which fostered the planning of many systems that were too extensive and too expensive. The incremental policy has forced urban areas to be far more realistic in general, and has provided transit planning agencies with valuable assistance in forcing local officials to come to grips with the difficult process of establishing priorities for regions. This finding is supported by experience in almost all of the urban areas which have a long history of UMTA funding of planning studies. Perhaps the extreme example is Cleveland, which went through several years of difficult efforts to select a priority corridor supported by careful technical evaluation of many alternatives. For a long part of this period most of the local officials held out for their local corridors, but finally accepted the merits of the technical evaluation results and the recommendations of the Citizens Task Group which grew out of the thorough evaluation process.

The incremental development policy, however, has clearly had the effect of diminishing attention to the development of long range transit plans. The contrast between UMTA-funded and other urban areas is particularly clear in this regard. Denver, San Diego, and the Canadian urban areas have all had an extensive history of planning for multicroridor rail systems. By contrast many of the UMTA-funded urban areas have limited their system planning activities mostly to selection of priority corridors, and have performed only very preliminary technical
studies relating to the operation of multicroridor systems. Urban areas that have performed multicroridor system planning studies are in far better position to understand the long range consequences of the initial corridor investment decision.

The tendency of the alternatives analysis process to foster overemphasis on limited length corridors at the expense of necessary system planning is perhaps best illustrated by Portland's experience. The initial alternatives analysis corridor study (the Banfield corridor) proceeded under the original UMTA-approved work program without any analysis of how a multicroridor LRT system might operate and what the cost and other consequences might be of an areawide system. At UMTA's urging, the only LRT option in the original program was a very short line, about half the length of the first line now under construction. This alternative was dropped early in the study largely because of its poor ridership projection due to its limited service area and the high proportion of transfers that would be required. Subsequently Tri-Met decided to conduct a very preliminary analysis of a multicroridor LRT system, completely outside of the alternatives analysis work program and the official committee structure for the process. The results of this analysis were instrumental in convincing the Tri-Met Board and other local officials of the merits of LRT technology for the region. This forced a major change in the Banfield alternatives analysis work program, adding a longer LRT route that was eventually selected as the preferred alternative. Meanwhile UMTA funded a Phase I system planning alternatives analysis study which focused almost completely on the selection of other priority corridors, without attention to any issues regarding the operation of a multicroridor transit system.

Experience in the case study urban areas relating to incremental development of transit systems leads to the conclusion that UMTA's basic policy is sound, but that the emphasis should shift somewhat to greater attention to long range transit system planning, as distinct from corridor priority setting. Corridor priority setting should continue to be emphasized, but should give greater attention to transit systems evaluation measures, as distinct from purely demand measures, which have tended to dominate evaluations in the Phase I studies in the past. The need for attention to long range planning was emphasized in many areas, notably Pittsburgh, where the MPO found that the benefits of certain alternatives which dealt with land use, economic growth, etc., could not be quantified adequately under the short timeframe imposed by the Phase I approach. Although UMTA's policy provides for support of long range planning and plan updates outside of the framework of alternatives analysis studies, it tends to exclude sufficient focus on long range planning issues within the framework of the corridor studies.

Long range planning issues are also frequently important in corridor studies, even if adequate long range system planning work has previously been accomplished. Detailed planning for a transit facility in one corridor can lead to consideration of possible changes in previous areawide transit system plans. For example, in Baltimore systems planning work was required in the CBD and in an outlying major center as part of the North Corridor study because issues were raised that affected long range plans and had not been previously addressed.

This need for a return to greater emphasis on long range planning should not be misinterpreted as support for the type of major areawide rail planning efforts of the 1960s and early 1970s. The amount of effort devoted to multicroridor system plans should be limited to that necessary to adequately inform decision-makers regarding the choice of mode, choice of priority corridor, or other major choices in the incremental decision-making process.

The fifth and final question raised above regarding the structure of the process is whether the environmental process is integrated with the alternatives analysis process in a logical way. Experience from the case studies indicates that the draft E.I.S. and final E.I.S. are logically related to the alternatives analysis decision-making process in terms of timing, but that the environmental work that is being done in most UMTA-funded Phase II studies is far in excess of what is required for environmentally responsible transit development. Phase I studies should continue to address environmental issues only to the extent that such issues are raised in the "scoping" process for these studies. No evidence was found in the case studies that either too little or too much environmental analysis was being required in Phase I studies. Most of the UMTA-funded Phase II studies involved wasted environmental analysis efforts, however. Phase II studies should be reoriented to provide much greater attention to overall evaluation, and allow the actual balance among specific local, real world issues to determine the relative emphasis on environmental issues vs. other issues which are frequently and justifiably more important in the decision-making process, such as transit operating costs, capital costs, land development policy, traffic conditions, etc. UMTA's new E.I.S. regulations do permit greater flexibility in this regard. However, both UMTA and local agencies should be more diligent than in the past in assuring that the work programs prepared by local agencies and supported by UMTA do not include environmental and other related studies that go substantially beyond the actual requirements of an environmentally responsible transit decision-making process.

ORGANIZATIONAL STRUCTURE FOR THE STUDIES

Recent major transit studies have not had a "typical" organizational structure. The extent to which the organizational structure has varied among the case study urban areas might be considered somewhat surprising in light of the important role that the U.S. Federal government has played in defining how alternatives analyses should be conducted. In many related program areas, the Federal government has sought to standardize the institutional framework for planning, decision-making, or administration at the local level. However, in the field of planning for major transit investments, local, metropolitan, or state officials have largely been left to work out the organizational structure best suited to their particular needs and the circumstances surrounding each major study. Local officials in Canada have had similar flexibility—provincial governments have provided financial support for major transit investment studies without accompanying organization requirements.

The lack of a typical organizational structure might also be considered somewhat surprising in light of the high degree of commonality that exists among U.S. urban areas in terms of the structure and functions of existing organizations which have an interest in this field. With relatively few exceptions, U.S. urban areas share the following organizational characteristics:
1. A metropolitan planning organization (MPO) has responsibility for transportation improvement programs and related planning throughout the urban area, but has relatively little or no authority for implementing plans or providing transportation services.

2. A transit operating agency has responsibility for providing public transportation service throughout most or all of the urban area.

3. A central city (or sometimes two adjoining cities) contains the principal focus of the transit system, the highest density area, and a high proportion of all transit trip ends, and therefore has the greatest interest among several local governments in the transit system.

4. A state department of transportation has the primary responsibility for major highways and many functions which relate to transit—but usually has less extensive or indirect responsibility for transit.

The U.S. Federal government has had a significant influence in fostering the degree of commonality that exists among urban areas in terms of these organizational characteristics through a series of regulations and requirements governing federal highway and transit programs. (See Appendix A for a history of these regulations and requirements.)

One of the few generalizations that can be made about the organizational structure for major transit studies is that most of them have involved the participation of several agencies in substantial roles. A high proportion of the studies has involved more than one agency’s participation in both the technical work program and the policy and decision-making process.

The findings regarding organizational structure are reported under the following three categories: (1) Lead Agencies for Studies, (2) Role of Various Agencies in the Studies, and (3) Role of Consultants.

### Lead Agencies for Studies

The term “lead agency” is used in CEQ regulations to refer to federal agencies responsible for the E.I.S. process. The lead agencies referred to in this section are known as the “local lead agencies” from the federal perspective.

When more than one agency is involved in the studies, a “lead agency” is commonly designated to coordinate the work program, although in a few cases even this role has been shared by “co-lead agencies.” Table 7 identifies the lead agencies for all of the major transit studies in the case study urban areas.

To facilitate comparisons in this table, the identities of agencies have been simplified by placing them in a few generic categories. For example, the lead agency is described simply by level of government (city, county, metropolitan government or state) in all cases where the lead agency is part of a general purpose government, as distinct from a single purpose regional agency (MPO or transit agency) having responsibility for that function across local jurisdictional lines. All studies have been characterized as either “transit system planning” or “corridor studies” regardless of their complexity and regardless of whether they were UMTA-funded or met UMTA’s requirements for Phase I or Phase II studies.

Table 7 illustrates the substantial diversity that has existed among the urban areas—except for the two Alberta cities, Edmonton and Calgary, no two case study areas have had precisely the same assignments of lead agency responsibilities for studies—leaving aside for the moment the even greater diversity in assignment of specific responsibilities within the planning work programs.

Table 7 also illustrates the flexibility that has existed within many urban areas in assigning lead agency responsibility for studies. In 12 of the 16 urban areas, the lead agency responsibility has changed during the relatively brief period covered (typically the period since 1975).

Most commonly, local officials have shifted responsibility for major transit studies as the focus shifts from system planning to corridor studies. The majority of the changes in designation of lead agency responsibility shown in Table 7 occurred as the focus shifted from system planning to corridor studies. Often the responsibility shifted from an MPO to a transit operating agency or to a unit of local government. Such shifts in responsibility can logically occur because the transit operating agency possesses more of the technical skills required for Phase II corridor studies, particularly the transit operations and cost estimating capabilities. The shift in responsibility can also logically occur because the selected priority corridor lies entirely, or almost entirely, within one jurisdiction (e.g., Cleveland), or because the local government has more technical staff expertise (e.g., Chicago).

In four instances, the lead responsibility has changed even within the more general study category, “transit system plan-
ning,” either because of the creation of a new agency to assume this responsibility (San Diego), because of the growing importance of transit in the area (Denver and San Jose), or because of the expanding geographic scope of the studies (Toronto).

In two instances, the lead responsibility has differed for transit corridor studies within the same urban area because of very particular conditions and events in each area. In Portland, this occurred because the available staffs of the Oregon Department of Transportation and the transit operating agency, Tri-Met, were both heavily committed in the very complex Banfield Corridor Alternatives Analysis, and competent staff were available in the MPO, the Metropolitan Service District, an agency whose powers had recently been greatly expanded and strengthened.

In St. Louis, responsibility for a non-UMTA-funded light rail feasibility study was assigned to the transit operating agency, the Bi-State Development Agency, in part as a result of frustration by some leaders over the lack of results (i.e., no rail plan) from the preceding UMTA-funded Phase I alternatives analysis which had been conducted by the MPO, the East-West Gateway Coordinating Council, leading to adoption of an all-bus long range transit plan. San Diego’s success in implementing the South Bay Trolley without federal funding encouraged several urban areas, including St. Louis, to conduct light rail feasibility studies without UMTA support at about this time. However, when it became clear to St. Louis officials recently that there were no means of implementing the proposed light rail system without UMTA funding, they turned back to the MPO to conduct a reassessment of the old alternatives analysis, in large part because of the fact that its governing board was more reflective of the local political structure which would ultimately have to make the difficult local funding decisions.

As might be expected, the MPO (or Metro in the case of Toronto) has been the lead or co-lead agency for system planning studies in the large majority of urban areas. The exceptions are Calgary, Edmonton, and Houston where the cities include virtually all of the urban areas. These two Canadian cities have no equivalent of an MPO. The Houston area does not have the profusion of local governments that most other large urban areas have. The City of Houston encompasses the vast majority of the urban population; Harris County encompasses all of the urban area; and the MPO therefore has very limited functions. The City performed most public sector transit-related functions until the Metropolitan Transit Authority was established by Harris County voters in a 1978 referendum.

The MPO has shared the lead agency responsibility for system planning in six urban areas. In Baltimore, the Governor has designated two agencies, the Regional Planning Commission and the Maryland Department of Transportation (which includes the transit operating agency), as the joint MPO for the urban area. The latter of the two, more specifically the Mass Transit Administration of MDOT, has been the lead agency for the two corridor studies, and will continue as the lead in a third corridor study soon to be initiated. In Boston the MPO is composed of six designated component agencies, which include the transit operating agency and its advisory board. The MPO and the transit operating agency were jointly designated as the lead agency for the system planning work; whereas the transit agency has been the lead agency for corridor studies. The MPO for the Chicago area, the Chicago Area Transportation Study, has been responsible for regionwide transit system planning, but the City has continued to perform more detailed transit system planning studies for the core of the urban area which is heavily served by the subway-elevated system. In Cleveland, the Phase I alternatives analysis, involving the evaluation of a large number of competing candidate rail transit improvements, was jointly managed by the transit operating agency, the Greater Cleveland Regional Transit Authority, and the MPO, the Northeast Ohio Areawide Coordinating Agency. The first system planning study in the Denver region was managed by a rather awkward compromise among the three principal competing agencies; each of the three (the MPO, the highway department, and the transit agency) had veto power over any plan under the formally constituted Joint Regional Planning Program. Finally, in the Toronto area, system planning studies have previously been the responsibility of Metropolitan Toronto’s Planning Department, which is the rough equivalent of an MPO in the United States, but has much stronger powers than most U.S. MPOs. However, recent system planning studies have been underway by both Metropolitan Toronto and the Province of Ontario, involving areas of differing geographic coverage, but both involving consideration of major potential new transit investments in the same corridors. Arrangements for coordinating mutual efforts in the future are being worked out at this time.

Although there has been some tendency to shift responsibility from MPOs to transit agencies or local governments as the focus shifts from system planning to corridor studies, the MPO has continued as the lead agency in three of the 16 case study areas. In the Milwaukee area, the Southeastern Wisconsin Regional Planning Commission, which has developed considerable in-house technical expertise during the Phase I study, will continue as the lead agency in the Phase II corridor study, acting as an agent for Milwaukee County. In Madison, Wisconsin, the MPO is conducting a follow-up to the Phase I system planning effort, which is directed toward implementation of a TSM program. The Metropolitan Service District, or Metro, in the Portland area has recently completed the Phase II West Side Corridor study very successfully, after also having developed considerable in-house expertise in the Phase I study. As noted previously, Metro had also been substantially strengthened a few years ago, and the other two principal transportation agencies were heavily committed in another very complex corridor study. Finally, the MPO for the St. Louis area, the East-West Gateway Coordinating Council, has been recently selected as the lead agency for the reassessment of the old alternatives analysis, as noted previously, because of its prior experience in the previous study, as well as the fact that the transit operating agency, the Bi-State Development Agency, is the only other potentially logical candidate as the lead agency, has a board composed of appointees of the two state governors—a factor which puts Bi-State in poor position to develop the necessary political support from local governments to implement the study’s plan.

Experience in the Portland area, in particular, indicates that an MPO can be a logical agency to conduct a Phase II corridor alternatives analysis. Caution should be taken, however, to avoid an overemphasis on land development and travel demand analysis, with which MPOs have greater familiarity, and an underemphasis on transit operations, engineering, cost-effectiveness, and financial feasibility analysis, and capital, operating, and maintenance cost estimating. Some MPO-conducted Phase I studies have had shortcomings because of misdirected emphasis of these types. The need to avoid such problems is even greater in Phase II studies because corridor studies should require more
detail and precision in developing transit operations plans, cost estimating, economic analysis, and preliminary engineering. Therefore, if the MPO is to take the lead role in Phase II studies, the transit operating agency should be directly involved in all aspects in its areas of expertise and should be supplemented with appropriate engineering skills.

Role of Various Agencies in the Studies

Table 8 provides a more detailed summary and comparison of the roles played by various agencies in all major transit studies in the case study urban areas. This table provides further illustration of the diversity of organizational structure that has occurred among the case study areas. It also illustrates the diversity of roles that have been played by each basic type of organization. These studies have commonly involved three to five agencies or units of government in both the technical work program and the policy and decision-making process.

As the table indicates, transit operating agencies are commonly major study participants, if not lead agencies. In all instances they have been direct participants. Only in San Diego has the role of the major transit operating agency been minor, and this occurred because a separate agency, the Metropolitan Transit Development Board, was specially created to plan and develop a guideway transit system.

MPOs have also been participants in almost all major studies, except where no separate MPO exists in Edmonton and Calgary, and in the instance of the non-UMTA-funded light rail feasibility study in St. Louis. However, in several instances, MPOs have played limited roles, particularly in corridor studies, typically performing land use analyses, travel demand forecasts, and/or network analyses.

State departments of transportation or highway departments have played widely varying roles in the studies, ranging from lead agency in Baltimore and Portland to no significant role in a few urban areas. Frequently the state or province provides funding for the studies without placing major requirements on them. Commonly, the state will be involved as a major participant when highway alternatives are an important part of corridor studies, as was the case in San Jose and Portland. In San Diego, the California Department of Transportation provided civil engineering and construction management expertise for the

Table 8. Summary of roles of organizations in major transit studies.

<table>
<thead>
<tr>
<th>URBAN AREA AND STUDY</th>
<th>TRANSIT OPERATING AGENCY</th>
<th>REGIONAL PLANNING AGENCY</th>
<th>STATE DEPARTMENT OF TRANSPORTATION</th>
<th>COUNTY(IES)</th>
<th>CITY(IES)</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltimore</td>
<td>System Planning</td>
<td>Co-Lead</td>
<td>Co-Lead</td>
<td>Baltimore</td>
<td>Lead Agency</td>
<td>Major Participant</td>
</tr>
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<td></td>
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<td>Network Analysis</td>
<td>Lead</td>
<td>Participant</td>
<td>Participant</td>
</tr>
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<td>Co-Lead</td>
<td>Boston</td>
<td>Participant</td>
<td>Participant</td>
</tr>
<tr>
<td></td>
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<td>Lead Agency</td>
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<td></td>
<td>Participant</td>
<td>N.A.</td>
</tr>
<tr>
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<td>Calgary</td>
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</tr>
<tr>
<td></td>
<td>Corridor Studies</td>
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<td>N.A.</td>
<td></td>
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</tr>
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<td>Lead Recently</td>
<td>Chicago</td>
<td>Participant</td>
<td>Minor Participant</td>
</tr>
<tr>
<td></td>
<td>Corridor Study</td>
<td>Operations Planning</td>
<td>Ridership Forecasts</td>
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<td>System Planning</td>
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<td>Cleveland</td>
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</tr>
<tr>
<td></td>
<td>Corridor Study</td>
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<td>Network Analysis</td>
<td></td>
<td>Participants</td>
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</tr>
<tr>
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<td>System Planning</td>
<td>Co-Lead</td>
<td>Co-Lead</td>
<td>Denver</td>
<td>Co-Lead Earlier</td>
<td>Co-Lead Early</td>
</tr>
<tr>
<td></td>
<td>Corridor Studies</td>
<td>Co-Lead</td>
<td>Participant</td>
<td></td>
<td>Participants</td>
<td>No Significant Role</td>
</tr>
<tr>
<td></td>
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<td>Network Analysis</td>
<td>Edmonton</td>
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<td>Major Participant</td>
</tr>
<tr>
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<td>Corridor Studies</td>
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<td>Major Participant</td>
<td></td>
<td>Participants</td>
<td>Participants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td>Houston</td>
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<td>Houston</td>
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</tr>
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<td>System Planning</td>
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<td>Lead Agency</td>
<td>Madison</td>
<td>(Part of City)</td>
<td>Major Participant</td>
</tr>
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<td>Lead Agency</td>
<td>Milwaukee</td>
<td>(Part of City)</td>
<td>Major Participant</td>
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<td></td>
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<td>Lead Agency</td>
<td></td>
<td>(Part of City)</td>
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<td></td>
<td>Corridor Studies: Initial Phase AA</td>
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<td></td>
<td>Participants</td>
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</tr>
<tr>
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<td>Corridor Studies: South Side of City</td>
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<td>San Diego</td>
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<td>Participant</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Participant Recently</td>
<td></td>
<td>Participants</td>
<td>Participants</td>
</tr>
<tr>
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<td>Major Participant</td>
<td>Lead Agency</td>
<td></td>
<td>Participants</td>
<td>Major Participant</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Participants</td>
<td></td>
<td>Participants</td>
<td>Participants</td>
</tr>
<tr>
<td></td>
<td>System Planning</td>
<td>Participants</td>
<td>Lead Agency</td>
<td></td>
<td>(Part of County)</td>
<td>Major Participant</td>
</tr>
<tr>
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<td>Corridor Study</td>
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<td>Lead Agency</td>
<td>St. Louis</td>
<td>Major Participant</td>
<td>No Significant Role</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minor Participant</td>
<td>Lead Agency</td>
<td></td>
<td>Participants</td>
<td>No Significant Role</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Major Participant</td>
<td>Lead Agency</td>
<td>Toronto</td>
<td>Participants</td>
<td>No Significant Role</td>
</tr>
</tbody>
</table>
two LRT corridor studies. In Madison, the State Department of Transportation played an important analytical role in Phase I by providing computer time and staff to run the modified SEWRPC mode split model for the Madison area.

Cities and counties have also had widely varying roles, ranging from lead agency in Alberta, Cleveland, and Chicago, to the more typical, limited role in providing data on the corridors, reviewing impacts, and participating in the evaluation and decision-making process. Commonly, local jurisdictions are actively involved in issues such as station location, parking at stations, access route improvements, and land development in corridors.

In a few instances, other special organizations played important roles in the studies. Chicago's Regional Transportation Authority participated in the Southwest Corridor study by analyzing feeder bus potential for the Corridor alternatives. In Cleveland, the Citizens Task Group played a major role in the Phase I alternatives analysis by being the first body to develop a recommendation for the selection of the priority corridor. The recommendation was arrived at as a result of intensive involvement with study staff over an extended period. The group's recommendation was subsequently adopted by the City, the MPO, and the transit agency, and is being further developed and evaluated in a Phase II study.

In Denver, the State Legislature influenced the study process in several important ways, including requirements for three referenda on tax measures to implement the proposed plans, and the holding of review hearings, resulting in revival of the transit agency's commitment to a light rail plan which had been dormant for almost three years since UMTA's rejection of a capital grant application.

The State Legislature also played an extremely important role in San Diego by establishing the Metropolitan Transit Development Board with a principal purpose of planning and constructing a guideway transit system. The Legislature also played a critical role by establishing the basic funding sources for San Diego's non-UMTA-funded South Bay trolley line.

This discussion of the roles of various types of agencies has excluded analysis of the part that has been played by UMTA and other agencies responsible for funding and regulating the decision-making process. This omission, in effect, is an acknowledgment that UMTA has played little or no direct role in the conduct of the technical studies or local decision-making process. UMTA (and most state or provincial funding agencies) chose to be removed from the conduct of the work and local decision-making in most cases, but to reserve authority for more general decisions regarding eligibility, planning requirements, and ultimate funding. UMTA's role in specifying planning requirements was discussed in the first section of this chapter. Its role in structuring the phases of the planning and decision-making process was discussed in the second section of this chapter. The second half of Chapter Three synthesizes this material and provides recommendations for some major changes in UMTA's role in the process, including the suggestion that the decision-making process should become a more closely shared one between UMTA and agencies involved in the local decision-making process. That section also provides recommendations for changes in regulations governing the process, changes in administration of the program, and possible changes in the basic structure of the grant programs.

Role of Consultants

One final important aspect of the organization of major transit investment studies is the role of consultants. Table 9 summarizes the roles played by consultants in all case study urban areas. As can be seen from this table, their roles varied quite widely, similar to the widely varying roles of public agencies as previously described.

In about half of the urban areas, consultants conducted the majority of the technical work—ranging from somewhat over half of the work (e.g., Chicago and Boston) to virtually all of the technical work (e.g., Baltimore, Calgary's first corridor, and both of St. Louis' UMTA-funded studies). A critical issue often arises when consultants are given responsibility for the majority of the work—is the contracting agency effectively organized and staffed to manage the consultant's work? In some of the major early rapid transit planning studies conducted prior to the mid-1970s, newly created transit or metropolitan planning agencies were inadequately prepared to manage major consultant studies and this became a significant factor in many of the problems with these studies. (U.S. Congress, Office of Technology Assessment. An Assessment of Community Planning for Mass Transit: Volume I: Summary, February 1976, page 27.)

In none of the more recent studies covered by this review were major problems of this type identified. Typically the responsible agencies have learned from these past problems in the field and have developed experienced staff to manage consultants' work more effectively. For example, in Denver the early studies conducted under the Joint Regional Planning Program involved very large amounts of work by the consultant team, with three agencies sharing responsibility for overall policy direction. The transit agency had been newly created and was just beginning to build up staff capabilities. Some of the technical problems that were identified in the Office of Technology Assessment review can be attributed in part to these conditions. However, since that time Denver's Regional Transportation District has developed substantial experience in managing consultant work and has successfully managed a continuing program of planning and preliminary engineering in several LRT corridors.

In two case study areas, Calgary and Baltimore, transit corridor technical studies were conducted almost entirely by consultants, but the work was performed under very effective staff management, assuring high quality technical work directed in a cost-effective manner at the important issues involved in the decision-making processes. The success of these efforts is a tribute to the competence of the staff managers of these contracts.

Some difficulties have been experienced with consultant studies where most of the work was conducted in other cities, thus limiting the opportunity for frequent review and creating conditions which increase the risk of technical problems and failure to meet deadlines. The efforts probably suffered because too little attention was given to the project by senior staff of the consulting firms. However, some out-of-town work has been conducted very competently by consultants and managed effectively by the contracting agencies. The only conclusion that can be reached is that greater care must be taken to assure frequent and effective attention by managers in both the consulting firms and contracting agencies when major work is being performed in other cities.
Table 9. Role of consultants in major transit studies.

<table>
<thead>
<tr>
<th>URBAN AREA</th>
<th>PROPORTION OF WORK BY CONSULTANT</th>
<th>EXTENT OF STAFF MANAGEMENT</th>
<th>ROLE OF CONSULTANT IN DECISION-MAKING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltimore</td>
<td>Major</td>
<td>Major</td>
<td>Evaluation of Alternatives</td>
</tr>
<tr>
<td>Boston</td>
<td>Major</td>
<td>Major</td>
<td>Evaluation of Alternatives</td>
</tr>
<tr>
<td>Calgary</td>
<td>Major</td>
<td>Major</td>
<td>Engineering Evaluation</td>
</tr>
<tr>
<td>Chicago</td>
<td>Major</td>
<td>Major</td>
<td>Evaluation of Alternatives</td>
</tr>
<tr>
<td>Cleveland</td>
<td>Minor</td>
<td>Major</td>
<td>Evaluation Procedures</td>
</tr>
<tr>
<td>Denver</td>
<td>Major</td>
<td>Moderate</td>
<td>Developed Recommendations</td>
</tr>
<tr>
<td>Early Studies</td>
<td>Moderate</td>
<td>Major</td>
<td>Engineering Evaluations</td>
</tr>
<tr>
<td>Recent Studies</td>
<td>Moderate</td>
<td>Major</td>
<td>Engineering Evaluations</td>
</tr>
<tr>
<td>Edmonton</td>
<td>Moderate</td>
<td>Major</td>
<td>Developed Recommendations</td>
</tr>
<tr>
<td>Houston</td>
<td>Major</td>
<td>Moderate</td>
<td>Developed Recommendations</td>
</tr>
<tr>
<td>Early Studies</td>
<td>Major</td>
<td>Minimal</td>
<td>Manage Design Decisions</td>
</tr>
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<td>Major</td>
<td>Major</td>
<td>Evaluation of Alternatives</td>
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<td>Moderate</td>
<td>Major</td>
<td></td>
</tr>
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<td>N.A.</td>
<td>None</td>
</tr>
<tr>
<td>Pittsburgh</td>
<td>Major</td>
<td>Moderate</td>
<td>Designated as Decision-Maker</td>
</tr>
<tr>
<td>Early Study</td>
<td>Major</td>
<td>N.A.</td>
<td>None</td>
</tr>
<tr>
<td>Recent Study</td>
<td>Moderate</td>
<td>Major</td>
<td>Portion of Evaluation</td>
</tr>
<tr>
<td>Portland</td>
<td>Moderate to Major</td>
<td>Major</td>
<td>for Most Studies; Recommended LRT</td>
</tr>
<tr>
<td>San Diego</td>
<td>Moderate</td>
<td>Major</td>
<td>System in One Study</td>
</tr>
<tr>
<td>San Jose</td>
<td>Moderate</td>
<td>Major</td>
<td>Developed Recommendations</td>
</tr>
<tr>
<td>St. Louis</td>
<td>Major</td>
<td>Moderate to Minimal</td>
<td>Developed Recommendations</td>
</tr>
<tr>
<td>Toronto</td>
<td>Moderate</td>
<td>Major</td>
<td>Engineering Evaluations</td>
</tr>
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</table>

The most common role of consultants in alternatives analysis in the United States is typically perceived to be the performance of an objective evaluation of transit alternatives, or some particular aspect of the alternatives, such as ridership forecasts or environmental impacts. However, among these 16 urban areas, consultants were hired to perform comprehensive evaluations of alternatives (as distinct from either more limited evaluations or going beyond objective evaluation to make recommendations) in only four case studies (Baltimore, San Jose, Boston, and Chicago).

In five cases, the consultant's role involved responsibility for developing recommendations (St. Louis, San Diego, and early studies in Denver and Houston, and one of the Portland studies). One case study involved virtually giving the consultant the decision-making power (local officials in Pittsburgh were unable or unwilling to develop a consensus on the alternative to be selected, but were willing to agree to abide by the consultant's choice).

Other studies involved more limited consultants' roles in the evaluation process. In Cleveland, the only role of a consultant was in developing evaluation procedures. In four case study areas, consultants were hired to perform evaluations that were limited primarily to engineering considerations, all of which were non-UMTA-funded studies: Calgary, Edmonton, Toronto, and Denver. In all of these cases, the overall evaluation of alternatives gave consideration to other factors in the evaluation process; however, whatever other evaluations were performed were the responsibility of the transit or planning agencies rather than the consultants.

One major finding that stands out in considering the varying roles of consultants is that UMTA-funded alternatives analyses have involved more comprehensive studies, but they can be characterized as being more extraordinary efforts of the agencies involved. The non-UMTA-funded studies have given more attention to preliminary engineering and capital cost estimates, and less attention to environmental impacts. The Canadian consulting contracts, in particular, can be characterized more as small scale supplementary efforts; in specialized technical areas, as part of ongoing agency planning programs. Canadian agencies generally have placed lesser reliance on consultants for guidance in nonengineering aspects of the studies or analysis of policy issues, and have tended to place more emphasis on the use of consultant contracts as part of a learning process to build up in-house expertise for future studies of a similar nature. To a significant extent, consultant contracts in U.S. studies conducted without UMTA funding have had some similarities to Canadian consultant contracts in this sense.
CHAPTER THREE

RECOMMENDATIONS FOR IMPROVEMENTS IN THE TRANSIT DECISION-MAKING PROCESS

This chapter presents recommendations, based on the findings of Chapter Two, that are addressed to two audiences: (1) local and state officials and others who are involved in organizing and managing studies of potential major transit investments, and (2) federal officials who are involved in managing the alternatives analysis program, overseeing environmental impact assessments, and making decisions on capital grants for major transit investments.

RECOMMENDATIONS FOR CURRENT PRACTICE

This section is divided into two subsections: (1) Technical Work Programs and (2) Organization of the Studies. A large number of recommendations are made for improvements in current practice, particularly in a few of the specific technical areas. Considerable improvement can be made compared to the work performed in many of the case studies. Nonetheless, the quality of the planning work has improved enormously over the last few years, due in part to progressive evolution of the state of the art, aided by diligent efforts on the part of the UMTA staff.

Technical Work Programs

Agencies involved in preparing work programs should review the case study reports of this NCTRIP project and consult with appropriate contacts at UMTA, state, provincial, and local agencies to help them in taking advantage of the best of recent practice. (Copies of all case study reports are available on a loan basis or may be purchased in microfiche form from the Publications Office of the Transportation Research Board.)

The recent UMTA-funded studies provide examples of the high quality work that has evolved rapidly over the last several years through an effective interactive process among UMTA staff and professionals throughout the field. Some of the recent non-UMTA-funded studies also provide examples of equally high quality work that has benefited from other studies and professional experience, particularly the LRT projects in Canada and the western U.S.

UMTA and other leaders in the field should consider conducting seminars in cities that are organizing new alternatives analysis work programs, such as was done in Houston just prior to the initiation of that study, and should invite managers from recently completed studies, including the non-UMTA-funded studies.

Some (but by no means all) of the UMTA-funded studies are very effectively documented, although copies of reports are often difficult to obtain. Unfortunately very little effort has been devoted to developing standards to progressively improve the quality of reports, or to developing documents from selected studies which can be used as teaching guides or as references for other studies. Non-UMTA-funded study reports are typically even more difficult to obtain, and are more variable in terms of substantive content and reference value.

Some of the UMTA-funded study reports effectively demonstrate the excessive burden imposed by UMTA’s requirements, or at least by some interpretations of UMTA’s requirements by staff of local or federal agencies. Study managers should develop a clear definition of what level of effort is needed in new work programs for an effective local decision-making process—this will aid them in negotiating study agreements with UMTA and/or other funding agencies. Under the new joint FHWA-UMTA rulemaking of August 1983, additional flexibility will be permitted in environmental studies, as described in Chapter Two.

Local officials and study managers should attempt to build contingencies into agreements with UMTA and with other agencies to provide the opportunity to conduct special studies within the framework of the alternatives analysis process, or its equivalent. Almost all case studies show that unforeseen problems do arise which require special study and attention to resolve. Unless study resources are available, these unforeseen problems can cause excessive delays in obtaining modifications to existing agreements or can cause other problems because of lack of timely attention to their resolution.

In order to avoid wasted study effort, local agencies should consider conducting scoping processes prior to the formalization of a consultant’s detailed work program so that any information developed during the scoping process can be used to shape the contract work program without delay due to renegotiations and federal approvals.

UMTA guidelines for work programs can provide an excellent start, and UMTA staff can be called upon for valuable assistance. However, work program planners should not follow standard UMTA study formats without careful review of each element to assure that it is warranted in the particular local circumstances. Recent experience has shown that when sufficient reason for special consideration is given, UMTA has proven flexible. Lessons can be learned from review of non-UMTA-funded programs in terms of the efficiency with which they address the real issues and the most feasible options in a cost-effective manner. Caution should be exercised, however, because some of these studies cut the level of effort below what should be recommended, particularly as relates to consideration of lower cost alternatives, demand analyses, and overall evaluation of alternatives.
The cost comparisons contained in Chapter Two of this report provide the basis for preliminary estimates of the cost of work programs, which will depend on the complexity of the studies and other factors. The average costs of the studies are not helpful because the costs and conditions vary so widely. Nonetheless these variations could be helpful to local program planners because the variations provide examples of how various factors can affect the costs. In making use of these data, one should note that costs and time requirements have been declining as experience has been gained at UMTA and in the field as a whole, and can be reduced further by reducing effort on environmental and related analysis, and by more efficient staging of the phases and decision-making process.

The following paragraphs contain recommendations for particular technical elements of the process. These recommendations approximately follow the sequence of topics presented under "Strengths and Weaknesses of Technical Elements" in Chapter Two of this report.

Demand analysis methods used in several of the recent UMTA-funded studies provide excellent examples to follow. UMTA staff can provide guidance and copies of documentation from better studies. However, some caution should be taken to avoid being led toward overemphasis on this aspect of the study because of the fact that greater expertise and prior experience are available at UMTA and elsewhere. Methods and assumptions should be carefully documented to facilitate later review and revision as conditions change. Consideration should be given to the use of more than one method in forecasting ridership to provide a check and improve credibility of the forecasts.

Despite the availability of excellent methodology, travel demand input data for analysis are usually very poor and/or out-of-date. Large-scale home-interview origin-destination surveys are prohibitively expensive and cannot be justified solely for alternatives analysis studies. Each urban area, however, should assess its needs for demand data for all transportation planning purposes, and consider conducting modest scale data collection efforts designed to complement the variety of other available data. One such source is the census journey-to-work data, which are lacking in both coverage of trip purpose and in precision of reporting, compared to special origin-destination surveys. On-board transit ridership surveys can also be used for analysis of existing ridership and for analysis of ridership on similar transit networks, but they should not be relied on for forecasting ridership on major new systems because of their lack of data on existing travel by other modes, and because of the inability to relate these data to characteristics of the market area.

Special small sample telephone surveys, such as have been conducted in a few areas, are usually the most cost-effective approach to developing a data base for model calibration purposes, and may be justified for alternatives analysis studies, unless the urban area is fortunate enough to have available a relatively recent home interview origin-destination survey of sufficient quality.

Small scale telephone surveys can be quite cost-effective and can be reliable so long as they are well organized with a high level of quality control. They should be concentrated on obtaining objective data on actual trip-making behavior, rather than on speculation about trip-making under hypothetical conditions, which tends to produce highly unreliable data. Alternatively, an urban area can avoid any new data collection for demand modeling and rely on models calibrated for other urban areas. If this is done, however, care should be taken in applying such models to provide some validation by comparison of results with available ridership data.

Preliminary engineering (P.E.) work should be incorporated in corridor studies in sufficient depth to:

1. Provide accurate cost estimates.
2. Determine alignments and the location of stations with sufficient precision and certainty to provide the basis for accurate assessments of related impacts on communities.
3. Provide the basis for substantially resolving all issues related to engineering feasibility.
4. Provide all of these data and conclusions with sufficient confidence to base firm decisions by local and federal officials.

Local officials and study managers should not delay all P.E. work until after commitment to a preferred alternative, as UMTA's guidelines have required in the past. They should seek to perform as much P.E. work as is required for responsible decisions on a preferred alternative and commitments to funding agreements by all parties as part of corridor alternatives analyses. However, not all P.E. work can be completed during more complex studies without causing substantial delay and wasted effort. Therefore, many studies should provide for completion of P.E. work after major commitments are made on the funding of the preferred alternative, and for subsequent refinements of cost estimates and funding commitments. A modest amount of P.E. work may be justified on more than one alternative during corridor alternatives analyses if the cost can be justified by the time savings involved. However, in order to avoid the waste of performing substantial amounts of P.E. work on several alternatives, Phase II studies that involve complex engineering problems on several alternatives should provide for narrowing down of the number of alternatives during the study to reduce the amount of P.E. work required to obtain good cost estimates.

Transit operations planning should be an important part of all major transit studies, particularly corridor studies, but also system planning studies. Operational considerations can be important factors in determining both the costs and the benefits of systems. For example, the need for grade separations for LRT, busway, or HOV routes should be determined by analysis of flows for the transit system and general traffic at all major intersections. As another example, the effectiveness of a potential major improvement in a transit corridor often depends on the effectiveness of transfer operations in the corridor, which in turn depends on the location of stations, feeder bus route lengths, and the ability to work out an efficient feeder system using timed transfer operations. Analysis of these types should be part of all major transit studies because their results are likely to be major factors in determining the overall cost-effectiveness of the transit investment.

Major bus system improvements should be seriously evaluated as alternatives in most transit studies. Bus system alternatives can take a wide variety of forms and should be carefully tailored to the particular conditions in each urban area and each corridor. The inherent flexibility of bus systems should be recognized as offering a challenge to planners to devise innovative alternatives which are optimally designed for each location, including alternatives involving bus service as the local and feeder complement to rail systems. Major bus alternatives should not be defined so as to mimic rail alternatives in terms of frequency of service, seat miles of service, line haul speed, length of transitway, station location, type of transfer operation, or any other
factor. Each major bus corridor alternative should be devised as an optimal system based on the inherent characteristics of the technology and the characteristics of the corridor, e.g., traffic conditions, existing ridership and demand potential, and available rights-of-way. The best available transit operations expertise should be used in developing these bus system alternatives.

Major bus system alternatives can be attractive investments from a cost-effectiveness standpoint under a wide variety of conditions. They can often be implemented in much less time at a fraction of the cost of rail systems, while offering comparable, and sometimes superior service, at comparable, and sometimes lower operating costs, depending on ridership levels and other factors. For these reasons, bus system alternatives should be seriously evaluated in most major transit studies even when the predisposition of public officials and opinion leaders is toward major rail investment.

Corridor alternatives analysis should include evaluations of varying lengths of transitway for all types of transit systems being considered, except in situations where the terminals of routes are obvious because of peculiar local conditions. This does not imply that several alternatives of the same technology with varying terminal locations should be taken completely through a formal evaluation process. Rather, each basic type of technology being evaluated should be subjected to special study of suboptions to determine the most promising configurations, taking into account approximate effects of the varying terminal locations on such important factors as vehicle requirements, capital cost, convenience of transfer, number of transfers required, speed, and ridership. The most promising, or perhaps the two or three most promising lengths of transitway for each alternative should then be subjected to more thorough evaluation as part of the overall assessment of corridor alternatives.

Environmental impact studies should be included in major transit studies to the extent that they are necessary to address important issues that arise in the process of devising final detailed work programs for the studies through the scoping process. Most major transit alternatives do not create substantial environmental impacts, nor are the differences among them usually significant from an environmental standpoint, except in cases where transitway alignments and stations impinge on nearby residences or other sensitive sites along particular portions of the route. If careful review of the alternatives being considered results in the early conclusion that no environmental impacts will be significant factors in the decision-making process, no further environmental analysis should be required, except documentation of this conclusion. Such an approach would result from implementation of the FHWA-UMTA proposed rule on environmental impact and related procedures, which was referenced earlier in this section and discussed in Chapter Two. Nonetheless, caution is advised in cutting back on environmental analysis because the cost of erring to the side of environmental concerns is less than erring on the side of neglect of environmental concerns.

The same recommendation applies for other factors which are usually of only minor relevance in major transit studies; e.g., parkland and historic site impacts. Energy consumption differences among alternatives are also of little consequence in most studies, although there is often interest in the assessment of overall energy consumption savings for major transit investments, as compared to a base case involving no major transit investment.

Most major transit studies should devote greater attention to the process of overall evaluation of alternatives; i.e., the process of synthesizing all evaluation work into summary comparisons such as benefit-cost, net present value, and cost-effectiveness measures. The process of performing these evaluations should be accomplished with higher standards than has been common in most past studies, and should rely on the best available guidelines. Environmental, historic, energy, and other community impacts should be integrated into the overall evaluation process insofar as feasible so that such impacts are placed in proper perspective—neither being omitted from consideration in the presentation of overall evaluation results, nor exaggerated through overemphasis.

In most studies the vast majority of the benefits and costs of alternatives can be translated into monetary terms using available unit cost measures. However, some of the benefits and cost of alternatives cannot be translated into monetary values with reasonable accuracy and confidence, and therefore must be left out of benefit-cost ratios or net present value comparisons of alternatives. However, the presentation of such evaluation results should be accompanied by presentation of all important evaluation results in concise summary form, whether in quantitative terms (e.g., riders gained, grams of emissions reduced, etc.) or qualitative terms (e.g., visual intrusion, land development potential, etc.). All important evaluation results should be presented to decision-makers in balanced fashion so that trade-off comparisons can be facilitated between the monetary "bottom line" and other factors not included in such values.

The overall phasing of the decision-making process according to UMTA's guidelines should be carefully considered in relation to decision-making needs by local officials and study managers who are planning major transit studies. Consideration should also be given to the following modifications to the standard UMTA model of the process:

1. If sufficient reasons and technical support exist to establish priorities among potential corridors, the Phase I alternatives analysis process might be bypassed. In such cases local officials might wish to seek to negotiate with UMTA (and/or state/provincial agencies) to provide support for a Phase II corridor study and to include whatever system planning work remains to be done to properly support corridor planning.

2. Phase I type of system planning studies might be desirable to conduct simultaneously with major Phase II corridor studies to provide sufficient assessment of how multicorridor transit systems would operate and what the ridership, operating costs, and other performance measures might be on a system basis.

3. If a Phase I system planning study is being planned with the likely outcome being a decision by local officials to pursue a Phase II corridor study, it might be desirable to negotiate an agreement with UMTA and/or other funding agencies whereby the Phase II study can proceed without delay upon satisfaction of predefined criteria regarding successful completion and local agreements in Phase I, subject to UMTA's timely review and approval.

4. Preliminary engineering work should be programmed into Phase II corridor studies in sufficient depth to provide all the technical data, conclusions, and reliable cost estimates needed to base responsible decisions on funding by both local officials, UMTA, and other funding agencies.

5. All studies should include contingency items in the work
programs and budgets to cover potential unforeseen problems which almost always occur in major transit studies. The amount of these contingency funds might vary over a range of perhaps 5 to 20 percent or more of the budget depending on the complexity of the study and technologies involved.

6. All complex major corridor studies should consider including in the work program and budget a Phase III effort for undefined technical staff work and support for participating officials, to be allocated as needed to resolve conflicts, modify alternatives, or to address issues raised in the review of the Phase II work by UMTA and/or other agencies. This Phase III work should be performed concurrently with the completion of P.E. work, as necessary to refine Phase II cost estimates.

7. Local officials should seek prior agreement with UMTA and other funding agencies on how the funding decision is to be made and what criteria are to be used, insofar as possible.

8. Major transit investment studies should lead to the establishment of a first priority increment of transit investment, if any, along with possible subsequent priorities for implementation. However, the development of short range priorities should be based on both short and long run development considerations, and should include assessments of the capital and operating requirements of long range multicorridor system plans, if such plans are recommended as a result of the studies.

Organization of the Studies

A wide variety of forms of organizational structure may be appropriate for the conduct of major transit investment studies. The simplest, of course, involves placing all responsibility for technical work, coordination, and managing the participation process in a single agency. This agency should be the one which is best prepared to assume these responsibilities in light of its available staff, makeup of its governing board, and its current mission and responsibilities. Depending on particular local circumstances, such an agency could be either a metropolitan planning organization (MPO), a transit operating agency, a transit development agency, or a transportation agency of a city, county, or state.

Very often, however, circumstances dictate that more than one agency should be directly involved in the study process either because of available staff expertise, because of the political need to more directly involve officials from other jurisdictions or agencies, or because of the important closely related responsibilities of different agencies. If the reason for involvement of multiple agencies is principally the first of these several reasons (i.e., available staff expertise), the most efficient arrangement is for the agencies involved to enter into an agreement whereby key staff members needed for the study will be loaned to the lead agency under appropriate conditions and time commitments. Arrangements of this type have proven to be more effective than coordinated multiagency work programs, both in terms of staff productivity and in terms of fostering a spirit of interagency cooperation.

Despite the advantages of managing a study with all staff under one roof, coordinated multiagency work programs can be carried out successfully, if properly managed. A key to the success of such efforts is clear definition of roles in management, decision-making, and technical work responsibilities, with agreement on these at the start of the process. Such agreements should provide for mutually agreed upon procedures for adjustments to meet changing study needs as the process evolves.

A critical element to success in coordinated multiagency studies is the designation of a lead agency with clear responsibility for coordination among participants, and with sufficient management authority over the work program to assure adherence to deadlines and budgets, and to assure integration of technical products. Periodic progress review meetings should be scheduled to achieve this objective. Ideally, the lead agency should have the authority to redirect study resources in the event that participating agencies are unable to adhere to the originally agreed upon schedule for interim technical products, for whatever reason.

Co-equal joint responsibility for study management should be avoided if possible because of the tendency to foster an unproductive competitive spirit between the agencies, and because it can result in confusion about overall responsibility and authority, even if work elements are clearly assigned among agencies. If political considerations dictate that a study be managed by two co-lead agencies, it is essential that specific authorities and responsibilities for each agency be defined and agreed upon. Authority for particular decisions should be assigned to a single agency, insofar as feasible, and a specific procedure for conflict resolution should be provided for dealing with whatever joint decisions are necessary.

Lead agency responsibility can logically change over time, e.g., from an MPO to a transit operating agency or to a transportation agency of a local jurisdiction, as the focus of studies shifts from system planning to corridor studies. Key factors in considering a shift in lead agency responsibilities include:

1. Timing of the shift—e.g., at completion of a study phase.
2. Available staff expertise.
3. Location of a selected study corridor entirely within (or nearly so) a single local jurisdiction.
4. Conduct of the study within the purview of public officials having the necessary authority for decisions which may result from the study.

Potential agency conflicts can be avoided if an early understanding is reached as to when the lead agency responsibility should be transferred, and to which agency.

If the MPO is designated as the lead agency, the danger can exist of having lack of sufficient expertise in some important technical areas, such as transit operations, engineering feasibility, cost estimating, and economic feasibility analysis. If such expertise is lacking in the MPO, efforts should be made to borrow the necessary staff expertise from other agencies or to enter into a joint study management agreement with the appropriate agency (or agencies). Acquiring such expertise through consultant contracts is, of course, another alternative, but consideration should still be given to use of the best available public sector expertise to monitor the consultant work and to avoid the potential for inadequate direction or insufficient attention to important technical issues. If care is not taken in acquiring this balanced expertise, an MPO-managed study can have the danger of overemphasis on land use planning and travel demand forecasting. Even in Phase I system planning studies, careful attention should be given to technical issues related to transit operations, engineering feasibility, capital and operating costs, and economic and financial feasibility.
Similar problems in lack of balance in available staff expertise could occur if other types of agencies are designated as lead agencies (although this has not been a significant problem in the case studies). Examples might include lack of expertise in land development planning or ridership forecasting within a transit operating agency, or lack of a regional development perspective within a transportation agency of a local jurisdiction.

Corridor studies in two or more corridors simultaneously can be beyond the capacity of a single agency to manage effectively, particularly if they are to be major studies meeting all of UMTA's requirements. Different agencies can be designated to conduct two or more major transit studies in the same urban area, but specific mechanisms and work elements should be planned to coordinate the efforts and assure that sufficient attention is given to system planning issues, particularly transit operations analysis for the combined corridor alternatives.

Consultant contracts should be effectively managed by competent agency staff, ideally by the lead agency if major contracts are let. The competency and time commitment of contract managers are particularly important if consultants are to conduct most or all of the technical work. Consultant contracts should be monitored with great care if much of the work is to be conducted in distant urban areas. Frequent and substantive involvement in review of work progress by contract managers is essential in such cases to assure that the consultant's senior professionals are effectively managing the work.

Consultants can be used effectively in a wide variety of roles, ranging from very limited, specialized technical activities (such as assessment of advantages and disadvantages of alternative technologies, development of evaluation criteria and methodology, ridership forecasting, and capital or operating cost estimation), to performance of most, or all of the technical work, and even to recommending preferred alternatives. Regardless of the roles assigned to consultants, however, all final decisions should rest with the responsible agency and its governing board. The greater the role given to the consultant, the greater should be the agency's attention in assuring that top agency managers and decision-makers are actively involved.

If consultants are used in major roles, consideration should be given to using the contractors to train staff, particularly if similar studies are planned in the near future.

RECOMMENDATIONS FOR FEDERAL PROGRAMS

This section is divided into three subsections: (1) Changes in the Alternatives Analysis and Related Regulations, (2) Administration of the Program, and (3) Possible Changes in the Grant Programs. These three subsections discuss a large number of specific changes that should be considered. Many of these recommendations are expected to result in significant improvements in the decision-making process. Nonetheless, the basic alternatives analysis policy is judged to be sound and should be continued.

Changes in the Alternatives Analysis and Related Regulations

The need for immediate change in regulations is minimal. The existing policy statements and regulations are flexible enough to permit accomplishment of most, but not all of the recommendations in this chapter without change. This subsection presents a topic-by-topic evaluation of the existing regulations and the need for possible change in these regulations, based on an evaluation of the basic objectives of the alternatives analysis program.

During most of the history of the alternatives analysis program, UMTA was engaged in a continuing process of reviewing these guidelines and seeking to tighten them in order to improve the quality of the transit planning process in urban areas. This process sought to achieve several objectives:

1. Assure effective participation of all interested groups and affected persons.
2. Integrate the E.I.S. process with the alternatives analysis process in a logical manner and assure consistency of both with the long range comprehensive plans for the local area.
3. Coordinate the highway and transit planning processes and the federal requirements for both.
4. Require local officials to give serious objective consideration to alternatives of lower capital cost than rail systems, particularly TSM, HOV lanes, busway alternatives, as well as a full range of multimodal alternatives, as a precondition for federal support.
5. Require local officials to develop a consensus on funding priorities, including incremental implementation of segments of a transitway, with each segment being economically justifiable on its own.
6. Stage the local decision-making process in a logical manner.
7. Improve the quality of the planning process by ensuring use of appropriate techniques for all technical work including overall evaluation of alternatives.
8. Assure that grants are allocated in a cost-effective manner.
9. Assure that particular issues of national concern were given sufficient attention in the planning process, such as mobility of the elderly and handicapped, energy conservation, impacts on historic sites and parklands, etc.

Other potential program objectives can be identified which could influence UMTA's regulations. These include the following:

10. Encourage participation of the private sector, an objective which was not fostered to a significant extent in the past but is now receiving attention by the current Administration.
11. Require local officials to give serious objective consideration to the long term consequences of major transit investments in terms of operation of the overall system, operating costs and subsidy requirements, and land development.
12. Encourage localities to participate in a national process of technology development.

Each of these objectives will be commented on in the paragraphs that follow, as they relate to federal regulations. Findings from the case studies, as reported in Chapter Two, are drawn on to support the conclusions and recommendations relating to the achievement of each of these recommendations.

No significant problems were identified in the case studies as relate to the participation process—either in terms of lack of opportunities for participation, or in terms of the regulations placing an unwarranted burden on localities. (This conclusion does not apply to the potential program objective of encouraging private sector participation, which is discussed in order below.)
The E.I.S. process has placed a greater burden on localities than is warranted; however, this is correctable within the framework of the recent changes in E.I.S. guidelines. No examples of problems can be cited to support a need for strengthening of the E.I.S. regulations, or for changing the manner in which the E.I.S. process is linked with the alternatives analysis process.

The highway and transit planning processes are sufficiently well coordinated, at least in terms of regulations per se. Any remaining problems encountered in the case studies were due to problems inherent in the legislative differences between the two types of grant programs, or were due to differences in the way the two programs are administered by FHWA and UMTA.

Similarly, any remaining problems in getting local officials to give more serious attention to lower capital cost alternatives are due not to weaknesses in regulations, but to inherent characteristics of the UMTA and FHWA grant programs under existing statutes, or to ways in which the programs are administered.

In some of the case studies, local officials originally had an unreasonable view of what the decision-making process should be. In such cases the alternatives analysis requirements had the desirable effect of forcing them to give more serious consideration to the costs and other impacts of their decisions and forced them to give serious consideration to options that should be considered but otherwise would have been ignored. The regulations have been very effective in forcing local officials to develop consensus on priorities and to select initial segments of moderate length as highest priorities for implementation. No related problems were encountered, except for the resulting overemphasis on the short term, which will be discussed in the following in response to objective (11) above.

The regulations have had both positive and negative effects in terms of seeking to stage the local decision-making process in a logical manner. In several urban areas, this aspect of the regulations has been enforced with difficulty, but has resulted in imposing a desirable discipline on the process which would not have occurred otherwise. This is particularly true in a few areas regarding the requirement to select a priority corridor as a product of the Phase I process. The regulations were effective in forcing a consensus on a priority corridor when consensus would otherwise have been very difficult to achieve. In several corridor studies, the more lengthy process of selecting a preferred alternative and achieving a funding commitment from UMTA provided opportunities to resolve conflicts and develop more fully coordinated joint development programs, e.g., with highway and/or urban development agencies.

Often, however, localities have been frustrated by what they see as an unnecessarily protracted decision-making process, one that is not understood by many of the participants and is seen as an artificially imposed federal model that does not fit the realities of the environment in which these decisions are made. By dragging out the process and trying to completely separate decisions on corridor selection from decisions on the locally preferred alternatives, and separating local decisions from federal decisions on investment by many months of formal study, UMTA's regulations are viewed by many local officials as being primarily a means of stalling on federal decision-making, or as a budget cutting device.

One conclusion that can be reached is that UMTA's regulations should not arbitrarily force the decision-making process to be drawn out in all cases, to the full extent of the model process outlined in Table 6 and the accompanying text in Chapter Two. UMTA has demonstrated flexibility recently in imposing these regulations, so that the potential problem has been minimized. Nonetheless, some formal clarification of the policy in this area would reduce the likelihood of future problems. Another conclusion is that the planning and decision-making process should be more of a shared local and federal process.

UMTA's regulations have contributed substantially to improvement of the quality of the planning process and will probably continue to do so in their present form. Some refinements could be made to the regulations to encourage many of the improvements in current practice discussed in the first section of this chapter; however, these improvements could be achieved through UMTA staff initiative under the existing regulations. No feature of the existing regulations is currently retarding improvements in the quality of the technical aspects of the planning process. The proposed rules revising UMTA's E.I.S. procedures should further promote improvements in the process by focusing analysis on real issues.

Existing regulations have resulted in forcing localities to provide a great deal of information that is at least of potential value to UMTA in awarding grants on the basis of their cost-effectiveness. An assessment of UMTA's internal decision-making process has been outside the scope of this study. However, when viewed from the perspective of the case studies and the history of the program since the initial policy statement, it is clear that UMTA has failed to clarify the basis on which it decides the relative merits of investments among the urban areas. In fact, UMTA's commitment to this objective has been less clear over the last few years than in the early period of the alternatives analysis policy. An unfortunate consequence of this has been to force the grant approval process to become more political in both the Legislative and Executive branches, and therefore to reduce the value of the alternatives analysis process to a great extent. This problem could be solved by clarifying UMTA's decision-making process and the way in which the results of alternatives analysis are to be used in this process through a revised policy statement or regulation.

Admittedly the danger of undercutting the honesty of local evaluations exists if such a policy statement or regulation were to rigidly link UMTA's decision-making criteria to specific quantitative indices such as particular cost-effectiveness measures or a benefit-cost ratio. Some flexibility must be provided to give weight to nonquantitative local and national criteria, as well as to considerations of equity and comparative merits of grant applications among competing urban areas.

The regulations have been effective in assuring that issues of national concern are given sufficient attention in the planning process; in fact, they have typically resulted in overemphasis in the technical work programs on national issues that are not usually of significance in the local decision-making process. Recent changes in the regulations, however, have mitigated this problem by reducing the requirements for accessibility for the handicapped, energy analysis, and other factors. No further changes in the regulations appear to be necessary in this regard.

Even though considerable emphasis has been placed on encouraging participation of the private sector in all aspects of the transit program, no policy statement or regulations have been issued urging or requiring such participation in major transit investment studies. Issuing of new regulations to further this objective does not appear to be necessary or desirable, at
least at this time. The proper role of the private sector in these studies is unclear at this time. The transit industry is quite divided on this issue, and the level of interest of the private sector varies widely among urban areas. This is the time for encouragement, experimentation, and recognition of good examples, rather than issuance of formal requirements.

As noted earlier in comments related to objective (5), UMTA's policy statements emphasizing an incremental approach in establishing priority transitway segments have tended to result in overemphasis on the short term. Experience in the case studies indicates that greater attention in many urban areas should be placed on evaluating long term impacts and on planning of areawide transit systems—without diminishing in any way the current attention to setting near term priorities.

Several years ago UMTA developed an unofficial policy of negotiating with urban areas in the grant approval process to secure commitments of local officials to land development policies that would enhance the transit-orientation of new rail corridors, and to secure commitments of the private sector to major development projects in these corridors. This policy has unfortunately not been pursued in recent years, despite the fact that it was rather widely supported by the transit industry, local officials, and transportation professionals.

Although nothing in federal regulations presently precludes attention to the long range, consideration should be given to the development of a policy statement that would place greater emphasis on long range transit system planning issues that might be important in alternatives analyses, including such factors as:

1. Operational plans for areawide transit systems.
2. Impacts of the transit development program on future operating costs and subsidy requirements.
3. Land development impacts.
4. Commitments of local officials to land development policies to enhance the transit-orientation of corridors.
5. Commitments of the private sector to major development projects in corridors in accord with the policies to be adopted by local officials.
6. Areawide bus service needs and deficit implications.
7. Need for, and location of, maintenance facilities and other major systemwide considerations which may have different solutions when seen from an areawide basis as compared to the corridor level.

This recommendation should be contrasted with UMTA's original 1976 policy on major investments which required that "major mass transportation investments shall be consistent with an urban area's comprehensive long range plan. . . ." The findings of this study clearly show that consistency with preexisting comprehensive plans is often an inadequate criterion to achieve the optimum long range benefits of current investment decisions. Major transit investments have the potential for becoming key factors in improving long range plans, and therefore, possible federal commitments can, and should be used as an effective leverage in encouraging local officials to re-assess local plans to take maximum advantage of these investments.

Closely related to the objective of encouraging attention to long range plans, is the final possible objective (12) listed early in this subsection, i.e., encouraging localities to participate in a national process of technology development.

There are two basic problems that such a program might address. The first is that previous experience reveals that U.S. technology development efforts have sometimes failed to adequately take into account factors that are important in actual urban planning environments. For example, had the controversial "Skybus" project in Pittsburgh been developed through an alternatives analysis process, the concerns of both the community and elected officials could have been incorporated into that proposal. A real world planning approach might have led to a proposal which would have been supported, thus eliminating the lengthy controversy and large expenditure of funds involved in that project which never came to fruition.

The second basic problem that such a program might address is the lack of long term continuity in working toward evolutionary improvements in the system designed to serve the full range of urban transportation environments.

U.S. policy in this area has been managed very ineffectively over the long term compared to many other industrialized nations. Emphasis on particular technological solutions has shifted too quickly, too often, and too completely toward single types of technology. Over the last 20 years, emphasis has shifted from almost exclusive encouragement of heavy rail transit, to ART, to ART or GRT, to TSM, HOV lanes and busways, to DPMs and to LRT systems. (Transit professionals sometimes referred to these changing promotional efforts as "mode of the month.") At the same time, technology development programs have too frequently shifted from emphasis on the long range to emphasis on immediate implementation of unproven technology. Pressure to see near-term results has played a large role in forcing these changes in program direction.

By contrast, Canada, and particularly the Province of Ontario, has engaged in a long term program without major shifts in direction, with relatively balanced attention to the interests of all major groups concerned: national, provincial, and local governments; manufacturers; transit industry; and transportation professionals. As a result, this evolutionary program has already seen the operational use of a new standard light rail transit (LRT) vehicle to replace the Presidential Commission Car (PCC) streetcars, the start of construction of new automated LRT systems with linear induction motors, and advanced planning for the next generation of higher speed systems.

A significant difference between U.S. experience and that of Canada (as well as other countries) appears to be the inability of U.S. programs to maintain freedom from external pressures, and their inability to draw upon the most skilled managers of technology development, demonstration, and deployment. These problems can be overcome by the establishment of a strong advisory group to insulate the program from unrealistic short term demands and to draw upon the best talents of the transit industry, manufacturers, state and local government, academia, and transportation planning professionals.

Legislation may be required in order to achieve the maximum benefits of such a program. However, within the framework of existing statutes, consideration should be given to the development of a program which would encourage urban areas and industry to work more effectively with U.S. DOT on an evolutionary effort of this type. Selected urban areas would be encouraged to seriously evaluate evolving technologies within the framework of major transit studies, and U.S. DOT should contribute technical staff resources and funds to work with selected state and local agencies in evaluating new equipment and systems, and setting up programs for testing of prototypes.

This last recommendation would appear to offer substantial
long range benefits when viewed from the perspective of this review of alternatives analysis practice; however, it must be considered as a very preliminary suggestion for others to evaluate and develop because it should be based on a critical evaluation of U.S. DOT's transit research and development program as a whole.

Administration of the Program

The recommendations for changes in program administration are presented below following the same order of presentation as for changes in regulations above.

Since the quality of participatory processes has risen to a relatively high level in the United States, no additional special efforts are required by UMTA staff beyond current practice. It is interesting to note that Canadian practice places far less demands on agencies to establish continuing participatory mechanisms during major transit studies. In fact, this is judged by this study staff to reflect an historically greater trust of government in Canada, a stronger tradition of professional responsibility in civil service at the local and provincial levels, and less history of disruptive shifts in direction of transportation programs. U.S. transportation programs have been through rather extraordinary efforts to overcome past problems in this area, most notably in reaction to Interstate highways in many urban areas. The recent lack of problems could lead to a reduction of opportunity for participation and a repeat of the distrust that arose in the 1960s in transportation program administration.

Increased flexibility should be exercised in administering the E.I.S. requirements for transit studies, as is provided for in the most recent proposed joint FHWA-UMTA rulemaking. If the scoping process identifies no substantial environmental issues among the choice of transit alternatives, this should be documented and no further study required. A contingency budget, which is recommended elsewhere in this report, can provide for analysis of subsequent unforeseen issues, if any. UMTA staff can help local agencies plan and conduct work programs with less effort wasted on environmental analyses that will be of no substantial concern in the decision-making process. Funding should not be provided for detailed air quality or energy analysis merely to provide arguments in favor of major transit investments—very little analysis is needed to develop approximate estimates for such purposes.

Far greater effort should be devoted to achieving common FHWA and UMTA administration of major corridor studies. Many complaints were expressed in the case study interviews regarding lack of coordination. A fairly typical local perspective is that field staff will acknowledge official common policy and regulations, but insist that the reality is that the programs are really different. The problem is intensified in many urban areas because of the lack of local UMTA or FHWA offices. Far more could be done to train field staff to have common understanding of regulations and policy, and to be prepared to represent the Federal government as a whole, or at least U.S. DOT as a whole.

Part of the problem in the current situation is that there is often a low level of interest in the nonlead federal agency staff due to lack of clear responsibility when both highway and transit elements are involved, as they very often are. When an alternatives analysis study results in an implementation program involving both federal agencies, the local agency sometimes finds that it must spend a great deal of time satisfying the less involved federal agency that federal requirements have been met when it has already satisfied the other agency. U.S. DOT should not allow itself to be playing such a counterproductive role.

UMTA staff have been quite diligent in encouraging local agencies to give serious attention to lower capital cost alternatives. However, efforts to encourage consideration of bus-oriented alternatives have proven to be only partially successful because of the inherent tendency of the discretionary program to create an incentive to choose rail systems. Emphasis on consideration of TSM programs as basic alternatives to major transit investments has continued to be emphasized by UMTA staff. Despite the inherent logic of considering major TSM efforts as basic alternatives to major transit investments, in many cases experience shows that it is impractical to expect that local agencies will devote serious objective effort to devising very low cost ways of accommodating projected demand which will have the effect of undercutting the justification for major transit investments. Nonetheless, UMTA's efforts to achieve this objective make good economic sense. Somewhat more effort should be given, however, to encouraging TSM actions as part of major transit investment alternatives, in the same way that greater attention should be given to transit operations planning as part of the planning process. Very often the most important near-term product of major transit studies can be important transit operations of TSM improvements that are viewed as initial steps toward eventual major transit investments.

As a precondition for approval of grants, UMTA staff and other funding agencies should continue to require local officials to develop consensus on priorities and to select segments of moderate length as highest priorities for implementation, but should not seek to deemphasize long range planning objectives.

UMTA staff should be very flexible in enforcing existing policy regarding the staging of the alternatives analysis decision-making process. The recommendations for local practice on the staging of the process were presented at the end of the first section of this chapter. Local judgments as to the proper staging of the decision-making process should be given careful consideration by UMTA and accepted in most cases so long as it is clear that responsible local officials have a clear perception of how the technical planning process is going to relate to the decision-making process. Negotiated agreements should be reached through a cooperative process.

The quality of the technical planning work has been improved enormously over the last few years, and a large part of this improvement is attributable to competence and diligence of UMTA staff. The "Technical Work Program" section of this chapter cites several further specific improvements that should be fostered by UMTA staff. In two particular areas, engineering and environmental analysis, UMTA should consider adding staff expertise or drawing more heavily on existing staff expertise elsewhere in U.S. DOT. Local agencies could often benefit from greater UMTA guidance on the extent and scope of preliminary engineering and environmental analysis that should be included in the alternatives analysis work program, as well as greater effort in review of these efforts as they are being conducted to assure that issues are being properly addressed and that effort is not wasted in needless E.I.S. work.

In the preceding subsection the recommendation was made that UMTA should consider a revised policy statement or reg-
ulation that would clarify UMTA's decision-making process for evaluating grant applications based on the alternatives analysis process. If such action is not taken, UMTA could accomplish the basic objective to a substantial extent through less formal means. An internal policy could be developed regarding the process and criteria for evaluating grant applications. UMTA should communicate to officials in each urban area undertaking an alternatives analysis its intent to base its decision largely on the results of the analysis and insist on high standards in performing the overall evaluation of alternatives. The basis for UMTA's decision should then be clearly specified in relation to the study results. This approach would greatly reduce the uncertainty for local officials as to how the outcome of the studies is to be judged, while reserving to UMTA some flexibility in applying the policy in each urban area. If such an approach were to be applied with consistency and fairness over time, the credibility of the alternatives analysis program would be substantially improved and the incentive for politicizing the grant application process would be reduced. The same caution as was made in the preceding subsection needs to be repeated here relating to the danger of undercutting the honesty of local evaluations if UMTA's decision-making process is linked too closely to specific quantitative evaluation measures.

Although no changes were recommended in the regulations regarding issues of national concern (e.g., mobility of the elderly and handicapped, energy, historic sites, and parkland impacts), UMTA staff could further reduce the burden on local agencies by assisting them to plan and conduct work programs with less time and effort devoted to wasted analysis in these areas. As was recommended for environmental analysis, the work should be sufficient to properly address issues that arise in the scoping process.

UMTA officials have been encouraging greater participation of the private sector in all aspects of the transit program. No experience from these case studies leads to recommendations as to how this objective should be furthered, other than to suggest that accomplishments in particular urban areas should be called to the attention of officials and business leaders in other urban areas which might profit from similar approaches.

A recommendation was made in the preceding subsection that consideration should be given to the development of a policy statement that would place greater emphasis on long range transit system planning. Whether or not such a policy statement is issued, UMTA staff should develop and disseminate examples of good practice from selected urban areas.

The final recommendation in the preceding section urged that consideration be given to the development of a policy statement and a long term program for involving state and local agencies and industry in evaluating and implementing evolving technologies within the framework of selected major transit investment studies. Accomplishment of this recommendation will require greater continuing interaction between units of U.S. DOT responsible for research, development, and demonstrations, and UMTA staff responsible for the alternatives analysis program.

Changes in the Grant Programs

A review of the basic structure of the grant program is beyond the scope of this project. Nonetheless, the analysis has resulted in some conclusions which raise questions about the basic structure of the U.S. DOT's urban transportation grant programs:

Is it feasible to avoid major distortions in decision-making in favor of capital-intensive transit so long as the program continues as a large-scale discretionary program? Can the alternatives analysis process really be expected to force a rational decision-making process based on cost-effectiveness criteria within the framework of a discretionary program? What distortions are imposed on local decision-making when major transit investments require years of alternatives analyses, while major highway investments do not require alternatives analysis but instead are more readily stalled through other procedural requirements? (Despite the fact that no equivalent of the alternatives analysis policy exists for highways and that nothing similar to the "no new rail starts" policy has ever been established for highways, nonetheless federal environmental and other regulations have been effectively used to restrain highway development in urban areas, probably to a greater extent than for transit.) Can the highway and transit programs be sufficiently integrated within urban areas to avoid continuing major distortions in local decision-making so long as the basic structure of the two grant programs are so dissimilar?

If the recommendations of the preceding sections of this chapter are carried out, some of the problems that give rise to the foregoing questions would be mitigated. The major pro-rail bias inherent in the current alternatives analysis program might be reduced somewhat if improvements were made in current practice for cost-effectiveness analysis, analysis of bus alternatives, transit operations analysis, and operating cost estimating. This bias would also be reduced if UMTA would carry out the recommendations regarding the definition of its criteria and procedures for evaluating grant applications.

Yet the inherent incentive for local officials to select high capital cost alternatives would remain unless UMTA could limit the amount of the discretionary grant to the estimated capital cost of the most cost-effective alternative based on more specific criteria defined and applied by UMTA using local study results. This would be extremely difficult for UMTA to administer unless UMTA was required by law to impose such a limit. Furthermore, such a policy (whether required by law or regulation) would tend to force a contest over the merits of technical estimates and forecasts between UMTA staff and local staffs to a much greater extent than currently occurs. This would have a very undesirable effect on the basic nature of the alternatives analysis process. The role of UMTA staff would shift from constructive reviewer and technical assistance provider to investigator-policeman-auditor, and the quality of the work in the field might tend to suffer substantially because of the resulting added incentive to inflate rail ridership forecasts and to underestimate rail costs, relative to other alternatives.

One conclusion is that under the current discretionary program there will always be some degree of contest between UMTA staff and local officials and study managers, with the latter group seeking to justify rail systems and UMTA staff seeking to encourage more serious attention to lower cost alternatives. The seriousness of this distortion could be reduced, of course, if the amount of discretionary funds was reduced relative to formula grant funds.

Another structural change in the grant programs that would address this problem and others discussed previously is to combine urban highway and transit capital grant programs into a single formula grant program. This would allow local and state decision-makers to make trade-offs between highway develop-
ment and transit development to an extent that can not occur under current programs, even though such trade-offs are logical and important decisions, and even though responsibility for such decisions should clearly rest with local and state officials.

A major problem in achieving such a restructuring of urban transportation programs is that the basic highway program is administered by the states, whereas the transit program is administered by various agencies (e.g., transit operating agencies, MPOs, and local governments), primarily at the local rather than at the state level. Even the urban portions of the highway programs, which are controlled by local officials to a substantial extent in many urban areas, are primarily administered by the states in most cases. Federal action can have only limited influence over states' prerogatives in this regard.

Another structural change in the grant programs which would achieve essentially the same objective while recognizing states' prerogatives is to establish separate urban highway and transit formula grant programs, but to provide relatively easy trade-in provisions for both programs, following the precedents of the Interstate and Federal Aid Urban System programs. Some restraints would probably have to be placed on the amounts that could be transferred (as has been done in the past for several of the specific highway funding categories) to assure that a balance among modes is maintained in each urban area over a multiyear period, consistent with national policy.

Restructuring of this type would avoid the problems discussed above and could also address the problems in coordination of the highway and transit program. Such a restructuring would give state and local officials far more incentive to coordinate their programming processes for highways and transit and to give joint consideration to trade-offs between them. Major rail investments could only be implemented by delaying major highway investments, and vice versa, and these difficult, but logical decisions, would fall primarily to those officials who should be most responsible. The analysis of major alternatives for highways and transit would tend to be treated more similarly regardless of federal regulations and program administration. UMTA and FHWA field staffs would be forced to coordinate their activities more carefully and to develop more common procedures. Local and state decision-makers and planners would be given more flexibility and incentive to devise plans which involve joint highway and transit components, as well as components that now tend to be overlooked or ignored because they "fall between the cracks" or are judged to be not worth the paperwork burden inherent in the current federal programs. A restructured program of this type could facilitate reducing the federal paperwork burden for minor capital investments, such as most TSM activities, and thereby create an incentive which has been difficult to achieve under current program structures.

Results of this study merely suggest that further attention should be given to possible major program restructuring of the above type. Many aspects of these programs not considered in this review and perhaps other alternative solutions would have to be evaluated in greater depth before a specific recommendation should be made.

CHAPTER FOUR

RECOMMENDATIONS FOR RESEARCH AND SYNTHESIS OF PRACTICE

The majority of the work that is recommended in this chapter is intended to provide the basis for improving the quality of major transit studies. Most of the recommendations involve a synthesis of the best of current practice rather than original research. The recommended projects, however, do involve significant elements of research, either to improve upon work previously performed or to generalize the results of previous work to make it more applicable to other North American urban areas. The projects recommended below fall into the nine following areas.

1. Costs of major transit studies.
2. Travel demand data.
3. Travel demand modeling.
4. Preliminary engineering.
5. Transit operations planning.
6. Transitway route length evaluation.
7. Overall evaluation.
8. Research, development, and demonstration planning within the context of alternatives analysis.
9. Evaluation of possible structural changes in urban transportation grant programs.

The amount of effort devoted to these proposed projects should depend on the number of urban areas likely to be funded for future alternatives analyses and the expected scope of these studies. Each of the recommended projects is discussed in the following.

COSTS OF MAJOR TRANSIT STUDIES

The cost estimates for transit studies reported in Chapter Two and Tables 3 through 5 were inadequate to provide a useful product for accurate planning of study budgets for future alternatives analysis. In the process of assembling the data, it became obvious that such data would be highly useful to both UMTA and study managers planning new work programs. Unfortunately such UMTA data were not easily retrievable. Almost all of the estimates were provided by local or state agency staff,
and many of the estimates are based on memory because of the difficulty of obtaining the data from records, particularly for studies which involved numerous funding sources, several contracts, interagency sharing of staff and separate in-house efforts, as well as changes in the work program and budget during the course of the studies. Many of the studies also involved use of regular agency staff work which was not covered by UMTA or other grants. In most cases, non-UMTA-funded study costs were much more readily available.

The recommended product of this project would be a set of guidelines for budgeting the principal components of major transit studies. An effort should be made to obtain as large a sample as possible to provide a more reliable basis for estimating study costs than the sample of 41 studies in 16 urban areas compiled for this study. Actual records and any available audits should be checked wherever feasible to assure accuracy. UMTA staff and the various agencies involved should also be interviewed to ensure reliability. The work should involve a more detailed assessment of the factors affecting the costs, including an attempt to assess instances where budgets were either too high or too low in retrospect.

**TRAVEL DEMAND DATA**

The product of this recommended project is a set of guidelines for major transit studies for the collection and processing of survey data on travel demand and transit ridership. The project should involve a review and synthesis of several recent studies and the development of detailed recommendations for practice, including detailed guidance for managing a data collection program. The project should probably be divided into two phases, with the second involving the demonstration of the data collection methods and procedures for integrating data from existing secondary sources with newly collected data. Two or three urban areas should be selected for the demonstrations to cover the range of different situations (e.g., an urban area where regular transit on-board origin-destination surveys are periodically conducted and an area where only minimal transit survey data are available to satisfy Section 15 requirements). Also, urban areas where major special census surveys were conducted in the mid-1970s might be distinguished from areas without such surveys.

The project should give attention to each of the basic sources of data that may or may not be used in particular studies, including:

1. Old, comprehensive, home interview origin-destination surveys that are usually available but were last conducted in the 1960s in most areas.
2. Journey-to-work surveys from the decennial Census of Population and Housing.
3. Special journey-to-work surveys conducted by the Bureau of the Census for UMTA in selected major SMSAs in the mid-1970s.
4. On-board transit origin-destination surveys.
5. Ridership counts at maximum load points, jurisdictional boundaries, etc.
6. Screen line counts, for example around CBDs or on major water crossings.
7. Special small sample telephone origin-destination surveys.

The study should encompass a review of the procedures used to check and to expand sample data. This includes procedures used to expand data to cover all work trips (as distinct from "usual" trips) and to cover nonwork trips, and procedures for expansion of ridership surveys from peak periods or peak-plus-base periods to cover typical weekdays and weekends. The study should also cover all procedures used to adjust and prepare the data for demand modeling and forecasting.

**TRAVEL DEMAND MODELING**

The product of this recommended project is a set of guidelines for travel demand modeling in major transit studies. Since the state of the art is highly advanced in this area, no research or extensive testing of models is envisaged. The scope should include a detailed review of several of the recent major studies, including ones involving basically different scopes of work (e.g., corridor vs. system planning studies), different types of transit systems (bus-only vs. multimodal transit systems), and different modeling approaches (e.g., use of the UMTA software package vs. use of elasticities for factoring of existing ridership data vs. a combination of methods with consistency checks). Submodal split models for rail access mode predictions should be included. All of the types of consistency checks applicable in demand modeling should be covered.

**PRELIMINARY ENGINEERING**

A set of statistics and examples should be developed from recent studies and other data sources to provide a basic reference for Phase II alternatives analysis studies and other preliminary engineering (P.E.) work for transit systems. Case studies should be made of P.E. work performed for recent major transit investment decision, and should include a review of the amount of P.E. work done during Phase II studies and the extent to which cost estimates changed subsequently. Portland, San Jose, and Houston are good candidates for such case studies.

One basic function of the document would be to provide guidance on the level of detail of P.E. work that should be incorporated in Phase II studies in order to:

1. Provide accurate cost estimates.
2. Determine alignment and the location of stations with sufficient precision and certainty to provide the basis for accurate assessments of related impacts on communities.
3. Provide the basis for substantially resolving all issues related to engineering feasibility.
4. Provide all of these data and conclusions with sufficient confidence to base firm decisions by local officials.

The reference document should incorporate a synthesis of material from several of the better recent studies illustrating the level of detail required to satisfy the above objectives. Examples should also be shown, as appropriate, pointing out instances where the level of detail was insufficient to provide the desired level of confidence.

A major part of the document should be comprised of reference statistics on costs of all types, in the appropriate level of detail for P.E., plus guidelines for applying the cost data in preparing estimates of costs under varying conditions, including adjustments for such factors as local price differentials, correc-
tions for inflation, discount factors, and scale of construction or amount of rolling stock purchased. Cost data should be based on actual construction or purchase prices and should be converted to common current year dollars using the most appropriate construction or other type of price index.

**TRANSIT OPERATIONS PLANNING**

As discussed in Chapters Two and Three, transit operations planning has been found to be an important, but often inadequate part of alternatives analyses. Operational considerations are often important factors in determining both the costs and the benefits of alternatives. Yet, unfortunately, very little material is available from UMTA, the case studies, or other sources, which can be of direct benefit as a reference, particularly for use in the context of major transit investment studies.

A set of guidelines should be prepared for transit operations planning within major transit studies based on a synthesis of the best experience from recent alternatives analysis studies, as well as from transit operations planning experience from other contexts. A review of sources in the transit operations planning literature is expected to result in considerable useful material that has not been published, but can be found in the files of major transit agencies and a few of the smaller, more progressive transit agencies.

The guidelines will have to draw on material that is oriented to more detailed operational applications such as route and schedule planning, but should be organized in a manner suited to the alternatives analysis context (i.e., situations in which costs, ridership impacts, and other data must be developed for large-scale changes in transit systems and for widely differing types of systems).

At least four specific types of operations planning analyses should be covered in the guidelines:

1. Methods for estimating operating costs based on formulas related to service parameters, such as peak vehicles required, miles of service provided, etc. (NCTRP Project 40-2 will provide recommendations on methods for estimating costs of transit service at a more detailed level for planning of changes in service. The basic approach that has been used to provide accurate estimates of operating costs by formula is to allocate all elements of a transit agency’s actual costs to each of several most closely related factors (vehicle-hours, vehicle-miles, and peak vehicles, for example) and then to develop the formula based on these actual costs.)
2. Procedures for evaluating the location of maintenance garages, taking into account the cost of deadheading from garages and other cost factors associated with garage locations, in addition to analysis of in-service miles.
3. Guidelines for the planning of timed transfer operations, for the planning of transit centers for timed transfer operations, and for the special management attention required to achieve successful operations.
4. Procedures for evaluating transit operating options within the context of complex traffic conditions, including the application of signal preemption and other transit priority measures, and the evaluation of alternative ways of handling transit operations through geometric design solutions.

**TRANSIT ROUTE LENGTH EVALUATION**

Unfortunately, very little technical work has been performed in evaluating the trade-offs involved in extending routes progressively farther into suburban areas. UMTA’s original guidelines stressed the need for this type of analysis, and it received considerable attention in the discussion of the first alternatives analysis policy statement because it was so much in contrast to prior practice at the time.

Some limited conceptual analytical work has been devoted to the problem, and, as mentioned in Chapter Two, at least two of the case study urban areas have performed evaluations of transitways of different lengths in the same corridor. However, no example has been found of a systematic effort to identify the several factors involved in the evaluation process and to develop a basis for determining the optimum length of transitways.

The recommendations made in Chapter Three suggest that each basic type of technology being evaluated in an alternatives analysis be subjected to special study of suboptions to determine the most promising configurations, taking into account the effects of varying terminal locations on such factors as vehicle requirements, capital costs, convenience of transfers, number of transfers required, speed, and ridership. The guidelines developed in this project should provide guidance on how each of these factors should be analyzed in this context and should provide examples of such analysis for specific urban areas with references to sources that can be used for cost estimates for all these factors.

**OVERALL EVALUATION**

The quality of overall evaluation work (i.e., benefit-cost analysis, net present value assessments, and cost-effectiveness evaluations) in the case studies is one of the weaker technical elements of the process, as was discussed in Chapter Two. Part of the reason for this is undoubtedly that local study managers are reluctant to apply hard economic investment analysis standards to alternatives that are already locally preferred. However, another part of the reason is that guidelines are not available that are written specifically for alternatives analysis, and UMTA staff have not had recent examples of good practice available for reference, at least until quite recently.

This project would involve a review and critique of recent practice in this field, and would draw upon sources in closely related work for development of specific applications for major transit studies. The references cited in Chapter Two in evaluating current practice on overall evaluation of alternatives under “Technical Analysis” provide basic references to use in developing these guidelines, including complete citations of all relevant literature as of 1978.

**RESEARCH, DEVELOPMENT, AND DEMONSTRATION PLANNING WITHIN THE CONTEXT OF ALTERNATIVES ANALYSIS**

The recommendation was made in Chapter Three that consideration be given to the establishment of a strong advisory group to guide U.S. DOT’s program of transit technology research, development, demonstration, and deployment, drawing
upon the best talents of the transit industry, manufacturers, state and local government, academia, and transportation planning professionals. As envisioned this group would encourage selected urban areas and industry to work more effectively with U.S. DOT on a continuing evolutionary program. Urban areas would be encouraged to seriously evaluate evolving technologies within the framework of major transit studies, and the U.S. DOT would contribute technical staff resources and funds in this effort.

As a first step in achieving this objective, a study should be conducted to evaluate the proposed concept and develop an initial recommended program. The study should have the following components:

1. Critical review of the history of U.S. DOT's program of transit research, development, demonstrations, and deployment.
2. Review of parallel programs in Canada and other selected major industrialized nations.
3. Development of preliminary conclusions on relative strengths and weaknesses of the U.S. program.
4. Development of recommendations on the composition of the advisory group, how its members should be appointed, and the powers it would have.
5. Preparation of an initial program for the advisory group leading to a more definitive assessment of the U.S. transit technology research, development, demonstration, and deployment program.
6. Development of recommendations on the framework for involving urban areas in the planning and implementation of technological evolution for their transit systems.

EVALUATION OF POSSIBLE STRUCTURAL CHANGES IN URBAN TRANSPORTATION GRANT PROGRAMS

As discussed in the last subsection of Chapter Three, consideration should be given to major changes in the structure of urban transportation grant programs because of the fundamental bias that is caused in the current large-scale discretionary grant program in favor of capital intensive rail systems. Options that should be considered in a reassessment of the existing capital grant program include, but should not be limited to:

1. Legislative limitation of the amount of any discretionary grant to the estimated capital cost of the most cost-effective alternative, based on specific investment criteria to be defined and applied by UMTA using the results of the alternatives analyses.
2. Reduction in the amount of the discretionary capital grant program with an offsetting shift to a formula grant program.
3. Integration of urban highway and transit capital grant programs into a single formula grant program.
4. The establishment of separate urban highway and transit formula grant programs, to be administered in a more integrated manner with easy trade-in provisions for both programs, within some constraints to assure a reasonable balance among modes over a multiyear period.

Chapter Three contained a preliminary discussion of some of the more important factors involved in evaluating these options. However, this study has considered these options only from the perspective of the alternatives analysis process and related local studies of major transit investment decision-making. To this should be added a review of Congressional intent, U.S. DOT administration of both programs, and the states' perspectives in administering the urban portion of the highway program and providing assistance to transit (which varies from virtually no role to full responsibility for operations and financial support).

In order for this proposed assessment to have maximum potential for success, the entire process of defining the scope and reviewing the work progress should be guided by a carefully selected panel with high credibility that would be in the best possible position to advise on implementation of the resulting recommendations.

INVolVEMENT OF EXPERTS IN RESEARCH PROGRAM MANAGEMENT

U.S. DOT should consider more general use of panels of national experts to provide guidance for research, development, and demonstration programs, in a manner similar to that recommended above for transit technology programs—following the successful approach that has been used by the Transportation Research Board in managing the NCTRIP and NCHRP.

U.S. DOT and the Transportation Research Board should consider convening a conference soon to critically evaluate these findings and recommendations. The Transportation Research Board should consider establishing a committee or subcommittee on alternatives analysis that would provide guidance on research topics such as the above-recommended projects, and provide a continuing forum for sharing research experience on topics in this field.
## APPENDIX A

### CHRONOLOGY OF SELECTED FEDERAL ACTIONS RELATED TO URBAN TRANSPORTATION PLANNING

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<tr>
<th>YEAR</th>
<th>ACTION</th>
<th>IMPACT</th>
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| 1962 | Federal-Aid Highway Act | Encouraged development of comprehensive transportation systems.  
Directed states to develop long-range highway plans coordinated with other modes.  
Required that all federally funded highway projects be based on a continuing, comprehensive, and coordinated planning process (3C) involving states and local communities.  
Defined planning focus as the urban area. |
| 1963 | Guidelines for Implementing the 3C Process | Resulted in quick development of relatively standardized planning processes in all urbanized areas. |
| 1964 | Urban Mass Transportation Act | Encouraged planning of areawide urban mass transportation systems.  
Established federal support match for acquisition and construction of transit facilities at two-thirds of cost. Federal share was limited to 50 percent when no comprehensive plan existed.  
Required that all funds be channeled through public agencies to projects initiated locally.  
Established a program of mass transportation research, development, and demonstrations. |
| 1966 | Amendments to UMT Act of 1964 | Established program of two-thirds federal support for planning, engineering, and design of local transit projects which would lead to a federal grant application.  
Established grants for transit management training.  
Established program to develop new system technology. |
| 1966 | Department of Transportation Act | Created U.S. DOT and provided focal point for coordinated federal transportation policy. |
| 1966 | Demonstration Cities and Metropolitan Development Act | Section 204 required review of federal aid applications by an areawide agency for coordination with long-range comprehensive development plans. |
| 1967 | U.S. DOT Policy and Procedure Memorandum 50-9 | Specified the 3C process for urban transportation planning, including jurisdictions covered, plan elements, scope of studies and citizen participation. |
| 1968 | Federal-Aid Highway Act | Required that Secretary of U.S. DOT not approve a program or project requiring use of publicly owned park, recreation area, or wildlife or water fowl refuge unless (1) there is no prudent and feasible alternative, and (2) all possible planning has been done to minimize harm.  
Required public hearings. |
| 1968 | Intergovernmental Cooperation Act | Required that national, state, regional, and local viewpoints be taken into account (to the extent possible) in planning of federally assisted development programs and projects. |
| 1968 | Reorganization Plan No. 2 from the President to Congress | Established the Urban Mass Transportation Administration within DOT and transferred existing urban mass transportation programs from the Department of Housing and Urban Development to DOT. |
| 1968 | U.S. DOT Instructional Memorandum 50-4-68 | Required Operations Plans defining organizational structures, and provided further specification of procedures for urban transportation planning.  
Provided additional guidance for technical approaches and scheduling of plan reviews and reevaluation. |
Required areawide comprehensive planning agencies to comment on the relationship of proposed projects to the planned development of the area.  
Required that federal agencies notify governors of awards within their state. |
Required consideration of a full range of social, economic, and environmental impacts. |
<p>| 1969 | Environmental Quality Improvement Act | Established Office of Environmental Quality. |</p>
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<tr>
<th>Year</th>
<th>Act/Order</th>
<th>Key Actions</th>
</tr>
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| 1969 | National Environmental Policy Act | - Required the preparation of Environmental Impact Statements (EIS) for major federal actions to include discussions of alternatives and unavoidable adverse effects.  
- Required a systematic interdisciplinary approach to planning and decision-making.  
- Created Council on Environmental Quality to implement policy. |
| 1970 | Amendments to Clean Air Act | - Created the Environmental Protection Agency, authorized to set ambient air quality standards.  
- Required development of State Implementation Plans (SIP) for these standards.  
- Set deadlines for meeting EPA's ambient air quality standards.  
- Required focus on low-capital and traffic management actions. |
| 1970 | Urban Mass Transportation Assistance Act | - Required that transit systems consider special needs of the elderly and handicapped.  
- Required environmental impact hearings. |
- Authorized expenditure of highway funds on bus transit projects.  
- Required promulgation of guidelines to assure that adverse economic, social, and environmental effects are fully considered in highway projects.  
- Increased federal share for non-Interstate projects to 70 percent.  
- Amended Section 134 to require consultation with local officials before any highway project was built in urban areas with populations of 50,000 or more. |
| 1971 | Federal Highway Administration Instructional Memorandum | - Established annual certification of 3C processes. |
| 1972 | Policy and Procedure Memorandum 90-4 “Process Guidelines” | - Required states to develop their own action plans to describe organization and procedures for highway planning and allowed different procedures for different categories of projects (more flexibility than a federally prescribed approach).  
- Topics to be covered included social, economic, and environmental effects, alternative courses of action, involvement of other agencies and the public, systematic interdisciplinary approach, decision-making process, responsibility for implementation, and fiscal and other resources. |
| 1972 | UMTA Order 1000.2, the UMTA External Operating Manual, Appendix 2 | - Provided description of planning requirements related to urban mass transportation. |
| 1973 | Federal-Aid Highway Act | - Allowed expenditure of FAUS funds on urban mass transportation projects.  
- Allowed withdrawal of Interstate segments and substitution of mass transit projects.  
- Made funds available to local agency designated by state as responsible for 3C process in urban areas.  
- Required that programs for projects on the urban system be in accordance with Section 134 planning procedures.  
- Authorized rural highway public transportation demonstration program. |
| 1973 | CEQ, Preparation of Environmental Impact Statements | - Provides guidelines to federal departments and agencies for preparing detailed environmental statements.  
- Directs individual agencies to establish formal procedures. |
| 1974 | DOT Order 5610.1B | - Formalized DOT procedures for environmental impact statements. |
| 1974 | Interstate System Revisions | - Authorized Federal Highway Administrator, upon request from the Governor and local officials, to withdraw segments of the Interstate if they are not necessary to the completion of the system.  
- Authorized the substitution of a mass transportation project for the amount of the federal share of the cost of an Interstate segment which has been withdrawn. |
| 1974 | National Mass Transportation Assistance Act | - Authorized federal operating assistance for urban mass transit systems.  
- Made funds available for purchasing capital equipment used for rural transportation systems. |
| 1975 | FHWA-UMTA Joint Regulations on Urban Transportation Planning | - Required that governors designate a metropolitan planning organization (MPO) in each urban area.  
- Required a unified planning work program and a prospectus.  
- Required Transportation Systems Management (TSM).  
- Required a Transportation Improvement Program (TIP) and an annual element detailing the next year's projects.  
- Required special efforts to plan for needs of the elderly and handicapped. |
1976 UMTA, Major Mass Transportation Investments
- Requires an analysis of transportation alternatives and final Environmental Impact Statement in order to be eligible for federal assistance for major investments.
- Establishes principles and procedures for UMTA review of alternatives analysis.
- Authorized the use of highway funds for projects related to transit and high-occupancy vehicles.

1978 UMTA, Policy Toward Rail Transit
- Clarified and supplemented earlier principles and procedures for UMTA review of alternatives analysis.
- Set September 30, 1986 as date by which all remaining portions of Interstate System must be under contract or be de-designated.
- Made funds available for Interstate System resurfacing as of FY 1980.
- Required the Secretary of DOT to create guidelines for Interstate System maintenance.
- Created highway bridge replacement and rehabilitation programs.
- Created formula grant program for areas other than urbanized (Section 18 of UMT Act).

1980 Environmental Impact and Related Procedures: Final Rule
- Established specific NEPA requirements to be followed by FHWA and UMTA.
- Specified 3 classes of actions which prescribe the necessary level of documentation.
- Outlined “scoping process.”

1981 FHWA-UMTA, Urban Transportation Planning: Interim Final Rule
- Simplified planning process for areas under 200,000.
- Gave states and local governments more discretion in determining what is an acceptable MPO structure.

1981 FHWA-UMTA Policy on the Applicability of Urban Planning Requirements in Newly Designated Areas
- Minimized burden of planning and programming requirements on 95 new urbanized areas (from 1980 Census).
- Intends to provide two-year transition period for new areas for complying with standards.
- Allows interim designations of MPOs in new areas, preferably existing agencies.

1982 UMTA and FHWA Notice of Proposed Rulemaking on Transportation Planning
- Revises previous regulations to increase state and local control and reduce red tape associated with planning, particularly for areas under 200,000 population.
- MPOs and states would be allowed to self-certify that plans comply with Federal regulations, expect those relating to private enterprise and civil rights.

1982 UMTA Final Notice on Letter of No Prejudice Policy (LONP)
- Authorizes applicants to incur costs on a future project utilizing non-federal resources with possibility of later federal reimbursement.
- Emphasized that the LONP does not provide moral or legal commitment to approve such projects.

1982 Architectural and Transportation Barriers Compliance Board Final Rule
- Limits the requirements for vertical access in new stairs or escalators provided in transit facilities to those which are structurally practicable. “Impracticability” is defined in terms of increasing cost by 50 percent or more of the value of the building or facility involved.

1982 UMTA Statement of Paratransit Policy
- States policies on paratransit services applicable to mass transportation programs funded under the Urban Mass Transportation Act of 1964, as amended.
- Encourages diversity, innovation, and private sector participation in mass transportation projects.

1982 Intergovernmental Review of Department of Transportation Programs and Activities
- The proposed rule would implement Executive Order 12372 and thereby replace the intergovernmental consultation system developed under OMB Circular A-95
- State and local officials, not the Federal government, will determine what Federal programs and activities to revise and the procedures by which the review will take place.
- Provided contract authorization in the amount of $779 million against the Mass Transit Account of the Highway Trust Fund, thereby establishing for the first time a dedicated source of funding for Sec. 3.
- The Federal/local funding ratio was changed from 80/20 to 75/25 percent.
- Sec. 3 capital grants will be primarily used for major, non-recurring projects and new systems.
- The Sec. 9 (9A for FY 83 only) block grant program was added.
- Provides for a new self-certification approach in meeting a number of specific UMTA requirements.
- Required revisions of sec. 504 regulations.

1983 Federal Public Transportation Act of 1982
- Established a new FY 1983 Section 9A formula program funded from the Mass Transit Account of the Highway Trust Fund for transit capital projects.
- Contains complete apportionments for all urbanized areas.
Generally, this rulemaking would streamline project development and EIS review processes for FHWA and UMTA grant programs and provide increased decision-making authority to agency field offices.

- EISs for exclusive busways on or alongside an existing highway facility would not be required. Only an environment assessment (EA) would be required.
- Need for an EIS for an urban redevelopment-related transit project will be determined by UMTA on a case-by-case basis.
- Administrative, planning, design, and very light construction activities and minor expansion of existing facilities would be excluded from EIS requirements.
- Bus transfer facilities, except in residential neighborhoods, would be exempted from environmental analysis.

APPENDIX B

BIBLIOGRAPHY

This bibliography contains items of general interest to readers of the Final Report. Specific bibliographic references to case study materials are presented separately in the appendixes to each individual case study.

THE TRANSPORTATION RESEARCH BOARD is an agency of the National Research Council, which serves the National Academy of Sciences and the National Academy of Engineering. The Board's purpose is to stimulate research concerning the nature and performance of transportation systems, to disseminate information that the research produces, and to encourage the application of appropriate research findings. The Board's program is carried out by more than 270 committees, task forces, and panels composed of more than 3,300 administrators, engineers, social scientists, attorneys, educators, and others concerned with transportation; they serve without compensation. The program is supported by state transportation and highway departments, the modal administrations of the U.S. Department of Transportation, the Association of American Railroads, the National Highway Traffic Safety Administration, and other organizations and individuals interested in the development of transportation.

The Transportation Research Board operates within the National Research Council. The National Research Council was established by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and of advising the Federal Government. The Council operates in accordance with general policies determined by the Academy under the authority of its congressional charter of 1863, which establishes the Academy as a private, nonprofit, self-governing membership corporation. The Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in the conduct of their services to the government, the public, and the scientific and engineering communities. It is administered jointly by both Academies and the Institute of Medicine.

The National Academy of Sciences was established in 1863 by Act of Congress as a private, nonprofit, self-governing membership corporation for the furtherance of science and technology, required to advise the Federal Government upon request within its fields of competence. Under its corporate charter the Academy established the National Research Council in 1916, the National Academy of Engineering in 1964, and the Institute of Medicine in 1970.