

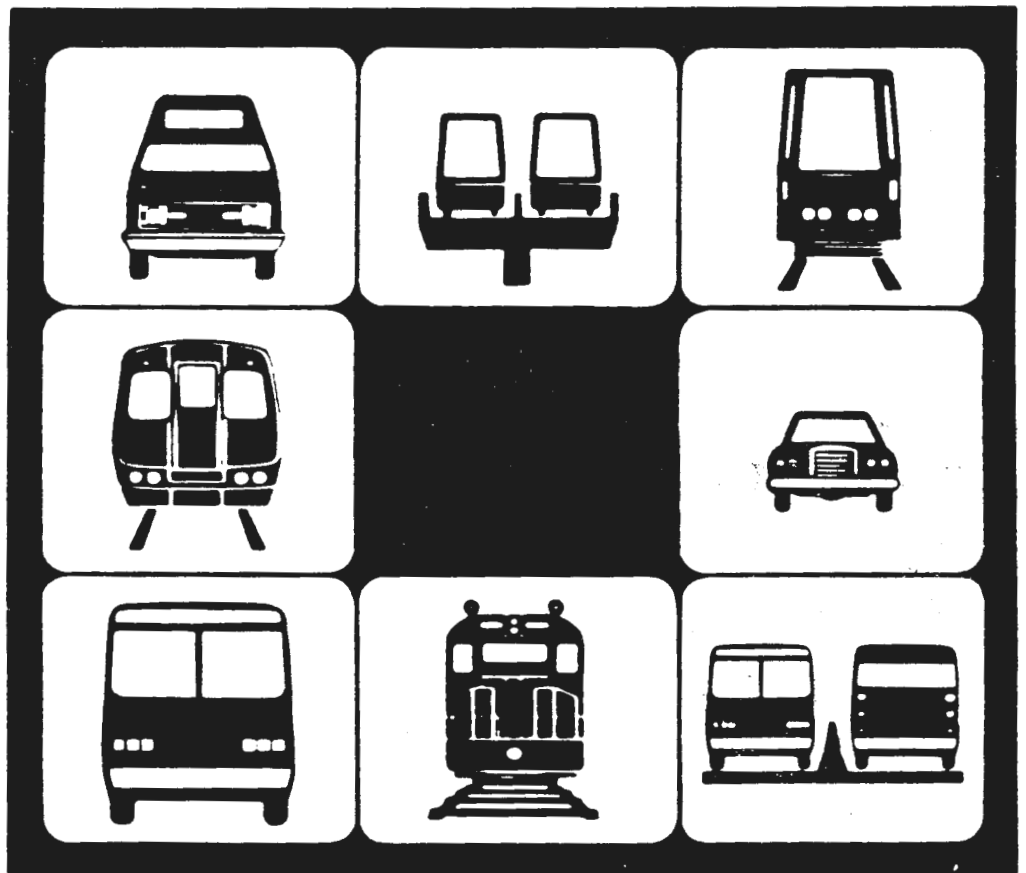


U.S. Department
of Transportation

Urban Mass
Transportation
Administration

Procedures and Technical Methods for Transit Project Planning

REFERENCE ONLY



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Procedures and Technical Methods
for Transit Project Planning

by

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FOREWORD

Project planning is a critical step in the development of transit capital improvements. This step focuses on a specific transportation need, identifies alternative actions to address this need, and generates the information needed to select an option for implementation. The typical project planning effort addresses such issues as costs, benefits, environmental impacts, and financing to support project selection. It often spans a wide range of technical disciplines, ranging from engineering to patronage forecasting to the natural and social sciences. In many respects, project planning is the key step in project development since the selection of a project for implementation establishes the improvements that will be achieved, the costs that will be incurred, and the environmental consequences that will result.

Project planning for fixed guideway transit projects (new rail lines, extensions to existing lines, and busways) is referred to as alternatives analysis. While alternatives analysis has been a key part of the UMTA process for advancing rail and busway projects for the past 10 years, it is still widely misunderstood. In part, this is because alternatives analysis is a complex technical process and makes use of terms and phrases -- such as equilibration, bias constants, and cold starts -- that are not part of many people's vocabulary. Further, much of the knowledge on how to properly conduct an alternatives analysis has been passed on by word of mouth. As a result, many local agencies have urged UMTA to provide detailed written guidance to help them carry out alternatives analysis studies. The General Accounting Office, in a review of UMTA's alternatives analysis requirement, also pointed to the need for written guidance.

Since fixed guideway projects have traditionally consumed a significant share of UMTA resources, UMTA staff efforts have focused on the procedures and technical methods that apply to alternatives analysis. Yet many of the concepts that apply to fixed guideway projects also serve as models for other kinds of project planning. Many rail modernization projects, for example, are aimed at increasing the capacity of the current system, are as costly as new fixed guideway projects, and have similar kinds of transportation and environmental impacts. The procedures and methods used in alternatives analysis can be used to ensure that rail modernization projects reflect a thoughtful and technically sound analysis. Similarly, large expansions in bus service and transit financing alternatives can be assessed using many of these same kinds of procedures and methods.

This guidance has evolved from efforts undertaken during the late 1970's. In 1981, UMTA distributed a draft report, Alternatives Analysis Procedures and Technical Guidelines, by Michael Jacobs of the Transportation Systems Center. This report was never finalized, but was widely read and served as a comprehensive source of guidance on the alternatives analysis process. During 1983 and 1984, UMTA staff prepared a series of detailed outlines for a more thorough guidance manual, and used these outlines as the basis for a series of training seminars on alternatives analysis procedures and

techniques. This guidance manual, based upon those detailed outlines, represents the long-awaited completion of this effort. It provides local agencies with a complete overview of the project planning process. This guidance further provides an introduction to the technical elements that are performed during each project planning study.

In issuing this guidance, it is not UMTA's intent to be prescriptive about how future studies should be performed. Nor do we wish to stifle creative thought on how to do project planning. The primary objective of this guidance is to share the best professional practices of the past 10 years, during which time UMTA has been an active participant in transit project planning studies across the country. This guidance reflects the creative thoughts of a multitude of transportation planners in State and local governments, consulting firms, and the academic community. By bringing this past experience together in one place, it is our hope that future planners will build upon these experiences, and that future project planning studies will be at least as good as those done in the past.

This guidance is specifically designed for State and local agencies that are considering the implementation of fixed guideway transit projects -- new rail systems, rail extensions, busways, and the like -- with UMTA funds. The primary audience is local project managers and their staff who will be performing or supervising the analysis. Familiarity with this guidance is essential for all individuals involved in conducting an alternatives analysis involving new or extended heavy rail, light rail or busway projects for which UMTA funding is being contemplated. Cities that have completed alternatives analysis, but which are being asked to provide updated information on the cost-effectiveness of their proposed projects, will also find this guidance essential to their cost-effectiveness studies. With this information, local agencies should be able to carry out a technically sound planning study in an efficient manner.

The guidance contained herein may also be of interest to local and State officials who are anxious to understand the Federal perspective on major investments and the type and amount of work which will be done by their staff and consultants to satisfy UMTA's alternatives analysis requirement. In addition, the responsibilities of UMTA's regional staff are described so that there is a clear division of responsibility between headquarters and regional staffs.

This guidance should also have a broader audience. As UMTA funding is reduced to help balance the Federal budget, some cities are considering the development of fixed guideway systems without Federal assistance. They may be proposing to use local tax revenues, or seeking investment by the private sector. UMTA strongly believes that its major investment planning procedures represent good technical practice, and that this guidance would be of assistance even where Federal capital funding is not anticipated. Furthermore, many of the ideas expressed in this guidance would be applicable to the development of financial plans and to planning for large scale rail modernization, bus fleet expansion, and highway projects.

This guidance is divided into three major parts:

- o Part I: The Major Capital Investment Planning Process. This part provides an overview of the planning process for major investments, defining the various phases in the process and the UMTA policies that apply. It contains a chapter on the system planning process, and establishes the framework for moving from system level studies into project planning. The last chapter in this part, Framework for the Analysis, describes the scope of project planning, defines the roles and responsibilities of the principle study participants, and explains how to obtain UMTA approval to initiate alternatives analysis.
- o Part II: Conduct of the Technical Analysis. This section explains, in summary fashion, methodologies for generating the technical information that will appear in the draft EIS or environmental assessment. It provides guidance on technical elements that are a part of each study, including the the management of the study, development of alternatives, patronage forecasting, estimation of capital and operating costs, financial analysis, environmental impact estimation, and evaluation.
- o Part III: The Decisionmaking Process. This part discusses how the technical information generated in the study is put together in a way that will assist project decisionmaking. It presents Federal procedures for the preparation and circulation of the draft EIS or EA, and procedures for holding a public hearing. It concludes with guidance on the selection of a locally preferred alternative and preparation of a preferred alternative report.

The manual also contains a series of appendices which bring together the most important regulations, policy statements, and other information relevant to project planning. Appendix L, which provides a sample outline of an EIS, should be of particular interest because it illustrates the kinds of technical information that often need to be generated in project planning.

UMTA intends to supplement the technical guidance in Part II with a series of detailed manuals on specific technical topics. The first of these, Estimation of Transit Supply Parameters, was published in October 1984. Future manuals will provide guidance on capital and operating cost estimation, evaluation, analysis of economic development impacts, financial analysis, and the assessment of noise, energy and air quality impacts.

Additional guidance is available in other UMTA documents. These include joint UMTA/FHWA regulations on urban transportation planning and environmental impact statements. UMTA has also issued program circulars such as "Guidelines for UMTA's Environmental Protection Process", "Land Acquisition and Relocation Assistance", as well as Section 8 and Section 9 grant application procedures. These various documents and others may contain information needed for specific project planning activities. Such documents are referenced at appropriate points throughout this manual, and those of particular relevance to project planning are contained in the appendix.

UMTA would welcome comments on this guidance manual. UMTA policies and procedures, as well as the state of the art in transportation planning, are continually evolving. We anticipate that this guidance will be updated from time to time as changes occur, and have used a loose leaf format to facilitate changes. Comments should be directed to:

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Samuel Zimmerman, Deputy Director,
Office of Planning Assistance

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PART I

The Major Capital Investment Planning Process

Urban Mass Transportation Administration

Office of Planning

Office of Mobility Enhancement

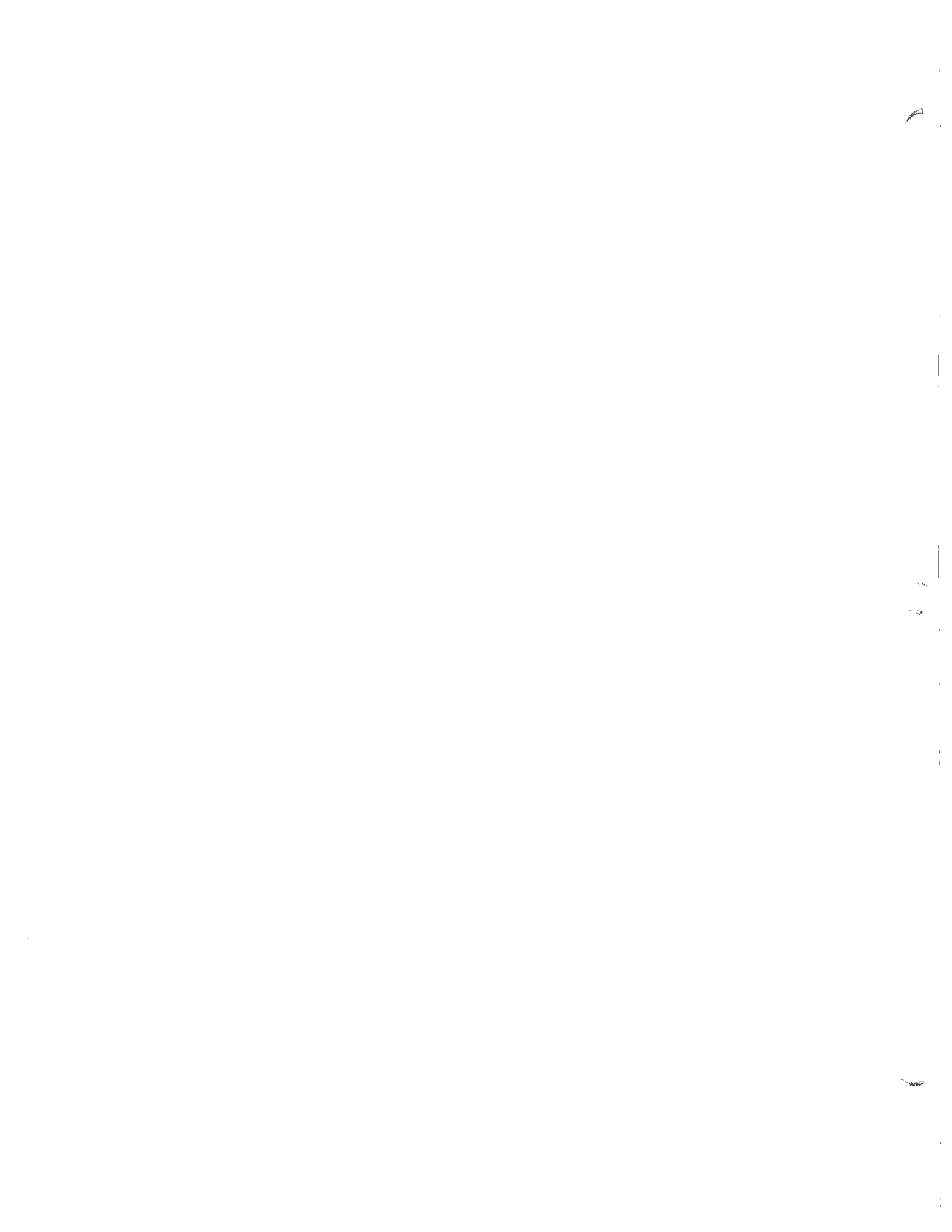


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I.1. Introduction to Major Capital Investment Planning

New rail systems, extensions to existing rail systems, busways, and other kinds of fixed guideway transit facilities are developed through a process UMTA calls "major capital investment planning." This process begins with the initial recognition that a fixed guideway system may help solve local problems, continues through the analysis of technology, alignment and financing options, and concludes with final decisions to build and operate a guideway. The planning process for large scale transportation projects can be costly and involved. It includes highly complex analyses of potential changes in local travel patterns, economic development conditions, and environmental quality. Furthermore, it is often conducted in a dynamic political and institutional setting. But the purpose of the planning process is quite straightforward: to develop sound and objective information necessary for informed project decisionmaking.

Part I of this guidance discusses the procedural aspects of major capital investment planning, reviews the system planning phase, and introduces the alternatives analysis process. The material in this Part is founded in UMTA's Major Capital Investment Policy, environmental impact statement regulations, and other requirements. To establish a proper background for Part I, this chapter contains a synopsis of UMTA's major capital investment policy as it has evolved since 1976 and outlines the major procedural requirements contained in these policy statements and related environmental regulations.

1.1 Policy and Regulatory Background

UMTA's latest Major Capital Investment Policy was issued in May, 1984 (Appendix A). It sets forth the policies and procedural framework that apply to fixed guideway projects that are proposed for UMTA capital funding. The policy applies to projects that involve the construction of a new fixed guideway segment, or extension of an existing fixed guideway, for use by buses or rail vehicles. These projects are often planned with the presumption that substantial funding will be available from the Federal government, but the cost of those projects undergoing planning at any one time far exceeds the amount of Federal funds likely to be available. Accordingly, the policy statement is designed to help UMTA identify the best use of scarce Federal resources. More importantly, however, the policy statement is founded on a sound technical framework for developing the information needed to support informed decisionmaking by local, State and Federal officials.

The 1984 policy built upon certain key policy tenets that have remained constant since UMTA's first major investment policy was issued in 1976:

- o Proposed guideway projects shall be consistent with the area's comprehensive long range transportation plan which articulates the overall direction for metropolitan development and identifies major transportation corridors;

- o Where the plan calls for a fixed guideway, it should be proposed for implementation incrementally, one usable segment at a time.
- o Projects must be cost-effective as determined through an analysis of transportation alternatives, including low cost improvements to the existing infrastructure and better management and operation of existing transportation facilities.
- o There should be full opportunity for the timely involvement of the public, local elected officials, and all levels of government in the alternatives analysis process.
- o Project decisions should be based upon realistic cost estimates and financing proposals that take into account the operating expenses of the proposed transit system.
- o The local area should consider a program of local supportive actions to enhance the project's cost-effectiveness, patronage and economic vitality. These supportive actions are to include land use planning, zoning, joint development, feeder bus services, adequate parking and other pricing, regulatory and enforcement measures.
- o At the end of alternatives analysis, UMTA will commit only to funding preliminary engineering for the proposed project. A commitment for construction funding comes only at the end of preliminary engineering.
- o A full funding contract between UMTA and the local agency will be developed indicating the maximum amount of Federal financial participation in the project.

Since the early 1980's, the amount of Section 3 discretionary new start funds available has averaged about \$400 million a year. These funds have been allocated to about 8 to 12 projects annually, while there may be another 20 to 30 projects that are potential candidates for Federal funds. The number of candidate projects is significantly greater than during the 1970's. Not only has the number of potential projects increased, but also the magnitude and duration of Federal transit investments has changed significantly. Proposed projects are more costly and are taking longer to build. The pressure of the competing demands requires that UMTA ensure that available Federal resources be utilized in the most prudent and cost-effective manner.

In recognition of this situation, the 1984 policy statement added two new elements to the framework established in earlier policies. First, it spelled out a rating system that UMTA would use to evaluate projects proposed for funding under the discretionary program. The rating system would be used each year to identify those projects most worthy of Federal support. Second, the policy statement defined a set of threshold criteria to help guide decisions on advancing projects through the planning and project development process.

Description of the Rating System. Under the 1984 major investment policy statement, two primary factors are used to evaluate projects that are candidates for UMTA discretionary funding: cost-effectiveness and local financial effort. The first factor, cost-effectiveness, is used to identify groups of projects with similar levels of investment worthiness. Information on local financial effort, the second factor, can then be used to differentiate between projects with similar levels of cost-effectiveness.

Within UMTA's rating system, cost-effectiveness means the extent to which a project returns benefits relative to its costs. The cost-effectiveness of a proposed major investment is measured in terms of its added benefits and added costs when compared to a transportation system management (TSM) alternative. The TSM alternative includes such low cost actions as traffic engineering, transit operational changes, and modest capital improvements. It is designed to address specific transportation problems in the corridor and demonstrate the extent to which these problems can be solved without a major investment in new facilities. The TSM alternative is designed within real world limits — street capacity to accommodate bus movements, financial resources to fund operating deficits, and so forth — and is therefore a realistic option that represents a true alternative to major new transit facilities. The TSM alternative provides a baseline beyond which it is possible to isolate the added costs and added benefits resulting from a proposed major investment.

The TSM alternative plays a key role in ensuring an even-handed comparison between cities whose transit properties may today have very different levels of service efficiency. Since cost-effectiveness is measured against the TSM alternative, the rating system avoids crediting a less efficient property with benefits that could be achieved through low-cost actions that already have been taken by other properties competing for Federal assistance.

To assess the cost-effectiveness of a proposed guideway project, costs and benefits are considered over the expected life of the project, typically 40 to 50 years. The benefits considered are:

- o attraction of new transit riders;
- o improvement in service (travel time) for existing riders; and
- o reductions in operating and maintenance costs.

The first two measures capture very well the direct benefits of a transportation improvement. They focus on transportation benefits, which are primary from the Federal perspective. They are also good indicators of a wide range of other benefits associated with major transit projects, such as reductions in pollutant emissions, energy conservation, and support for urban development. The third measure reflects the Federal interest in reducing operating costs and deficits as a means of strengthening the financial position of local transit operators.

Two indices are computed to support the evaluation of projects in terms of their cost-effectiveness. The "total cost-effectiveness index" is meant to be indicative of a project's societal costs and benefits. It includes three categories of benefit noted above, plus all capital costs, regardless of who will be paying them. The "Federal cost-effectiveness index" concerns itself with only that portion of the capital cost that is to be borne by the Federal government, and thus represents the return on the Federal investment. Data used to compute the indices is developed by local agencies as part of the planning and project development process.

Both indices measure the cost of each new transit trip created by the project (the indices have the units dollars-per-added-rider). A lower index corresponds to a more cost-effective the project. In accordance with the major investment policy, projects that fare well on both indices are considered highly rated for cost-effectiveness.

Local financial commitment, particularly the stability and reliability of local sources of operating funds, is a factor used to order projects that rate similarly in terms of cost-effectiveness. The assessment of local fiscal effort includes three principal factors:

- o Capital overmatch, or the percent of project construction funds provided by the local project sponsor in excess of the local match required by Federal law. Overmatch is prized in the rating process for both reducing the required Federal commitment and for evidencing a strong local commitment to the project. Overmatch is measured as the percent of aggregate projected capital costs to be met from non-Federal revenue sources. For rating purposes, cities were divided into those which (a) just meet the statutory minimum requirement, (b) provide additional non-Federal resources and (c) comply with Congressional guidance suggesting a level of 50 percent non-Federal match.
- o The plan of capital financing. The plan is reviewed in detail to determine the stability and reliability of each proposed source of local match. This includes a review of inter-governmental grants, tax sources, and debt obligations. Each revenue source is reviewed for availability within the project timetable. The financing plan is also evaluated to determine if adequate provision has been made to cover unanticipated cost overruns.
- o Stability and reliability of the source of operating revenue. This factor assesses the ability of the local transit agency to run the system as planned once the guideway project is built. The existence of stable and reliable revenues to cover operating costs reduces the risk that after a large Federal capital investment local resources will not be available to maintain and operate the transit system. This rating focuses on the operating revenue base and its ability to expand to meet the incremental operating costs of a new fixed guideway segment.

Appendices F and G describe the rating system in greater detail and identify the kinds of information that needs to be provided for UMTA to evaluate each project.

Environmental Requirements. The primary law governing UMTA's environmental protection process is the National Environmental Policy Act (NEPA) of 1969 as amended. Section 102(2)(c) of the Act requires that Federal agencies prepare a detailed statement on the environmental effects of alternative courses of action before decisions are made to implement a project. Section 14 of the Urban Mass Transportation Act further declares that an application for financial assistance under Section 3 shall not be approved unless it is found that no adverse environmental impacts are likely to result from the project, or that there are no feasible and prudent alternatives to these effects and all reasonable steps have been taken to minimize such effects. Sections 3(d) and 5(h)(2) of the UMT Act also require the consideration of social, economic and environmental effects for projects proposed for UMTA funding.

Additional requirements applicable to UMTA projects are found in other laws, executive orders, and regulations. Section 4(f) of the Department of Transportation Act restricts the use of parkland for transportation projects. Section 106 of the National Historic Preservation Act applies whenever projects impact historic and cultural resources. The Clean Air Act, the Safe Drinking Water Act, the Clean Water Act, and other statutes contain further requirements. Executive orders on floodplain management and the protection of wetlands also apply. The Council on Environmental Quality (CEQ) has issued "Regulations Implementing the Procedural Provisions of NEPA" (Appendix D). The CEQ regulation applies to all Federal agencies but allows individual agencies to develop supplemental procedures while ensuring that decisions on specific projects are made in accordance with the policies and purposes of NEPA. A summary of environmental laws and requirements that apply to UMTA projects appears in Appendix J.

To ensure that environmental requirements are addressed in a meaningful way, and to minimize red tape, UMTA has merged the required environmental analyses and documents into the project planning process. This approach is reflected in the UMTA/FHWA joint "Environmental Impact and Related Procedures," which provide the supplemental procedures required under the CEQ regulation. The project development process set forth in UMTA's Major Capital Investment Policy reflects both UMTA's need for sound technical information on the costs and benefits of proposed projects, but also the environmental process stipulated in NEPA and elsewhere.

1.2 The Project Development Process

The major capital investment project development process within which local officials plan and develop fixed guideway transit projects contains five phase of activity leading from project conception to construction: system planning, alternatives analysis, preliminary engineering, final design, and construction. As proposals advance through these phases, their costs, benefits, and impacts are more clearly defined. Alternatives that are not found to be cost-effective are dropped from consideration such that, ideally, only the most cost-effective alternatives ultimately remains.

Local agencies are responsible for performing the various planning and engineering studies that are performed during the project development process, and for supervising construction. UMTA provides funding and technical assistance during each of the phases. At key points, UMTA reviews local technical work for completeness and accuracy, and concurs in the methods being used and the results obtained. Between each phase is a major Federal decision point, at which time UMTA decides whether to support continued planning and project development. UMTA offers assistance in the development of cost-effective alternatives.

Each of the local phases of the project planning and development process, and the Federal decision points that separate the phases, are described below and shown on Figure 1-1.

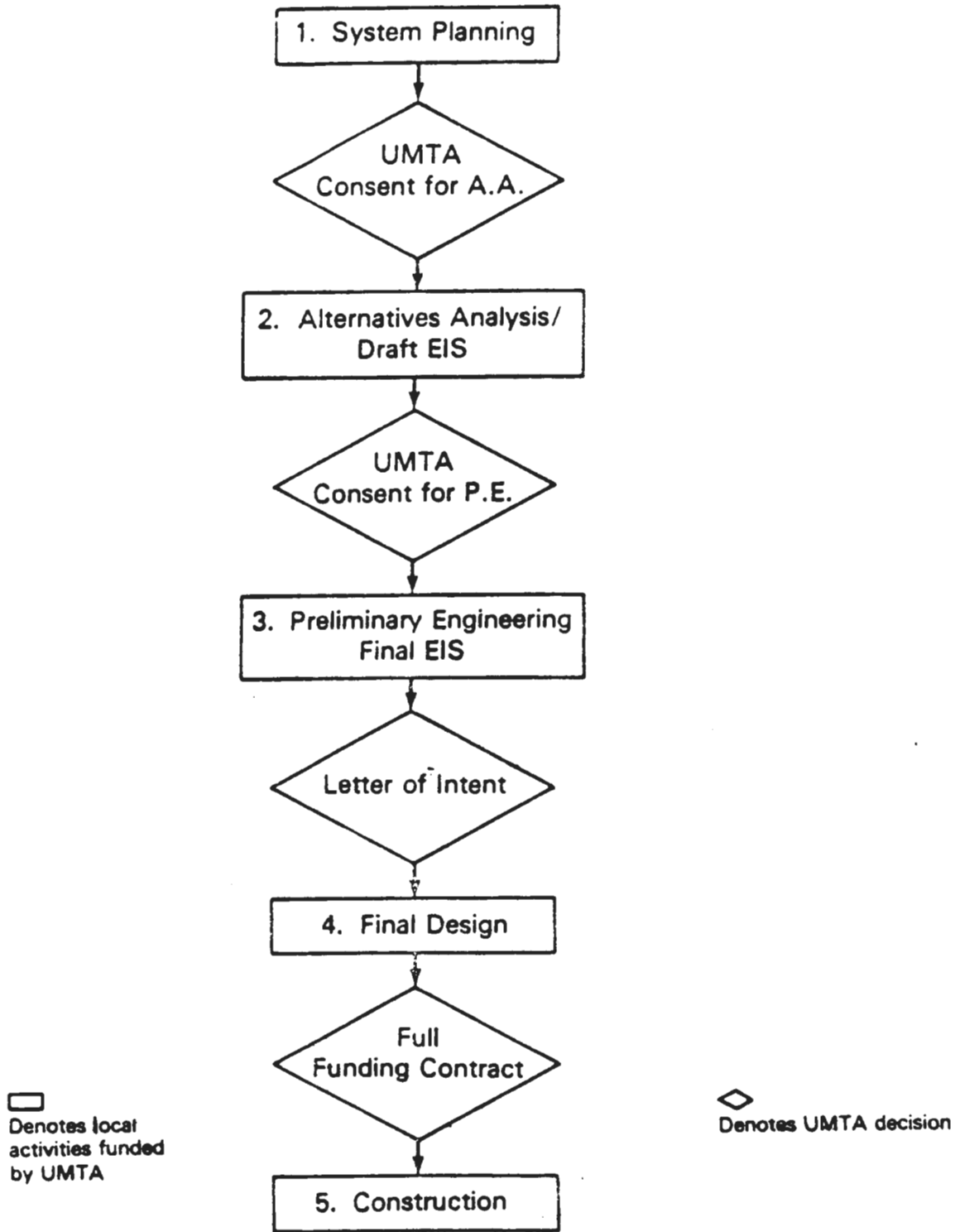
- o System Planning. System planning refers to the ongoing 3-C urban transportation planning process conducted in each urbanized area by its metropolitan planning organization. During system planning, local officials develop or update regional goals and objectives, collect data on regional travel patterns, and project future land use and travel. This leads to the identification of current and anticipated transportation problems. Basic planning methods such as travel demand forecasting models are developed, revised, and refined as part of the ongoing system planning process. The availability of financial resources for future capital and operating costs is assessed. A wide range of alternative solutions to the region's identified problems are examined, and short- and long-range implementation programs are developed, reflecting the availability of financial resources.

Where local officials find that one or more corridors in the region are candidates for fixed guideway transit investments, they select a priority corridor and identify a small set of potentially cost-effective alternatives for detailed study. They then seek UMTA approval to initiate alternatives analysis. This approval is given where the results of system planning demonstrate that there is a reasonable possibility that the fixed guideway alternatives proposed for study will be shown to be cost-effective. Two threshold criteria used to guide this decision are:

- the priority corridor should currently have at least 15,000 daily transit riders; and
- fixed guideway alternatives in the corridor should have total cost-effectiveness indices of no more than \$10 per added rider.*

*The \$10 threshold is based on an estimate of the value of one work trip diverted from an automobile to transit, and includes allowance for indirect benefits and the level of precision in system planning estimates. The threshold is subject to change as the value of time and auto operating costs increase or decrease.

Figure I-1.1: UMTA Project Development Process



When local officials propose to use Section 9, Interstate Transfer, or local funds for the analysis, approval may be given even if the threshold criteria are not met.

- o Alternatives Analysis. Upon receiving approval to initiate an alternatives analysis, the designated local lead agency studies the priority corridor in detail, looking at alternative solutions to the transportation problems identified in system planning. The range of alternatives typically will include one or more rail options, a bus guideway alternative (often with provisions for use by carpools), and a non-guideway bus (TSM) alternative that represents the best that can be done without a major investment in new infrastructure. This phase also includes the development of a draft environmental impact statement (EIS) documenting the results of the study, a public hearing, selection of a locally preferred alternative, and preparation of a realistic funding plan. This phase usually takes 12 to 24 months to complete, depending on the complexity of the alternatives to be studied, and may cost over \$1 million.

At the conclusion of this phase, a "locally preferred alternative report" is transmitted to UMTA together with a request for approval to initiate preliminary engineering. This approval can be expected where the locally preferred alternative is reasonably cost-effective. Two criteria used to guide this approval are:

- the locally preferred alternative must offer greater ridership and travel time benefits than lower cost alternatives; and
 - the total cost-effectiveness index for the locally preferred alternative should not exceed \$6 per new transit trip.*
- o Preliminary Engineering. During the preliminary engineering phase, local project sponsors refine the design of the locally preferred alternative, taking into consideration all reasonable design alternatives. The TSM alternative and perhaps other fixed guideway alternatives found to be cost-effective are also further refined. More precise estimates of costs and impacts are developed, producing a cost estimate which has a high confidence level. Local financing arrangements including private sector financing are finalized and the EIS process is completed. This phase may take 6 to 18 months and may cost as much as 5 percent of the capital cost of the proposed guideway.

*The \$6 threshold is based on an estimate of the value of one work trip diverted from an automobile to transit, and includes allowance for indirect benefits and the level of precision in system planning estimates. The threshold is subject to change as the value of time and auto operating costs increase or decrease.

UMTA uses its rating system to evaluate the relative merit of all projects undergoing preliminary engineering, identifying those that represent the most productive use of Federal resources. Letters of intent would normally be given to those most meritorious projects that can be funded within available budget authorizations. These letters can be issued to the most meritorious projects only after completion of the EIS process. A letter of intent is a way in which UMTA indicates its intent to pay for large multi-year projects. However, it is not a binding commitment because funding is subject to annual appropriations.

- o Final Design. Upon receipt of the letter of intent and initial year funds, local agencies may proceed with right-of-way acquisition and the preparation of final construction drawings general plans, construction management plans, project specifications, engineer's cost estimates and bid documents. This phase may take 12 months and cost 10 to 25 percent of the ultimate project cost.

During final design the grantee may enter into a full funding contract with UMTA. Construction grant contracts between UMTA and the grantee are negotiated with a fixed ceiling or maximum amount of Federal participation in the project and a yearly funding schedule. Localities are required to complete construction of the project, as defined, to the point of initiation of revenue operations, and to absorb any additional costs incurred, except under certain extraordinary circumstances.

- o Construction. The grantee undertakes physical construction, procurement of vehicles, and pre-service testing. Federal funding is provided in accordance with the full funding contract, subject to the availability of appropriations and the ability of the grant recipient to use the funds effectively.

This manual focuses on the alternatives analysis phase of the process and provides detailed procedural and technical guidance for local and State transportation analysts and consultants. However, to set the context for undertaking alternatives analysis, the next chapter provides guidance on the conduct of system planning. The system planning chapter describes the kinds of analyses that local agencies need to perform to be in a position to advance into the alternatives analysis phase.



I.2. System Planning

This guidance manual provides procedural guidance on the conduct of alternatives analysis, the second phase in the development of major capital investments, or fixed guideway transit projects. Before dealing specifically with the alternatives analysis phase, however, Chapter 2 further explains the system planning phase which should set the stage for successfully moving into alternatives analysis. This Chapter is not a complete guide on how to do system planning, but it offers suggestions on how to do system planning in such a way that it sets a proper foundation for moving forward into alternatives analysis. UMTA requirements applicable to system planning are spelled out in the joint UMTA/FHWA planning regulations (49 CFR Part 613).

System planning establishes the corridor where alternatives analysis will be performed, defines the corridor's transportation (and possibly other) problems that may be addressed through transportation improvements, and identifies the alternatives that should be considered. It also is the phase when the basic methods to be used in alternatives analysis are developed. Not surprisingly, then, UMTA has found that urban areas that do a particularly good job of system planning are better able to perform alternatives analysis quickly and efficiently.

This Chapter suggests ways that local areas might better conduct their ongoing system planning process to set a proper background for alternatives analysis. To do this, this chapter covers three subjects: the role of system planning in the development of major investments, important components of system planning studies, and UMTA involvement.

2.1 Role of System Planning in the Development of Major Investments

System planning refers to the ongoing 3-C urban transportation planning process carried out by metropolitan planning organizations throughout the country. The planning process routinely develops long and short range plans and programs for improving the transportation system in an urban area. These might include regional highway and mass transit plans, financial plans, parking management plans, as well as more localized plans for congestion relief. In some areas the 3-C process is more fragmented and a separate system planning study for the purpose of considering fixed guideway options, while not desirable, may be necessary. In either case, system planning serves as the first phase of the five-phased process for developing fixed guideway mass transit projects.

Many of the activities performed during the system planning process are necessary for the systematic consideration of fixed guideways. During system planning, local agencies examine long range urban development trends, collect travel data, forecast needs, and evaluate regionwide transportation policies and investment options. Based on their preliminary assessments of travel patterns and problems, local agencies evaluate a wide range of

alternatives leading to the identification of those potentially cost-effective and financially feasible alternatives that merit further study. (These alternatives will be studied in detail during alternatives analysis, leading to the selection of a locally preferred mode and alignment alternative.) If one or more corridors may require a major transit investment, these corridors are ranked in order of local priority.

The system planning phase produces a considerable amount of information that will later be used in alternatives analysis. This includes:

- o Specific statement of regional goals and objectives.
- o A definition of the region's transportation problems, both long- and short-range. These will reflect current and projected population, employment and land use, as well as the condition of the region's transportation network.
- o Long- and short-term strategies the region has chosen for addressing these problems. Some corridors may be identified as having potential for the development of fixed guideway transit, while others may be more suitable for the development of improved highways, bus improvements, or transportation system management kinds of strategies. Some may require multi-modal solutions, or at least the consideration of multi-modal options. Some may offer opportunities for private sector participation in the provision of transit service.
- o An analysis of the region's financial capacity to provide planned improvements in transportation facilities and services. This analysis would include an assessment of historical trends in transit funding agencies' revenues, expenditures, assets, and liabilities and the capacity of the existing revenue base to meet future transit financial requirements.
- o Transportation priorities, including the identification of which fixed guideway corridor will be advanced into alternatives analysis first.*
- o A set of promising alternatives for addressing the transportation problems in the priority corridor. Promising alternatives are those that are potentially cost-effective, based upon a preliminary analysis of cost-effectiveness, and that appear to be within the financial reach of the local community to build and operate.

* A "corridor" is a part of a metropolitan area that contains both trip attractors and trip generators. It consists of a single travel shed, encompassing not only all of the promising alternatives but also the area served by these alternatives. The travel shed should be anchored by a central business district (CBD) or major activity center to which a significant portion of the corridor's travel is destined. Corridors are typically wedge shaped, with the CBD or activity center at the apex.

- o Mid-term directions for the transportation system, such as planned expansion of the transit system, TSM programs, operating plans for highway facilities and the transit system, and funding considerations, including revenue sources and financing plans for capital and operating costs.
- o Development and validation of the basic analytical tools needed for alternatives analysis. Of particular importance is a set of travel forecasting models suitable for predicting future travel demand characteristics for corridor level alternatives.

The system planning phase should not result in the selection of a particular transit technology for the region, or for a corridor. Each corridor in the region will have different travel characteristics, and offer different physical opportunities and constraints. Consequently, decisions on whether a particular corridor should be provided with heavy rail service, light rail, or a busway, should be made on a corridor by corridor basis, following a detailed study and evaluation of promising alternatives. The alternatives analysis phase is designed to produce the kinds of information normally needed to choose mode and alignment. In most cases, selection of technology on the basis of systems level information is premature.

Transitional System Planning Studies. In the mid-1970's, when many cities first advanced fixed guideway transit proposals for UMTA consideration, UMTA found that many long range planning studies did not give adequate treatment to the study of alternatives. It thus was not possible to use these studies to determine whether the incremental costs of the guideway were in line with the incremental benefits, or what a small set of promising alternatives might be. Where alternatives were studied, the evaluation was often performed on a regional basis. The regional technology chosen may have been superior overall, but not necessarily superior in individual corridors. UMTA also found that many long range planning studies did not identify regional priorities. Consequently, UMTA established a step between long range system planning and alternatives analysis called "phase 1 alternatives analysis," and required many areas to perform phase 1 studies prior to ~~undertaking~~ detailed corridor planning. Phase 1 studies were designed to help local officials select a priority corridor and a small set of promising alternatives, and to establish the technical methodologies needed for alternatives analysis.

The phase 1 studies created several problems, however. First, they were an awkward setting for the consideration of multimodal tradeoffs. Phase 1 studies were typically conducted off-line from the rest of the planning process, and often considered only transit alternatives. Second, in the corridor prioritization process, there was an overemphasis on choosing a winner. The process of selecting a priority corridor was viewed as a win-lose competition between different local jurisdictions, with only one winner, rather than a rational process of setting priorities for the entire region. Finally, phase 1 studies tended to be rather insensitive to short range decisions. As a result, in recent years, UMTA has been encouraging local authorities to structure their ongoing planning activities in such a

way that they consider alternatives, establish corridor priorities, and identify a small set of promising alternatives in that corridor. The term "phase 1 alternatives analysis" is no longer used.

There still may be situations where the 3-C process does not provide an adequate basis for proceeding directly into alternatives analysis. It is not unusual that an area desires to move into alternatives analysis, but has not resolved all of the issues that are normally taken care of in the system planning phase. Perhaps these issues could be resolved if an update to the region's plan were undertaken, but this might involve more time and effort than is desired. In such cases, local areas have undertaken what have come to be known as "transitional studies," which focus specifically on system planning issues that should be cleared up before the detailed corridor studies are undertaken.

Transitional system planning studies may address any number of planning issues. However, those that UMTA has been involved in are predominantly of three types:

- o **Establishment of corridor priorities.** In a number of cities, local officials have adopted a long range plan calling for fixed guideway mass transportation facilities in more than one corridor. Transitional studies have been undertaken to provide technical basis for local officials to identify which corridor should be advanced first.
- o **Screening of alternatives.** In cities that have chosen a priority corridor, a transitional analysis might be performed to identify the set of alternatives that have the greatest potential cost-effectiveness. By using preliminary data to screen out those alternatives that are least promising, local agencies can reduce the time and cost required for the alternatives analysis phase. In other instances, there could be a small number of alternatives, but questions might exist as to their potential cost-effectiveness. A transitional analysis might be designed to indicate whether any guideway alternatives are sufficiently promising to warrant an alternatives analysis.
- o **Analysis of engineering or financial feasibility.** Local officials may have selected a priority corridor and identified a small set of alternatives, but are not sure that they can afford to build or operate any of the alternatives. The transitional analysis will allow local officials to obtain further information on potential costs and revenues before committing to a full corridor study.

Transitional studies are viewed by UMTA as an interim device to answer system planning kinds of questions that, for one reason or another, were not resolved during prior system-level studies. They should not be considered a routine element of the planning process. UMTA urges local agencies to carefully design their system planning studies to respond to a full range of issues, so as to reduce the need for transitional analyses in the future.

Feasibility Studies. Local agencies should be careful in undertaking feasibility studies during system planning. Local decisionmakers may not understand the difference between project feasibility and project merit, or cost-effectiveness. Feasibility means that something can be done, not that it is necessarily a good idea. Decisions to build a transit guideway should hinge not only on feasibility, but also on questions of merit (costs and benefits). It is important that system planning consider such questions "Would the project provide a reasonable return on the investment?" and "When compared with lower cost alternatives, are the added benefits of the project greater than the added costs?" Feasibility studies do not normally address these kinds of questions because they typically look at one alternative or a few alternatives in isolation. Decisionmakers are given little information on the choices and trade-offs facing them.

In addition, while feasibility studies are often undertaken in the interest of reaching a project decision quickly, they usually have the opposite effect. Under the National Environmental Policy Act, Federal decisions on project funding cannot be made until a full range of alternatives have been considered, impacts have been examined, public input has been solicited, and necessary environmental documents have been completed. If a feasibility study does not address these requirements, it only adds an unnecessary step to the process, and does not replace what needs to be done. UMTA's experience has been that feasibility studies tend to delay the start of EIS development and extend the time required for project planning.

2.2 Important Components of System Planning Studies

This section addresses issues often raised by local, regional, and State planning agencies during the conduct of system planning studies. It also focuses on issues frequently raised by UMTA reviews of local study designs and planning reports. Suggestions are offered to help local agencies conduct system planning studies in such a way as to develop a strong foundation for subsequent project development activities.

Goals and Objectives. A key element of the system planning phase is the development of regional goals and objectives. These goals and objectives should be not only comprehensive, but also as specific as possible, avoiding vague "motherhood and apple pie" kinds of statements. The goals and objectives can then be used to identify specific transportation problems in the corridors of interest. The problem statements should then guide the development of alternatives that are tailored to the individual situation in each corridor. Regional goals and objectives may also be useful for helping local officials reach agreement on a priority corridor.

Table 2.1 illustrates one of the objectives adopted for one recent system planning study, together with the supporting principles and standards. The principles and standards were used to quantitatively apply the objectives in the design, testing, and evaluation alternative long range system plans.

Table I-2.1: TRANSPORTATION SYSTEM MANAGEMENT AND DEVELOPMENT OBJECTIVES

OBJECTIVE NO. 1

An integrated transportation system which, through its location, capacity, and design, effectively serves the existing land use pattern of northwestern Milwaukee County and southern Ozaukee County, and promotes the implementation of the regional land use plan, meeting the current and anticipated travel demand generated by the existing and proposed land uses.

PRINCIPLE

A transportation system serves to interconnect the various land use activities within a planning area, thereby providing the attribute of accessibility essential to the support of these activities. Through its effect on accessibility, the transportation system can be used to support and induce development in desired locations and to separate incompatible land uses.

STANDARDS

1. The transportation system should, without regard to color, race, or national origin, provide service within the urbanized portion of the study area such that a maximum number of residents are within:

- a. 30 minutes overall travel time^a of 40 percent of the Milwaukee urbanized area's employment opportunities;
- b. 35 minutes overall travel time of three major retail and service centers;^b
- c. 30 minutes overall travel time of a major medical center or a hospital and/or medical clinic;
- d. 40 minutes overall travel time of a major park and outdoor recreation area;^c
- e. 40 minutes overall travel time of a technical or vocational school, college, or university; and
- f. 60 minutes overall travel time of a scheduled air transport facility.

2. The relative accessibility provided by the transportation system should be adjusted to the adopted regional land use plan, providing to areas in which development is to be induced a higher relative accessibility than that provided to areas which should be protected from development.

Selection of Priority Corridor. The Major Capital Investment Policy states that regional fixed guideway systems should be developed in stages, one operable segment at a time. This incremental approach is intended to ensure that the most cost-effective segments receive priority attention, that the burden of financing the system is spread out over time, that the benefits of the public investment begin to accrue as soon as possible, and that maximum flexibility is preserved to modify the system in response to subsequent advances in technology, changes in growth patterns, and other unforeseen circumstances. UMTA implements this policy by only permitting one corridor at a time to proceed into the alternatives analysis phase.

UMTA has declined to participate in more than one alternatives analysis even in cases where UMTA planning funds were not used to support one or both of the studies. One basic reason is that the alternatives analysis phase initiates a formal Federal environmental impact analysis process which should follow a local priority setting judgment with respect to corridor project planning. Our experience is that commencing this process per se tends to elevate expectations for funding. Accordingly, UMTA can be expected to decline to participate in the preparation or circulation of a locally prepared draft EIS for a second corridor until the environmental process has been completed and a construction funding decision made for the first priority corridor.

The choice of a priority corridor is entirely a local decision. The only Federal requirement that applies to the selection of the priority corridor is the threshold criterion that requires at least 15,000 current transit riders in the corridor. UMTA is concerned not with the corridor chosen for advancement, but with making sure that there is sufficient ridership to warrant consideration of a fixed guideway, and that the alternatives proposed for study are potentially cost-effective.

UMTA has observed two approaches for selecting corridor priorities and a small set of promising alternatives for the priority corridor. Some cities select priority corridor on the basis of perceived need for transit improvements and the perceived likelihood that some type of fixed guideway facility would ultimately prove to be cost-effective. Then, alternatives are identified and assessed to establish the small set of options to be carried into alternatives analysis. This approach is appropriate for use in situations with simple trade-offs. Other cities evaluate a set of alternatives in each corridor and choose the alternatives and corridor at the same time. Here, alternatives are developed and evaluated for a number of corridors, so that the corridor with the greatest potential for a fixed guideway investment can be selected. The second approach is suitable where complex trade-offs or large uncertainties exist. The analysis in this case has a stronger emphasis on the incremental costs and benefits prior to corridor selection. It requires more time for the analysis, and is more costly, but produces more comprehensive information for use in the corridor selection decision.

Generation of Alternatives. The system planning phase should encompass a full range of transportation alternatives. This would include not only potential fixed guideway transit options, but also one or more non-guideway transit alternatives designed to make the most efficient use of the existing

transportation system. The non-guideway alternative is referred to as transportation system management (TSM) alternative in UMTA's Major Capital Investment Policy. Since the TSM alternative serves as a real decision option, and also as the base for establishing the cost-effectiveness of the guideway alternatives, it should be designed with great care to ensure that it indeed represents the best that can be done to improve transit in the corridor without the construction of a fixed guideway. Where the best non-guideway alternative is not clearly evident, it may be necessary to analyze and evaluate several TSM alternatives to determine which is optimal.

It is particularly important that the alternatives considered in system planning, and which may later be advanced into alternatives analysis, be tailored to the kinds of problems found in the corridor. A radial fixed guideway, for example, may help relieve problems associated with congestion on a freeway bringing commuters into a central business district. But if the congestion is on the arterials leading to the freeway, rather than the freeway itself, and if the only guideway alignment is within the freeway right-of-way, the guideway would do little to relieve congestion. Thus, the first step in generating alternatives is to get a good understanding of the problems that are to be addressed. Problem statements should be as specific as possible, indicating the kind of problems, their location and severity. This information can later be used to evaluate the effectiveness of the alternatives in terms of how well they overcome the identified problems.

Alternatives should be defined in terms of both their physical and operating characteristics. These characteristics will be needed to establish the alternative's potential cost-effectiveness, and thus whether it merits advancement into alternatives analysis. The physical characteristics of interest at this stage of planning include technology (heavy rail, light rail, busway, etc.), general location of the guideway and stations, termini, and number of lanes or tracks. Operating characteristics of interest include operating strategy, fare policies, headways, and route spacing. For busways, at least two operating strategies are available: integrated line haul and collector service, where feeder buses provide not only local service to collect riders but also operate in an express mode on the guideway, and separate line haul and feeder services.

Although a full range of alternatives should be considered in system planning, it may not be necessary to analyze a large number of fixed guideway alternatives. The potential cost-effectiveness of a fixed guideway could be established by looking at only a few generic guideway alternatives that are typical of the available alternatives in terms of cost and ridership potential. Where large differences in cost may exist, however, investments at various cost levels should be evaluated.

On the other hand, if the corridor has a large number of alternatives, it is wise to view system planning as an opportunity to reduce this number on the basis of preliminary data. Carrying a large number of alternatives into the alternatives analysis phase can be quite costly and burdensome, and is discouraged by UMTA. In such cases, preliminary cost and benefit data should be developed on the many alternatives to identify those that are potentially most cost-effective.

Some travel markets are clearly highway oriented, while others can be well served by transit. Thus, some corridors may lend themselves to the examination of highway or transit options exclusively. Highway solutions are usually appropriate in situations where trip origins and destinations are widely dispersed. Transit is most effective where origins and/or destinations are concentrated. Most urban travel corridors do not fall neatly at either of these extremes, suggesting the desirability of developing sets of alternatives that include both highway and transit elements, and including an analysis of modal trade-offs in system planning.

Analysis of Alternatives. During system planning, the analysis of alternatives focuses on identifying fatal flaws and a preliminary analysis of cost-effectiveness and financial feasibility. First, the alternatives should be screened to see if they have any characteristics that are likely to prevent their implementation. Potential fatal flaws might include high capital or operating costs in relation to realistic revenue projections, lack of engineering feasibility, major environmental impacts, or unproven technology. Second, those alternatives that survive the screening are subjected to a preliminary evaluation of cost-effectiveness. Three types of information are particularly important for evaluating cost-effectiveness: transit patronage, capital cost, and operating and maintenance cost. Such information should be developed for both the transit guideway alternatives and a low cost TSM alternative that represents the best that can be done to improve transportation without construction of a fixed guideway.

The preliminary evaluation of cost-effectiveness should include calculation of the UMTA's total cost-effectiveness index. The index should then be compared with the threshold criteria developed under UMTA's Major Capital Investment Policy. Guidance on the calculation of the cost-effectiveness indices and the threshold criteria is provided in Appendix E. To advance into alternatives analysis, the results of system planning should demonstrate that the guideway alternatives proposed for study are likely to yield a total cost-effectiveness index that is not excessive. The current threshold value has been set at \$10 per added trip.

The level of detail for this analysis should recognize that the nature of the decision at hand is to choose a corridor and to narrow the range of alternatives, not to select one alternative for implementation. Simplified analysis techniques and assumptions may often be applied. Nevertheless, it is important that the data developed in system planning provide a reasonable representation of the choices involved. There should be some confidence that the data is representative of how the alternatives will perform, and the relative differences between the alternatives. Although the estimates may have a sizable margin of error in absolute terms, they should accurately represent the relative costs and benefits of the alternatives.

The analysis of alternatives performed in the system planning phase will differ from that to be done in alternatives analysis in several key respects. First, alternatives are defined to a much lower level of detail. There is little examination of sub-alternatives, and only a cursory examination of alternative operating plans. Second, planning data is more aggregated and there are more simplifying assumptions -- hence, there is a wider range of uncertainty in the results. Cost and financial analyses, for

example, are usually detailed enough to determine whether capital and operating costs are in line with realistic revenue expectations, but are probably not suitable for detailed financial planning. Similarly, the environmental analysis is generally limited to a screening for potentially fatal flaws such as major community disruption and Section 4(f) involvement. It is useful to make sure that local decisionmakers are aware of the imprecision in data developed at this stage and do not make premature decisions on the basis of preliminary results that may change considerably in later stages.

Private Sector Involvement. When conducting system planning studies, careful thought should be given to the role private carriers can play in providing improved transit service. Private carriers may be able to offer improved service, consistent with local objectives, without public subsidy or with less subsidy than public carriers. Normally, this is accomplished by contracting out certain transit routes or types of service, such as elderly and handicapped service. Several cities have recently been actively considering the possibility of private sector ownership and operation of fixed guideway transit facilities. Even where publically owned and operated guideway facilities are contemplated, there may be opportunities for private sector participation in the cost of building and operating these facilities.

UMTA's October 22, 1984 Policy on Private Enterprise Participation in the Urban Mass Transportation Program (Appendix B) provides the following guidance relevant to the system planning phase:

- o Local entities, as part of their transportation planning process, should provide reasonable notice to private transportation providers and possible new business entrants regarding proposed services and opportunities for private transportation providers in order that they may present their views concerning the development of local plans and programs.
- o Private providers should be given an opportunity to participate in the development of projects that involve new or restructured mass transit services.
- o When new service needs are developed, or services are significantly restructured, consideration should be given to whether private carriers could provide such service in a manner which is consistent with local objectives and without public subsidy.
- o Where public assistance is required, consideration should be given to the capability of private providers to provide such new or substantially restructured service.

Accordingly, private transit providers and other interested private enterprise entities should be invited to participate in all system planning studies. Their input should be of particular relevance to the generation and analysis of alternatives.

Documentation. The results of system planning studies should be carefully documented to facilitate local decisionmaking. The reports should describe current and future travel patterns and problems, define possible solutions to these problems, and present preliminary data on the costs, transportation benefits, environmental impacts, and financial feasibility of these alternatives.

Where major investment alternatives are proposed for further study, system planning reports may also be used by UMTA to decide whether to participate in a future alternatives analysis. Section 4.1 of this manual describes the information that should be provided in any request to initiate alternatives analysis. Local planning agencies are advised to include this information in their system planning reports to avoid the need to prepare supplementary documentation.

2.3 UMTA Involvement in System Planning

UMTA's 10 regional offices work closely with local areas during the system planning process. Headquarters staff may also be brought in from time to time, particularly when a detailed corridor planning study involving fixed guideway alternatives is contemplated. This section explains the roles and responsibilities of the respective UMTA offices involved in system planning for potential fixed guideway projects.

Role of the Regional Staff. Regional office staff serve as the focal point for contacts between local agencies and UMTA. They review unified planning work programs, process grant applications and, once a grant has been approved, monitor projects for budget and schedule adherence. They also perform a technical monitoring and assistance function. When undertaking system planning studies involving potential fixed guideways, local agency staff should contact the UMTA Regional office to establish desired review points. The following points are suggested:

- o the proposed detailed scope of work;
- o technical reports or working papers developed during the course of the study on such topics as the development of alternatives, patronage forecasting, the estimation of capital and operating costs, and the evaluation of alternatives; and
- o draft final report.

The primary objective of these reviews will be to ensure that the information UMTA will need to make a decision on whether to approve alternatives analysis is developed, and that this data is sufficiently sound for that decision to be made. This reduces the chance that UMTA will take issue with the study results after the work has been completed. It should also reduce the need to supplement or redo some of the work. Where necessary, the regions may solicit assistance from Headquarters to support them in these reviews.

Role of the Headquarters Staff. Headquarters staff generally does not become involved in individual system planning studies, except as assistance is requested by a regional office or local agency. Headquarters maintains an awareness of what cities are conducting system planning studies involving fixed guideway alternatives and the issues these studies are addressing. This is for the purpose of providing national oversight to the program and developing procedural guidance. Unless assistance is requested during system planning, however, Headquarters involvement often does not occur until a request to advance into alternatives analysis is received. Headquarters then reviews this request and supporting technical documentation to determine whether system planning requirements have been met and that the threshold criteria for initiating alternatives analysis have been satisfied.

Local planning agencies are encouraged to send copies of system planning reports to UMTA headquarters as these reports are forwarded to the regional offices. Such reports will help headquarters staff track the progress of system planning studies that are considering fixed guideway alternatives. In addition, as time permits, headquarters staff will review these reports and provide technical assistance.

In summary, the system planning phase encompasses a broad range of activities that support the development and implementation of transit improvements. During system planning, local agencies develop or update regional goals and objectives, collect data on regional travel patterns, and project future land use and travel. This leads to the identification of current and anticipated transportation problems. Basic planning methods such as travel demand forecasting models are developed, revised, and refined as part of the ongoing system planning process. The availability of financial resources for future capital and operating costs is assessed. A wide range of alternative solutions to the region's identified problems are then examined, and short- and long-range implementation programs are developed, reflecting the availability of financial resources.

In most cases, the transit improvements recommended from system planning will consist of a relatively low cost expansion of existing services to meet future demand. Future travel demand can usually be met through the addition of new bus routes, changes in the vehicle fleet mix, reduced headways, and other transportation system management (TSM) kinds of improvements. However, in a few cases, more expensive improvements such as fixed guideway alternatives may be potentially cost-effective and warrant further study. In such cases, system planning studies should develop the information necessary to justify the initiation of a detailed evaluation of fixed guideway alternatives. In addition, a priority corridor should be selected and a small set of promising alternatives should be identified. The system planning phase is not the time to reach closure on a single preferred mode or alignment alternative.

When local officials seek UMTA approval to initiate alternatives analysis, the results of system planning studies are used by UMTA to decide whether to participate in further detailed study of guideway alternatives in the corridor. Much of the information needed to make these decisions should be available in reports produced during the system planning phase.

I.3. Framework for the Analysis

Following system planning, the next major phase in the major investment project planning process is alternatives analysis. This Chapter briefly describes the scope of the alternatives analysis phase and the steps involved in conducting an alternatives analysis. The availability of UMTA funds for the study, procedures for initiating alternatives analysis, and contractual considerations are also discussed.

3.1 Overview of the Alternatives Analysis Phase

During alternatives analysis, the priority corridor identified in system planning is studied in detail, looking at alternative solutions to the corridor's transportation problems. Information on the costs, benefits, and impacts of each alternative is developed to provide a sound technical basis for project decisionmaking. The alternatives analysis phase also includes the preparation of a draft environmental impact statement (EIS) initiating the environmental process required by the National Environmental Policy Act of 1969. At the conclusion of this phase, local officials select a preferred mode and general alignment, adopt a plan for financing the project's capital and operating costs, and request UMTA's approval to enter preliminary engineering and prepare a final EIS.

Corridor Focus. UMTA's experience has been that corridor level planning is the most suitable setting for the selection of a preferred mode (e.g., heavy rail, light rail, bus, etc.) and alignment alternative for transit guideways. For the most part, each corridor of an urban region has travel patterns that are independent of those in other corridors. Less than 10 percent of transit trips normally pass through a central business district from one corridor to another. Thus, mode and alignment alternatives in each corridor can be studied independently of alternatives in other corridors. Furthermore, by focusing project decisionmaking at the corridor level, sufficient information on the costs and benefits of each mode and alignment alternative can be produced to provide a sound technical basis for selecting a preferred alternative. Accordingly, the selection of a preferred mode and general alignment is best made on a corridor by corridor basis.

Small Set of Promising Alternatives. The alternatives analysis phase examines a small set of alternatives that have been shown to be promising solutions to the corridor's transportation problems. These alternatives are chosen on the basis of system planning analyses that provide a preliminary analysis of cost-effectiveness, financial feasibility, and potential fatal flaws. As explained in Section 2.2, alternatives are not considered promising unless they satisfy UMTA's threshold criteria for cost-effectiveness.

The range of alternatives often includes a no-build or do-nothing alternative, one or more rail options, a bus guideway alternative (often with provisions for use by carpools), and at least one non-guideway

transportation system management (TSM) alternative that represents the best that can be done to improve transit service without a major investment in new infrastructure. These alternatives should be structured so as to demonstrate the added benefits of higher levels of investment. Thus, it is important that the build alternatives exhibit a range of capital costs, including the least expensive and shortest guideway capable of addressing the transportation problems in the corridor.

The TSM alternative serves as the baseline for evaluating the added costs and added benefits of a fixed guideway facility. The TSM alternative includes such low cost actions as traffic engineering, express bus service and other transit operational changes, and modest capital improvements such as reserved lanes, park-and-ride lots, and transit terminals. It is designed to address specific transportation problems in the corridor and demonstrate the extent to which these problems can be solved without a major investment in new facilities.

While the range of alternatives should include all reasonable and promising choices available to decisionmakers, it is normally desirable to keep the number of alternatives considered in alternatives analysis as small as possible. A large number of alternatives increases the complexity of the analysis process, adding to the time and cost of the study. A large number of alternatives also tends to create a draft EIS which is too large and incomprehensible for the average reader. Where a large number of alternatives are proposed for advancement into alternatives analysis, UMTA encourages local sponsoring agencies to perform a preliminary screening task early in the study to reduce the number of alternatives to a manageable few.

Major Steps in the Alternatives Analysis Process. The alternatives analysis process may be divided into six major steps: initiation of the study, the scoping process, development of alternatives and analysis methodologies, analysis and refinement of alternatives, preparation of the draft environmental impact statement (EIS), and selection of the locally preferred alternative (see Figure I-3.1). These steps generally follow one another in sequence, with the results of each phase serving as necessary inputs to the following phase.

Initiation of the study involves obtaining UMTA approval to undertake alternatives analysis. This approval ensures UMTA participation in the study. While local agencies are of course free to perform technical studies similar in nature to alternatives analysis, UMTA will not necessarily recognize this work unless UMTA has approved the initiation of the study and participated in the work. Further guidance on how to obtain UMTA approval is provided in Section 3.4 of this chapter.

The scoping process is initiated once UMTA approval to perform an alternatives analysis has been received. During this phase, the roles and responsibilities of participating agencies are defined, issues to be addressed in the study are defined, and the availability of data and models for addressing these issues is determined. The public involvement process is initiated. The scoping process results in three documents which will guide the remainder of the study: a detailed work plan for the alternatives

analysis, a conceptual definition of the alternatives to be included in the study, and a first draft of the Purpose and Need chapter of the draft EIS. The scoping process is further explained in Part II, Section 1.4.

Once scoping is completed, the next step is to further define the alternatives and the methods to be used in the analysis. This step is designed to ensure that all participants in the process are in general agreement with the alternatives and analysis methodologies before the technical analysis process is undertaken. Often this step also includes a preliminary analysis to screen out those alternatives or sub-alternatives that show the least amount of promise. Further guidance on the development of alternatives and analysis methodologies is contained in Part II, Chapters 1 and 2 of this guidance.

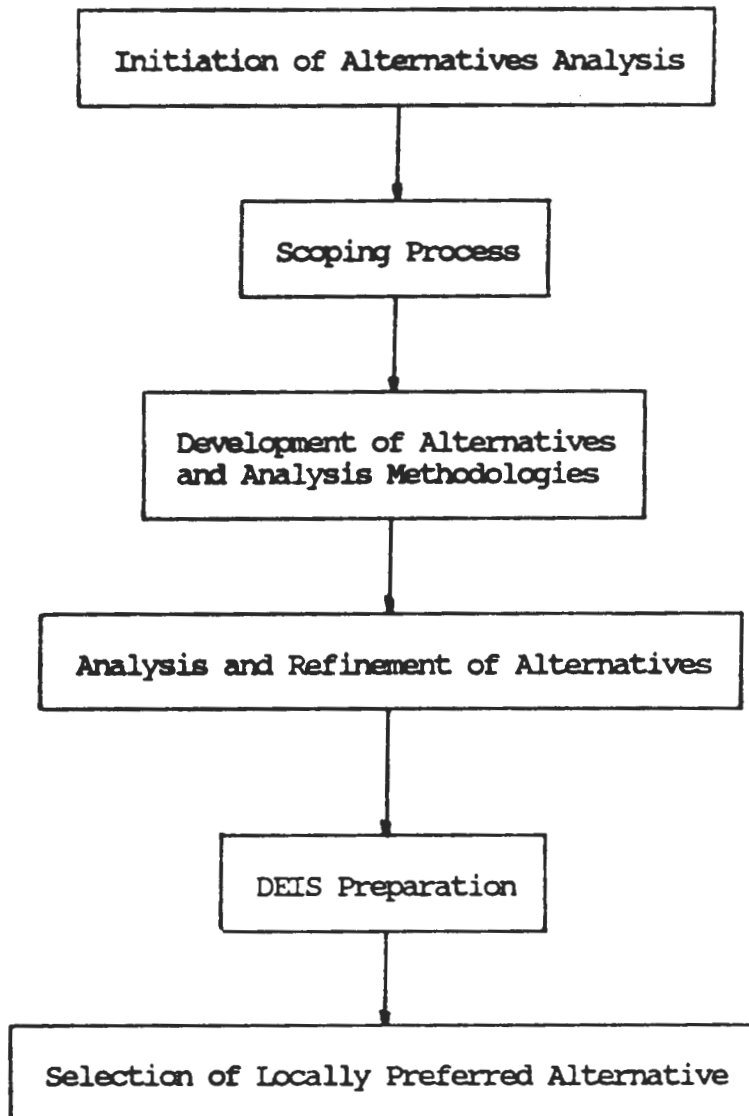
The fourth step, the analysis and refinement of the alternatives, constitutes the main technical work of the study. This step will include conceptual engineering for each alternative and an assessment of each alternatives transportation and environmental impacts. Capital and operating costs are estimated and potential funding sources are assessed. Agreement is achieved among the study participants on the technical results of the study. Further guidance on this step may be found in Part II.

Once the technical results are agreed upon, the fifth step involves preparation of a draft EIS summarizing and interpreting the results of the study. The draft EIS will pull together in one place all of the technical information deemed relevant to the selection of a preferred alternative. The draft EIS will serve as a vehicle to obtain public input to the decisionmaking process. Part III provides guidance on the preparation of the draft EIS.

The alternatives analysis process concludes with the selection of the locally preferred alternative. The selection process includes circulation of the draft EIS, a public hearing, a local decision on the preferred alternative, and development of a financing plan for the preferred alternative's capital and operating costs. Part III provides guidance on the selection of the locally preferred alternative.

Alternatives analysis also includes certain basic technical elements. Typically, these technical elements consist of the development of alternatives; travel demand forecasting; estimation of capital and operating costs; analysis of social, economic, and environmental impacts; financial analysis; public involvement; and evaluation. Work is performed on each of these elements during each step in the alternatives analysis phase, as data is collected, methods are developed, analyses are performed and documented, and the results are presented for public review and taken into account in local decisionmaking.

Figure I-3.1: Major Steps in an Alternatives Analysis



3.2 Agency Roles and Responsibilities

The vast majority of the work done in an alternatives analysis is usually performed locally by the transit operator, metropolitan planning organization, or agency of municipal government. The responsibility for the conduct of the study is often shared among several local agencies, with one having lead responsibility, or by a consultant reporting to a local lead agency. This section provides guidance on the responsibilities of the local lead agency, and on the selection of an agency to be the local lead. The use of some type of formal mechanism, like a memorandum of understanding, to document the responsibilities of the participating agencies, is also discussed.

In some cases, State transportation agencies have played an active role in the conduct of an alternatives analysis. This is particularly the case where localities will be looking to the State to provide a portion of the capital funding. If this is the case, State involvement in the alternatives analysis study should be encouraged to ensure that issues of State concern are brought to the fore early in the project development process.

While participating local and State agencies are responsible for ensuring that the study is conducted in a technically sound manner, UMTA also oversees the work and signs off at key points. The EIS is considered a Federal document, and UMTA must approve it before it is circulated for public comment.

The Local Lead Agency. The local lead agency has the primary responsibility for overseeing the conduct of the alternatives analysis. It ensures that the work is performed in a technically sound manner, and is successfully completed in accordance with the project schedule and budget. The local lead may also perform all of the technical work, share responsibility for the work with other local agencies, or contract out all or part of the work to a consultant. Some of the more important activities involved in properly managing the study are:

- o Development of a detailed work plan identifying the tasks that will be performed, the sequence in which they will be completed, agency responsibilities for completing the work, and the anticipated cost of the respective study tasks.
- o Identifying agency responsibilities for completing assigned tasks, and ensuring that the involved agencies are organized, staffed and supported so as to be able to fulfill their roles in a timely manner. Attention should be paid to ensuring that the staff is technically competent for the assigned tasks, and that interdisciplinary skills are brought to bear where necessary.
- o Providing professional management and direction as the work progresses, ensuring that work is done in an efficient manner and that deliverables are obtained in a timely fashion.

- o Taking necessary steps, such as establishing a technical advisory committee, to ensure the technical quality of the work.
- o Coordinating with local cooperating agencies and UMTA by means of study steering committees, monthly reports, etc.
- o Obtaining UMTA concurrences at designated milestones.
- o Keeping other interested agencies, private operators, and the public informed and seeking their input through established public involvement mechanisms (see Chapter 4).
- o Responding to information requests by decisionmakers during the course of the study.

Choice of a Local Lead Agency. Performing an alternatives analysis requires a wide range of skills — skills which may not all reside within one agency. In many cities, for example, the metropolitan planning organization is expert in travel demand and land development analyses, but the transit operator may have greater expertise in transit operations, project design, cost estimation, and financial analysis. Either or both may have project management ability. The distribution of these skills will probably be unique to each urban area.

Many different kinds of agencies have served as the local lead for UMTA-sponsored alternatives analyses. These have included transit operators, metropolitan planning organizations, agencies of city government (e.g., departments of public works), state highway and transportation departments, and regional port authorities. From this experience, it is clear that any of these can be qualified to serve as the local lead. The choice will depend upon local conditions. Some questions that might be asked in considering which agency is most suitable are:

- o Which agency has the greatest experience in conducting, managing, and administering similar types of corridor or system level planning studies?
- o Which agency has the greatest breadth and depth of technical skills needed for the analysis?
- o Which agency tends to have greater credibility with decisionmakers and the public?
- o Which agency is most likely to have responsibility for implementing the project that is ultimately selected?
- o Do the jurisdictional boundaries of the proposed agency encompass the entire corridor?

Because a wide range of skills must be brought to bear to successfully complete an alternatives analysis, more than one local agency frequently will play an active role. A memorandum of understanding may be helpful in

such cases to clearly define the responsibilities of each participating agency. This might include responsibilities for the conduct of various study tasks, for funding the work, and for the selection of a locally preferred alternative.

Local Responsibilities under NEPA. The local lead agency may be recognized either as a "joint lead agency" or as a "cooperating agency" for the purpose of meeting the procedural requirements of the National Environmental Policy Act (NEPA). It may assume "joint lead agency" responsibilities if it is a public agency and is subject to State or local requirements comparable to NEPA. Joint lead agencies develop substantive portions of the environmental document. Although UMTA will be responsible for the scope and content of the environmental document, joint lead agencies are expected to sign the document and share responsibility for its scope and content with UMTA.

Most local agencies that are seeking UMTA capital assistance are considered to be "cooperating agencies" for the purposes of NEPA. During the environmental process, UMTA will discuss the scope and content of the appropriate environmental document with the local agency before decisions are made on the scope and depth of the environmental analysis. The local agency then carries out these decisions. During alternatives analysis, local lead agencies designated as cooperating agencies assume responsibility for preparing analyses and proposing language for the EIS or EA. They do not sign the environmental document or take responsibility for its scope, content, or conclusions.

UMTA Involvement. UMTA plays two roles in the alternatives analysis process: (1) technical and procedural oversight, and (2) technical assistance. The oversight role recognizes that the results of alternatives analysis are normally presented in a Federal draft EIS or EA. As lead (or joint lead) agency for the preparation of the environmental document, UMTA is responsible for the scope, content and conclusions of the EIS or EA. UMTA makes sure that the environmental document fulfills Federal requirements and presents a complete and objective basis for mode and alignment decisions. In addition, UMTA bases its decisions to advance a project into preliminary engineering on the information contained in the EIS or EA. Thus, the environmental document must contain the data UMTA will need to arrive at this decision. To ensure that the results satisfy UMTA's needs, UMTA staff is actively involved throughout the alternatives analysis process.

The second role, technical assistance, recognizes that UMTA developed many of the techniques used to analyze alternatives. Over the years, UMTA has helped cities across the country to apply these techniques in previous corridor planning studies. UMTA welcomes opportunities to share this experience with local staff engaged in ongoing and future studies.

For the most part, UMTA's involvement occurs in a highly informal manner. (As discussed in section 4. , the process also provides for a series of formal review points at which time UMTA review and concurrence should be obtained.) this section describes the role that the various UMTA offices will play in the alternatives analysis.

The local lead agency should consider UMTA staff to be a member of the local technical committee that participates in each study. This on-line involvement not only enhances UMTA's ability to provide technical assistance, but also helps ensure that UMTA input to the study is timely and informed. In the ideal situation, UMTA technical reviews will occur at the same time as those of State and local participants.

At some points in the process, there may be two levels of local review: technical and policy. This might occur, for example, at the conclusion of the scoping process when decisions are reached on the alternatives to be included in the study. In such instances, UMTA will normally provide technical assistance and comments as part of the local technical review. Once a local decision is made at the policy level, UMTA would be asked to provide a formal concurrence in the local decision.

Both UMTA Regional offices and UMTA Headquarters are involved in each alternatives analysis study. Normally, there will be one Regional staff person and two Headquarters staff people assigned to each study.

Role of UMTA Regional Offices. The Regional Office of UMTA will be the lead point of contact for local agencies. It handles grantmaking activities, serves as the focal point for contacts and correspondence, represents UMTA at meetings, monitors progress, reviews, products, processes the draft EIS, and seeks Headquarters concurrences or assistance when needed. These roles played by the Regional office are further explained below:

- o Grantmaking. The regional office reviews grant applications, approves grants, and performs normal grant administration functions.
- o Focus of Contacts and Correspondence. Incoming correspondence should be directed to the Regional Administrator (with copies to the Headquarters contact). Similarly, all outgoing correspondence will be signed at the Regional level. Regional staff will also normally handle informal requests for guidance and assistance, such as routine telephone calls, although a call within specific technical focus might be directed to Headquarters technical staff.
- o Representation at Meetings. As necessary, Regional office staff will represent UMTA at technical and policy level meetings that occur during the study. Their role will be to explain overall UMTA policies and procedures, to explain UMTA positions on specific procedural issues, and to provide technical guidance in conjunction with Headquarters.
- o Monitoring and Reviews. The Regions will maintain UMTA knowledge of project status to enable the agency to respond to inquiries. In addition, they review and comment on study products, and identify technical and procedural problems that may require Headquarters attention. At those points in the process where Headquarters concurrences are required (see below), the Regions ensure that the local transmittals are complete and recommend an UMTA position.

- o DEIS Processing. At the start of the scoping process, the Regional Office prepares the Notice of Intent to Prepare an Environmental Impact Statement (see Section 5.1). Toward the conclusion of the study, it reviews and (with Headquarters concurrence) approves the draft EIS. The Regional Office then files the signed draft EIS with the Environmental Protection Agency (see Section 5.2).

Role of UMTA Headquarters. The Office of Grants Management (UGM) and the Office of Research and Technical Assistance (URT) in UMTA headquarters develop guidance on the alternatives analysis process, monitor individual studies, prepare recommendations for the Administrator, and offer technical assistance. These roles are further explained below:

- o Guidance Development. UGM and URT develop overall procedures for the alternatives analysis process, and prepare manuals, reports, papers, etc. containing procedural and technical guidance for use by the Regional Offices and local agencies. They also conduct training courses and share good examples from past studies with agencies currently performing alternatives analyses.
- o Oversight of Individual Studies. Headquarters reviews the procedures, methodologies, and results of each study to ensure national consistency and technical credibility. These reviews also help ensure that the data required for UMTA decisionmaking is available. Headquarters review and concurrence is required at six key points:
 - (1) initiation of the alternatives analysis study,
 - (2) the results of the scoping process, i.e., detailed work plan, conceptual alternatives, and impacts to be considered;
 - (3) study methodologies and detailed alternatives;
 - (4) analysis results, including final alternatives; and
 - (5) circulation of the draft EIS.
 - (6) initiation of preliminary engineering
- o Development of Technical Assessments and Recommendations. Headquarters staff prepare technical assessments and recommendations for the Administrator to support decisionmaking on the initiation of alternatives analysis and preliminary engineering.
- o Development of Annual New Start Ratings. As described in Chapter 1, UMTA's Major Capital Investment Policy established a rating system for identifying those projects most deserving of Federal capital assistance. Under the policy, ratings are to be developed each year to guide budget decisions for the succeeding fiscal year. While the calculation of individual cost-effectiveness indices is done locally, development of the annual ratings is the responsibility of UMTA Headquarters.

Division of Responsibility Between UGM and URT. As noted above, two UMTA Headquarters responsibilities are involved in the alternatives analysis process, the Office of Grants Management (UGM) and the Office of REsearch and Technical Assistance (URT). Overall responsibility for alternatives analysis rests with the UGM, with URT serving in a technical support capacity. Accordingly, UGM develops procedural guidelines for alternatives analysis, provides procedural guidance to the Regions as needed, and oversees Regional Office implementation of these guidelines. UGM also coordinates the six Headquarters concurrences noted above, and prepares options and recommendations for the Administrator prior to the initiation of alternatives analysis and preliminary engineering.

URT provides technical support to UGM, the Regions, and local agencies throughout the alternatives analysis process. When an application to undertake alternatives analysis is received, URT performs a technical review of the system planning work to determine whether these analyses support the proposed alternatives analysis. URT staff examines the technical methods reports and results reports prepared during the study, providing comments as necessary.

Once a locally preferred alternative is chosen, URT prepares a technical evaluation that examines the cost-effectiveness of the project and evaluates the financial plan.

3.3 Funding the Analysis

In previous years, UMTA set aside a portion of its Section 8 funds to help local agencies support alternatives analysis. This set-aside was no longer deemed necessary following the enactment of the Section 9/9A formula program. Consequently, local agencies are now expected to fund any alternatives analyses through their regular apportionments under Section 8, 9, 9A, plus Interstate Transfer and local funds. Regardless of the source of funding, approval to initiate alternatives analysis must be obtained from the UMTA Administrator, as explained in Section 4.

Funding for the alternatives analysis study should appear in the region's unified planning work program. Where the study is to be funded with Section 9/9A, funding should also appear in the Section 9/9A program of projects.

The source of funds to be used for the study is strictly a local decision. However, there does seem to be an advantage to using Section 9/9A and Interstate Transfer funding. These sources are larger than the region's Section 8 apportionment, allowing the area to reserve sufficient funds to complete the study in a timely manner. Reliance on Section 8 funds exclusively is likely to require that the study be spread out over many years.

3.4 Initiation of the Alternatives Analysis Phase

The alternatives analysis phase can not be initiated until the study has been approved by the UMTA Administrator. In general, this approval can be expected where the results of the system planning phase show that fixed guideway alternatives may be a promising solution to local transportation problems. All of the information required by UMTA in order to consider a request to initiate alternatives analysis should have been developed in system planning.

To obtain UMTA approval to initiate alternative analysis, the local agency proposing the analysis should transmit a request for approval to UMTA's Regional Administrator, with copies to UMTA's Office of Grants Management (UGM-20) and Office of Methods and Support (URT-40). The request should include:

- o Identification of the priority corridor and a statement of the transportation problems in the corridor. The corridor should be defined in terms of its geographic extent, physical characteristics, and travel patterns. The discussion of travel patterns should lead directly into a description of the corridor's transportation problems.

Although each corridor has a unique set of problems, typical problem statements include: 1) slow transit speeds due to highway congestion, 2) slow auto and transit speeds due to bus congestion, 3) over-crowding and lack of transit capacity, 4) lack of schedule adherence due to congestion, 5) very high operating costs because of high demand, and 6) inconvenience of transit due to transfers, circuitous routing, etc. The discussion of the problems should not only describe the type of problem but also its location (routes, intersections, etc.) and severity (e.g. the magnitude and duration).

- o Small set of promising alternatives for dealing with the corridor's transportation problems. This would include both the physical and operating characteristics of each alternative proposed for further study. Physical characteristics of interest are: general location of the proposed guideway and stations for each technology considered, termini, and the number of lanes or tracks. Operating characteristics include: operating strategy, fare policies, headways, and route spacing for both the guideway alternatives and their feeder systems. At least one of the alternatives must consist of transportation systems management (TSM) activities, such as increased bus service and reserved lanes on existing roadways, designed to respond to the corridor's transportation problems without a major investment in new facilities.
- o Preliminary indicators of cost-effectiveness and financial feasibility. The request should present the number of daily riders in the priority corridor and a brief explanation of how this number was determined. It should also provide evidence that the alternatives proposed for further study are likely to yield cost-effectiveness indices that are not excessive. The most direct way to demonstrate this condition is with preliminary cost-effectiveness indices developed

during system planning studies to update the region's long range transportation plan. Supporting documentation should describe the methods and assumptions underlying the estimates of ridership, travel time savings, and capital and operating costs so that UMTA can determine the reliability of these estimates. Financial feasibility can be demonstrated by means of a system wide financial plan that takes into account the cost of operating the planned transit system, the range of capital costs for planned transit improvements, the cost of rehabilitating existing facilities, and a realistic forecast of future revenues.

While UMTA is concerned primarily with the cost-effectiveness and financial feasibility at this state, it is understood that local areas may wish to evaluate the alternatives using their own criteria. UMTA has no objection to the inclusion of other evaluation measures in the submittal.

- o Preliminary scope of work and budget for the analysis. The scope of work and budget is essentially a summary of the detailed work plan that will be prepared during the scoping phase of the study (see Section 4.6 below). It should describe the proposed study in sufficient detail to demonstrate that the local intent is, indeed, to perform an alternatives analysis, as opposed to system planning or preliminary engineering. The scope of work should also point out the primary technical elements of the study, particularly any unusual features of the study such as model development or screening of alternatives. The work scope should also demonstrate that the local agency understands the level of effort and funding requirements of an alternatives analysis.

When UMTA receives a request to initiate alternatives analysis, the request is reviewed by UMTA headquarters and regional staff, giving particular attention to the cost-effectiveness indicators and how they were derived. The first step in this review is to establish the technical adequacy of the system planning effort. Where patronage, costs, or operating efficiencies are outside the bounds of commonly observed values, UMTA will raise questions on the reasonableness of the results. Sometimes, resolution of these issues requires additional system planning analysis, in which case UMTA will provide comments designed to assist the applicant in correcting or improving its system planning work. (Consequently, it is advisable that the local agency involve UMTA technical staff before the formal submittal is made so that these kinds of problems can be avoided.) Once technical adequacy is established, a staff evaluation is prepared leading to the Administrator's decision on whether to proceed into alternatives analysis.

UMTA's Major Capital Investment policy (May 1984) established two threshold criteria to guide decisions on the initiation of alternatives analysis. To receive approval for alternatives analysis, the results of system planning should show that:

- o there are more than 15,000 existing daily transit riders in the corridor

- o there is a reasonable possibility that the fixed guideway alternatives proposed for study will be shown to be cost-effective. Preliminary cost-effectiveness indices (total index) of less than \$10 per new trip are considered to indicate that the guideway alternatives are potentially cost-effective.

If the alternatives analysis is to be funded with local, Section 9 or Interstate funds, the analysis may be permitted even when the thresholds are not met. Under the Major Capital Investment Policy, UMTA may issue a "letter of exception" allowing the analysis to proceed. The "letter of exception" will publicly state that, in UMTA's opinion, further study of fixed guideway alternatives is not warranted, but the local area may nevertheless proceed with the study using its own formula funds.

3.5 Contractual Considerations

The local lead agency should discuss with UMTA the use of consultants in preparing environmental documents. UMTA usually will not be involved in the selection of consultants but will advise applicants on the need for interdisciplinary skills. UMTA may also help the local agency evaluate a consultant's qualifications. UMTA's role in the procurement of consultant services to assist in the preparation of the EIS is limited to the procurement procedures contained in UMTA Circular 4220.1A, Third Party Contracting Guidelines.

Where the use of consultants is contemplated, the local lead agency will need to determine the best time to issue its request for proposals (RFP) -- early in the scoping process, or after a detailed work plan has been developed. The local lead agency will often prefer to issue its RFP early in the scoping process in cases where it anticipates a strong consultant role in designing the study, or where local procedures involve a lengthy procurement process. Several approaches have been followed in past studies:

1. Issue the RFP after the scoping meeting. The RFP can then reflect any issues raised at the scoping meeting and specify the work that should be done to address these issues. With a more specific RFP, consultants have a better basis for developing detailed proposals. In addition, this approach requires that local staff take the lead in the scoping process, which helps ensure that the study is designed with a focus on the information needs of local decisionmakers.

This approach has several disadvantages, however. First, consultants are less likely to be present at the scoping meeting and be sensitized to the issues. Adequate preparation for the meeting is solely dependent upon local staff. Finally, in cities that have a lengthy procurement process, issuing the RFP after the scoping meeting could mean a time consuming lag between the scoping meeting and the initiation of the technical work. Such a lag could cause local interest in the study to wane.

2. Complete the procurement process before the scoping meeting, making it clear that the contract is subject to renegotiation based on the results of scoping. This approach ensures that there is no lost time between the scoping meeting and the start of the technical analysis. In addition, the consultant is available to help with preparations for the scoping meeting and can be sensitized to issues that arise during scoping. But the need to renegotiate the contract if significant issues arise in the scoping meeting may diminish local willingness to respond to scoping meeting comments.
3. Issue the RFP just before the scoping meeting. Interested consultants can then attend the meeting and, in their proposals, indicate how they would address any issues raised at the scoping meeting. Negotiations with the contractor could then be conducted in concert with the development of the final detailed work plan.

Local agencies should be aware of the conflict of interest provisions regarding work by consultants. Section 1506.5(c) of the Council on environmental Quality's Regulations for Implementing the Procedural Provisions of NEPA (Appendix D) prohibits contractors from preparing an EIS when they have a financial or other interest in the outcome of the project. For example, a firm that prepares an EIS for a construction project cannot at the same time have an agreement to perform the construction or won the site. It is not prohibited, however, that the firm compete for future design or construction contracts.

PART II

Conduct of the Technical Analysis

Urban Mass Transportation Administration

Office of Planning

Office of Mobility Enhancement



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II.1. Organization and Management

Transit project planning can be a highly complex technical process. When fixed guideway alternatives are involved, the process can be as challenging as any transportation planning effort can be. The technical aspects of the study are often complicated by the dynamic political and institutional setting in which many project planning studies are conducted. There is no way to overcome the technical and managerial difficulties inherent in conducting such studies. However, project planning seems to proceed most smoothly when the work to be done by each participating agency, and the resources required to do the job, are carefully spelled out in advance. In addition, managerial techniques that foster cooperation among study participants are critical to a successful project planning study.

This chapter covers a number of subjects related to managing a project planning study. The chapter begins by describing the committee structure that is normally established to guide and coordinate the study. It continues by describing the purpose and content of the work plan, providing guidelines for technical documentation, and identifying the points in the alternatives analysis process where UMTA concurrence should be obtained. This is followed by a discussion of public involvement and private participation in the study. Finally, the chapter explains the scoping process, during which a detailed work plan is developed and agreement is reached on the alternatives to be studied and the impacts to be analyzed.

1.1 Organizational Structure

In Chapter I.3, the roles and responsibilities of the local, State, and Federal agencies involved in project planning were discussed, together with considerations in choosing a local lead agency. This section will build upon that foundation by discussing the committee structure that is often used to guide and coordinate the study on a continuing basis. In virtually all cases, at least two committees are established: a policy committee and a technical committee. Frequently, a citizens advisory committee is also established as part of the citizen participation program.

The purpose of this section is to describe a policy and technical committee structure that has been effective in past studies. UMTA does not insist upon any particular committee structure. The use of citizens advisory committees is further discussed later in this chapter (section 1.4).

Policy Committee. Overall direction for the study is normally provided by a policy or steering committee composed of elected officials from the project area. The committee may also include senior managers from the participating agencies and non-elected representatives of affected communities, such as citizen and business leaders. Policy committees will normally review and adopt the range of alternatives to be studied and the evaluation criteria to be used. This helps ensure that the study generates the kinds of information that policy makers feel they will need when they are called upon to choose a locally preferred alternative and adopt a financing plan at the

conclusion of the study. The policy committee should also be involved in establishing key input assumptions that will be used in the analysis. This might include such assumptions as growth and development forecasts, operator wage scales, and parking and fare policies. The policy committee may also be called upon to resolve any differences of opinion that arise within the technical committee.

The policy committee may or may not be the same as the governmental body or bodies that will select the locally preferred alternative and adopt the financing plan at the conclusion of the study. If not, the policy committee should be representative of those who will ultimately make these decisions.

Technical Committee. In most project planning studies, a technical committee reports to the policy committee and serves two functions: oversight of the technical analysis and interagency coordination. Technical committees tend to be composed of staff from each participating agency and affected jurisdiction. Citizen and business leaders, such as firms involved in joint ventures and private transit operators, may also participate as regular or ad hoc members.

To carry out its oversight function, the technical committee reviews the technical products developed by the lead agency and/or consultant staff, provides comments and suggestions for revising these products, and recommends action by the policy committee. The technical committee should assess the adequacy of the mode and alignment alternatives being considered in the study, as well as offer comments on the technical methods and assumptions being applied. The technical committee may suggest the consideration of different implementation strategies and funding sources. An active and capable technical committee can be indispensable to ensuring a complete and sound technical analysis and to achieving consensus on the results.

1.2 The Work Plan

One of the responsibilities of the local lead agency is to develop and maintain a work plan describing the steps to be performed in the study. The work plan expands upon and refines the scope of work transmitted with the application to undertake project planning. While the work plan is prepared early in the study and is submitted to UMTA for review and concurrence, it should be viewed as a dynamic document and updated as conditions warrant. This section describes the purpose of the work plan, provides guidance on its content and use, and provides observations on typical schedules and budgets of alternatives analysis studies.

Purpose of the Work Plan. The work plan will serve as an important management tool throughout the study. During the scoping process, when the work plan is still in draft form, it will be a vehicle for obtaining agreement among participating agencies, including UMTA, on the approach to be followed in the study, the level of effort and funding required, agency responsibilities, and the organizational structure for guiding the study. As the study progresses, the work plan becomes a tool the local lead agency

and established committees should use to monitor study progress, particularly adherence to the adopted schedule and budget. The work plan will help the local lead agency insure that input data is available when required, and that necessary local and Federal concurrences are obtained, without unnecessarily impeding the progress of the work. It also is useful tool for ensuring that adequate funding is available as needed.

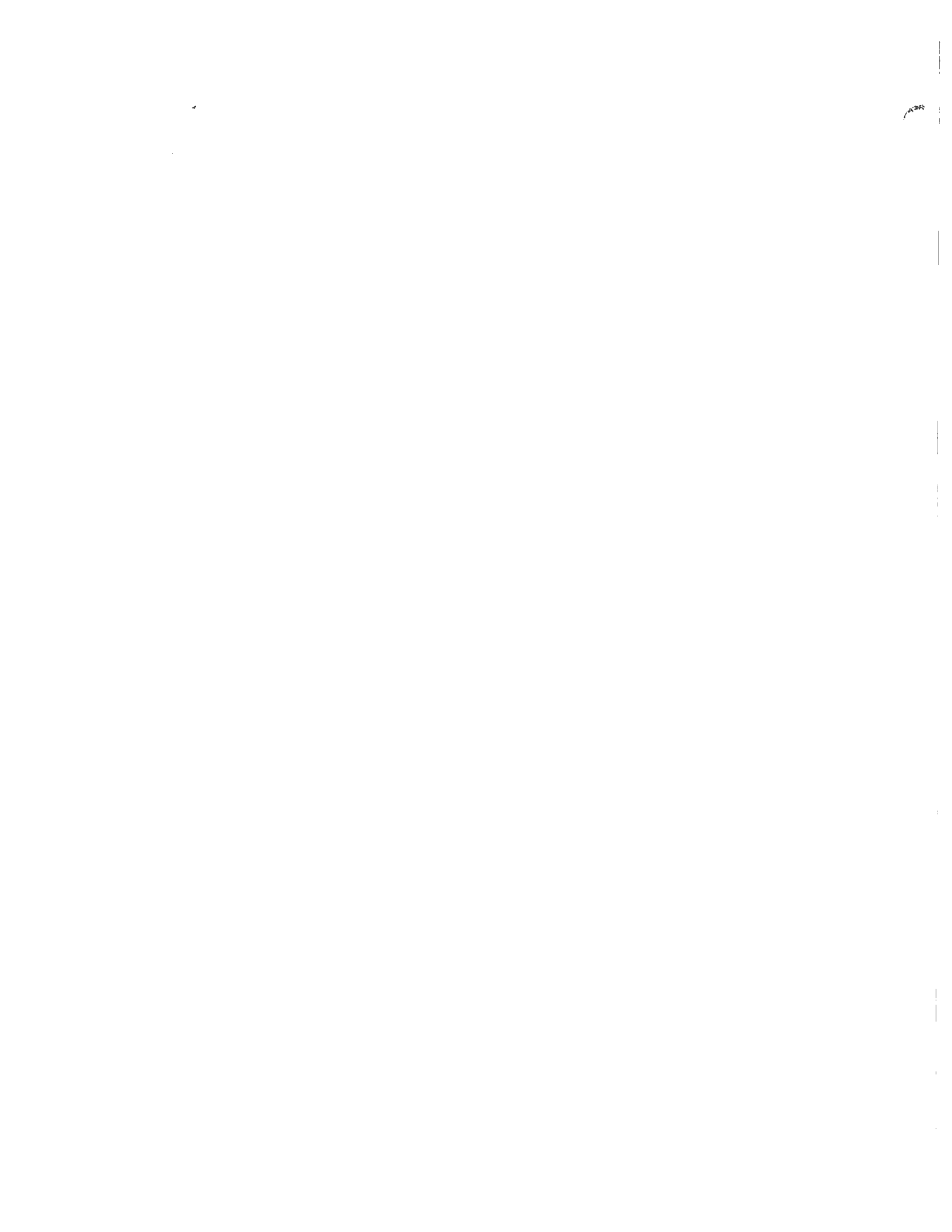
The local lead agency should closely monitor the study's progress and, at least quarterly, identify changes that should be made in the schedule, budget, and task descriptions. These changes should be distributed to all participating agencies. Changes in the scope of the study or the addition of new tasks should be submitted to UMTA for concurrence.

Content of the Work Plan. In order to serve its purpose as a management tool, the work plan should be sufficiently detailed to be useful in directing and monitoring the conduct of the work. It should contain a detailed description of each task and subtask to be performed in the study, identify the interrelationships between the tasks, and define the products to be developed in each task. It should also define the responsibilities of participating agencies, identify major review and decision points, and set forth a realistic schedule and budget for completing the study.

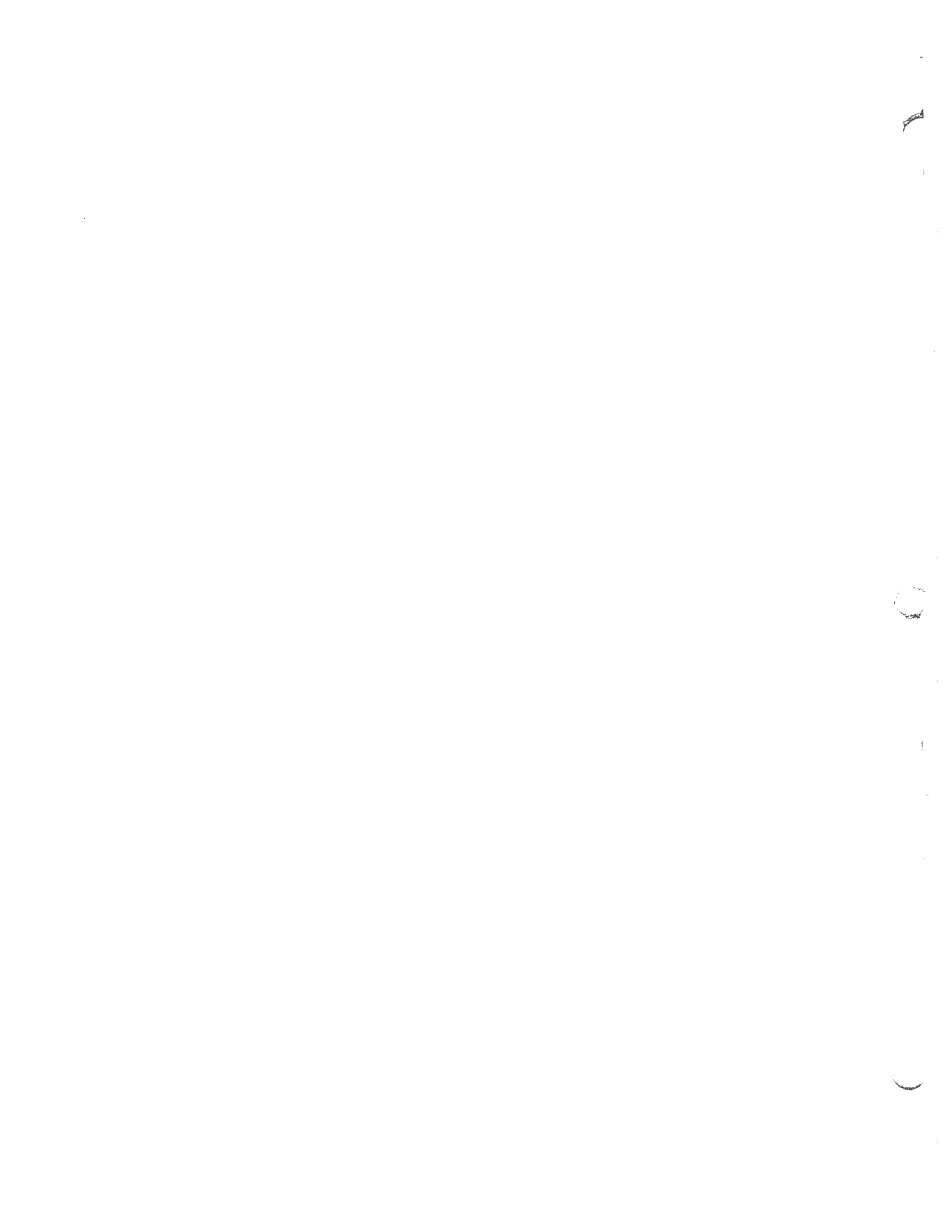
To assist in the development of the work plan, UMTA has prepared a Work Flow Diagram for a Typical Alternatives Analysis (Figure II.1-1). The work flow diagram illustrates the tasks that are normally performed during each of the five steps of an alternatives analysis discussed in Chapter I.3 (i.e., scoping process, development of alternatives and analysis methodologies, analysis and refinement of alternatives, draft EIS preparation, and selection of the locally preferred alternative). The work flow diagram also shows the interrelationships between the tasks and the points in the process where UMTA concurrence should be obtained. Using the work flow diagram as a model, each local lead agency should tailor its work plan to the specific conditions involved in its study.

Project planning studies will normally include tasks for estimating the capital and operating costs of each alternative, forecasting ridership, assessing transportation and environmental impacts, involving the private sector and the public, and evaluating financial options. Nevertheless, each work plan will be unique, because it reflects the status of planning for the corridor, the kinds of alternatives to be considered, and other issues of importance to local decisionmakers. Key issues should be apparent from previous system planning activities, and the scoping process affords further opportunities to identify these issues and consider how they might be addressed in the study. Once issues have been identified, the local lead agency should assess the status of model development for addressing these issues, as well as the availability of necessary input data. To the extent models require further development, or additional data must be collected, the work plan should provide for this.

The work plan should not only define the tasks to be performed, but also recognize the interrelationships between the tasks. Many of the tasks



Insert Figure II.1-1 Here



performed as part of project planning are dependent upon the products of previous tasks. Capital costs, for example, cannot be estimated until plan and profile drawings have been produced as part of conceptual engineering. Likewise, the draft environmental impact statement should not be developed until agreement is reached on the technical methods and results. The work plan should clearly recognize these interrelationships so that the work can be performed in a logical, efficient sequence. A flow chart such as UMTA's work flow diagram should be included in each work plan to illustrate the key interrelationships.

The work plan should also indicate the level of effort that will be required for each task. Level of effort will be a function of the amount of detailed information needed to make a reasoned decision from among the alternatives. The estimates of costs, benefits, and impacts produced in project planning should be sufficiently precise to allow a decision to be made with confidence. Where there are large unknowns, such as subsurface conditions that may have a considerable effect on the cost of a subway alternative, the work plan should provide for more detailed engineering than would normally be required in project planning. The study need not examine issues that have no effect on the decisions that will result from the study. For fixed guideway projects, for example, design options that do not significantly affect the relative costs, benefits, and impacts of the mode and alignment alternatives can normally be put off until the preliminary engineering phase.

Finally, the work plan should provide a realistic schedule and budget for completing the study, recognizing the amount of work that must be performed, the interrelationships between tasks, opportunities for participating agencies to review interim products, and available resources.

Experience with Study Schedules and Costs. Project planning schedules and costs vary widely from one city to the next. The time required to perform project planning is essentially a local matter. Most cities are able to complete the alternatives analysis process in one to two years, and some in considerably less time. Other alternatives analyses, however, have continued for five years or more. The time required depends on such factors as the number of alternatives being studied, the complexity of corridor travel patterns, the sensitivity of potential environmental impacts, the scale of the public involvement process, local technical capabilities, and the willingness of local participating agencies to devote the necessary staffing and financial resources.

The cost of performing project planning may vary from several thousand dollars to several million, again depending upon the specific conditions involved. Alternatives analyses typically cost at least \$500,000, and average around \$1 million. Listed below are several factors that have been found to influence the cost of performing an alternatives analysis:

- o number of alternatives and their lengths
- o number of subalternatives
- o vertical alignment

- o right-of-way availability
- o complexity of travel patterns
- o number of significant environmental issues
- o duration of the study
- o proportion of work done in-house versus contracted out
- o data requirements
- o status of model development

During the preparation of the detailed work plan, the local lead agency should carefully estimate the cost of the study and budget sufficient resources for its completion. The work plan should then be used as a management tool to keep the study on schedule and within budget.

1.3 Technical Documentation

During the course of each project planning study, three sets of technical reports are recommended: one that describes the alternatives at key points in their development, a second that identifies the technical methodologies to be used, and a third that documents the results. In alternatives analysis studies, these three sets of reports are required by UMTA. It is important to understand the philosophy behind the preparation of these reports and their role in project planning.

Alternatives analysis and other project planning studies often require a large commitment of resources, both in planning funds and staff time. The effort proceeds most quickly and efficiently when participating agencies — local, State and Federal — reach agreement early in the study on the alternatives to be analyzed and the specific methods and assumptions to be used in the study. This generally helps minimize the chance that participating agencies will take issue with the results of the study because of a disagreement over methods and assumptions, and reduces the chance that part of the study will need to be redone. Similarly, project planning progresses most smoothly when participating agencies agree on the study's technical findings before further work dependent on these findings is undertaken. The draft EIS, for example, can be prepared quickly and easily once the participating agencies agree on the technical results.

In addition, UMTA advocates that the draft EIS — a key product of alternatives analysis — be kept as short and simple as possible, yet recognizes that some reviewers will want more detailed documentation. Both goals can be well served through a series of technical reports that can be made available to interested parties. These reports provide a place to document the supporting analyses for the contents of the draft EIS that remains outside of the document itself. Thus, the draft EIS can be prepared with decisionmakers and the general public in mind, avoiding where possible, overly complex and lengthy discussions of technical details.

Figure II.1-2 shows how this philosophy is applied in alternatives analysis. Initial efforts and documentation are focused on refining the set of alternatives to the point that their implications for the technical work can be identified. Once agreement on the specific definition of the alternatives is reached, work can proceed on the preparation of methodology reports that identify both the technical methods to be used and the ways in which they will be applied in this particular context. Following agreement on the methodologies, the heart of the technical work occurs. This work is documented in the results reports that, once accepted by the participating agencies, provide the source and backup for the draft EIS.

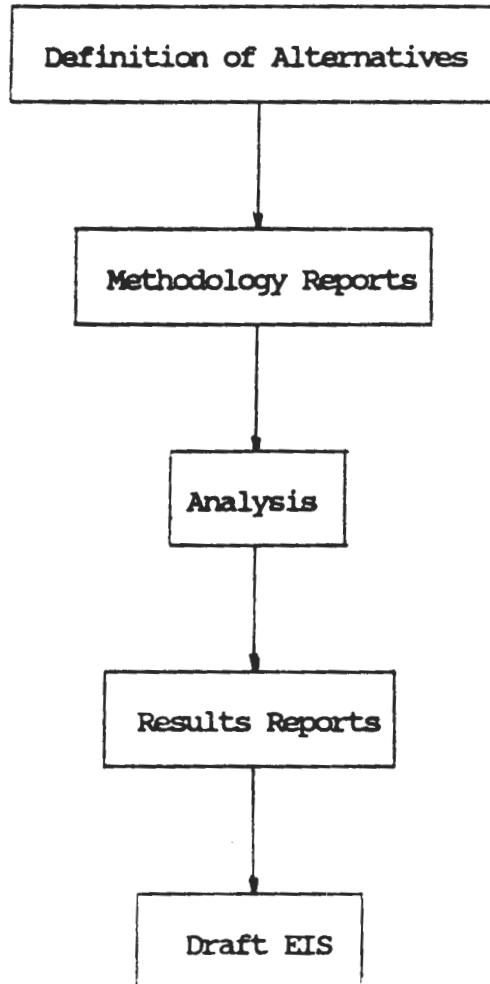
Reports on the range of alternatives, technical methodologies, and technical results should be reviewed by participating local, State and Federal agencies, usually through a technical advisory committee. For alternatives analysis studies, they should also be submitted to UMTA for review and concurrence, and technical analyses should not be undertaken without UMTA's concurrence in the methodologies. (Otherwise, the local agency may face the time and expense of performing the analysis a second time.) The local lead agency's work plan should provide sufficient time for these reviews, as well as for possible revisions in response to comments.

Approach to Documentation. The contents of each of the reports on alternatives, methodologies, and results are discussed in the appropriate technical chapters to follow. However, it is useful to review the nature of each of the three types of reports in order to provide a perspective on their function, general contents, and level of detail. One obvious concern is the potential volume of materials produced during the study and several points should be remembered in this regard. First, authors of the reports should remember that conciseness, not length, is the key to a useful document. Where a simple table or figure can present the information adequately, there is no need to repeat the data in the text. Text should be reserved for explanation and interpretation of the data.

Second, the methodology reports should build upon this technical guidance. Assuming that this guidance establishes the basic approach to the analysis, there is no need to repeat material provided here. Neither is there any need to write lengthy descriptions of models and techniques that are documented elsewhere, or to produce textbook-like descriptions of basic concepts. Discussion should concentrate on applications of methods to the local context and highlight any differences between the proposed methodologies and the material provided in this guidance. Where local agencies propose to use techniques that vary from those suggested, the differences should be clearly defined and explained.

Finally, while the term "report" is applied to each of the documents, there is no constraint on the consolidation of related topics into single volumes. For example, each of the methodology reports might be a chapter in a single volume on methodologies. In some cases, local agencies have distributed three-ring binders or other filing materials and then transmitted individual reports as chapter inserts into the binder. At the very least, this

Figure II.1-2: Technical Documentation for Alternatives Analysis



approach reduces the number of pages devoted to titles, introductions, and discussions of context.

The following sections further discuss each of the three sets of technical documentation required during alternatives analysis and serve as recommendations for reports prepared in other project planning studies.

Definition of Alternatives Reports. The alternatives considered during alternatives analysis are developed in several steps. At the beginning of the study, during the scoping process, the physical and operating characteristics of the alternatives are defined in conceptual terms. These concepts are made progressively more explicit as the analysis proceeds so that, at the conclusion of the analysis phase, plan and profile drawings as well as operating plans have been developed which match each alternative's capacity with projected demand.

UMTA recognizes three major milestones in the development of the alternatives and requests an opportunity to review and concur in the alternatives at each of these points. The three review points are:

- o Conceptual Definition of Alternatives Report. Describes the general physical characteristics and location of the alternatives together with initial outlines of the operating strategy for new transit guideways.
- o Detailed Definition of Alternatives Report. Presents the location and nature of improvements in the TSM alternative, a section-by-section description of each guideway alternative, typical cross-sections of guideway facilities, preliminary drawings of station types, and initial specification of design standards. The report also includes design year and opening year operating plans that are defined in terms of the necessary inputs to transit network coding (routes, link speeds, headways, fare structure, etc.).
- o Final Definition of Alternatives Report. Contains a physical description consisting of plan and profile drawings for each guideway alternative, typical cross-sections, and final layout drawings of each station type. It also provides final operating plans including estimates of service requirements (transit vehicles, vehicle-miles, vehicle-hours, etc.) for use in estimating operating and maintenance costs.

The conceptual definition of alternatives report is one of the products of the scoping process. The detailed definition is developed during the phase called "Development of Alternatives and Analysis Methodologies." The final definition is produced during the "Analysis and Refinement of Alternatives" phase, prior to the estimation of capital and operating costs of each alternative. Guidance on the content of these reports may be found in Chapter II.2.

Methodology Reports. The purpose of the methodology reports is to bring about agreement among the participating agencies with regard to the specific technical methods and assumptions to be used in the analysis. It must be emphasized that methodology reports are not to be viewed as academic treatises on the various technical analyses. Rather, they serve to document the initial technical work involving data collection, evaluation and selection of methods and input assumptions, and plans for the application of these methods to the specific characteristics of the corridor and the alternatives. In most cases, the reports should emphasize this last consideration — how the analysis will be focused on the issues that will be important to the selection of a preferred alternative. Consequently, while work on the reports can commence early in the analysis, they are most useful when finalized after agreement is reached on the detailed definition of alternatives.

Thus, the methodology reports are interim documents documenting the early technical work and specific work plans for the remainder of the analysis including the refinement of alternatives. They are working documents designed to set forth guidelines for the remaining work, rather than unfocused, general discussions that contribute little to the conduct of the study.

Listed below are six major technical areas that are covered in methodology reports:

- o Social, Economic, and Environmental Impact Assessment
- o Capital Costing
- o Operating and Maintenance Costing
- o Service and Patronage Impact Assessment ←
- o Financial Analysis
- o Evaluation of Alternatives

Guidance on the content of the methodology reports is provided in Chapters II.3 through II.9.

A methodology report on citizen, agency, and private sector participation is often prepared in addition to those listed above. This is appropriate when the procedures to be followed to involve outside groups are not fully described in the detailed work plan. Local agencies may prepare methodology reports on these or any other subjects where local concerns dictate a particular emphasis.

Results Reports. The series of results reports provides detailed documentation for each of the key technical areas, presenting findings and explanations in detail sufficient to serve as back-up to the draft EIS. Thus, the results reports will be more detailed than the draft EIS, which will summarize and explain the analysis results and focus on those findings which are most significant. If necessary, they also highlight any changes in the methods and assumptions presented in the methodology reports.

Five results reports are typically prepared to document the analysis and the refinement of alternatives:

- o Social, Economic, and Environmental Impacts and Mitigation
- o Capital Cost Estimates
- o Operating and Maintenance Cost Estimates
- o Transportation Impacts
- o Financial Feasibility

A report on the results of the evaluation is normally not necessary since it would typically be nearly identical to the evaluation chapter in the draft EIS.

1.4 Citizen Participation and Private Sector Involvement

Public involvement is a very important part of project planning. While it is important that the study develop sound and unbiased technical information, the development of this information alone is not sufficient to insure a successful planning study. It is also vital that the analysis respond to issues of concern to the public, and that the technical results be properly presented to the public and interested agencies. Many sound proposals for needed projects have never survived public and agency review because public involvement was ignored or left to the last minute. A successful public involvement program requires a great deal of planning and advanced preparation. Proper coordination requires contacting and involving the public and interested agencies and organizations early in the process and throughout the study, and doing everything possible to gain and keep the confidence of all participants.

The citizen and agency participation process has two primary objectives:

- o to ensure that information is made available to other agencies and the public throughout the duration of project studies, and that such information is as timely, clear, and comprehensive as practicable;
- o to ensure that interested parties — including local governments and metropolitan, regional, State and Federal agencies; the public; and private enterprise — have an opportunity to participate in an open exchange of views throughout the analysis.

The scoping process should lay the foundation for a successful process of public and agency involvement which will continue throughout the study. The continuing process will be multidimensional with a variety of groups and individuals participating in different aspects of the study. By encouraging citizens and organizations to express their opinions and concerns through an open exchange of views, all of the significant issues should be identified which will insure that all impacts are addressed and that all of the information necessary for decision-making is developed.

Each project planning study will disseminate information on the alternatives being considered, the scope of the analysis and the methods to

be used, and the costs and impacts. This information is required in order for the public, policy-makers, and organizations to participate in the selection of a preferred alternative. Additional information or more detailed information will also have to be developed to respond to the concerns of particular groups or to reflect the unusual impacts of one or more alternatives being considered.

Approach. The citizen and organizational participation process normally consists of a mix of formal and flexible techniques. The formal techniques include a scoping meeting to initiate the formal participation process and a public hearing during the circulation of the draft EIS. Between these formal events, the study should include an on-going process which consists of less formal but no less important activities involving the public.

Each local area will probably utilize a variety of techniques for the ongoing, informal program. Frequently used techniques include public meetings and workshops, advisory panels, technical groups, newsletters, surveys, press releases, presentations, transit advertising, etc. One of the most successful approaches is to have the agency responsible for that issue perform that part of the analysis — this should insure that all of the agency's concerns are addressed. Another successful technique is to provide periodic status briefings to interested groups, such as the Chamber of Commerce or neighborhood organizations, and to request their review and comment on interim study products. Each of these approaches should be supplemented with extensive personal contacts to insure that all of the concerns of the organizations are addressed as the study progresses. Wherever possible, existing community institutions should be utilized, rather than creating new groups and organizations.

The exact number and composition of the participation will vary from study to study depending on the characteristics of the local community and the impacts of the alternatives. Each study is likely to have a citizen advisory committee, a policy advisory committee, and one or more technical advisory committees. In addition, informal groups will probably be formed to deal with specific issues such as private participation, historic preservation, parkland impacts, business disruptions during construction, etc. For example, it is likely that representatives of the local agency, their consultants, the State Historic Preservation Officer, and other groups interested in historic preservation could meet informally and irregularly concerning impacts on historic properties.

There are several points during the course of project planning when public involvement is particularly important. Among the key milestones where information should be shared and comments requested are:

- o detailed definition of alternatives,
- o methods reports,
- o results of the environmental, patronage, and financial analyses,
- o results of the capital and operating cost analyses,
- o evaluation of alternatives.

A plan for informing and involving outside groups should be prepared during the scoping process and included in the detailed work plan or be issued as a separate methodology report. This plan would identify the techniques to be used as well as the points in the process when public involvement will be solicited.

Private Sector Involvement. The private sector can participate in the development and operation of mass transit improvements in many ways. Private transit providers can operate buses or rail vehicles under contract to local public agencies, or through a franchise arrangement. Transit operators may use private contractors to maintain facilities and equipment. Land owners and developers may provide funds for capital and operating expenses, or may agree to offer feeder services to fixed guideway transit operations.

Three provisions of the Urban Mass Transportation Act address the role of private enterprise generally, and private transportation providers specifically, in UMTA's assistance programs:

- o Section 8(e): Directs UMTA grantees to encourage the maximum feasible participation of private enterprise in the plans and programs funded under the Act.
- o Section 3(e): Prevents the Secretary from approving projects to acquire an interest in a private mass transportation company, to purchase a private mass transportation company's facilities or other property, to construct or improve any facilities or other property acquired from any such company, or to support facilities and equipment that operate in competition with an existing private mass transportation company, unless certain conditions are met. One of these conditions is that the program of projects provides for the maximum feasible participation of private mass transportation companies.
- o Section 9(f). Requires each recipient of Section 9 funds to develop a program of projects through a participatory process that involves affected citizens, private transportation providers and local elected officials. The recipient must consider comments and views, particularly those of private providers, when preparing the final program for submittal to UMTA.

UMTA's October 22, 1984 Policy on Private Enterprise Participation in the Urban Mass Transportation Program (Appendix B) also provides guidance on how the private sector should be involved in project planning.

In view of these requirements, it is important that local agencies give careful consideration to involving the private sector in project planning. Representatives of private transportation providers and business interests should be added to mailing lists and informed of opportunities to express their views on the alternatives, the technical analysis process, and the assessment of impacts. They may also be invited to participate on any steering or technical committees established to guide the study.

In the technical studies performed in support of project planning, there are at least three points where the opportunities for private participation should be taken into account:

- o During the development of alternatives, existing private transit services should be examined as well as opportunities for the expansion of these services.
- o Calculations of capital and operating costs should take into account opportunities to reduce cost through contracting out.
- o The financial analysis should investigate funding options that entail private contributions for capital and/or operating expenses.

1.5 The Scoping Process

Scoping is the first step in project planning. The scoping process establishes the work to be done as part of the project planning, defines the alternatives to be examined, identifies the impacts to be considered, and establishes the goals and objectives that will guide the evaluation of alternatives. Key issues are identified, and the technical analyses that will be done to address these issues are defined.

Scoping includes the active consultation and participation of the public and all interested agencies. By requesting the input of citizens and organizations early in the process, the local lead agency will insure that:

- o The public and agencies are involved in setting the direction of the study including the determination of which alternatives, issues, and impacts are to be studied;
- o All reasonable alternatives and potentially significant impacts are known and are examined from the beginning of the process;
- o Insignificant issues and impacts are eliminated early in the process;
- o The roles of the appropriate agencies are identified and agreed to at the beginning of the study.

But public and agency involvement is only a part of what should occur during scoping. The scoping process provides the setting for reviewing the availability of data and models for addressing the various technical issues that the study will address. It provides an ideal opportunity to clearly define the goals and objectives that will be used to establish the purpose and need for transportation improvements in the corridor and to evaluate alternative ways of addressing those needs. This sets the stage for finalizing the study work plan that fully recognizes the technical activities that need to be performed as part of the study.

Before the introduction of the scoping process requirement, there were many instances of poor communication between the local lead and other agencies with an interest in a particular project. In these cases, significant issues of interest to a particular agency could easily be overlooked during the preparation of the draft EIS. Many times these omissions were not discovered until the draft EIS was circulated, causing ill-feeling between agencies and sometimes a great deal of extra work. The scoping process is designed to eliminate this problem by requesting, in the beginning, the comments and participation of the public and all agencies with a possible interest in the impacts of the alternatives. Not only does this insure a more complete document, it weakens the case for insignificant issues that may be raised late in the process.

As one of the first steps in the scoping process, the local lead agency should prepare a list of all potentially interested organizations, agencies and individuals. This list is crucial to the success of the citizen and public agency participation process. The list should include local elected officials, neighborhood groups, civic groups, professional organizations, business organizations, private operators, major institutions, transportation advocacy groups, environmental organizations, etc., as well as all local, State, and Federal agencies with a possible interest in the project. Efforts should be made to identify a contact person in each organization so that personalization of the process can be initiated.

Notice of Intent. When a project planning study involves alternatives that require preparation of an EIS (see Chapter III.1), a Notice of Intent is published in the Federal Register to announce that UMTA intends to prepare an EIS. The Notice should not appear until UMTA and the local lead agency are in general agreement on a draft work plan for the study and the range of alternatives to be presented at the scoping meeting. The Notice of Intent briefly identifies the corridor, discusses the preliminary alternatives and their expected impacts, summarizes the purpose of the scoping process, and requests the participation of the public and public agencies in determining the scope of the study (including the alternatives and potential impacts considered). The Notice should also contain the name, address, and phone number of an UMTA and local person who will receive comments and answer questions. The time, location, and date of the scoping meeting should be featured prominently in the Notice. Appendix H contains a sample Notice of Intent.

At the same time as the Notice of Intent is published in the Federal Register, the local lead agency should notify interested parties of the intent to initiate an EIS by publishing notices in local newspapers and sending letters to all potentially interested parties. Additional methods to inform the public are also encouraged such as press releases, press briefings, transit ads, fliers, etc. All of these notices contain about the same information as the Federal Register notice. But the local notice and the letters to interested parties should contain, in addition to the information in the Notice of Intent, a map of the corridor showing possible alternative alignments, and other expansions as appropriate.

The UMTA Regional Office is responsible for preparing the Notice for the Federal Register and for the review of local notices. Normally, the Federal Register notice is drafted by the local agency and edited by the Regional Office to insure the proper content and format. After the draft Notice is reviewed by the Regional Counsel, three original copies are signed by the Regional Administrator. These three copies are sent to the UMTA Chief Counsel's office, which will forward them to the Federal Register.

The local and Federal Register notices should be published at least fifteen days prior to the scoping meeting, and at least 30 days should be allowed for the receipt of written comments. Three days should be allowed between the date the Federal Register receives the Notice and the date it is to appear in print.

The Scoping Meeting. The scoping meeting is the formal commencement of the public and organization participation process. However, the preparation and coordination for the study will have begun long before the formal meeting. The local decision to undertake project planning will be made in coordination with several agencies, and in many cases with the participation of the public. The scoping process will be used to expand the past consultations into a formal and comprehensive participation process.

One of the main purposes of the scoping meeting is to encourage the participation of citizens and agencies in the preparation of the draft EIS. Two elements of the meeting are important in accomplishing this goal. First, the more information presented, the more likely it is that interested parties will be able to provide informed and useful comments. Second, the participants must be made to feel welcome, and to feel that their participation is valued and will be incorporated into the study.

The scoping meeting is conducted by the local lead agency in a location convenient and well known to all interested parties. The timing should also be convenient. Vacation and holiday periods should be avoided if possible. Many local areas have found it useful to hold the scoping meeting in two sessions, one during working hours for agency representatives, and another in the evening when the general public is more likely to be available.

Every effort should be made to encourage all attendees to sign up for study mailings and to participate in the citizen advisory groups if they are interested. Local staff people should attempt to establish a personal relationship with all the attendees, especially with the representatives of those agencies whose approval of the document is required or desired. Therefore, the local agency should be prepared to have sufficient staff and materials to insure that all attendees are made to feel welcome, that all questions are answered, and that all interested individuals and organizations are identified and informed of the role which they can play in the study.

Handouts should be available documenting the process and the study. These materials should include maps of the corridor, the alignments of the alternatives, a statement of the need for a fixed guideway in the corridor, definitions of the conceptual alternatives, impacts to be examined, the study schedule, the public participation plan and contact person(s), and the methodology reports, if available. The schedule should highlight the key milestones of the study, especially those where citizen or agency input or approval are expected.

Although the study scope, alternatives, and impacts are tentative at this point, presentations at the scoping meeting should give the public as much useful information as possible. At a minimum, the public should be informed as to the alternatives proposed for study, the impacts to be examined, and the impacts that are not likely to be considered unless there is sufficient interest or new information. The local lead agency should also discuss the methodologies it proposes to use for obtaining additional public input and for disseminating information. When significant environmental issues are anticipated, the lead agency should be prepared to explain the approach it plans to take to predict the impacts of each alternative. Maps should also be provided to indicate the seriousness of the expected impacts by geographical area. It is very likely that the methodologies for determining each impact will vary depending upon the severity of the impact. By presenting maps which show a preliminary estimate of the severity of the impacts, the public will be better able to relate to these impacts and therefore be better able to participate intelligently in the study.

Adequate time should be taken to prepare for the scoping meeting. The local lead agency will need to develop a clear and concise summary of the proposed study emphasizing the role of the public in the decisionmaking process. Maps, summary charts, visual aids and handouts also need to be prepared to enhance the understanding of the audience.

It must be emphasized that the purpose of the scoping meeting is not to seek public comment on which alternative should be selected. Citizens attending scoping meetings are often confused as to the purpose of the meeting, and use it as an opportunity to express preference to one or more of the alternatives, or to oppose others. The purpose of the meeting, however, is to help establish which alternatives will be studied, not which one will be advanced toward implementation. Nevertheless, comments favoring or opposing one or more alternatives can be useful in revealing issues that the study will need to address. To help focus the scoping meeting on the how the study should be designed, the local lead agency often needs to stress the purpose of the scoping meeting in its prepared remarks, and reiterate this point throughout the meeting. This will help ensure that attendees understand that the meeting will not immediately lead to the choice of a preferred alternative, and that they will have additional opportunities to participate before decisions are made.

Figure II.1-3 provides a suggested agenda for a scoping meeting together with some suggestions for what should take place during each part of the meeting.

Reports Resulting from Scoping. It is not necessary to prepare a transcript of the scoping meeting, but the results of the meeting should be documented in a technical report. The report would cover the major issues raised at the scoping meeting, alternatives recommended for consideration, and impact areas proposed for detailed analysis or special studies. Impact areas that are not germane to the decision at hand, and those that require discussion in the EIS but no detailed analysis, should also be identified. The scoping report should help the local lead agency prepare a detailed work plan to guide the remainder of the project planning study.

Several additional reports are normally produced at the conclusion of scoping. Three that are of interest to UMTA are:

- o Final Detailed Work Plan. Guidance on the preparation of the detailed work plan is provided earlier in this Chapter.
- o Conceptual Definition of Alternatives. This will be an update to the conceptual definitions transmitted with the request to initiate alternatives analysis. The update will reflect comments made at the scoping meeting.
- o Draft of Chapter 1 of the draft EIS, "Purpose and Need." This chapter describes the problem in the corridor and explains why a fixed guideway solution is being considered. By establishing the "purpose" of the study early in the process, the analysis can be guided to its conclusion without unnecessary deviations. The draft statement of "Purpose and Need" can be edited later in the study.

The detailed work plan and conceptual definition of alternatives are transmitted to UMTA for review and concurrence. Once concurrence has been obtained, the study moves into the second step, development of alternatives and analysis methodologies.

Figure II.1-3: Suggested Agenda for a Scoping Meeting

1. Welcome and Introductions.

2. Outline of the Agenda.

3. UMTA Statement.

(A representative of the UMTA Regional Office will present a statement similar to the one Appendix I. The statement will describe the UMTA perspective on major capital investments and the UMTA project development and decision-making process.)

4. Local Official Presentation.

(This generally covers local perspectives on alternatives analysis and the local decision process. Opportunities to serve on advisory and technical committees are often emphasized.)

5. Description of the Study.

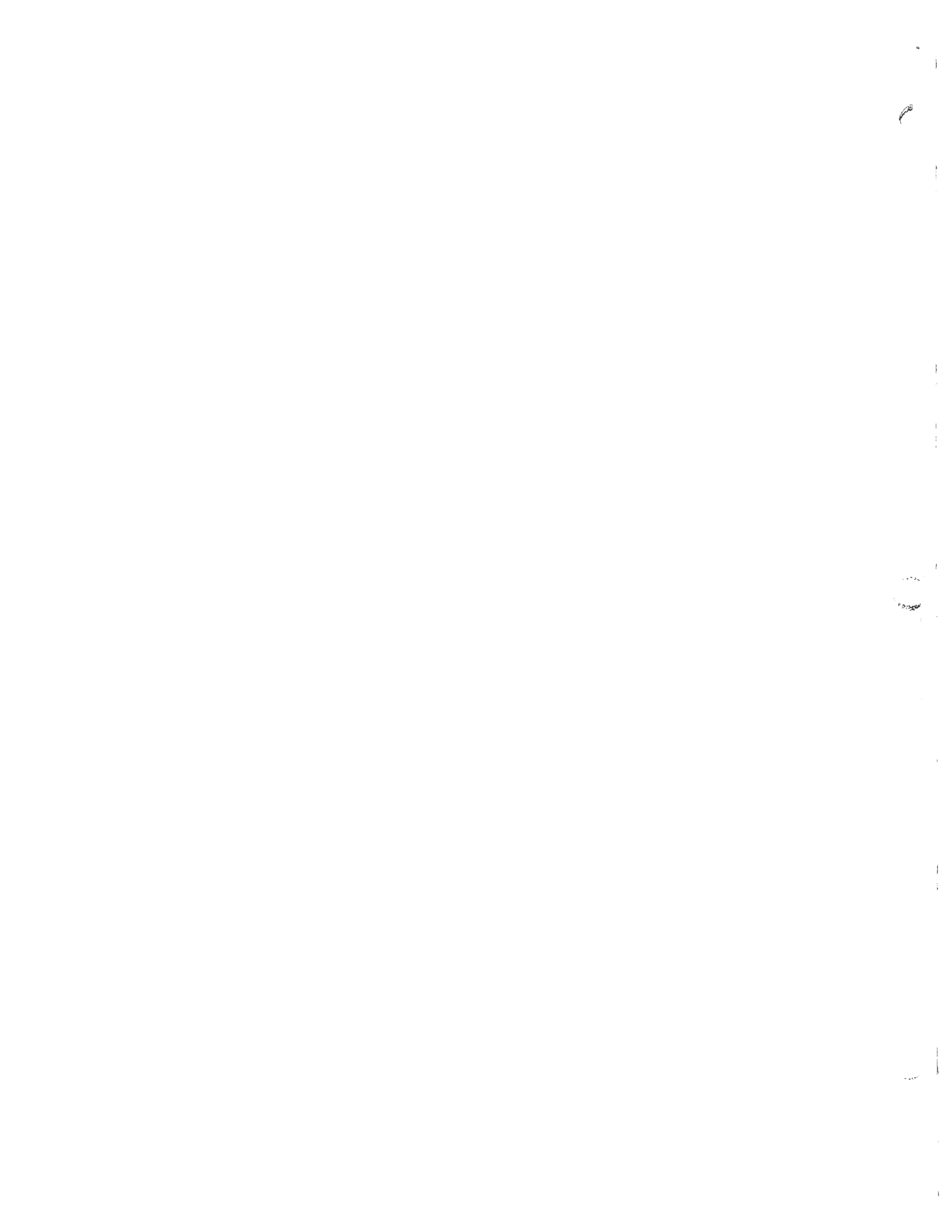
(Local staff review the proposed scope of work for the study, covering such topics as:

- o a description of the corridor and its transportation problems,
- o the conceptual alternatives to be studied and reasons other alternatives have been eliminated,
- o the potential impacts to be analyzed,
- o the relationship between this study and other projects,
- o study schedule with emphasis of decision points and opportunities for public involvement, and
- o roles and responsibilities of participating agencies.

This presentation is key to the success of the scoping meeting, the sponsoring agency should emphasize that the study scope, alternatives, and potential impacts are tentative at this point and will be changed to reflect the comments of the public and other agencies.)

6. Comments, Responses, and Discussion.

(This part should begin with a reminder that the purpose of the meeting is not to select or endorse a particular alternative, but to make sure that the study includes the all reasonable alternatives and impacts. Positive suggestions should be encouraged. Participants who endorse or oppose an alternative on particular grounds should be viewed as indicating impacts to which the analysis should be sensitive. Small group working sessions may be used to discuss the concerns of particular groups or agencies in detail. Blackboards are often used to summarize the comments and to show how the work scope will be modified to incorporate the concerns expressed.)



II.2. Development of Alternatives

"Knowin' what to throw away, knowin' what to keep."

- from The Gambler, sung by Kenny Rodgers

The selection of the alternatives to be considered in project planning is perhaps the single most important activity in the entire effort. Without a set of alternatives that is structured to isolate the differences between options and to highlight the trade-offs inherent in the selection of a preferred alternative, even the highest quality technical analysis cannot produce the full set of information needed by decisionmakers.

The development of alternatives has been given careful consideration in the preparation of this guidance. The process that has resulted does not require any specific set of alternatives. Rather, it outlines the steps to be taken (1) in the development of a set of alternatives that is relevant to the decision at hand and (2) in the definition of each alternative to optimize its performance within the limits of its technology and operating characteristics. The process provides for rigorous local and UMTA review of the alternatives as they are identified and refined. It relies on the collective good judgment of technical staff and local officials, as well as other agencies and the public who are involved through the public participation program.

2.1 Developing Alternatives through a Narrowing of Options

Throughout the project development process -- from system planning, through corridor or project planning, through preliminary engineering -- the primary nature of the decisions to be made is a narrowing of options toward selection of a specific project for implementation. In many cases, decisionmakers face initial questions on priority corridors, then proceed through the selection of a transit mode and general alignment, and finally select a set of design standards and a specific alignment.

The project development process is designed around these decisions. It is structured so that the options considered and the technical work required can be focused only on the decision at hand, avoiding unnecessary grappling with issues that are relevant only at later stages. A key part of the process, then, is the definition of alternatives only in the detail needed to support the decisionmaking at hand. For example, in decisions on corridor priorities, it is unlikely that the specific location of each station on a guideway alternative is necessary to judge the relative need and potential for improvement in alternative corridors. However, in selecting a particular alternative for the priority corridor, the cost and environmental impacts of various station and park/ride options requires that the stations be defined more specifically. Finally, before determining the specific design for stations and sizes of park/ride lots, it is necessary to define and analyze design options in yet greater detail.

It is useful to review the setting in which project planning is conducted. Ideally, the analysis proceeds from a sound system planning effort that has given adequate consideration to systemwide and regional issues. These issues include

(1) the interdependence of corridors in terms of travel demand, system design, and system operations; (2) the feasibility of various mode and alignment combinations in each corridor in terms of their engineering, cost, operational, and environmental impacts; and (3) the regionwide financial implications of various investment levels in each corridor. Also ideally, the system planning effort recognized the difference between the foregoing of precision and the sacrifice of accuracy in the technical work, so that estimates of costs and impacts, while coarse, are at least "in-the-ballpark" indicators of the potential merits of the alternatives.

A rigorous system planning effort of this nature is of significant benefit in the initial stages of project planning since it provides the basis for selection of the small set of alternatives to be considered. Without such an effort, the initial phases of the study may necessarily revert to a reappraisal of system planning issues, redoing much of the technical work and delaying the start of corridor planning. Where regional systems are contemplated, a sound system planning effort will also have identified considerations beyond the priority corridor and enable analysts to avoid alignment and design decisions that preclude future options.

There are situations, however, in which the transition from system planning to project planning does not proceed along this ideal course. Two fairly frequent situations can lead to other sequences. First, in cases where the system planning effort has dealt with a large number of possible corridors and options, there may have been only limited screening of the mode and alignment possibilities in the corridor ultimately selected for initial project planning efforts. If the remaining screening effort is complex, it may be desirable to do a "transitional" study for the specific purpose of narrowing the range of alternatives. Where the screening effort is less difficult, it may be carried out as an initial step in project planning. The second situation leading to a less-than-ideal sequence is where an alternative is generated outside of the normal planning process. Where a right-of-way becomes available, for example, the idea of reserving it for a transit guideway may be a real but unforeseen option. A transitional study is usually needed in this situation to identify reasonable options for the corridor and get a preliminary indication of the potential merits of investment in a guideway.

The central task in project planning is to identify one or more alternatives that are the most desirable solutions to problems identified in the corridor. Because the analysis will result in the local selection of a preferred alternative, it is necessary to develop reliable information on costs and impacts so that the selection is not affected by errors in the projections. Fortunately, since there are relatively few alternatives, it is possible to consider each in substantially greater detail. Reasonably detailed analysis of the physical characteristics, operating plans, patronage and revenue implications, and environmental impacts of each option is appropriate.

At the same time, however, it is important to recognize that the alternatives need not be defined in the detail required to advance them into final design and construction, nor to complete the environmental analysis. These tasks are left to preliminary engineering, in which detailed specifications for the preferred alternative and the Final EIS are developed. Such issues as the specific alignment through downtown (2nd Street versus 3rd Street, for example), may well

be resolved in preliminary engineering if they have only minor differences in cost and environmental impact. In many cases, unnecessary work can be avoided in project planning with a clear understanding of the difference between issues germane to the selection of an alternative and issues related to its ultimate construction.

In summary, then, one important consideration in the development of alternatives at any stage of the process -- and particularly in alternatives analysis -- is the appropriate detail in which they are defined. In system planning, the detail is only that necessary to explore the potential merits of the alternative as a solution to problems in a corridor. In alternatives analysis, it is the detail necessary to support a sufficiently reliable analysis so that a mode and alignment alternative and a financing plan can be selected with confidence in the projections of costs and impacts. In preliminary engineering, it is the detail required to select the design specifications and operating plan, and to accurately estimate costs, so as to obtain all necessary funding commitments and carry the project into final design.

2.2 Identifying the Set of Promising Alternatives

To ensure a well structured set of alternatives for project planning, eight key points should be considered on the relationship between the alternatives included in the set. These points are used by UMTA in assessing the alternatives proposed for consideration in alternatives analysis.

- 1) The set of alternatives must include the necessary baseline options.

For studies that will produce an EIS, environmental requirements mandate the consideration of a Do-Nothing alternative as the environmental baseline. Further, any study considering major cost options should also include an option that optimizes transportation facilities and services in the corridor but stops short of major capital expenditures. For alternatives analyses, this option is labeled the transportation system management (TSM) alternative.

- 2) The alternatives should include all reasonable modes and alignments, but only those that are reasonable.

This consideration, founded on Council on Environmental Quality regulations (40 CFR Part 1502.14), addresses both the addition and deletion of alternatives. It requires the addition of alternatives that make technical sense in terms of addressing the corridor's transportation problems, even where those alternatives may not be consistent with pre-existing notions on the desired project. Equally important, it provides a basis for excluding alternatives that are simply not appropriate for the setting. Thus, for example, a study considering an extension of a heavy rail line would not be likely to include light rail options, but might include highway and bus options to improve access to the current terminal. Further, local analysts should avoid carrying clearly uncompetitive options through project planning simply because their elimination might be opposed by a few individuals or groups. The postponement of this decision to the end of project planning is unlikely to make it any easier, and will increase the time and cost of the analysis. Therefore, where sound technical information indicates, and a majority of technical and policy participants agree that an option is undesirable, every effort should be made towards its early elimination.

Financial feasibility should be one of the considerations in assessing the reasonableness of an alternative. Where the resources needed to build and operate an alternative clearly exceed the amount of funding that can realistically be anticipated, there are grounds for eliminating an alternative despite its potential transportation or other merits. UMTA has carried this consideration one step further for new start projects. On several occasions, the agency has taken the position that alternatives that fail to meet the cost-effectiveness thresholds should not be advanced through the alternatives analysis process unless they are to be fully financed without UMTA funding.

- 3) Alternatives designed to address differing goals and objectives should be included.

The study area is likely to be composed of a variety groups and individuals with divergent goals, values, and needs. Some may stress the achievement of mobility goals, while others may emphasize the need for environmental quality or fiscal responsibility. By including alternatives that respond to these different goals, the trade-offs inherent in choosing a preferred alternative can be made more explicit, and citizens of varying viewpoints can be brought into the process. Similarly, the corridor is likely to contain a variety of travel markets, such as travel by particular population subgroups, travel within or between specific geographic areas, or travel for particular purposes. No one alternative is likely to serve all of these markets well. It may then be useful to define different alternatives for different travel markets. For example, a rail line with closely-spaced stations may be included in corridors with a large number of relatively short trips. A second alternative, perhaps using the same technology and alignment, might be developed with fewer stations to better serve longer distance trips.

- 4) The set of alternatives should include all options that have a reasonable chance of becoming the locally preferred alternative.

A locally preferred alternative emerges from the evaluation of mode and alignment options in project planning. In cases where an alternative is chosen that is significantly different from any option considered during alternatives analysis, it may be necessary to do additional analysis, and possibly prepare a supplemental DEIS, before proceeding to preliminary engineering. The delay associated with these additional analyses can possibly be avoided if the initial set of alternatives is developed with care. This care extends to the service policies within which the alternatives are defined. If, for example, all of the alternatives in the DEIS assume a large systemwide service expansion that increases the operating deficit substantially, the selection of one of the guideway options without the service expansion would require additional analysis since the environmental impacts and cost-effectiveness of the selected alternative may be very different from those of any previously considered option.

- 5) The alternatives should encompass an appropriate range of options without major gaps in the likely costs of the alternatives.

In most cases, it is not desirable to structure the set of alternatives to include, for example, several relatively low cost options (less than \$100 million) and several high cost options (greater than \$500 million) with no

intermediate cost alternatives. There are several reasons that this outcome is undesirable. First, it is likely that one or more potentially cost-effective options do exist within the gap; omitting them would distort the analysis. Second, the gap limits the flexibility of local decisionmakers in choosing an alternative. Third, the exclusion of intermediate-cost options risks a result where no alternative has a significant effect on the problems in the corridor and is financially feasible.

The analysis of shorter (i.e., "minimum operable segment") options is a ready means of including intermediate-cost alternatives. In alternatives analysis and preliminary engineering, UMTA urges consideration of one or more minimum operable segment options as separate alternatives so as to provide flexibility in any full funding negotiations that may follow.

- 6) Where questions remain on feasibility of specific alternatives, other alternatives should provide related fall-back options.

While most questions on feasibility should be resolved before the initiation of project planning, there are cases where alternatives may turn out to be infeasible. In these situations, the set of alternatives should include other options that are derived from the potentially infeasible alternatives but include adjustments that address the source of the potential problem. For example, a busway alternative may lead to a significant increase in the number of buses in the downtown during rush hours and the detailed analysis to establish the capacity of downtown streets to handle the buses will be done during project planning. If it is likely that existing streets may not have sufficient capacity, a second alternative that incorporates a transit mall or some other distribution option should be considered. A second example is a situation in which there is uncertainty of the future availability of funds for operations, perhaps where a referendum is needed to expand existing sources of funds. In this case, while some of the alternatives may well exceed the financial capacity of current funding sources, the baseline alternatives and a number of the investment options should be financially feasible with existing sources of funding.

- 7) The number of alternatives should be manageable, in the sense that decisionmakers can realistically be expected to understand the implications of each and make a thoughtful choice.

The number of alternatives can easily reach unmanageable levels when there are a variety of physical and operational elements that can be packaged together in a variety of ways. Testing all of the possible combinations and permutations will quickly consume available resources, and may overburden decisionmakers with more information than they can comprehend. UMTA stresses the analysis of a small set of promising alternatives in order to keep the technical and decisionmaking process manageable. There is no magic number of alternatives, beyond which the number is clearly excessive, but experience has shown that the process can become unwieldy when the number of alternatives exceeds 8 to 10.

One way to reduce the number of alternatives is to include a screening step early in the process. Clearly inferior combinations can be eliminated without detailed analysis. Another way is to perform a series of sensitivity analyses to investigate the impacts of changed conditions that may affect a number of

alternatives. By presenting the results of these analyses as variations on a theme, rather than as entirely new alternatives, the number of alternatives can be kept reasonable while still providing decisionmakers with necessary and useful information.

2.3 Defining Individual Alternatives

Several key considerations also apply to the definition of each alternative to be considered. For alternatives analyses, UMTA uses these considerations in evaluating the adequacy of the alternatives proposed for analysis.

- 1) The alternatives must, within the limits of their technology, respond to the transportation problems identified in the corridor.

The single most important consideration in the definition of alternatives is that they must address the goals, objectives, and specific transportation problems identified in the corridor. Only with a strong sense of "solutions" to specific problems can a set of alternatives be evaluated meaningfully. This linkage can be illustrated by examining the likely configuration of a busway alternative in two corridors with very different transportation problems. In one corridor, a strong focus on travel to downtown together with severe peak-direction highway congestion on the inner segments of highway facilities would suggest that a busway alternative be configured initially to provide one-way service without intermediate stations and be limited in length to the inner portions of the corridor. In contrast, a corridor with major activity centers outside of downtown and substantial highway congestion throughout the corridor in both directions would suggest a more elaborate two-way busway with on-line stations.

A target year for the analysis must be chosen as part of the effort to define transportation problems. If too short a planning horizon is used, the project may not be designed with sufficient capacity to accommodate future growth. As the planning horizon is extended, projections of future demographics and traffic congestion levels become increasingly speculative. There is also the question of whether funds should be directed toward solving existing or future problems. As a compromise on all of these considerations, a planning horizon of approximately 15 years is used as the primary basis for all alternatives analysis studies and new start ratings. This is supplemented with an opening year forecast, principally for financial planning purposes. At local option, other long range analysis years (beyond 15 years) may be added to the analysis. This may be necessary, for example, in cases where the Federal Highway Administration serves as joint lead, since highway projects are generally planned with a 20 year horizon, or where the financing strategies are expected to involve longer maturation periods (e.g., a 30-year bond issue).

- 2) Each alternative should be defined to optimize its performance in the corridor.

Since different technologies have different strengths and limitations, this optimization may in some cases lead to alternatives that have different alignments, lengths, and operating plans. For example, in the first corridor used in the example above, a rail alternative may use a significantly longer alignment to reach a logical terminus point for transfers to feeder buses. Thus the rail alternative would be longer and provide two-way service with

intermediate stations while the busway alternative would be relatively short and provide peak-direction non-stop service, possibly with High Occupancy Vehicles (HOVs) permitted in addition to buses. The differences between these two alternatives are a direct reflection of the different nature of their basic technologies. These differences do not violate any notions of "comparability" of the alternatives. Indeed, to require the busway in that corridor to mimic the physical and operating characteristics of the rail option would clearly risk a resulting busway alternative that would be significantly less cost-effective than the shorter, one-way facility.

- 3) The policy and land use setting in which the alternatives are defined and analyzed must be unbiased and consistent across the alternatives.

Since a primary purpose of the project planning analysis is to select a mode and alignment alternative, it is necessary to hold the policy setting constant so that the impacts of the mode and alignment alternatives can be isolated. Service and fare policies should be defined in broad terms and then applied consistently across all alternatives. For example, a fare policy that calls for a \$.25 transfer fare and a \$1.00 fee at park/ride lots means that all alternatives will have these transfer charges and parking fees. If fare policies were to differ across alternatives, it would be difficult to determine whether an alternative that recovers a higher percentage of costs from the farebox does so because of the operating efficiency and patronage attraction of the alternative, or because it has a different fare structure. Similar considerations exist regarding land use policy. If land use assumptions differ among the alternatives, it would be difficult to isolate the effect of the alternatives themselves from the impact of the assumed land use changes. Appropriate sensitivity analyses may be included in the study, if desired, to explore the implications of different service, fare, and/or land use policies.

- 4) The alternatives must be defined in all dimensions, including their operating plans, institutional setting, and financing strategy.

In project planning, an alternative is defined in terms of its mode and general alignment the policies, institutions, and financial setting within which it would operate. Table 2-1 identifies these dimensions. Mode is defined to include technology, degree of right-of-way separation, and the operating characteristics of both guideways and feeder services. Thus, in addition to the obvious technology differences, alternatives can be different to a very significant extent in their operating policies. Continuing the example above, the one-way HOV-way would be a distinct alternative from a two-way facility limited to buses only.

General alignment is defined to include the approximate horizontal and vertical alignment, approximate station locations, and length. Thus, major shifts in horizontal alignment, large variations in the lengths of segments with different vertical alignments, significant changes in overall station spacing, and major increments in the length of the facility, would lead to separate alternatives. Some of these variations are not so obvious as others, but can lead to substantial difference in the alternatives that have caused past studies to expand the set of alternatives fairly late in the effort.

The institutional setting for project implementation and operation also needs to be defined for each mode and alignment alternative. Institutional factors to be

Table 2-1. Dimensions for Defining Alternatives

Dimension	Characteristics	Options
Mode	<ul style="list-style-type: none"> ○ Technology ○ Degree of Right-of-Way Separation ○ Operating Characteristics 	<ul style="list-style-type: none"> ○ Bus ○ Rail ○ Automated Guideway ○ Highway ○ Etc. ○ Mixed Traffic ○ Separation except at Intersections ○ Exclusive ROW ○ Local vs. Express ○ Stations vs No-Stop ○ Integrated Feeders vs. Transfers ○ Single vs. Double Lane/Track ○ Etc.
General Alignment	<ul style="list-style-type: none"> ○ Horizontal ○ Vertical ○ Station Locations ○ Length 	<ul style="list-style-type: none"> ○ Streets ○ Medians ○ Rights-of-Way ○ Elevated ○ At-Grade ○ Open Cut ○ Subway ○ Parking Provisions ○ Bus Transfers ○ Accessibility ○ Alternative Terminus Locations
Policies	<ul style="list-style-type: none"> ○ Operations ○ Fares 	<ul style="list-style-type: none"> ○ Service Standards ○ Loading Standards ○ Etc. ○ Flat ○ Zone ○ Distance-Based ○ Transfer Charges ○ Park/Ride Lot Fees

Table 2-1 (cont.): Dimensions for Defining Alternatives

Dimension	Characteristics	Options
Institutional Arrangements	<ul style="list-style-type: none"> o Legislative Authorities o Labor Agreements o Role of Private Sector 	<ul style="list-style-type: none"> o Existing agencies o New agencies o Legislative changes o Existing agreements o New agreements o Public implementation and operation o Turnkey o Franchise o Contracting out
Financing Strategy	<ul style="list-style-type: none"> o Capital Financing o Operations Financing 	<ul style="list-style-type: none"> o Pay as you go o Debt o Privatization o Farebox recovery o Public subsidy

considered include the roles and responsibilities of public agencies, the need for new legislative authorities, labor agreements, and the role of the private sector. For the purpose of evaluating mode and alignment alternatives, the institutional setting should be unbiased and consistent across all alternatives, but there may also be a parallel need to consider optional institutional arrangements, and one or more additional alternatives may need to be defined to explore these options. Thus, the project planning study may include two alternatives that are identical in terms of mode and alignment, but that have different public or private entities responsible for project implementation or operation, or that have different assumptions regarding labor agreements.

The financing dimension reflects the fact that the transit alternatives can be financed through a range of public, public/private, or private sector strategies. These strategies will generally include one or a combination of pay-as-you-go, the issuance of debt, and privatization. The analysis of optional financing strategies must be performed in such a way that it does not bias the analysis of mode and alignment alternatives, or introduce a large number of new alternatives to be carried through the study. The use of carefully designed sensitivity analyses or special studies may be the most practical approach. Once a financing strategy or combination of strategies has been selected, it is necessary to ensure that there is sufficient revenue to support that strategy, which may entail the analysis of alternative revenue sources (see Chapter II.8).

The dimensions noted above are not necessarily independent of one another. In some urban areas, for example, public agencies have been established with the authority to implement only certain transportation technologies. The need to consider new institutions or legislation would depend upon the range of alternatives deemed to be reasonable in the corridor. There is a strong linkage between the alignment and financing options. To the extent that one technology or alignment alternative costs more than another, new financial strategies may need to be explored. An agency's ability to finance a project with joint development revenues may well depend upon finding a suitable alignment and station locations. These interrelationships should surface during the project planning phase to ensure that a coordinated package, covering all dimensions, emerges from the study.

- 5) To the extent possible, the alternatives should be designed from the start with environmental considerations in mind.

Certain environmental statutes and executive orders mandate the avoidance of parks, historic sites, wetlands, floodplains, etc. except under specified conditions. These requirements must be continually considered and reconsidered as candidate alignments and potential station locations are being identified. In other cases, proper sensitivity to community concerns may suggest that a particular mode and alignment is unreasonable. For example, a rail alignment should not be drawn through a noise-sensitive neighborhood, such as a university campus, if it is known that disruptive levels of noise will result. Similarly, a station oriented for feeder bus and park-and-ride access might be unacceptable in an older neighborhood with limited street capacity.

Many environmental concerns cannot be taken into account at the early stage of development of the alternatives. A detailed analysis which quantifies the impacts and the costs of avoidance or mitigation may be needed before the alignment is adjusted or other refinements are made to minimize adverse impacts. Such detailed analysis may not occur until the preliminary engineering phase of project development. Nevertheless, as the alternatives advance from the conceptual stage to the final detailed description in project planning, the relevant environmental issues should be considered in refining the alternatives at a level of detail commensurate with the detail of the alternatives.

- 6) The mode and alignment alternatives must be significantly different, or they are simply design variations that can be resolved in later engineering work.

Clearly, judgment and preliminary analysis are needed to determine whether the possible variations in the definition of an alternative should be treated as separate alternatives. For example, where two horizontal alignment options are available for a relatively short segment of a particular alternative, preliminary cost estimates and an environmental review might be useful in determining how these options should be included in the alternatives. If the alignments are not likely to be significantly different in cost, ridership, or environmental effect, they might be treated as simple design variations that can be resolved in preliminary engineering. Alternatively, significant differences between the alternatives, where the more costly options also appear to have greater benefits, would suggest that the two alignments should be treated as separate, major alternatives. Finally, a large difference between the alignments, where higher

costs or significant environmental impacts are not accompanied by higher benefits, might suggest that the more expensive or intrusive option be eliminated.

2.4 Issues in the Development of Alternatives

Although the definition of alternatives is determined largely by local conditions and local goals and objectives, there are a number of issues commonly encountered in defining and developing the alternatives. These include the nature of the Do-Nothing and Transportation System Management (TSM) alternatives, and the approach to developing operating plans for guideway alternatives that optimize their performance.

2.4(a) The Do-Nothing Alternative

The Do-Nothing alternative provides the baseline for establishing the environmental impacts of the alternatives, the financial condition of the transit operator, and the cost-effectiveness of the TSM alternative. It also establishes much of the information needed for the DEIS Chapter 1 on Purpose and Need since it examines horizon year (currently 2005) travel demand and its impact on a largely unimproved transportation system. This alternative is therefore defined to include those transportation facilities and services that are likely to exist in the forecast year. All elements of the Do-Nothing alternative must be part of each of the other alternatives.

Within these general guidelines, there are several possible definitions of the Do-Nothing option. Choice among these is determined by the local situation, particularly the degree of certainty that other transportation improvements will be made in the corridor between now and the horizon year.

The optional definitions include:

- 1) A literal interpretation that involves absolutely no improvements to transportation facilities or transit services in the corridor. Capital investments are limited to the replacement of existing facilities and equipment as they wear out.
- 2) A conservative definition that adds only "committed" improvements — typically those in the annual element of the Transportation Improvement Program or local capital programs — together with minor transit service expansions and/or adjustments that reflect a continuation of existing service policies into newly developed areas.
- 3) A more flexible definition that includes "planned" improvements — usually those included in a Transit Development Program that is currently being implemented — for which need, commitment, financing, and public and political support are clearly in place.

The first option is useful where there is a desire to demonstrate the implications of taking no action to respond to anticipated growth in the corridor. The second is usually more realistic in that it recognizes whatever improvements are essentially certain to occur because they are simply incremental

responses to growth in the corridor and have been programmed by the region. The third entails some risk in that the inclusion of "planned" improvements may lead to a Do-Nothing alternative, and consequently all other alternatives, that incorporates projects that may not happen. Since all of these definitions fall within the requirements of both the environmental process and UMTA's policy requirements, the choice of a definition is left to the joint discretion of local and UMTA staff. It must be reemphasized, however, that the choice of the third definition requires extreme care in judging those improvements that are likely to occur and have currently in place all of the elements necessary for their implementation.

The Do-Nothing alternative should generally have the same transit operating strategy as that currently in place. New bus routes may be added and existing bus routes extended, but the underlying strategy should remain the same. Thus, for example, if the current bus system is oriented toward providing radial service to the CBD, that same strategy should be assumed in the Do-Nothing alternative. Changing that strategy to, say, a grid pattern might be considered as part of the TSM alternative. The Do-Nothing alternative can then serve as a basis for evaluating the costs and benefits of a revised operating strategy.

2.4(b) The TSM Alternative(s)

Compared with a fixed guideway investment, transportation system management alternatives are relatively low cost approaches to addressing transportation problems in the corridor. They also provide a baseline against which all of the major investment alternatives are evaluated. The TSM alternative represents the best that can be done for mobility with existing infrastructure — that is, without construction of a new transit guideway. Generally, the TSM alternative emphasizes upgrades in transit service through operational and small physical improvements, plus selected highway upgrades through intersection improvements, minor widenings, and other focused traffic engineering actions. Typically, this emphasis leads to a TSM alternative that includes such features as bus route restructuring, shortened bus headways, expanded use of articulated buses, reserved bus lanes, contra-flow lanes for buses and HOVs on freeways, special bus ramps on freeways, expanded park/ride facilities, express and limited-stop service, signalization improvements, and timed-transfer operations. While the scale of these improvements is generally modest, TSM alternatives may cost tens of millions of dollars when guideway alternatives range up to several hundreds of millions of dollars or more.

Given the crucial role of the TSM alternative as both a realistic near-term package of improvements and a rational baseline for evaluation of the guideway investments, it deserves significant attention in its definition and refinement. In alternatives analyses, UMTA staff give particular scrutiny to local efforts to develop a useful TSM alternative.

In many respects, the TSM alternative is the most difficult alternative to define and develop. The potential components of the alternative are many and varied, and tend to be small in scale and widely distributed in location. The cumulative contribution of the individual actions can be hard to measure and translate into changes in travel patterns. Most importantly, since the TSM alternative is designed to represent the "best" that can be done without major new capacity

improvements, the wide variety of possible actions need to be sifted to identify a package that approximates an optimum mix of actions. This sifting requirement often leads to several iterations on the definition of the TSM alternative as components are added and deleted as the analysis proceeds. In many cases, this iterative process provides a means of sorting out questions on appropriate nationwide transit policies on service levels and fare structure. The results of this analysis then provide a sound basis on which to develop the operating plans for the guideway alternatives.

As TSM alternatives are being defined, four issues often arise: the treatment of demand management strategies, the feasibility of some TSM strategies, the assumed highway network, and the number of TSM alternatives that should be studied.

Demand Management. Most recent project planning studies have included a single TSM alternative that represents a comprehensive program of sound, low cost improvements to expand and speed existing transit service. Recent studies have not generally included non-capital actions often associated with the TSM theme — staggered work hours, road pricing, parking management, transportation management organizations, employer-based ridesharing incentives, and so forth. The thinking behind the exclusion of such demand management strategies was that was that they would rarely affect the choice of a preferred mode and alignment alternative. The evaluation process (see Chapter II.9) focuses on the differences in costs and benefits between the alternatives. If these types of non-capital strategies were included in all of the alternatives, as they would need to be to maintain a consistent policy setting, they would have little or no impact on incremental costs and benefits.

This line of reasoning overlooks the fact that these types of strategies can have a marked impact on the use of all transit alternatives. By excluding them from the analysis, an opportunity for identifying actions that might reinforce the benefits of a fixed guideway is lost. A major fixed guideway investment may provide the leverage that is needed to obtain local acceptance of demand management measures that might otherwise be politically difficult.

In the future, UMTA will strongly encourage the consideration of non-capital TSM strategies during project planning. The analysis of such strategies might be treated as a special study that looks at the applicability of demand management techniques, their potential benefits, and institutional considerations.

Technical vs. Political Feasibility. Generally, UMTA's view is that technical considerations should be the primary determinant of feasibility. Technical reasons for judging an option infeasible include operational difficulties, high costs relative to expected benefits, and environmental impacts that exceed standards or guidelines. Where local officials view a technically feasible option as politically unacceptable, it may again be useful to include two TSM alternatives in the analysis: one option that includes only those actions judged to be politically feasible, and a second with all technically feasible options. This approach recognizes local policy positions, provides UMTA with a fair baseline for comparing projects across cities, and permits the analyst and local decisionmakers to consider the merits of the actions thought to be politically infeasible with an eye toward their potential merits.

Highway Network Assumption. The technical analyses performed during transit project planning are geared toward isolating the costs and benefits of the various alternatives. To meet this objective, the same background highway network is generally assumed for the TSM and other build alternatives. But it is not always clear what that highway network should be. One option is to assume that all of the highway facilities in the adopted long range plan will be implemented. This tends to provide a worst case scenario for transit ridership, and may not be realistic if the cost of the long range plan far exceeds realistic expectations on funding availability. At the other extreme, the existing highway network might be assumed, but this is probably just as unrealistic, particularly in rapidly growing or congested corridors, and would lead to exaggerated forecasts of transit guideway ridership. UMTA suggests the use of a highway network that falls somewhere between these extremes — i.e., a highway network that includes some increases in capacity but yet is financially realistic. However, some local agencies have had difficulty reaching agreement on such a network, since it requires establishing priorities on the projects in the long range plan.

Number of TSM Alternatives. Ideally, a single TSM alternative can be agreed upon that represents a comprehensive program of sound, low cost actions for addressing identified transportation problems. But there are situations in which more than one TSM alternative is necessary. Some examples follow:

- 1) One possibility is the case where the long range plan includes a major effort to upgrade highways throughout the region, but the funding and schedule for this effort are uncertain. The use of two TSM alternatives that differ in their level of highway improvements can be useful in recognizing the uncertainty, determining the interdependence between transit and highway improvements, and possibly setting priorities for the highway upgrades.
- 2) The optimal operating plan for the TSM alternative may be unclear. One project planning study, for example, was evaluating extensions to a light rail line that ended just a few miles outside downtown. Two bus operating plans were developed for the TSM alternative: one with buses feeding the light rail terminal, the other with buses running all the way downtown. This allowed for an explicit recognition of the advantages and disadvantages of each operating plan in terms of costs, transit service levels and ridership.
- 3) There may be legitimate questions regarding the feasibility — operational, political, or financial — of some elements of the TSM alternative. Analysis may be required to assess the feasibility of contra-flow lanes on a freeway that is presently uncongested in the off-peak direction. A greatly expanded bus fleet may require financial resources that are not presently available.

In such cases, advancing two or more TSM alternatives may be the best way to answer legitimate questions and keep the analysis process moving forward.

2.4(c) The Fixed Guideway Transit Alternative(s)

Several difficult issues are frequently encountered in the development of guideway alternatives. While no guidance can substitute for the informed judgment of local analysts in these areas, past experience leads to several comments and cautions on the development of realistic alternatives.

Relationship to the TSM Operating Plan. The operating plans for the guideway alternatives are derived from the optimized plan developed for the TSM option. This approach is the best way to ensure a feeder and background bus system that is compatible with the guideway but is also consistent with the overall operating policies governing all of the alternatives. The approach effectively requires a two-step analysis for each guideway alternative. In the first, the guideway is overlaid on the TSM operating plan and adjustments are made in bus routings to eliminate unnecessary parallel service and to integrate the bus and guideway operations where possible. The second step then develops headways for service on the guideway itself and reviews headways on connecting bus service for possible headway shortening to meet any anticipated increase in volumes.

Parallel Bus Services. A trade-off frequently exists between the desire to integrate on- and off-guideway services as much as possible. At higher levels of integration, the operating efficiency in the corridor approaches its maximum, usually accompanied by degradation in service levels for some travel markets. One example is that a guideway with fairly long station spacing will often not provide good service to any short trips along its alignment. A second example is that areas on the fringe of the corridor with direct express service to the downtown may be less well served if the bus routes are converted into feeders that require a somewhat more circuitous route to the downtown. These and other markets facing potentially lower service levels warrant particular attention in the development of the alternative. Careful analysis of the implications for service levels and operating efficiencies should precede final selection of the operating plan. Some ways to identify the service implications for individual travel markets are discussed in Chapter II.6.

Guideway Operations. One of the most difficult aspects in the development of sound guideway alternatives is the selection of an operating plan that optimizes the performance of the alternative. The wide variety of operating possibilities, plus the range of possible TSM improvements that can be incorporated into the guideway alternatives, present a broad array of options. The challenge in this regard is particularly evident for bus/HOVway facilities that have a myriad of operational possibilities: one-way vs. two-way service, on-line stations vs. no stations, HOVs vs. bus-only, integrated collector/line-haul service versus forced transfers from feeders, and so forth. Further compounding the challenge is that a mix of operations — some express and some "all-stops" services on the busway — is often the optimal operation.

One useful approach to sorting out the various options is to reserve the analysis of busway alternatives until after the analysis of operating plans for rail alternatives (if rail alternatives are being considered). Examination of the transit trip tables and station volumes for the rail options can help distinguish between high volume travel markets in the corridor that may warrant integrated express service on the busway, and lower volume markets that are more

appropriately served by feeder services into stations on the busway. This approach can minimize the number of adjustments to the initial operating plan needed to produce a final plan that matches travel demand in the corridor. Where no rail alternatives are being considered, an initial operating plan can be assumed to provide both an "all-stops" service on the busway and integrated feeder/line-haul service from all residential areas to major activity centers in the corridor. This over-supplied operation can then be scaled back in a subsequent iteration to match supply and demand levels.

Park/ride Facilities. Much of the potential success of transit improvements in a corridor depends on the accessibility of new guideways to potential transit riders. The level of feeder bus services and the capacity of park/ride lots are key aspects of the alternatives that must be developed carefully. To a large extent, there is a trade-off to be made between the bus- and auto-access opportunities. Existing transit guideways show a wide range in the mix of access modes used by their riders. Some have very little feeder bus service but attract fairly heavy ridership through park/ride and kiss/ride access. More commonly, a large share of guideway riders use feeder buses to access the guideway service. The potential trade-offs among ridership attraction, the availability of space for park/ride facilities, and the cost of operating feeder bus services require careful attention during project planning, possibly including a sensitivity analysis of ridership and costs with different access strategies.

Current methods used to estimate patronage for guideway facilities typically have no automated way to recognize capacity constraints on parking at park/ride stations. Thus, one necessary step in the development of the operating plans is to determine whether the predicted (unconstrained) demand for parking at stations can be accommodated. Where capacity limitations occur, the excess demand must be allocated to other park/ride lots, to other access modes, and/or to non-transit travel.

Guideway Design Standards. There are no widely accepted design standards or specifications upon which to base conceptual engineering and project costing. For rail projects, each system ultimately develops its own standards and specifications by drawing upon the work of previous systems and revising it to reflect local conditions. Project planning studies assume a set of standards that are representative of operating projects elsewhere in the country and/or the world. These cover such matters as minimum clearances, geometrics, signal systems, and vehicle size and performance (see Tables 2-3 and 2-4). UMTA takes a flexible position on the design standards used in individual studies, provided that the standards proposed for use are proven safe and effective in actual application, and that they are consistent with assumed performance characteristics.

An example is the design standards for busways and HOV lanes. In 1983, the American Association of State Highway and Transportation Officials (AASHTO) issued a Guide for the Design of High Occupancy Vehicle and Public Transfer Facilities which contains desirable cross-sections for HOV projects. Oftentimes the cross-sections advocated by AASHTO cannot be accommodated within available right-of-way or without extreme cost. The State of Texas and others have developed bus/HOV lane design guides with lower standards, and further work is now underway to modify the AASHTO guidelines. To the extent that the standards

proposed for use in a particular situation have been proven safe and effective, UMTA will agree to a standard less than that advocated by AASHTO. UMTA may even advocate the use of different standards as a cost saving measure. Design standards that have not previously been used may also be acceptable if supported by adequate research.

Vehicle Loading Standards. Project planning studies often entail comparisons between alternatives with different types and sizes of vehicles. To keep the evaluation on an equal footing, consistent vehicle loading standards are used for all alternatives. Headways are set such that, during peak periods, all seats are filled at the maximum load point. To the extent that standees are also anticipated, each alternative is designed to provide the same amount of space for each standee. The loading standard is expressed in terms of square feet of standing area (floor area of the vehicle less seating area) per standee.

Questions sometimes arise about whether the loading standards might vary with the type of service (such as local and express) or operating environment (reserved lanes or mixed traffic). Some States, for example, require seated loads on express buses operating on freeways. Different loading standards may be appropriate in such situations provided they are expressed in terms of a regional policy that is consistently applied to all alternatives. Thought should be given to the degree of bias this may introduce into the analysis.

2.4(d) Highway Alternatives

Although transit project planning studies are often undertaken with an eye toward various transit solutions, the transportation problems that are being addressed are frequently highway problems, such as peak hour traffic congestion. Thus, in many cases, there will be highway solutions as well transit solutions warranting analysis. There may or may not be highway projects that are already being contemplated by the responsible highway agencies.

Where major highway alternatives are contemplated in the corridor, highway and transit corridor studies should be merged or, at a minimum, closely coordinated such that the relative merits and interrelationships of highway and transit options can be explored in the analysis using a consistent set of methods and assumptions. Even if highway improvements are not being contemplated, the initial screening of alternatives should consider the potential for highway solutions to identified problems.

Multi-modal corridor studies can be complicated both technically and institutionally. Technical complications arise from the fact that multi-modal studies have three objectives: to compare highway alternatives with each other, to compare transit alternatives with each other, and to compare highway alternatives with transit alternatives. A rather large total number of possible combinations may need to be tested to isolate all of the relevant costs, benefits, and interactions between alternatives. Table 2-2 shows how one project planning study structured its set of alternatives to address the possible highway and transit combinations. Note that the alternatives set allows for a comparison of the transit alternatives' relative costs and benefits, keeping the highway network constant, as well as comparisons among highway alternatives and between transit and highways.

Table 2-2: Example of Multimodal Set of Alternatives

Alternative	Key Components	
	Highway	Transit
1 No Build	Current Transportation Improvement Plan including Interstate System completion in Salt Lake area	UTA Short Range Plan and financially attainable service plan to 2010
2 TSM (Rehabilitation I-15) - Best Bus	Minor operational and safety improvements and rehabilitation of I-15	Expand bus routes to optimize Corridor transit and service to the urban area for 2010
3 One Lane - Best Bus	Add one general purpose lane in each direction to I-15 (in median); selected interchange additions and reconstruction; local street improvement rehabilitation of I-15; improvements to 2100 South Interchange	Same as Alternative 2
4 Two Lanes - Best Bus	Add two general purpose lanes in each direction to I-15 (one in median, one on outside); selected interchange additions and reconstructions; local street improvements; rehabilitation of I-15; improvements to 2100 South Interchange.	Same as Alternative 2
5 One Lane + Reversible HOV - Best Bus	Same as Alternative 4, except median is reversible HOV lane	Same as Alternative 2
6 One Lane + One HOV Lane - Best Bus	Same as Alternative 4, except median lanes are HOV lanes	Same as Alternative 2
7 Highway TSM - UPRR LRT Loop	Same as Alternative 2	Light rail on UPRR ROW from 10600 South to CBD, with CBD Loop System
8 Highway TSM - State/Main LRT Loop	Same as Alternative 2	Light rail on State Street from 10600 South to 4500 South, then transition to Main Street to CBD, with CBD Loop System
9 One Lane - UPRR LRT Depot	Same as Alternative 2	Light rail on UPRR ROW from 10600 South to CBD, with the terminus at Union Station Depot
9 One Lane - UPRR LRT Main	Same as Alternative 2	Light rail on UPRR ROW from 10600 South to CBD, with the terminus on Main Street at South Temple
9 One Lane - UPRR LRT Loop	Same as Alternative 2	Light rail on UPRR ROW from 10600 South to CBD, with the terminus a one-way loop on 400 South, 200 East, South Temple, and West Temple
10 One Lane - State/Main LRT Loop	Same as Alternative 2	Same as Alternative 6
11 Two Lanes - UPRR LRT Loop	Same as Alternative 4	Same as Alternative 7
12 Two Lanes - State/Main LRT Loop	Same as Alternative 4	Same as Alternative 6

2.5 Documentation of the Alternatives

Because of the importance of the careful development of alternatives, an iterative approach with three distinct review points should be used to define alternatives. Figure 2-1 summarizes the process that begins with a "conceptual" definition of the alternatives, produces a "detailed" definition that forms the basis for the heart of the technical work, and concludes with a "final" definition that is then summarized in the DEIS. In alternatives analyses, written documentation of the alternatives is developed at each of the three stages of the study.

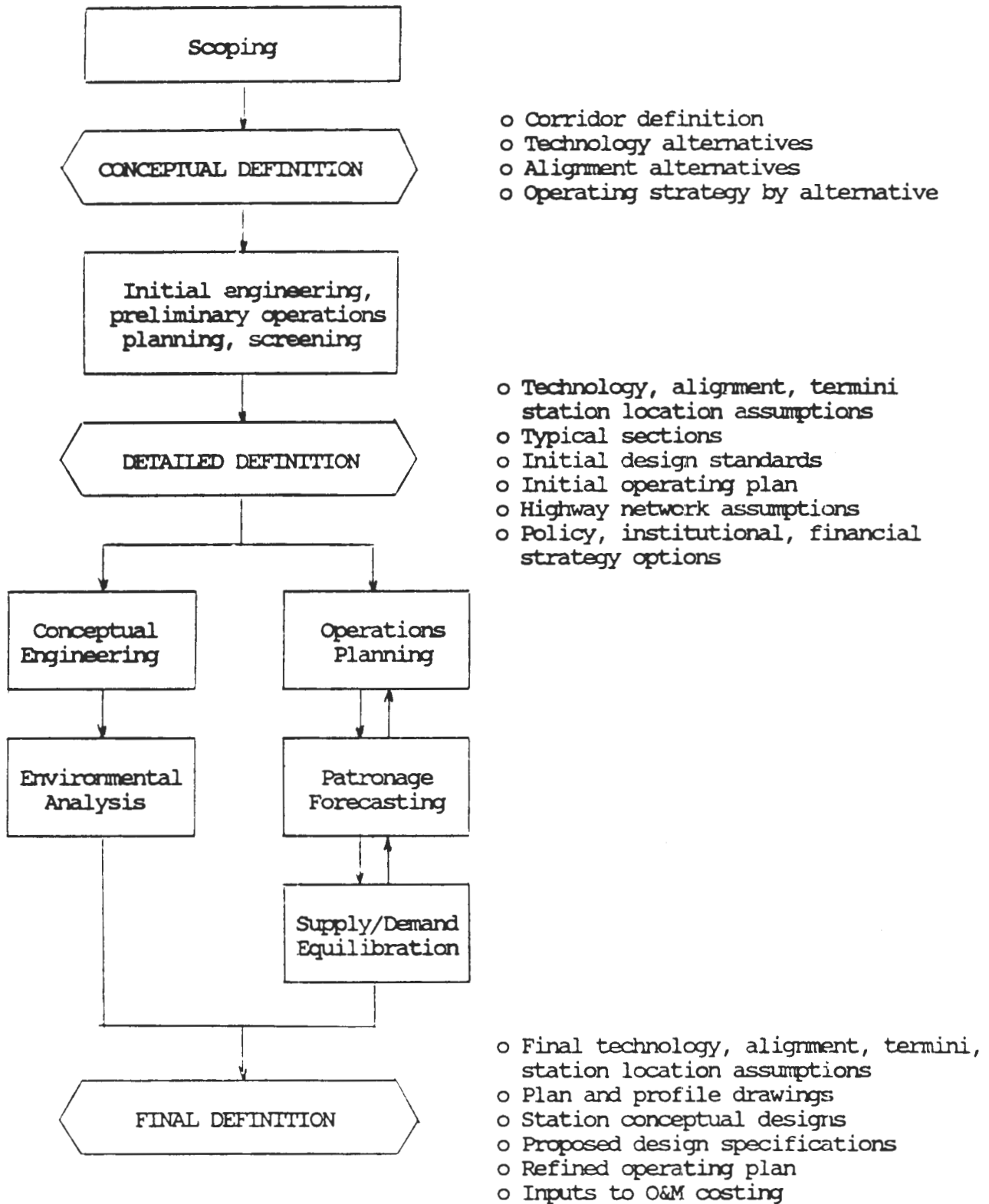
Conceptual Definition. The conceptual definitions of the alternatives are ideally produced in system planning and then reviewed in the early scoping activities during project planning. For each alternative, the conceptual definitions include the preliminary identification of candidate alignments and operating strategies. The operating strategies -- as distinct from operating plans developed as project planning proceeds -- give general ideas of overall bus service levels, service standards, and guideway service options. These definitions are sufficient to address such general concerns as ranges of costs, ridership potential, likely cost-effectiveness, and financial feasibility. They also serve in the initial scoping process to identify the range of options to be considered and to shape the technical work scope.

The subsequent preliminary analysis may be quite brief or very involved, depending on the complexity of the corridor, the variety of options, and the amount of preliminary screening done during system planning. It uses fairly coarse criteria to sort among the various alignment and operating options, and to develop preliminary definitions of alignments, standards, and operations. Where large numbers of options remain (often because the prior system planning effort left many system-level issues unresolved), this preliminary analysis may be preceded by a significant screening effort to sort out the broader issues before work begins on the preliminary specifications and operating plans.

Detailed Definition. The detailed descriptions provide sufficient information for each of the technical disciplines to begin detailed analysis. They provide specific identification to the engineering and environmental teams on horizontal and vertical alignments, station locations, typical sections and stations, vehicle loading standards, and initial specifications. At this stage, reference is made to design standards developed by the local transit operator, the State highway agency, AASHTO, and other sources. Close coordination is necessary between the development of the detailed definition of the alternatives and the methodology report on capital costs. The definitions provide a description of the standards and design criteria to be used while the capital cost methodology depicts specific cross-sections for segments of the alignment and identifies the specific assumptions on equipment and unit costs. Tables 2-3 and 2-4 provide outlines of the physical items typically covered in the specifications documented in the detailed definition of the alternatives.

The detailed definition of alternatives report should also present initial design operating plans and policies for each alternative. The operating plans describe each bus and/or rail route, including the feeder system, in terms of routing, location of stations or stops (or average stop spacing), peak and off-peak

Figure 2-1. Steps in the Development of Alternatives



headways, and peak and off-peak speeds. Both the design year operating plans and the opening year operating plans should be presented. The operating plans should be described in sufficient detail to permit a careful review by participating technical staff and to permit the demand forecasting team to code the transit network for each alternative. Operating policies of importance include peak and off-peak fares, loading standards, parking charges at park/ride lots in the corridor, and the supply and/or price of CBD parking.

Policy options, institutional arrangements, and financial strategies may also be described, providing input to the relevant technical analyses. For example, the detailed definition of alternatives report should identify any travel demand management options to be considered in the service and patronage analysis. Where land use options are to be evaluated, the report would describe these options in terms of possible differences in the location and scale of new development, so as to guide the associated ridership, environmental, and financial analyses. As appropriate, the report should also identify the different institutional arrangements and financial strategies to be evaluated in the study. The report should be written in such a way that the reader can appreciate the interrelationships among decisions on the mode, alignment, service and other policies, institutional arrangements, and financing options to be considered.

Clear graphics are an essential part of the detailed definition of alternatives report. Maps illustrating the operating plans often require careful thought so that individual bus routes are distinguishable. Color coding is frequently helpful despite the reproduction problems it creates.

Final Definition. The final definitions of the alternatives consists of the plan and profile drawings, cross-section drawings for various line segments, conceptual drawings of stations and park/ride lots, and proposed specifications developed in the conceptual engineering effort. In addition to the finer detail provided in these materials, the final definitions may also differ from the detailed definitions because of changes made in response to cost, operational, and environmental considerations. The design specifications are labeled "proposed" because, while providing the basis for the cost estimates, they are subject to further refinement in preliminary engineering.

The final operating plans are likely to differ from the initial plans provided as part of the detailed definition. The final definition reflects the equilibration of transit service levels with ridership demand. (To the extent that the initial plans anticipated ridership levels accurately, there may be little revision needed to produce the final operating plans.) To document the equilibration process, the final definition of alternatives report should include, for each alternative, and for both the design year and the opening year, tables showing each route's initial headway assumption, the initial peak hour peak direction volume (at peak load point), the revised headway assumption, the final peak hour peak direction volume, the resulting peak hour vehicle loadings, and the adopted vehicle loading standards.

The final definition of alternatives report also presents inputs to the capital costing and O&M costing tasks. In addition to the plan and profile drawings, the capital costing inputs include the vehicle requirements for each alternative. Information on the service variables to be used for O&M costing is likely to include vehicle-hours, vehicle-miles, and peak vehicles.

Table 2-3. Sample Line Items in Busway Design Specifications

[Specifications are presented for each environment: at-grade, elevated, tunnel, highway medians, or-street, busway stations, access ramps, etc.]

1. Cross-Section(s)
 - o lane width
 - o shoulder width
 - o median
 - o drainage control
 - o minimum total width (shoulder-to-shoulder or curb-to-curb)
2. Minimum Clearances
 - o vertical clearances for overcrossings and undercrossings
 - o lateral clearances
3. Geometrics
 - o design speed
 - o horizontal curves
 - minimum radius
 - desirable radius
 - curb radius at intersections
 - o vertical curves
 - sag K value
 - crest K value
 - o maximum grade
4. Pavement Loading Standards
5. Vehicles
 - o dimensions
 - o performance
 - rates of acceleration and deceleration
 - cruising speed
 - o passenger capacity: seated plus standing at stated densities
6. Fare Collection Methods
7. Passenger Stations
 - o platforms
 - o access provisions: bus, park/ride, kiss/ride

Table 2-4. Sample Line Items in Rail Design Specifications

[Specifications are presented for each environment: at-grade, elevated, tunnel, highway medians, on-street, stations, yards, etc.]

1. Cross-Section(s)
 - o track centers
 - o drainage control
 - o minimum total width
 - o trackwork: ballast, rail, ties, fasteners, turnouts
2. Minimum Clearances
 - o vertical clearances for overcrossings and undercrossings
 - o lateral clearances
3. Geometrics
 - o design speed
 - o horizontal curves: minimum and desirable radii
 - o vertical curves: minimum and desirable radii
 - o maximum grade
4. Electrification
 - o overhead or third-rail specifications
 - o substations
5. Signals
 - o way signals
 - o street and highway crossings
6. Vehicles
 - o dimensions
 - o performance: acceleration, deceleration, cruising
 - o passenger capacity: seated plus standing at stated density
7. Fare Collection Methods
8. Passenger Stations
 - o platforms
 - o access provisions: bus, park/ride, kiss/ride

Other Resources

Individuals involved in defining alternatives for transit project planning studies may find additional guidance in the following selected references:

American Association of State Highway and Transportation Officials. Guide for the Design of High Occupancy Vehicle and Public Transfer Facilities. AASHTO (Washington: 1983)

Elms, Bamberg, Eldredge, et al. Light Rail Transit Car Specification Guide. Urban Mass Transportation Administration (Washington: 1981)

Jacobs, Skinner, and Lemer. Transit Project Planning Guidance: Estimation of Transit Supply Parameters. Urban Mass Transportation Administration (Washington: 1984)

Hintzman, Kershaw, Mori, Pearson, Rogers, and Talbot. Rail Transit Criteria for System Review and Preliminary Design. California Department of Transportation. (Sacramento, 1979). Includes extensive bibliography.

Levinson, Adams, and Hoey. Bus Use of Highways: Planning and Design Guidelines. Transportation Research Board (Washington: 1975)

Mounce and Stokes. Manual for Planning, Designing, and Operating Transitway Facilities in Texas. Texas Transportation Institute (College Station: 1985)

Voorhees & Associates, Inc. Methods for the Identification of Alternatives: Generation of Alternatives. Monograph prepared for U.S. Department of Transportation, Transportation Systems Center (1979)

II.3. Estimation of Capital Costs

This chapter discusses methods used to estimate capital costs of facility construction and vehicle procurement, the annualization of capital costs for use in cost-effectiveness calculations, and projections of capital cash flow requirements for financial planning.

Capital costs are defined as those costs incurred in the implementation of an alternative. Thus, they include the costs of construction and initial vehicle procurement, including associated allowances for contingencies, engineering, and administration. Excluded from this definition are the out-year reconstruction/replacement of facilities and components, including replacement of vehicles acquired as part of the implementation of an alternative. Costs of reconstruction and replacement are treated as part of the life-cycle cost analysis and are not included specifically in the capital costs to avoid double-counting.

3.1 A Framework for Project Development and Capital Costing

The procedural phases in the development of major transit projects have been defined by UMTA to include system planning, alternatives analysis, preliminary engineering, and final design/construction. These steps are structured around the major choices that must be made as a needed improvement emerges from broad regionwide planning efforts and proceeds toward implementation: 1) which corridor has the greatest needs? 2) what kind of improvement is appropriate and 3) what design standards should be used? The first substantial engineering efforts usually occur in this process during alternatives analysis, with progressively more intense engineering work as a project nears construction. Table II-3.1 summarizes the context of the engineering work in terms of the decisions made at the end of each phase of the process.

Clear understanding of the context of each phase is crucial since it provides the best guide for identifying the appropriate level of effort and detail for the engineering/costing work. While the varying contexts make it impossible to specify a particular level of effort that is correct for all project planning efforts, a useful guideline is to recall the role of project planning in the development of a major project. Project planning in general, and alternatives analysis specifically, is used to select an alternative that is the best candidate for implementation, but not to accomplish all of the steps necessary to its implementation. Thus, the level of effort and detail invested in alternatives analysis should be that necessary to ensure that the choice of an alternative is not distorted by errors in the cost estimates.

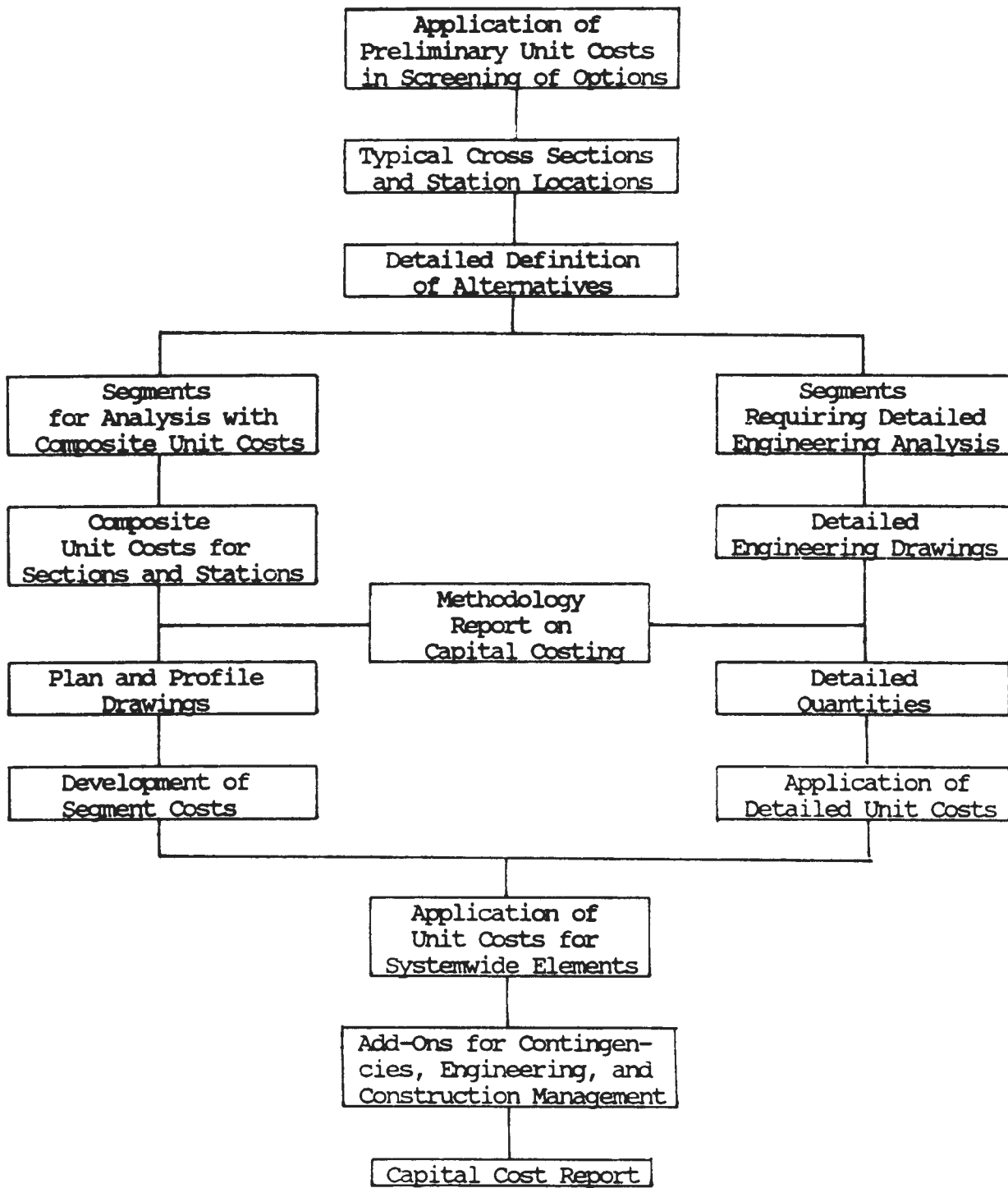
3.2 A General Approach to Conceptual Engineering for Project Planning

Figure II-3.1 depicts the overall flow of work on engineering and capital costing during alternatives analysis. Typically, the engineering/costing effort begins in a screening step with the development of very preliminary

Table II-3.1 Engineering Analysis in the Development
of Major Transit Projects

<u>Phase</u>	<u>Engineering Efforts</u>	<u>Decisions</u>
System Planning	<ul style="list-style-type: none"> o General concepts on options for technology and alignment o Engineering feasibility o Preliminary cost ranges 	<ul style="list-style-type: none"> o Need for major capital improvements o Priority corridor for improvements o Long-range financial plan
Alternatives Analysis	<ul style="list-style-type: none"> o "Conceptual engineering" o Modes and general alignments o Prototype design standards o Significantly narrowed cost ranges o Approximately 10 percent of total engineering effort 	<ul style="list-style-type: none"> o Preferred mode and general alignment o Tentative design standards o Financial plan o Supporting actions
Preliminary Engineering	<ul style="list-style-type: none"> o Analysis of alternative design standards and local alignment variations o Capital cost estimate o Approximately 30 percent of total engineering effort (cumulative, including the preceding conceptual engineering effort) 	<ul style="list-style-type: none"> o Design standards o Specific alignment o Financial commitments o Federal funding
Final Design	<ul style="list-style-type: none"> o Construction drawings o Specifications o Other construction documents 	<ul style="list-style-type: none"> o Procurements

Figure II-3.1 Engineering and Capital Costing



estimates of capital costs that are used with initial estimates of other important factors -- ridership, traffic impacts, safety, environmental impacts -- to sort among the many variations in alignments and design standards that might be adopted for the alternatives. The screening step ends with the detailed definition of the alternatives that outlines the selected alignments and design standards.

During project planning two levels of engineering effort will be used, one for "typical" facilities and the other, much more detailed, for "special" situations. For segments of alternatives that can be analyzed at a fairly aggregate level, a "typical cross-section" for the segment is defined. Detailed unit costs are used with quantities taken from the typical sections to derive costs per lineal foot for each section. A similar approach is used to derive a per-station composite cost for various station types -- at-grade, elevated, subway, terminal, etc. The development of these composite costs is then documented in the methodology report on capital costing. Plan and profile drawings are prepared for each alternative and quantities -- lengths, numbers of over- and underpasses, special features, etc. -- are taken off. "Segment costs" are computed to represent the capital cost of each identified segment, exclusive of systemwide elements and add-on items.

Segments that cannot be handled with the typical-section approach are those where special conditions -- typically major structure or an uncertain alignment in areas with major existing structures or difficult terrain. These segments are costed in detail, with drawings, detailed quantities, and detailed unit costs. Again, the cost estimates for these segments are exclusive of systemwide items and add-on costs.

Systemwide elements include vehicles, electrification, and signal/control systems since these items are not well defined on a segment-by-segment basis. They are costed with unit costs applied to systemwide quantities. Add-on items consist of contingency allowances and the costs of engineering and construction management services. These items are usually costed through multipliers that express the add-on costs as percentages of the estimated baseline capital costs.

The reports on methodologies and results play a central role in documenting the costing work for review by project staff, the Technical Advisory Committee (TAC) and UMTA. The methodology report presents 1) the segments into which each alternative is divided, 2) sketches that have been prepared of cross-sections, stations, and difficult segments, 3) unit costs for the detailed quantities, composite costs for typical sections, and systemwide elements, and 4) factors that will be used to compute add-on costs. The results report summarizes the development of costs for each segment, systemwide elements, and add-ons so that the cost estimates can be reviewed and understood by staff and the TAC.

3.3 Dealing with Uncertainty during Conceptual Engineering

A recurring problem in the estimation of capital costs at the planning stage is the inadequate treatment of uncertainty and potential error in the

estimates. There is by now a lengthening track record that clearly demonstrates the consistent underestimation of costs at the planning stage. Unfortunately, these estimates tend to be used without regard for their inherent uncertainty, serving as the basis for project commitments, financial plans, and programming. This section identifies potential sources of error in cost estimates at the planning stage, suggests ways of reducing potential errors, and identifies ways of acknowledging remaining uncertainties.

3.3(a) Potential Sources of Error.

If "error" in planning cost estimates is defined as the difference between these estimates and the actual cost of the project that is ultimately implemented, then it is possible to identify four potential sources of error:

- o changes in the scope of the project;
- o changes in design standards;
- o incorrect unit cost assumptions in the planning estimates; and
- o unforeseen problems in implementing the project.

Changes in Scope. In project planning, analysts often face a wide variety of options on vertical and horizontal alignment, degree of grade separation, and other significant determinants of the scope of the alternative. Often, the specific alternatives analyzed in project planning are effectively prototypes of the mode and alignment options that are thought to adequately represent the more likely possibilities. This approach is likely unavoidable in many project planning contexts where the many combinations of mode and general alignment prevent the detailed analysis necessary to further define the specific alignments.

Changes in Design Standards. Similar to the broader uncertainties on scope but more specific in nature, changes in design standards in later stages of project development can also lead to changes in project costs. Design standards cover the entire range of the physical characteristics of the project. Thus, any number of decisions in preliminary engineering or final design can change standards and increase (or decrease) costs: upgrading station amenities, employing high rather than low platforms in the stations, using more sophisticated signal system, abandoning barrier-free fare collection in favor of fare gates, and so forth.

Errors in Unit Cost Assumptions. A variety of potential errors exist in the unit cost assumptions used in project planning. Often, many of the unit costs are derived from projects in other cities. Their transfer to the current situation is often uncertain in terms of the commonality of definitions used for both the historic data and the unit costs defined for the project planning effort. For example, the historic data may include minor utility relocations in trackwork costs while the current planning effort is maintaining utility relocation as a separate line item. If the mismatch in the definitions is not identified through careful attention to the underlying assumptions, this example would lead to an overestimate of

costs. Additional sources of uncertainty in unit costs include, the availability of the appropriate construction firms, likely mobilization costs, local industry demand for construction labor and its impact on wage rates, the bid climate during the construction period, and fluctuations in basic material prices.

Difficulties in Implementation. Perhaps the largest source of uncertainty in costs in the planning stage is the inability to anticipate difficulties that will be uncovered in later stages of project development. An informal survey by UMTA staff of local agencies that have recently built new guideways suggests that substantial additional costs have been discovered in later engineering efforts and during actual procurement and construction. Many of the examples given have been associated with right-of-way acquisition, utility relocations, and soil conditions. For example, in at least one instance, the assumption during project planning was that no right-of-way would be required along an arterial street in which a light rail line was to be built at grade. Ultimately, however, an additional two feet of right-of-way was needed along the entire length of the arterial, requiring the acquisition of a narrow strip of property from each of several hundred property owners. Similar examples have occurred in which no street improvements were thought necessary in conjunction with at-grade rail construction but that ultimately included significant costs to rebuild intersections and to upgrade (or provide) sidewalks, lighting, and landscaping. Small changes in the assumption on the elevation of another at-grade rail project led to significantly greater costs to relocate utilities and regrade abutting properties, sidewalks, curb-cuts, and driveways.

3.3(b) Minimizing Potential Error

Efforts to minimize the potential error in cost estimates during project planning immediately encounter limitations on time and cost of the conceptual engineering effort. An important question, then, is the appropriate level of effort for the engineering analysis. Given the desire to allocate the work effort in a way that is proportionate to the areas of uncertainty, work should clearly focus on components that are both major items and have significant uncertainties in their costs. Therefore, subway sections warrant significant effort — including, for example, the acquisition of subsurface soil data from engineering studies of nearby construction projects and other existing sources — because of the major cost implications of different subsurface construction techniques. In contrast, at-grade segments on existing rights-of-way often, though not always, require substantially less detail and effort. An exception to the simple treatment of at-grade segments would be where small variations in horizontal alignment could cause substantial costs or environmental impacts — where the alignment passes through difficult terrain or near major existing structures, for example.

The notion of varying levels of effort and detail is implemented by dividing each alternative into a series of segments, where each segment includes, to the extent possible, a single typical cross-section. Where long stretches

of the same cross-section occur, the segments may be quite long -- five or six miles, for example where a guideway is placed in a freeway median. Where a difficult portion of the alignment is encountered, however, the segment may be much shorter -- a quarter-mile segment where a guideway transitions on structure from a railroad right-of-way to a highway median, for example. Each segment is then examined with the appropriate level of effort, ranging from application of an aggregate unit cost per foot of guideway for typical sections to more detailed engineering analysis for difficult construction conditions.

An additional strategy that helps focus effort on areas of greatest uncertainty is a top-down approach to the cost estimates. This approach entails the early development of a rough capital cost estimate for each alternative. These estimates are developed within an overall structure for the cost estimate that will be used throughout the analysis: it outlines the segmentation of the alternatives and uses the same cost categories that will be used for the final estimate. At this early stage, however, the information available on unit costs and quantities is quite limited and can support only a rough estimate that relies on highly aggregate unit costs and back-of-the-envelope estimates of quantities. The key role for this estimate, however, is to help focus attention on the major cost components and to identify areas with major uncertainties. This early estimate therefore helps ensure an appropriate allocation of the rest of the engineering and costing effort.

The early cost estimates also serve a number of other useful functions, as well. During the initial stages of project planning, decisions are often made on major aspects of the alternatives -- particularly alignment variations (both horizontal and vertical) and lengths of guideways -- that may have major impacts on their capital costs, financial feasibility, and cost-effectiveness. The early development of preliminary cost estimates, while decidedly sketchy by their nature, provides a useful basis for defining the set of detailed alternatives.

As the analysis progresses, the engineering work provides increasing detail on the quantities and unit costs. The initial cost estimates are therefore periodically updated to reflect the accumulation of better information. This approach therefore maintains a set of current estimates that provides all parties to the analysis with the best cost information available at any time. The final cost estimates then evolve over time rather than arrive abruptly near the end of the study.

Within the general framework of an analysis that focuses on segments of the alternatives and provides increasing detail as the work progresses, there are several specific areas that appear to require particular attention.

- 1) Where uncertainty exists, analysis should be done on the potential impacts and likely costs of options for the scope and design standards of each alternative.

Within reasonable bounds on level of effort, the engineering work should include specific analysis -- rather than unsupported assumptions -- on

significant alignment options, design standards, grade separations, station locations, environmental mitigation, and other sources of cost variations. Many of these analyses must be done in conjunction with other disciplines. The question of grade separation, for example, should reflect the trade-off between the engineering cost estimate of grade separating an intersection versus the traffic and environmental analyses of the impacts of at-grade crossing or street closures.

- 2) Right of way requirements should be assessed carefully.

Four aspects of the analysis should be emphasized to improve the reliability of the estimates of need for right-of-way acquisition. First, data collection and mapping deserves careful attention including, at a minimum, visual inspections of all proposed alignments to supplement and validate existing mapped data. In most cases, the data collection effort should also include a walking inspection of the alignments, at least for difficult segments with tight right-of-way constraints. Second, the analysis of necessary right-of-way widths must be done with realistic cross-section drawings and with careful attention to boundary conditions between the guideway cross-section and surrounding properties. Where doubt exists for lengthy segments on the existence of an easy transition between the transit right-of-way and adjacent parcels, further analysis may be appropriate to ensure accurate estimates of the consequences. Third, the analysis should recognize that parcels are often acquired that include excess right-of-way and higher costs. The excess acquisitions can occur to avoid a partial taking that would leave an unusable parcel, to acquire land for possible joint development efforts, or to provide for construction staging areas. Finally, the projected per-square-foot cost of land should reflect the history of price escalation in the assembly of right-of way.

- 3) Realistic assessments of required mitigation efforts and added physical amenities should be done for each alternative, through the public involvement process and reference to previous major transportation projects locally and in other cities.

Where an alignment passes through a particularly sensitive area — at-grade running on arterials through residential areas is an obvious example — it may be risky to assume that the necessary improvements will be restricted only to components of the transit facility itself. An important function of the public involvement process is to identify areas of concern and sound out local residents on the acceptability of various mitigation measures. Since these measures might range from the addition of sound barriers and landscaped screening to tunneling through the area, an appropriate effort should be made to understand the potential for ancillary improvements and alignment changes.

- 4) Historic cost data used to develop unit cost assumptions should be documented carefully, with particular attention to precise definitions of the individual line items.

Documentation of cost experience in transit construction tends to be inconsistent across different projects, specifically in the way individual

cost items are aggregated. Ideally, the development of unit cost assumptions for project planning would begin with a detailed analysis of a range of cost experience, isolating cost components at a very disaggregate level. These very detailed costs can then be combined as needed to appropriate levels for project planning. However, the effort needed for this analysis across a range of previous construction projects is largely beyond the scope of project planning. Analysts must therefore often rely on more aggregate historic cost summaries, or previous detailed analyses done for other purposes. In either of these cases, precise definitions of the unit cost items is critical to prevention of double-counting or omission of individual cost components.

3.3(c) Acknowledging Remaining Uncertainties

Even with the best possible efforts to identify the likely scope, design criteria, and implementation requirements for each alternative, the limited engineering analysis done in project planning usually leaves substantial areas of uncertainty. At least two interrelated actions can be taken to acknowledge this uncertainty. The first is to maintain upper- and lower-bound cost estimates for each alternative, in addition to the best-estimate that is typically prepared. The second is to use line-item-specific contingency allowances that recognize the varying levels of uncertainty in different unit cost assumptions. These two actions effectively separate the two data components of a cost estimate -- the quantities of material and labor needed and the unit costs of the materials and labor. Uncertainties in quantities resulting from possible changes in scope, design standards, and so forth are handled in the upper- and lower-bound estimates. Uncertainties in unit costs are handled with line item contingency factors.

This two-pronged approach is something of a departure from usual practice. Typically, most project planning cost estimates have assumed a specific scope for the project, applied the unit cost assumptions, and used an overall contingency factor to account for uncertainties. Often, the same contingency factor was used for all alternatives, regardless of their nature and uncertainty. A weakness in this approach is that the contingency allowances have attempted to cover both true contingencies (conditions that could not have been anticipated at this relatively early stage) and later design changes (reversals of earlier design decisions on alignments and/or standards). A better approach to the problem, then, is to separate these two aspects of cost uncertainty.

- 1) In addition to a best-estimate of capital costs, the analysis should develop upper- and lower-bound cost estimates.

Cost variations associated with alternative design standards, alignment options, underground construction methods, and so forth, should be identified specifically and used to compute both lower- and upper-bound cost estimates. It is important that the assumptions used to compute each estimate be consistent.

The lower-bound estimate must be based on reasonable assumptions and decisions that are uniformly favorable toward lower capital costs, while the

upper-bound estimate must be based on reasonable but uniformly unfavorable outcomes. As these estimates evolve over the course of the analysis, reviews by technical advisory committees and local officials can help sharpen the definitions of the alternatives and lead to most-likely estimates that lie somewhere between the bounds. This "most-likely" estimate should be used as the primary cost estimate in other aspects of the analysis — financing, evaluation, etc. — and is used by UMTA in rating the project nationally. The range of possible costs is also useful, however, in making judgments on the cost-effectiveness and financial feasibility of alternatives, the adequacy of the engineering/costing work done in alternatives analysis, and issues to be resolved in preliminary engineering.

- 2) Contingency allowances should vary across individual cost line items.

A major benefit of developing an upper-bound cost is that remaining uncertainties in the cost estimates are largely associated with the unit cost assumptions. These uncertainties are best handled through contingency allowances that vary across line-items according to the uncertainty for each item. This approach helps focus attention on the sources of uncertainty in the overall cost estimate. It is likely, for example, that the ranges of possible costs for right-of-way purchases and tunneling will be greater than those for vehicle acquisition and at-grade construction. (In fact, current conditions indicate much higher contingency factors are required for the purchase of rail vehicles than for bus). The approach has the added benefit that overall contingency add-ons, as a percentage of project costs, can vary across alternatives. This is undoubtedly a more realistic portrayal of uncertainties than an approach that applies the same project level contingency allowance to all alternatives, regardless of their nature. Thus, an alternative that emphasizes at-grade construction on an existing railroad right-of-way will end up with a lower overall contingency allowance than one that requires significant lengths of tunnel construction.

3.4 Elements of Conceptual Engineering for Project Planning

This section discusses the individual steps used to implement the general concepts outlined above for dealing with uncertainty. The discussion parallels the flowchart presented earlier in Figure II-3.1.

3.4(a) Screening

Initial phases of the engineering/costing effort often involve a screening process that is used to develop the detailed definition of the set of alternatives to be considered. Typically, the role of capital costs in this screening step is to sort among optional alignment variations and lengths. This role usually requires only rough estimates of the costs of guideway and station construction for various horizontal and vertical alignment options. The level of effort at this stage usually involves initial inventories of right-of-way options using maps and field inspections, plus the development and application of very aggregate unit costs, stratified by vertical alignment and numbers of lanes/tracks. Together with initial estimates of service levels, ridership influences, and environmental impacts, the

preliminary capital costs are sufficient to narrow the alignment variations to a very few (ideally one) for each of the alternatives presented in the "Detailed Definition of Alternatives."

Another role of the preliminary capital costing work is often the sorting of various design questions on fare collection methods, signals and train controls, accessibility provisions for the handicapped, and so forth. Rough estimates of the costs of the various options, together with an analysis of their merits in the specific application, can help shape the design standards documented in the report on detailed alternatives.

3.4(b) Development of Segment Costs

With the detailed description of the alternatives in hand, development of segment level costs can proceed. For segments analyzed with a composite unit cost for a typical cross section, the initial work involves the preparation of sketches of the typical cross-section for each segment and station type. Quantities are taken from each cross-section to represent the work -- grubbing, grading, ballast, trackwork, pavement, etc. -- required for one linear foot of the cross-section. For example, a 5-foot paved shoulder requires 5 square feet of pavement for each linear foot of guideway. Unit costs for each of these items are developed from engineering compilations of construction costs (the Dodge guide, for example) and from relevant local and national experience.

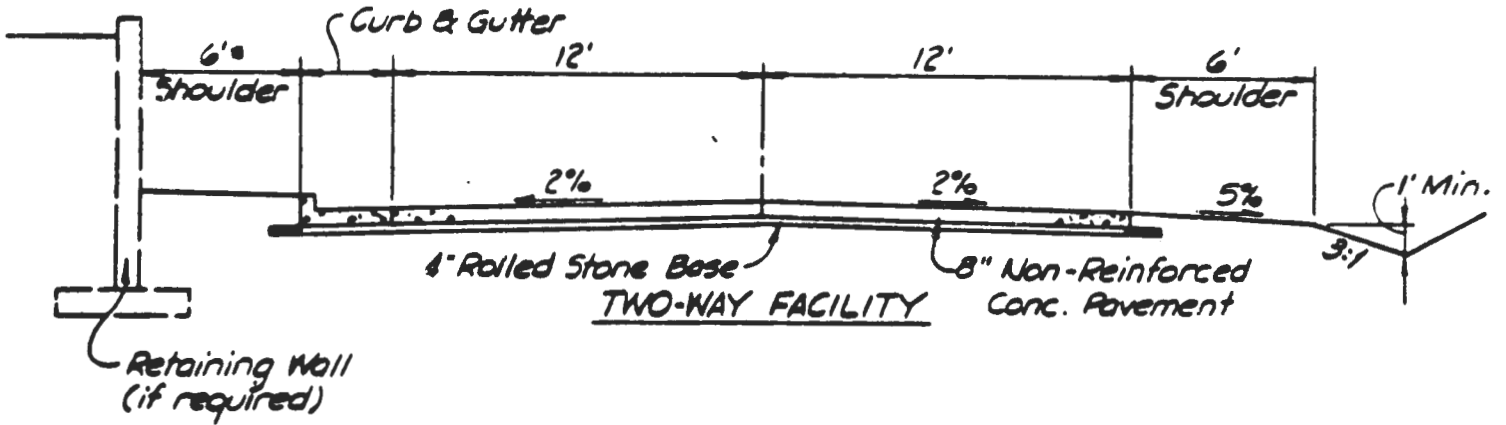
Application of the detailed unit costs to the quantities yields a composite per-foot unit cost for that cross-section. Variations in the typical section over the segment are also noted. These variations include crossings, under- and over-passes, and other non-recurring structures. Unit costs are developed for these items, usually on a lump-sum basis. Figures II-3.2 and II-3.3 illustrate the build-up of composite unit costs for typical busway and light rail cross-sections, while Figure II-3.4 illustrates the development of a composite cost for a typical rail station.

The approach used for more difficult segments differs from that described above in that it involves a detailed analysis of the physical features of a (usually) much shorter segment of the alignment. The appropriate level of analysis is defined by the size of the uncertainty in capital costs caused by the segment. In extreme cases, a substantial effort may be devoted to a relatively small portion of an alignment -- say, where a new underground rail station is to be integrated into a major existing structure.

The methodology report for capital costs documents a fairly significant amount of initial work. It presents the development of composite unit costs for segments with typical sections and identifies segments that will require detailed analysis. Thus, it occurs after a substantial effort has been invested in data collection and analysis, and represents a working plan for the remainder of the costing work.

Plan and profile drawings of the alternatives are done on either base map drawings or on aerial photographs. Typically, a 1" = 200' scale is used for the entire alignments, with supplemental drawings (difficult segments,

Figure II-3.2 Busway Section and Composite Cost

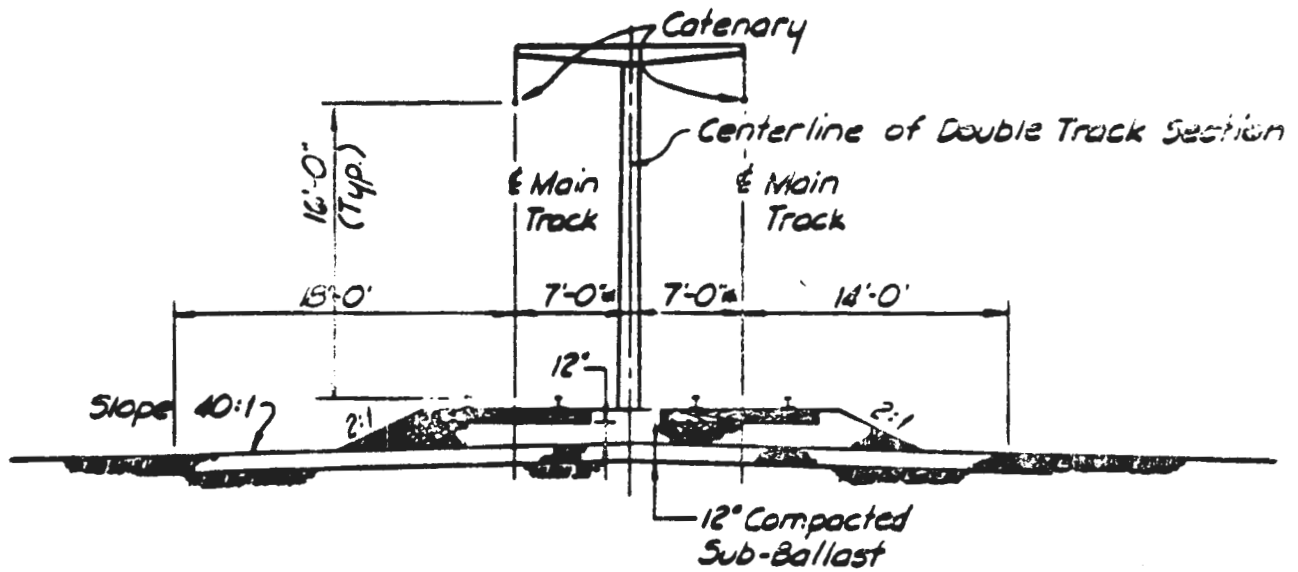


Southwest Corridor
Busway Section Type 1

Item	Unit Cost	Quantity	Cost per Linear Foot
Clearing and Grubbing	\$2000/acre	50 ft. width (0.00115 acre)	\$ 2.30
Grading	\$0.50/sq. ft.	50 ft. width	\$25.00
Pavement	.	.	.
Shoulders	.	.	.
Fencing	\$6.00/foot	2 ft.	\$12.00
Lighting	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
Section Cost per Linear Foot			<Column Sum>

Note: Cross-section and unit costs are for purposes of example only.

Figure II-3.3 Light Rail Section and Composite Cost

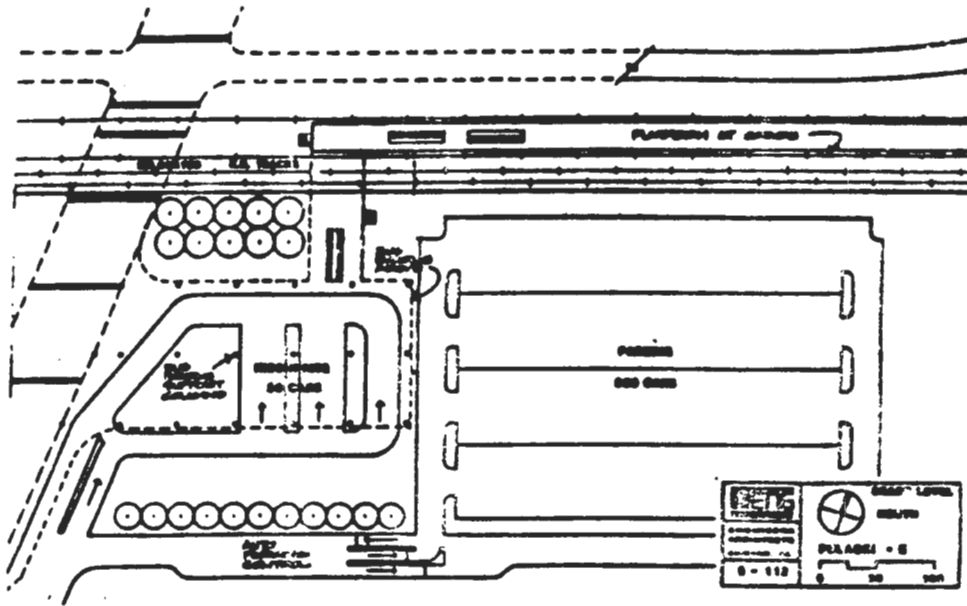


Southwest Corridor
LRT Section Type 3

Item	Unit Cost	Quantity	Cost per Linear Foot
Clearing and Grubbing	\$2000/acre	40 ft. width (0.00092 acre)	\$ 1.34
Grading	\$0.50/sq. ft.	40 ft. width	\$20.00
Fencing	\$6.00/foot	2 ft.	\$12.00
Rails	.	.	.
Ties	.	.	.
Ballast	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
Section Cost per Linear Foot			<Column Sum>

Note: Cross-section and unit costs are for purposes of example only.

Figure II-3.4 Light Rail Station and Composite Cost



Southwest Corridor
LRT Station Type 2

Item	Unit Cost 1/	Quantity	Cost
Site Preparation	\$2000/acre	2 acres	\$4000
Platform	\$4.50/sq. ft.	20,000 sq. ft.	\$90000
Melter	.	.	.
Fare Collection Equipment	.	.	.
Station Finishing	.	.	.
Stairs	.	.	.
Handicapped Access	.	.	.
Fencing	.	.	.
Auto Access	.	.	.
Parking Spaces	.	.	.
Street Improvements	.	.	.
Landscaping	.	.	.
Lighting	.	.	.
Bus Access	.	.	.
Ramps	.	.	.
Transfer Platforms	.	.	.
.	.	.	.
.	.	.	.
Cost for Station Type			<Column Sum>

Note: Cross-section and unit costs are for purposes of example only.

cross-sections, etc.) in more detail as appropriate. Figure 11-3.5 presents a sample plan and profile drawing appropriate for inclusion in the DEIS and other final products.

Baseline costs for each segment with a typical cross-section are developed through the application of the composite unit costs to the length of the segment. Costs for non-recurring items such as underpasses, overpasses, cross-overs, and intermittent retaining walls are added to derive a baseline cost estimate (exclusive of systemwide elements and add-ons) for each segment. Costs for difficult segments (again exclusive of systemwide and add-on items) are developed through detailed analyses of optional solutions for the segment.

3.4(c) Systemwide Elements

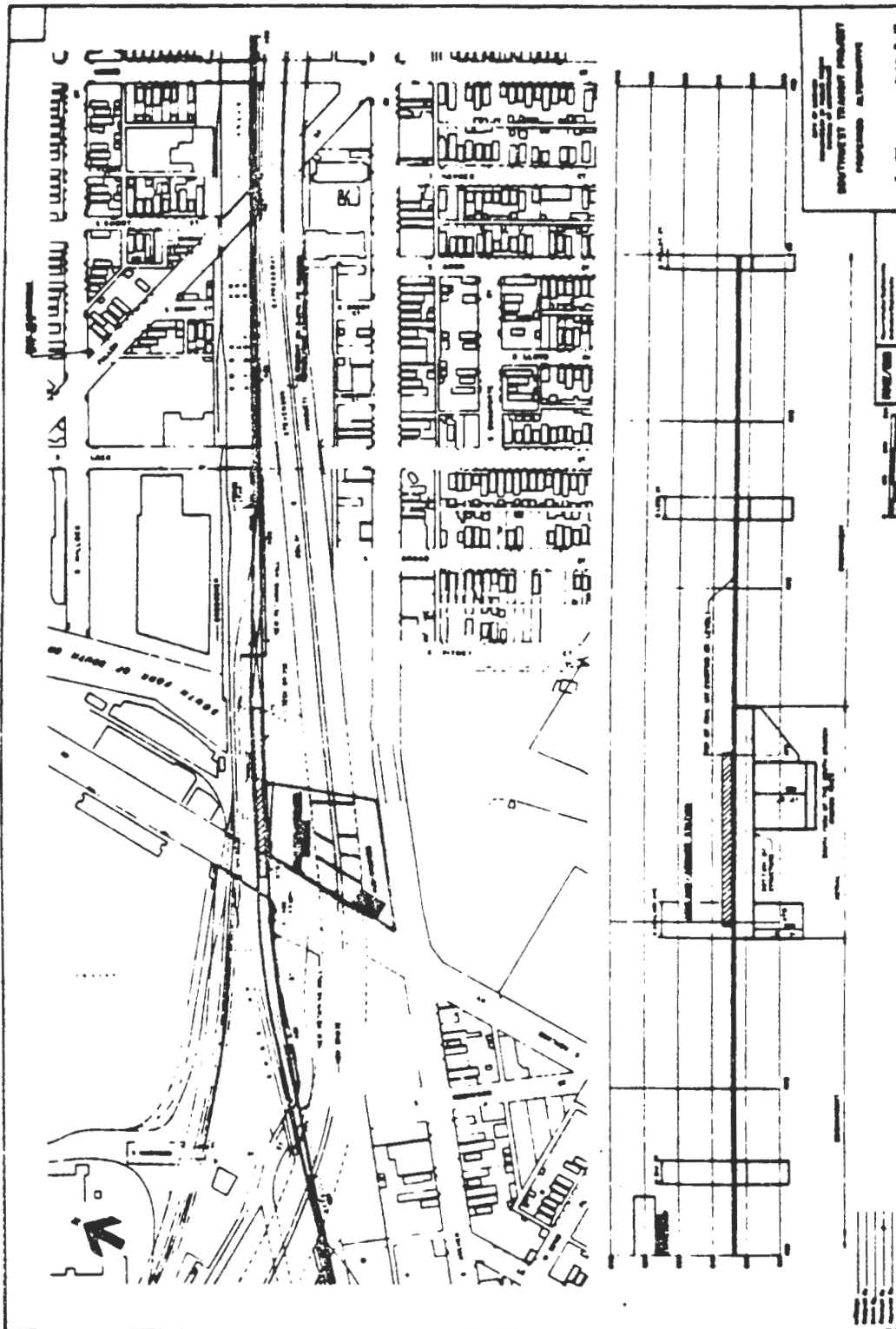
While most capital cost items are usually developed through the segment-by-segment approach outlined above, a number of items are better handled on a systemwide basis. Typically, these include vehicles and initial parts purchases, maintenance facilities, electrification, and signal/control systems. For some of these elements, their treatment at a systemwide level is fairly obvious -- vehicle requirements are clearly systemwide in nature. Maintenance facilities are unique in their location and sizing and should be costed separately. The treatment of electrification and signal/control systems is somewhat less obvious. It is possible to handle both as part of the composite unit costs applied to typical cross sections as in Section 3.1(c) above. However, the design of these systems is not independent from one segment to the next. The location of power substations, passing sidings, and passenger stations in one segment affects the power and signal requirements in adjacent segments. Thus, these elements are also better developed and costed through systemwide analyses.

Vehicle requirements are computed through an equilibration of transit supply parameters -- capacity, maximum headways -- with transit demand -- transit ridership by route and time of day. While this effort is discussed in detail in Chapter 5, it is important to emphasize here the importance of a carefully specified set of service standards in computing vehicle requirements.

Service standards define both loading standards (vehicle capacities) and maximum, or "policy" headways. Policy headways apply where relatively light passenger volumes lead to service headways that are longer than those judged desirable for local conditions and travel needs. Thus, where projected peak period demand on a bus route could be accommodated with a 40-minute headway, a policy of 30-minute maximum headways for the area served by that route would assign a 30-minute headway to the route. Policy headways are typically defined in terms of some characteristic of the local service area -- density, for example -- or service type -- bus, rail, radial, cross-town, limited-stop, express, etc.

Where no formally-adopted service standards exist, it will be necessary to develop a set of implicit standards from current service levels and submit them for review by the Technical Advisory Committee and other local

Figure II-3.5 Sample Plan and Profile Drawing



officials as appropriate. Such a review may also be useful further into the analysis as the implications of the policy headways on capital and operating costs are developed. Where costs are judged excessive, the maximum headways may be revised and reapplied to all of the alternatives.

Loading standards are used to determine vehicle capacities in different types of service. Vehicle capacities are computed as the number of seats plus the possible number of standees loaded at the standing density specified for that service type. For comparable service, UMTA requires that standing densities be the same in computing the capacities of bus and rail vehicles. While UMTA does not mandate any particular loading standard, it does insist that standing densities cannot be less than 2.7 square feet. This implies a loading which is exceeded on only a few lines in North America, and therefore is considered an extremely crowded condition.

3.4(d) Add-On Items

Add-on items are allowances for contingencies (unforeseen costs), engineering, construction management, and construction insurance. These are computed by a series of multipliers to the baseline costs estimated for each alternative.

Contingencies have typically been computed with a single factor — typically 20 to 25 percent — applied uniformly to the construction cost estimates of all alternatives. The discussion in Section 3.3 above suggests two methods for better representing uncertainty — developing bounds on the scope of the alternative and using line-item contingency factors on the unit costs.

Engineering and construction management costs are fees for engineering services required to implement each alternative — preliminary engineering, final design, and construction management. They include both contract costs and those incurred by the implementing agency. This category also includes system start-up costs as these activities are interrelated the engineering and design work.

Most alternatives analyses have used 20 percent of capital costs to estimate costs of engineering services. However, an analysis of heavy rail projects (PBQD, 1984) indicates that new heavy rail projects have experienced engineering costs on the order of 25-30 percent. Recent experience with the construction of light rail systems indicates that these costs are as high as 30% of total project costs. This suggests that engineering costs have been underestimated. It also suggests that the costs of engineering services as a percentage of capital costs vary with the complexity of the project and possibly with the degree of local experience with major transit construction. Consequently, in future alternatives analyses, UMTA will look for a more solid basis for the assumed cost of engineering services. It should be noted that these costs are usually applied as a percentage of the the sum of construction costs plus contingencies.

Construction insurance covers liabilities associated with construction of the project. It generally accounts for about 2 percent of the sum of construction costs plus contingencies.

3.4(e) Contents of the Methodology Report on Capital Costs

The methodology report on capital costs documents a substantial amount of data collection and analysis. These data include both information on the conditions found in the potential alignments of the alternatives and information gathered locally and nationally on unit costs of construction and vehicle acquisition.

Figure II-3.6 outlines the typical contents of the methodology report. The report begins with a listing of the detailed unit costs used in later sections, together with their sources. It then develops composite costs for the various station types -- elevated, at-grade, subway, terminal, transfer, etc. -- that are found among the alternatives. The third section of the document is structured around the alternatives. For each alternative, the section first presents a map of the alignment that identifies the segments into which the alternative has been divided as well as the general location and type of each station. The composite cost build-up for the segments are then presented sequentially using cross-section drawings and calculations similar to those in Figures II-3.2 through II-3.4. Section 4 presents the unit cost assumptions for systemwide elements and for add-on costs. The report concludes with Section 5, documenting the alternative assumptions that will be used to derive upper- and lower-bound cost estimates.

3.4(f) Contents of the Report on Capital Cost Results

The report on the results of the capital costing work is a straightforward summary of the cost estimates. Figure II-3.7 outlines the typical contents of the report. For each alternative, Section 1 summarizes the alternative's costs in a format similar to Figure II-3.8 and then presents the costs for individual segments and systemwide elements in a series of tables similar to Figure II-3.9. Following presentation of all of the alternatives in this fashion, Section 2 of the report documents the annualization of the capital costs in a table similar to Table II-3.7, presented below in Section 3.3.

3.5 Annualizing Capital Costs for Use in Cost-Effectiveness Analysis

The evaluation of the cost-effectiveness of each alternative, covered in detail in Chapter 7 of this document, requires that all evaluation measures (capital costs, operating costs, non-Federal funding, and user benefits) be expressed in annual terms. Since the capital cost estimate is thus far expressed only as a total expenditure of constant (base year) dollars, it is necessary to compute an annual payment that would be equivalent to what is in reality a one-time expenditure of capital funds.

3.5(a) Direct Annualization of Capital Costs

The conversion of capital costs into an equivalent annual payment is easily accomplished with basic techniques of engineering economics. The approach requires only the estimated cost and lifetime of each line item in the cost estimate, plus a discount rate that reflects the time-value of money. For each capital cost item, the annualized equivalent is computed through application of an annualization factor computed as:

Figure II-3.6 Sample Contents of the Methodology Report on Capital Costs

1. Detailed Unit Costs and Sources of Data
2. Composite Unit Costs for Stations
 - 2.1 Bus/Busway Stations
 - 2.2 Rail Stations
3. Segmentation of Alternatives
 - 3.1 Alternative A
 - a) Identification of Segments and Station Types
 - b) Unit Costs for Segments
 - i) Segment 1 (a segment with a typical cross-section, for example)
 - o cross-section
 - o build-up of composite cost
 - o exceptions to the typical section
 - ii) Segment 2 (a segment requiring detailed analysis, for example)
 - o nature of the difficulty
 - o potential solutions
 - iii) Segment 3
 - .
 - .
 - 3.2 Alternative B
 - .
 - .
4. Systemwide Elements and Add-Ons
 - 4.1 Electrification
 - 4.2 Signals and Communication
 - 4.3 Vehicles
 - 4.4 Maintenance Facilities
 - 4.5 Contingencies
 - 4.6 Engineering and Construction Management
5. Assumptions on Cost Ranges
 - 5.1 Variable Assumptions and Design Standards
 - 5.2 Summary of Upper- and Lower-Bound Assumptions

$$(3-1) \quad \text{Annualization Factor} = F(n, i) = \frac{i \times (1+i)^n}{(1+i)^n - 1}$$

where n = economic life;
 i = discount rate.

The annualized cost of the line item is simply the total capital cost of that line item multiplied by its annualization factor. The summation of all annualized line item costs gives the overall annualized cost for the alternative.

For the evaluation of any project advanced for Federal funding, the Office of Management and Budget requires that Federal agencies use a discount rate of 10 percent. Therefore, a 10 percent rate must be used in annualizing capital costs. Since this rate is used with costs expressed in constant dollars, it represents a rate of return net of inflation. A 10 percent return in this setting may appear somewhat higher than that commonly used in the private sector. This is done purposely to provide a margin of safety in computing the cost-effectiveness of publicly funded projects whose merits are based on forecasts of such difficult-to-predict measures as transit ridership, time savings, and operating costs.

Table II-3.2 summarizes values of the annualization factor for various economic lives. One indication from the table is that there is little variation in the annualization factor for economic lives exceeding 25 years. For example, the annualized value of a \$100 million item over 25 years would be \$11.0 million. The same item annualized over 40 years would have an equivalent annual cost of \$10.2 million, a change of about 7 percent. This suggests that precise identification of economic lifetimes of various capital items is not critical to the evaluation. Therefore, standard assumptions are used for all computations of annualized costs in alternatives analysis:

o right of way	100 years
o right of way preparation (major grading, etc.)	100 years
o structures	30 years
o trackwork	30 years
o signals, electrification	30 years
o pavement, parking lots, grade crossings	20 years
o rail vehicles	25 years
o buses	12 years
o contingencies	item-specific
o engineering, construction management	allocated

The last two items are typically included as add-ons in the estimation of capital costs. In computing annualized costs, contingencies are easily dealt with since they are available on a line-item basis. However, add-ons for engineering and construction management are available only on a project-wide basis and must be allocated to individual line items. As a simplifying assumption, the same factor used to compute the project-wide allowance for these costs is applied to each line item, giving it a share of the project's

Figure II-3.7 Sample Contents of the Report on Capital Costs Results

1. Capital Costs of Alternatives

1.1 Alternative A

a) Summary of Capital Costs

- i) segment-by-segment summary
- ii) "best-estimate" plus upper- and lower-bounds

b) Capital Cost Components

- i) Segment 1
- ii) Segment 2
- .
- .
- .
- m) Systemwide Elements and Add-Ons
- n) Effects of Alternative Assumptions and Design Standards

1.2 Alternative B

- .
- .
- .

2. Annualization of Capital Costs

2.1 Alternative A

2.2 Alternative B

- .
- .
- .

Figure II-3.8 Capital Costs Summary for Each Alternative

Corridor: Southwest
 Alternative: 19-mile LRT, Subway Option

Cost Estimates

Item	Lower Bound	Best Estimate	Upper Bound
<hr/>			
1. Segments			
A. 15th-Broadway	.	.	.
B. Broadway-Main	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
Subtotal	.	.	.
<hr/>			
2. Systemwide			
Electrification	.	.	.
Signals/Commun.	.	.	.
Vehicles	.	.	.
Maint. Facilities	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
Subtotal	.	.	.
<hr/>			
3. Engineering and Construction Management	.	.	.
<hr/>			
Total (1990 Dollars)	.	.	.
<hr/>			
4. Inflation (at X pct for Y year schedule)	.	.	.
<hr/>			
Total Cost	.	.	.

Figure II-3.9 Build-Up of Costs for One Segment

Corridor: Southwest
 Alternative: 19-mile IRT, Subway Option
 Segment: 15th to Broadway

Item	Unit Cost	Quantity	Base Cost	Contingency Multiplier	Total Cost
1. ROW Acquisition
2. Utility Work
3. Type 1 Cross-section
4. Non-Recurrent Items					
Retaining Walls
Crossovers					
At-Grade					
15th St.
Broadway
.
Overpasses
.
Underpasses
.
Other Unique Structures
.
Subtotal					— . —
5. Stations					
Crescent Heights					
Type 2 Base Cost
Site Preparation
Park/Ride Lot
Bus Access Facility
.
Silverado					
Type 3 Base Cost
.
Subtotal					— . —
6. Other					
Track Relocation	.		.		.
.	.		.		.
.	.		.		.
Total Segment Cost					<Column Sum>

engineering and management costs equal to its share to total capital costs. Table II-3.3 depicts the annualization of capital costs for a sample alternative.

3.5(b) A Note on Present Value Calculations in Annualizing Capital Costs

The approach outlined above is different from what might be termed the classical approach to computing an annualized capital cost, an approach that was used in most alternatives analysis prior to 1984. The classical approach starts with a time stream of capital costs over a predefined analysis period — typically 50 years for major construction projects. Within this time stream, capital costs are assigned to specific years, both during the construction period and for any replacement costs in later years. The cost in each year is then converted to its present value with a present value factor computed as:

$$(3-2) \quad \text{Present Value Factor} = \frac{1}{(1 + i)^n}$$

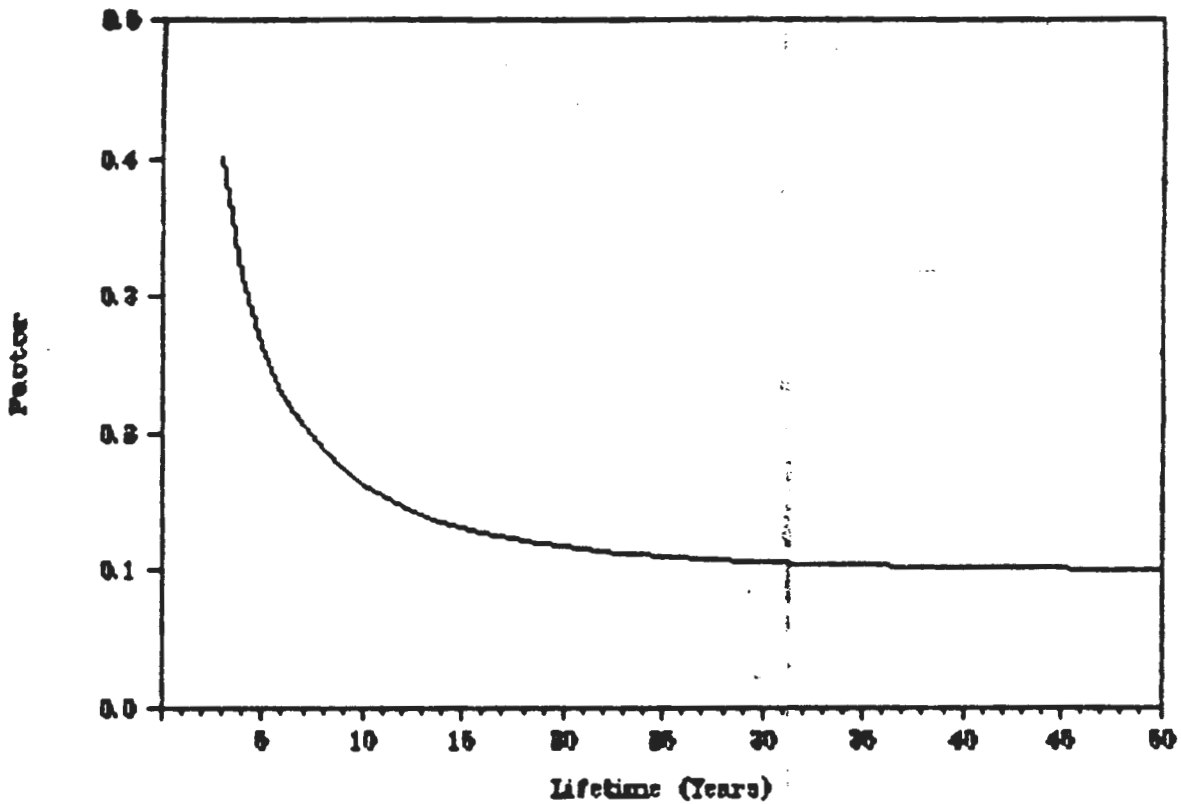
where n and i are the project life and discount rate, respectively.

The summation of the present values over the entire analysis period is therefore the present value of the project's capital costs over its lifetime. The annualized cost of the project is then calculated with an annualization factor computed with Equation (3-1), using the assumed 50-year project lifetime. This approach accurately reflects the lower annualized cost that results from the stretch-out of construction costs over a construction period of several years. Expenditures that occur later in the period have a lower present value than those occurring in the first year and therefore contribute less to the annualized costs. As a result, the classical approach gives a more accurate portrayal of equivalent annual costs.

However, a significant error has usually occurred with this method because, while it correctly recognizes the scheduling of capital costs over time, it has usually been used in an analysis that ignores the scheduling of benefits. Typically, the capital cost stream has been discounted back to a present value, while benefits (ridership, time savings) are fixed at their value in the forecast year (typically 2000). The error biases the analysis towards alternatives with longer construction periods since it discounts their out-year costs quite heavily but does no discounting on the similarly-delayed benefits. The error also invites game-playing with construction schedules, since stretching or delaying the construction period makes the project appear less expensive with no attendant decrease in benefits.

Two alternative approaches are available to correct this problem. The first, and "best," is to construct time streams of all items (costs, patronage, time savings) and discount everything to a present value. The

Table II-3.2 Annualization Factors



Discount Rate: 0.10

Lifetime of Asset	Annualization Factor	Lifetime of Asset	Annualization Factor
1	1.100	16	0.128
2	0.576	17	0.125
3	0.402	18	0.122
4	0.316	19	0.120
5	0.264	20	0.118
6	0.230	25	0.110
7	0.205	30	0.106
8	0.187	40	0.102
9	0.174	50	0.101
10	0.163	75	0.100
11	0.154	100	0.100
12	0.147		
13	0.141		
14	0.136		
15	0.132		

Table II-3.3 Annualization of Capital Costs

Corridor: Southwest
Alternative: 9-mile LRT, Subway Option

Discount Rate: 0.10

Item	Cost (\$ 000)	Lifetime (years)	Annuali- zation Factor	Annualized Cost, Infinite Stream (\$ 000)
Right-of-Way	15,000	100	0.10	1,500
Structures	65,000	30	0.11	6,895
Track Work	25,000	30	0.11	2,652
Signals; Electification	18,000	30	0.11	1,909
Vehicles				
Rail	20,000	25	0.11	2,203
Bus	10,000	12	0.15	1,468
Total	153,000			16,628

second is to ignore the scheduling of capital costs, just as the scheduling of benefits have been ignored. The following table summarizes the alternative approaches and their implications:

Method	O&M Costs and Capital Costs	Benefits	Effects on Evaluation
Old	Discounted stream	Forecast year values	Significantly understates costs compared to benefits
Best	Discounted stream	Discounted streams	Closest to the "true" trade-offs
Current	Direct annualization (no discounting)	Forecast year values	Moderately understates costs compared to benefits

The "best" approach is superior in the sense that it provides the most accurate accounting of costs and benefits, and yields an evaluation closest to the true trade-off between the investment and its transportation returns. This approach recognizes that benefits from any project begin to accrue only after the construction period is completed. It also specifically examines the growth rates over time for such benefit measures as transit patronage, traveltime savings, consumer surplus, and operating cost savings. Unfortunately, analysis by UMTA staff has indicated that the results of this approach are highly dependent on assumptions (guesses) made for the out-years of the time streams of patronage and time savings. Even with the heavy discounting of these out-year values, they are able to influence the indices significantly, particularly for projects that have relatively small benefits. Since it is very difficult to estimate patronage levels in 2020 with any confidence, the "best" approach has been abandoned.

The adopted method removes most, but not all, of the error in the past approach. The method essentially ignores timing on both sides of the question — costs as well as benefits. This approach implicitly assumes that capital costs and benefits occur at the same time. Since the benefits always occur after the construction costs, there remains some understating of the relative costs of projects with longer construction periods. This approach yields evaluation results that are somewhere between the old method and the "best" method.

In summary, the method now used in alternatives analysis ignores start-up timing effects, while specifically recognizing the economic lifetimes of individual capital components. This approach takes a broad view of the projects in assuming that, given the long lifetimes of major capital projects, both the costs and benefits of a transit project effectively begin

at the same time. While this is not entirely accurate, it is superior to alternative approaches that either ignore the timing of benefits while recognizing the timing of costs, or require year-by-year forecasts of measures that are difficult to predict even for one year.

Consequently, calculations that include the discounting of capital costs over time are not acceptable in the economic evaluation done as part of alternatives analysis.

3.6 Computing Cash Flow Requirements for Capital Expenses

In contrast to the economic analysis where timing effects are ignored intentionally, the financial analysis of the alternatives requires a year-by-year estimate of the funds that will be needed for construction. Development of this time stream requires an estimate of the length of the construction period, the percentage of costs (expressed in constant base-year dollars) that will be incurred in each year, and the inflation rate during the period.

It is important to recognize that all of the costing work discussed thus far has been in terms of constant dollars, ignoring the effects of inflation. This is appropriate since it simplifies the development of unit costs and yields cost estimates that are useable without adjustment in the economic analysis. However, since the total capital funding needed for a project will include the effects of inflation through its construction period, the financial analysis of the alternatives requires that costs also be projected in "current" dollars — dollars valued in the year in which they are expended. The inflated construction cost is documented in the presentation of capital costs in the DEIS (Chapter 2) and is examined in more detail in the financial analysis (Chapter 6).

Inflation costs are generally computed with multipliers that reflect the compounded effect of the projected inflation rate. The factors are computed with:

$$(3-3) \quad \text{Inflation Factor} = (1 + i)^n$$

where i is the inflation rate and n is the number of years after the base year.

A project estimated to cost \$200 million (1986 dollars) would have a cash flow requirement computed as follows for an annual inflation rate of 5 percent, a 4-year design and construction period, and costs estimated for a base year of 1986:

Year	Fraction of Costs	Expenditure (1986 \$)	n	Factor	Expenditure (current \$)
1986	0.05	10 MM	0	1.000	10.0 MM
1987	0.25	50 MM	1	1.050	52.5 MM
1988	0.40	80 MM	2	1.103	88.2 MM
1989	0.30	60 MM	3	1.158	69.5 MM
Total	1.00	200 MM			220.2 MM

Recent alternatives analyses have usually assumed that the inflation rate for transit construction projects will be equal to general inflation in the economy, reflected by changes in the Consumer Price Index. In the absence of evidence to the contrary, this assumption will remain adequate.

Assumptions on the length of the construction period should recognize both the optimal staging of construction and any constraints that may prevent the ideal schedule, particularly funding constraints. The analysis should be coordinated with the financial planning efforts, particularly in developing a range of assumptions on the inflation rate and length of the construction period for use in a sensitivity analysis of cash flow requirements.



II.4. Operating and Maintenance Costs

A reliable estimate of the costs of operating and maintaining each alternative is crucial to an accurate assessment of its cost-effectiveness and financial implications. This chapter recommends an approach -- resource build-up -- that has been used in recent alternatives analyses and is a significant improvement over the method used in earlier efforts.

4.1 General Approach

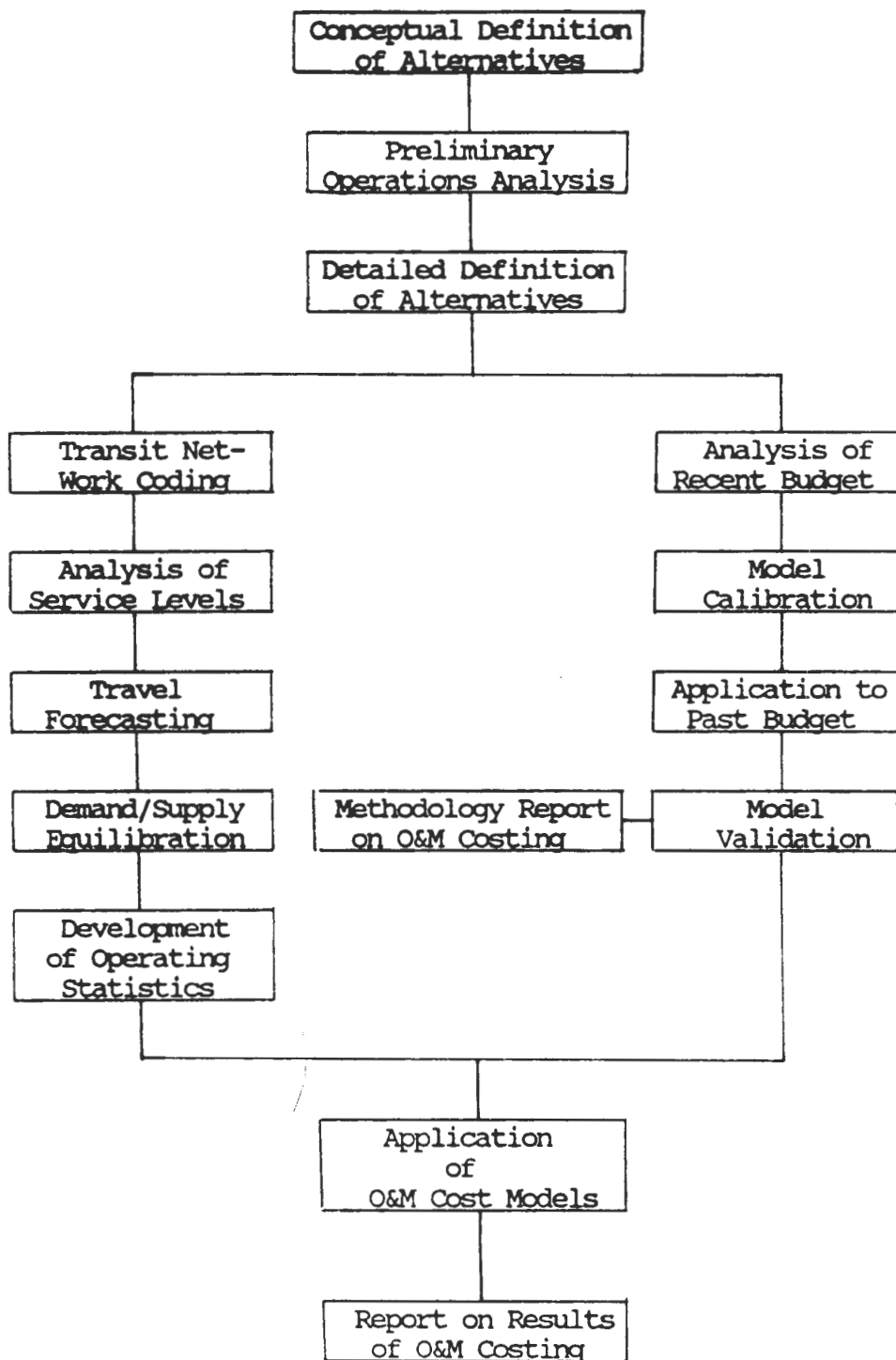
Figure 4-1 summarizes the scope and flow of the development of O&M costs. The initial phase of the work involves a preliminary operations analysis necessary to identify an operating plan for each alternative. These operating plans, together with route layouts and design standards, constitute the detailed definition of the alternatives. Work then proceeds on two fronts that are largely independent of each other. One front is the analysis of service and patronage levels necessary to develop a final operating plan for each alternative that optimizes its performance. This involves detailed coding and analysis of transit networks, patronage estimation, and the balancing of transit supply with transit demand. It culminates in the estimation of the operating statistics -- vehicle-miles, vehicle-hours, peak vehicles, etc. -- that drive the O&M cost models. This work is documented in reports on the travel demand analysis and need not be discussed in detail in the reports on O&M costing.

The other front is the development of the O&M cost models themselves. This effort requires a detailed budget statement and an accurate estimate of service characteristics from a recent fiscal year of the local transit operator. To the extent possible, the chosen fiscal year should be both stable -- in that no significant changes in service levels, labor productivity, or ridership patterns occurred -- and representative -- in that service characteristics are similar to the current operation. Where the alternatives include transit modes or operating practices that are new to the local area, the effort will also require data from other urban areas where these modes and practices are in place.

The O&M cost models are calibrated simply by identifying those costs that are variable with service levels, and then attributing each variable cost item to the service characteristic to which it is most closely tied. The resulting unit costs can then be applied to variations in service characteristics caused by an alternative to estimate the O&M cost of the alternative.

Ideally, the O&M cost models should be validated by applying them to a past fiscal year in which service levels were somewhat different and examining how well the estimated costs match the actual expenditures for that year. Obvious candidates for the fiscal year selected for the validation work are those prior to major expansion or contraction of service. Difficulties may arise in obtaining cost records in the same accounting format and staffing records in sufficient detail to examine changes in labor productivity. The

Figure II-4.1. Estimating Operating and Maintenance Costs



effort should be made, however, because the validation of the cost models against an operation that is somewhat different from that in the calibration year adds substantial credibility to its estimates for the alternatives.

The methodology report on O&M costing documents the development and validation of the O&M cost models, and, where data for new modes or operating practices have been taken from other transit operators, discusses the applicability of the resulting model to the local situation.

Application of the O&M cost models is straightforward. The service requirements for each alternative -- vehicle-miles, etc. -- are used in the models to estimate staffing levels, labor costs, and material costs. The results are documented in the O&M cost report on a line-item basis for each alternative so that participants in the analysis can examine the source of cost difference between the options.

4.2 Resource Build-Up Models

All alternatives analyses should use a resource build-up approach in the estimation of O&M costs. Resource build-up models compute costs by estimating the labor and materials needed to provide a given level of service, and then applying projected unit costs of labor and material. In its most detailed form, a resource build-up model represents costs in a series of equations of the form

$$(4-1) \quad \text{O\&M cost} = (\text{unit of service}) \\ \quad \quad \quad \times (\text{productivity ratio: resources per unit of service}) \\ \quad \quad \quad \times (\text{resource unit cost}).$$

Units of service typically include vehicle-miles, vehicle-hours, peak vehicles, yards, stations, garages, track-miles, and passengers. They are derived from both the physical descriptions of the alternatives and from the final operating plan for each alternative derived through equilibration of travel demand with system capacity and service policies. The resource-required-per-unit-of-service is a productivity measure expressed, for example, in such terms as "mechanics per vehicle-mile" for vehicle-mechanic labor and "gallons of diesel fuel per vehicle-mile" for fuel costs. These productivity ratios are derived from local budget documents and other records of recent operating years, and, in the case of new modes, from data obtained from operators of similar services in other cities. Unit costs are expressed in such terms as "average annual wages per mechanic" and "average price per gallon of diesel fuel." They are also derived from recent budget documents, supplemented where necessary with data from other transit operations.

For new modes care must be taken when cost data are derived from the operating budgets of other agencies because some costs may be omitted. For example, when a rail system begins service at an agency, the rail operating budget will frequently not include many of the agency's administrative costs, a portion of which support the rail service. Examples of such costs

are those for scheduling, personnel, marketing, insurance, and fare collection which may not be accounted for in the rail budget. Proper allocation of these costs can be accomplished by examining how they were allocated by mode for Section 15 reporting purposes.

When cost data are used from other agencies for new modes, it is important that the appropriate mix of new and older systems are represented in developing the unit and productivity costs to be used for the new mode. The objective is to develop a process which accurately predicts long term O&M costs for the system of concern. For example, rail maintenance costs should not be derived from systems recently opened because these costs are likely lower than the long term costs. Similarly, cost data from older systems, which incur higher than normal costs due to deferred maintenance practices, should not be used exclusively. Because judgement is required in deciding these issues, it is important that the justification for using one system over another, or for using a mix of systems, is properly documented in the methodology report.

Short Term Forecasts. Productivity ratios are central to this modeling approach and describe the manner in which labor and material requirements vary with service levels. In the short term these relationships can take one of three forms — continuously variable, step-wise variable, and fixed. Continuously variable items are those for which the added cost of an additional service unit — a vehicle mile — remains the same over the entire range of service levels. Such items as diesel fuel, electric traction power, mileage-based preventative maintenance activities, and so forth, are well represented as continuously variable cost items.

Items that vary in steps have significant discontinuities in their marginal costs. A common example is the cost tied to the operation of vehicle maintenance facilities themselves (as distinct from the vehicle maintenance done within the facility). This would include the costs of utilities, janitorial staff, security, etc. that increase only when an additional facility is needed. Thus, it would be incorrect to assign these costs to a continuous variable — peak vehicles, for example — since every additional peak vehicle would incorrectly add to the cost of these items. The correct approach is to vary the facility costs with larger increments (or steps) of peak vehicles, where the step size is the number of additional peak vehicles that would require the opening of an additional maintenance facility.

Finally, fixed items are those whose marginal cost is zero over the expected range of system variables. Staffing in administrative positions — the general manager's office, personnel, legal, etc. — is likely to fall within this category.

Long Term Forecasts. While this differentiation of costs into three categories is appropriate for short range projections involving annual cash flows, it is likely that all agency costs vary continuously over the 15 to 20 year planning period of major transportation investments. This effect is consistent with economic practice which treats all operating costs as variable in the long term. The approach makes sense even in cases in which

an agency decides not to increase certain staff positions when service is expanded. The following example discusses how this applies to what frequently are considered fixed costs.

If an agency projects no increase in certain staff positions due to service increases, two possibilities are likely resulting in either a hidden cost to the agency or a real one. An expansion in service is likely to result in additional work for all agency staff. Not increasing staffing levels means that less time can be spent on duties preformed prior to the system expansion. Schedulers may not fine tune schedules as frequently, or callers may have to wait longer for schedule information. Monetary costs to the agency remain the same as before the expansion but the quality of service may decline.

The costs incurred by the agency become more apparent if a second service expansion of similar magnitude to the first occurs. The cumulative effect of the two expansions could result in the hiring of several new employees, a cost partially created by the first service expansion. Making all costs continuously variable properly accounts for the costs caused by each service expansion.

Another effect of long term service expansion is an increase in real terms (net of inflation) in the salaries of department heads and other positions which would not otherwise increase in number. For example, a General Manager's salary is likely to increase in real terms as the size of the agency increases. Similarly, if the agency became significantly smaller, the General Manager's salary would likely decrease. It is difficult to predict the size of the increase or decrease, but relating the cost of these positions to a continuous service variable is a straightforward way of recognizing this effect.

UMTA requires that all agency operating costs be treated as continuously variable when computing the UMTA cost-effectiveness indicators. This approach does not preclude the assumption of fixed costs in computing cash flows for the financial analysis as explained in Section 4.7 below. This treatment of costs recognizes that the purpose of the cost-effectiveness index is to account for the benefits and costs associated with the project and not the cash flows which are of concern in the financial analysis.

Examples of Model. Table II-4.1 illustrates one approach to modeling the costs of bus maintenance and servicing for a representative transit operation. For each cost item, the third column identifies the service variable to which the cost has been assigned. The "model" itself consists of the productivity ratios and unit costs in the next two columns. Outputs from the model are the labor requirement (if any) for each category, and the estimated cost.

The table illustrates several options for portraying costs. In this example, all labor unit costs include both wages and fringe benefits. Thus the model would not be transparent in illustrating the effect of changes in the fringe ratio -- a limitation likely to be quite acceptable in an

Table II-4.1. Sample Sections of a Detailed O&M Cost Model

acct	resource category	service level	resource productivity	unit cost	staff	cost (000)
010	office of director of operations	peak veh	<u>1 staff</u> 200 peak veh	<u>\$47,000</u> staffer		
	schedulers	peak veh	<u>1 staff</u> 65 peak veh	<u>\$28,700</u> staffer		
	shift supervisor	garage	<u>3 supervisors</u> garage	<u>\$38,400</u> supervisor		
	street supervisor	veh-hr	<u>1 supervisor</u> 0.14MM veh-hr	<u>\$34,100</u> supervisor		
	support staff	garage	<u>5 staff</u> garage	<u>\$22,000</u> staffer		
032	fuel	veh-mi	<u>0.31 gal</u> 1 veh-mi	<u>\$0.94</u> gal		-
	lubrication	veh-mi	-	<u>\$0.012</u> veh-mi		-
033	tires and tubes	veh-mi	-	<u>\$0.021</u> veh-mi		
042	office of director of maintenance	peak veh	<u>1 staff</u> 250 peak veh	<u>\$38,000</u> staffer		
	maintenance supervisors	garage	<u>3 supervisors</u> garage	<u>\$36,200</u> supervisor		
	support staff	garage	<u>2 staff</u> garage	<u>\$22,000</u> staffer		
050	service mechanics	peak veh	<u>1 serv. emp.</u> 11 peak veh.	<u>\$24,600</u> service emp.		
	cleaning	peak veh	NA	\$0.06		-
060	bus mech. (including leadmen)	veh-mi	<u>1 mechanic</u> MM veh-mi	<u>\$29,600</u> foreman		
	parts	veh-mi	-	<u>\$0.213</u> veh-mi		-

alternatives analysis. An alternative specification would be to use separate line items for the wages and fringes in each labor category. The added flexibility of this specification must be traded-off, however, against the relatively large number of line items that would be added to the model. A useful compromise may be to use the more detailed specification for vehicle operators only, reflecting the magnitude of this expense and the variability of operator fringes.

Also in this example, all staff positions within a fixed line item are counted and costed together. Thus, in the office of the director of operations, the model does not identify individual positions or salaries and would not be able to illustrate the effects of different staff mixes. Again, this limitation would have no effect on the usefulness of the model in an alternatives analysis, and a more detailed specification of the fixed offices could be used in situations where the staffing mix was an issue.

The table also illustrates several forms of productivity ratios. These arise from an effort to keep the ratios in meaningful units. For labor items in which there are several staff positions associated with each service unit, the numerator of the productivity ratio is greater than 1. For example, operations supervisors are represented as three positions per garage, rather than one position per 0.333 garages. The converse occurs where there are several units of service associated with one position. Service mechanic, for example, are specified at 1 position per 11 buses rather than 0.09 positions for each bus. In both examples, the two specifications are equivalent and the model would yield the same result. However, the preferred specifications yield ratios that are much more easily interpreted.

Finally, the example illustrates the difficulty in computing productivity ratios for many material line items. While some items -- diesel fuel, for example -- have natural productivity ratios, many do not. Maintenance parts and cleaning supplies in this case cannot be quantified in any single unit. Their productivity ratio, then, is expressed directly in terms of costs-per-service-unit (\$/vehicle-mile and \$/peak-vehicle, respectively).

4.3 Standard System of Accounts for Alternatives Analysis

One of the benefits of the resource build-up approach to O&M costing is that assumptions on productivity ratios and unit costs are made explicit and are therefore easily compared with data from other operations. To facilitate comparisons across cities, UMTA staff are compiling O&M cost models from around the country and are supplementing these models with detailed analyses of labor and material productivity from a sample of transit operations. To facilitate cost comparisons among cities, UMTA has developed a standard system of accounts for O&M cost models used in alternatives analysis. The system is a simplification of the standard accounts, shown in Table II-4.2, used for reporting UMTA Section 15 data at Level A. Table II-4.3 summarizes the standard alternatives analysis accounts and indicates their relationship to the Section 15 Level A accounts.

Table II-4.2 Section 15 Level A Accounts

Level A
Account
Number

Account

011	Transportation Administration
012	Revenue Vehicle Movement Control
021	Scheduling of Transportation Operations
031	Revenue Vehicle Operation
041	Maintenance Administration - Vehicles
042	Maintenance Administration - Facilities
051	Servicing Revenue Vehicles
061	Inspection and Maintenance of Revenue Vehicles
062	Accident Repairs of Revenue Vehicles
071	Vandalism Repairs of Revenue Vehicles
081	Servicing and Fuel for Service Vehicles
091	Inspection and Maintenance of Service Vehicles
101	Maintenance of Vehicle Movement Control Systems
111	Maintenance of Fare Collection and Counting Equipment
121	Maintenance of Roadway and Track
122	Maintenance of Structures, Tunnels, Bridges, and Subways
123	Maintenance of Passenger Stations
124	Maintenance of Operating Station Buildings, Grounds, and Equip
125	Maintenance of Garage and Shop Buildings, Grounds, and Equip
126	Maintenance of Communication System
127	Maintenance of General Admin. Buildings, Grounds, and Equipment
128	Accident Repairs of Buildings, Grounds, and Equipment
131	Vandalism Repairs of Buildings, Grounds, and Equipment
141	Operation and Maintenance of Electric Power Facilities
145	Preliminary Transit System Development
151	Ticketing and Fare Collection

Table II-4.2 (con't) Section 15 Level A Accounts

Level A Account Number	Account
161	System Security
162	Customer Services
163	Promotion
164	Market Research
165	Injuries and Damages
166	Safety
167	Personnel Administration
168	General Legal Services
169	General Insurance
170	Data Processing
171	Finance and Accounting
172	Purchasing and Stores
173	General Engineering
174	Real Estate Management
175	Office Management and Services
176	General Management
177	Planning
181	General Function

Table II-4.3 Standard Accounts for Alternatives Analysis

Acct	Level A Accounts	Title
010	011, 012, 021	Administration and Scheduling of Transportation Operations
031	030	Operator Wages and Fringes
032	030	Fuel and Lube
033	030	Tires and Tubes
041	041	Maintenance Administration - Vehicles
042	042	Maintenance Administration - Facilities
050	051	Servicing Revenue Vehicles
060	061, 062, 071	Inspection, Maintenance, and Repairs of Revenue Vehicles
080	081, 091	Inspection, Maintenance, and Servicing of Service Vehicles
101	101	Maintenance of Vehicle Movement Control Systems
111	111	Maintenance of Fare Collection and Counting Equipment
121	121, 122	Maintenance of Roadway, Track, and Structures
123	123	Maintenance of Passenger Stations
124	124, 125, 127, 128	Maintenance and Repairs of Buildings, Grounds, and Equipment
126	126	Maintenance of Communication System
141	141	Operation and Maintenance of Electric Power Facilities
151	151	Ticketing and Fare Collection
160	162-164, 166-168, 170-177, 181	Other General Administration
161	161	System Security
165	165	Injuries and Damages
169	169	General Insurance

The development of O&M cost models for alternatives analysis should include the assignment of all accounts from the local accounting structure to one of the standard accounts in Table II-4.2. To the extent possible, all variable line items assigned to each standard account should be associated with the same service variable so that each account can be aggregated to a one-line expression.

Table II-4.4 provides descriptions of the standard accounts. The descriptions identify the types of transit employees covered in each account and an indication of the service variable(s) to which the account is assigned. Each account includes the total labor costs (salary and fringes), clerical support for the activity, relevant training, and necessary materials. More information on the expense components of each account is presented in "Urban Mass Transportation Industry System Of Accounts and Records and Reporting System," January 10, 1977, Vol. 2, available from UMTA.

4.4 Accurately Representing Unit Costs

The portrayal of unit costs for most accounts is usually straightforward. It is equally important to recognize differences in operating conditions (speeds in particular) and vehicles (standard and articulated buses). Judgment should be used to ensure that the level of sophistication in the portrayal of unit costs matches the size and potential variability of the line item, so that relatively small cost items are not made overly complicated.

Certainly the most important category of costs is operator wages and benefits. These items usually constitute 50 percent or more of total operating costs and are usually the most difficult to estimate accurately. If the kinds of service, composition of the work force (regular, parttime and extraboard operators, etc.) and the peak-to-base ratio of the service for the forecast year are similar to that of the calibration period, then the conversion to costs can be straightforward. However, if any of these change significantly, then the costing model must be sensitive to the cost implications of these changes.

Figure II-4.2 is an example of a method used to convert platform hours of service derived from a network simulation to payhours. It is based on an analysis of operator pay hours in a large bus operation. As the peak to base ratio increases, the figure shows a higher percentage of payhours at overtime and for mini-run drivers (part-time drivers) and open work (usually assigned to part-time, but given to regular drivers due to a limit on the number of part-time drivers who can be hired), and a decreasing percentage of payhours for regular drivers. This method recognizes that the cost of a vehicle hour of service is highly dependent on the peak to base ratio of the transit system. In addition, by explicitly accounting for part-time drivers and overtime work, it is sensitive to changes in part-time hiring policies and overtime rates.

Table II-4.4 Descriptions of Standard Accounts

010 - Administration and Scheduling of Transportation Operations includes all positions supporting the transportation function: operator instructors and students, service inspectors, supervisors of station and terminal activities, transportation managers, superintendents and others engaged in administering transportation activities. Also included are road supervisors, dispatchers, starters, timekeepers, and those associated with schedule making.

031 - Operator Wages and Fringes includes operators of revenue vehicles and those moving operators to and from relief points. Extraboard operators supporting revenue service, including their report time, are also included.

032 - Fuel and Lube includes gasoline, diesel fuel, lubricating oil, transmission fluid, grease, etc. used to operate revenue vehicles.

033 - Tires and Tubes includes owned or leased tires and tubes used on revenue vehicles only.

041 - Maintenance Administration - Vehicles includes staff costs associated with administering the maintenance of revenue vehicles, such as those preparing and updating vehicle maintenance data, superintendents, and supervisors and nonworking foremen, and leadmen engaged in both supervising maintenance and repairing vehicles.

042 - Maintenance Administration - Facilities includes costs incurred in activities relating to the maintenance of transit ways, structures, buildings, grounds and equipment.

050 - Servicing Revenue Vehicles includes staff and expenses associated with washing and cleaning the interior or exterior of revenue vehicles, hostling revenue vehicles throughout the service area, and refueling and adding oil and water to revenue vehicles.

060 - Inspection, Maintenance, and Repairs of Revenue Vehicles includes the inspection of revenue vehicle components on a scheduled preventive maintenance basis. Also included are the performance of major or minor repairs, changing lubrication fluids, making road calls, rebuilding and overhauling repairable components or repairing vehicles damaged in accidents or by vandalism.

080 - Inspection, Maintenance, and Servicing of Service Vehicles includes those performing the same kinds of activities as listed in accounts 050 and 060, but for service vehicles rather than revenue vehicles.

101 - Maintenance of Vehicle Control Systems includes the inspection, cleaning, repair, or component replacement of vehicle movement control equipment including radios, roadway phones, monitor units, etc.

Table II-4.4 (con't). Descriptions of Standard Accounts

111 - Maintenance of Fare Collection and Counting Equipment includes the inspection, cleaning, repair, and component replacement of fare collection and accounting equipment (fare boxes, vaults, counters, changers, sorters, etc.)

121 - Maintenance of Roadway, Track, and Structures includes the inspection, cleaning, repair, and component replacement of all roadways, track, structures, tunnels, bridges, and subways.

123 - Maintenance of Passenger Stations includes the inspection, cleaning, repair, and component replacement of passenger station buildings and equipment.

124 - Maintenance and Repairs of Buildings, Grounds and Equipment includes the inspection, cleaning, repair, and component replacement of buildings and equipment for garages, shops and general administration.

126 - Maintenance of Communication System includes the inspection, cleaning, repair, and component replacement of communication systems (office telephone, public address units, etc.), other than those devoted to the vehicle movement control function, which are included in Maintenance of Vehicle Movement Control Systems.

141 - Operation and Maintenance of Electrical Power Facilities includes the supervision and monitoring of power generation and distribution facilities and the inspection, cleaning, repair, and component replacement of these facilities.

151 - Ticketing and Fare Collection includes all staff and expenses involved in fare collection and counting activities. These activities include printing, distributing, counting and controlling tickets, transfers, tokens, etc., pulling vaults, and providing security for the fare collection process.

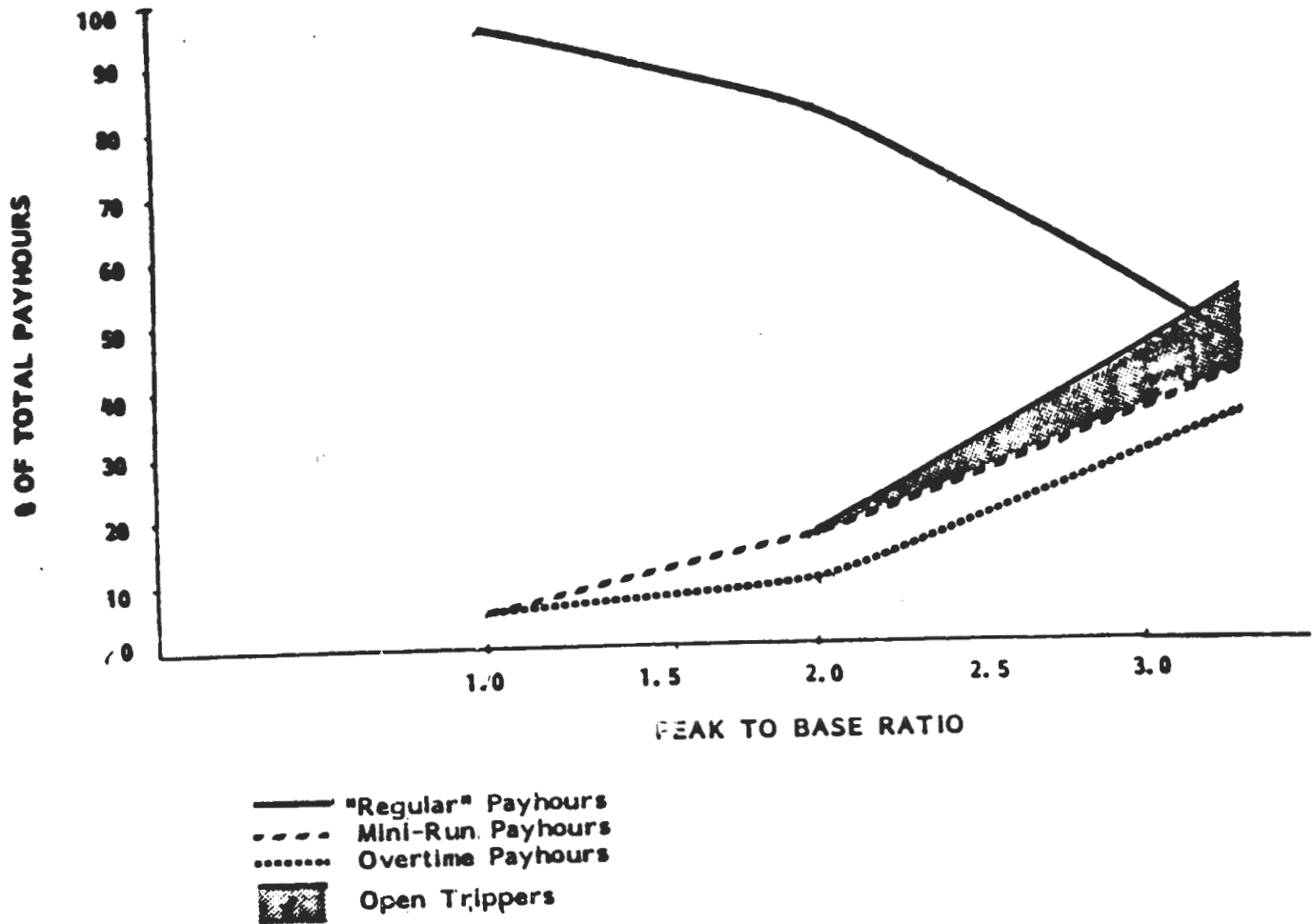
160 - Other General Administration includes all staff and expenses involved in activities relating to providing route information to the public, promotion of the system (advertising, public relations, etc.), market research, safety, personnel administration, and legal services.

161 - System Security includes all those who patrol revenue vehicles, passenger stations, yards, buildings and structures.

165 - Injuries and Damages includes all staff and expenses involved in insuring the transit system against liability losses, processing injury and damage claims, accident investigations, or defending public liability cases in court.

169 - General Insurance includes all staff and expenses involved in insuring the transit system against losses other than public liability (fidelity, fire, accident, etc).

Figure II-4.2 Effects of the Peak to Base Ratio on Payhours



Source: Westside Corridor Project: Financial Analysis Methodology.
 Tri-County Metropolitan Transportation District. (Portland, OR:
 April 1981)

In addition to computing the wages of drivers, calculation of the number of operators required is important in order to accurately estimate the costs of fringe benefits. More sophisticated models compute operator requirements based upon scheduled platform hours segmented by run type. These calculations are made for a typical week of service and extrapolated to an annual driver requirement. Extraboard or spare operators, which can account for as much as a third of operator staff, may need to be estimated separately if changes in service levels or work rules are anticipated. Where significant differences in operating policies are anticipated, the improved sensitivity provided by these more sophisticated methods may be warranted.

4.5 Estimating Input Service Variables

Because most of the input data for O&M cost models are projections of service variables for each alternative, it is important to estimate accurately the vehicle-hours, vehicle miles, and peak vehicles required to provide the planned service levels. Estimates of these service variables usually rely on the mathematically coded network representations used in demand forecasting.

Discussion of network coding is presented in Section 5.1 below. A large number of simplifying assumptions are made in developing these coded networks, assumptions that overlook many of the nuances of transit scheduling. Coded networks used for patronage forecasting cannot begin to describe all of the route variations, headway changes, and other details found in a real transit schedule. An understanding of the importance of these details helps to minimize their potential to introduce errors into the estimates of service variables.

It is most important that the transit network for an alternative have adequate service capacity to meet the projected demand. This "equilibration" step is discussed in more detail in Section 5.2(f) below. All additional analysis is predicated on the success of this step in achieving a balance between transit capacity and ridership demand.

In past studies, unacceptable errors have been introduced in the computer processing of coded transit networks with software that rounds up the route-level vehicle assignment to integer numbers. This is in contrast to scheduling practice where schedulers would adjust the headway on the route or interline several routes to make most efficient use of the peak vehicles. The additional vehicle hours introduced by the upward rounding are assigned to layovers, resulting in layover times that are larger than necessary and an overestimate of total vehicle hours and peak vehicles. One solution to this problem has been to fix layover time as a percentage of route running time and allow a fractional number of vehicles to serve the route. This approach assumes that estimating integer-numbers for vehicle requirements at the route level is an unrealistic constraint given the errors in simulating route length, headways and running times. It relies on the accumulation of fractional estimates as being more accurate when summed to the system level. Alternatively, methods which allow vehicles to serve multiple routes also yield a more accurate estimate of vehicle requirements.

Many of the differences between actual and simulated transit service are corrected by factors developed in a calibration process. Factors can be developed from the ratios between simulated service variables for the current transit operation and actual operating experience. However, when there are significant changes between the kinds of service offered in the calibration year versus the forecast year, these factors may not be applicable for the future network. One example is that significant increases in express service tends to increase the ratio of deadhead time to revenue time in the future network. A second instance is that increases in the portion of service operating with timed transfers raises both the percent of total time spent in layovers and total vehicle requirements. Both examples, occurring to a significant degree, would likely invalidate the application of base-year adjustment factors to future networks. In each of these cases, errors can be minimized by developing factors for each service type in which the factors may vary.

4.6 A Note on Aggregate Cost Models

Prior to 1984, virtually all alternatives analyses used methods for estimating O&M costs that differed significantly for rail and bus operations. In most cases where the rail mode was new to the region, a fairly detailed analysis of labor requirements was done, including the development of a staffing plan. In contrast, O&M costs of bus operations were estimated with a model calibrated on the existing bus service in the region. Invariably, the model employed a "cost allocation" approach in which 1) each line item of O&M costs from a recent budget year were allocated to one of several service variables, and 2) the costs assigned to each variable were summed and divided by the annual total for that service variable to yield a set of aggregate unit costs. The resulting model typically took the form:

$$(4-2) \quad \text{Total O\&M Cost} = C_m \times (\text{Vehicle-Miles}) + C_h \times (\text{Vehicle-Hours}) \\ + C_v \times (\text{Peak Vehicles}) + C_p \times (\text{Passengers})$$

where the C_x 's are the aggregate unit costs for each of the service variables.

There are several problems with this approach, most of which stem from the highly aggregate nature of the resulting model. First, it is difficult to adjust the model for service conditions that are quite different from those that prevail in the system on which the model was calibrated. For example, embedded in the aggregate unit cost per vehicle-mile are the fuel economy of current buses operating, for the most part, entirely in mixed traffic. Where an alternatives analysis considers a busway that would operate both standard and articulated buses on a reserved right-of-way, adjustments to the per-vehicle-mile cost are necessary to reflect the better fuel economy of standard buses in busway operations and the different maintenance and fuel economy of articulated buses. The appropriate adjustments are obscured by the aggregation of maintenance, fuel, and other mile-related costs into a single factor but are easily made with additional line items in the resource build-up approach.

Second, the aggregate nature of the model makes checks on labor productivity levels difficult. These checks are important when the year on which the cost model is calibrated may include anomalies in the bus operation. One example is the extra staffing of operators and mechanics in training, preparatory to a significant system expansion. Unit costs would be abnormally high in a model calibrated on this year since these staff positions contribute to costs while not yet providing additional service levels. Another example is intensive maintenance effort currently devoted to vehicles or equipment with significant reliability problems. Where capital programs are anticipated or are currently underway to replace these vehicles and equipment, improvements in labor productivity might be expected. Again, while the aggregate approach to O&M cost models obscures labor and material productivity, the resource build-up method makes assumptions on productivity explicit and easily checked against information from such outside sources as the UMTA Section 15 data.

Finally, the aggregate nature of the past approach to bus O&M costing has led to problems in comparisons with rail O&M costs that have been estimated through a much more specific build-up of labor and material needs. Since the bus cost model has been calibrated on an existing operation, it reflects all of the less-than-ideal parameters — absenteeism, work rules, etc. — that increase costs. These parameters are easily minimized or forgotten in the design of staffing plans for operation of a mode that is new to a region. At least one past alternatives analysis, for example, initially assumed a 5 percent absenteeism rate for the rail operation while the bus O&M cost model was developed on a budget year in which absenteeism had averaged nearly 20 percent. Unless work rules and operating policies are significantly different by mode, the labor productivity (e.g., platform hours per operator) for each mode should be about the same.

4.7 Computing Cash Flows of O&M Costs

To produce annual cash flows of a transit system's costs and revenues from the present to the forecast year, O&M costs must be accurately represented. This is done using information developed when travel demand modelling runs were made, and when other major service increases are planned.

If inflation is ignored, O&M costs can be expected to remain constant until service is increased. This generally occurs when new vehicles are purchased and put into service, so the determination of O&M costs over time involves estimation of the additional O&M costs incurred when service expands. These costs have usually been projected in detail for three time periods corresponding to travel demand modelling runs. These are the current year, the first year of operation of the planned project and the forecast year, which is generally 15 years in the future. For other years in which service expansion occurs, an estimate must be made of the increase of service variables when new vehicles are put into service. The number and timing of vehicle purchases is usually an output of the capital costing work.

While it is generally acknowledged that total agency O&M costs in the long run vary proportionately with service increases, this may not be the case

for the period immediately following a service expansion. For example, after a major service expansion is implemented, some operating costs categories may stay at the same level as before the increase. However, over time these costs likely will increase to a level that proportionately reflects the service increase. The challenge to the analyst is to estimate the length of time which these costs rise to a level consistent with the service increase. An example of such a cost variance is shown on Figure II-4.3.

4.8 Contents of the Methodology Report on O&M Costing

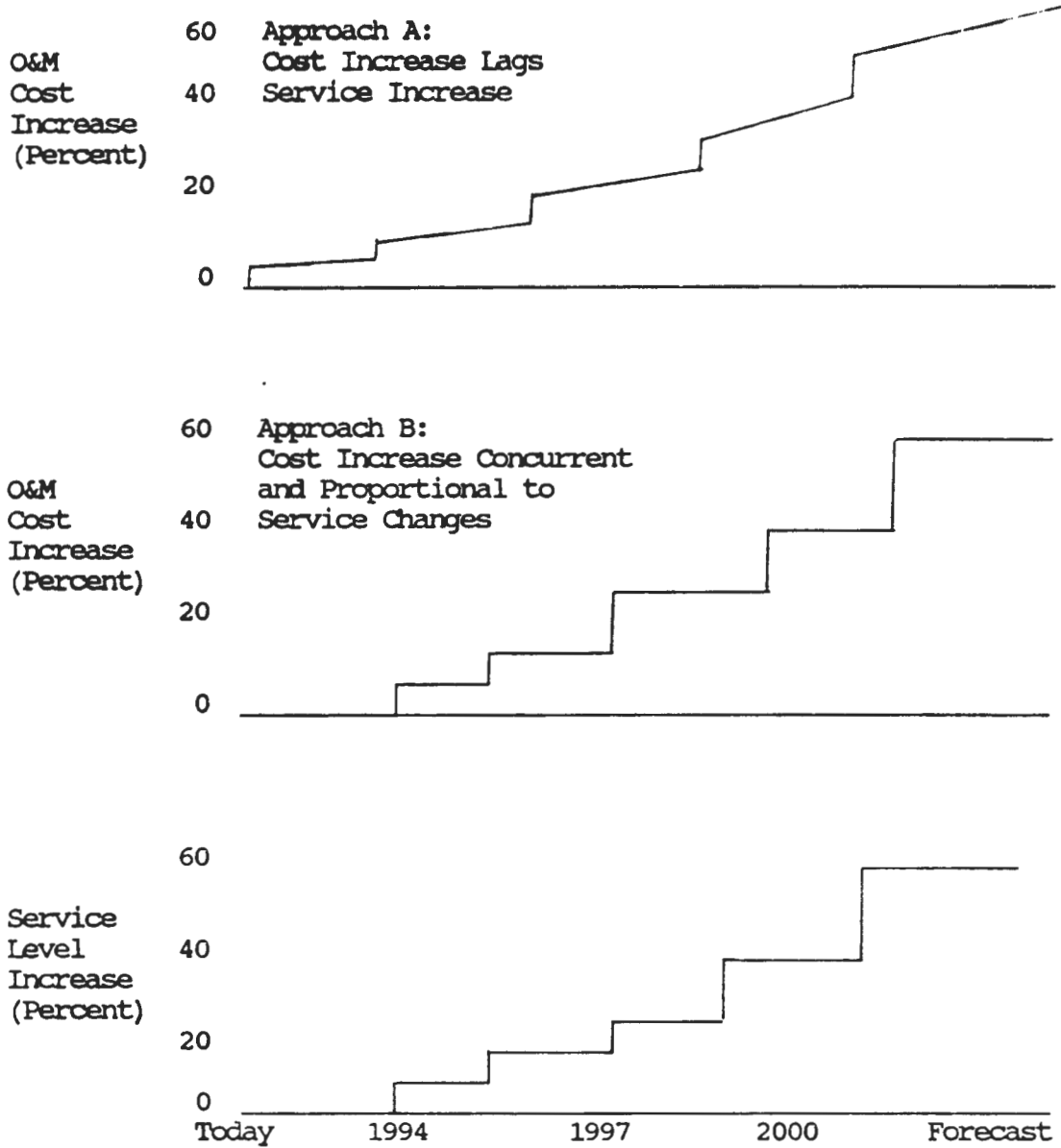
The methodology report on O&M costing summarizes the development of the resource build-up models for each transit mode to be considered. The development is usually most easily summarized by the line-items in the cost models themselves, so the report can be relatively brief and focused on presentations of the cost models in a format similar to that in Table 4-1. When other agencies' costs are used to calculate costs for the local system (e.g. a new rail system), an explanation of how the local costs were derived is necessary. This explanation should be provided for each cost item.

The emphasis of the report should be on unusual budget items requiring special treatment. These can include anomalies in the current local transit operation, adjustments made for new service environments (busways, private operators, etc.), or adjustments made for real (net of CPI) cost inflation projected for certain line items. Figure II-4.4 provides an outline of a typical methodology report.

4.9 Contents of the Report on O&M Cost Results

The results report on O&M costs can also be relatively brief in that it presents simple summaries, by account, of the costs and staffing required for each alternative. The text in this case is reserved for discussions of reasonableness, focusing particularly on those items that are new to the local situation. Assessment of reasonableness of results can be shown by comparing aggregate measures forecasted for each alternative to those for similar existing systems. Measures could include system costs per unit of service, staffing levels by major functions per unit of service, administrative staff as a proportion of total staff, etc. Figure II-4.5 outlines the typical contents of the results report.

Figure II-4.3. Relationship of Operating Costs to Service Levels



NOTE: All O&M costs are in today's dollars

Figure II-4.4 Contents of the Methodology Report on O&M Costing

1. Sources of Information
 - o local budget documents
 - o other transit operators
 - o other sources
 - o description of any anomalies in the calibration or validation years
 2. Summary of Bus O&M Cost Model
 - o summaries similar by account, applied to current operation
 - o brief discussion of the treatment of each standard account
 - o emphasis on adjustments made for new service types, etc.
 3. Summary of Rail O&M Cost Model
 - o summaries by account applied to current operation, if any
 - o brief discussion of the treatment of each standard account
 - o for new modes, justification for selection of operating data from other systems
-

Figure II-4.5 Contents of the Report on O&M Cost Results

1. Summary of Operating Statistics
 - o comparative tabulation of inputs to the cost models (vehicle-miles, vehicle-hours, etc.) for all of the alternatives
 - o discussion of causes and reasonableness of major differences in the operating statistics
2. Summary of O&M Costs and Staffing Requirements
 - o comparative summary tabulation of total O&M costs across alternatives
 - o discussion of sources of variations and their reasonableness
 - o summaries for each alternative similar to Tables 3-2 and 3-3

II. 5: Methods for Travel Forecasting

"The person who called economics 'the dismal science' must have been unaware of travel forecasting."

- Anonymous, 1985.

Of the many technical disciplines needed to analyze transportation improvements, probably no other is more central to the analysis than travel forecasting. The results of the travel forecasting work are used in capital costing to size facilities and estimate fleet requirements, in operations planning to set service levels and estimate operating costs, in the financial analysis to forecast operating revenues and deficits, and in the environmental analysis to examine impacts ranging from regionwide air quality changes to congestion on individual highway links. Further, the evaluation of competing alternatives depends heavily on the ridership and traveltime changes produced by the alternatives. Indeed, it is difficult to discuss any aspect of an alternative at length without dealing with travel-related information.

Unfortunately, travel forecasting may also be one of the least certain technical components of the typical analysis of transportation improvements. Part of the problem is attributable to the dependence of the travel forecasts on a range of input variables -- demographics, fuel prices, and so forth -- for a year well into the future. Fluctuations that have occurred over the past 15 years in downtown employment trends, fuel prices, and transit fares illustrate the difficulty in predicting these variables correctly for the next 15 years. An additional component of the problem is the complex nature of urban travel patterns. They are difficult to measure accurately and even more difficult to simulate. Finally, some of the problem must also be attributed to unsound analytical techniques, the less-than-careful application of the techniques, and the use of more-than-optimistic values for key inputs.

The experience in many previous transit improvement studies has led to doubts on the usefulness of travel forecasts. Ridership projections have been high by factors ranging from nearly twice to more than five times actual experience. As a result, these facilities are overdesigned, new vehicles sit idle, and doubts arise on the merits of significant investments in guideway facilities. Nevertheless, it is impossible to escape the central role of travel forecasts in developing and evaluating transit alternatives. Thus, it is necessary to learn from previous mistakes, isolate sources of particular problems, and structure the analysis to detect improbable inputs and results. Most of all, it is necessary to demystify the travel forecasting process so that it is subject to review by a larger audience than the analysts found in the inner sanctum of models, networks, and computers.

This chapter attempts to translate the technical jargon of travel forecasting into a more common tongue (English) and identify key assumptions and technical steps that deserve the utmost care in the analysis. Chapter 6 then discusses the development of acceptable input assumptions, suggests tests on the reasonableness of the travel forecasts, and summarizes the preparation of travel data needed by other technical areas during project planning. It is

hoped that these efforts will increase the scrutiny of travel forecasts by both travel forecasters and the users of the information, thereby encouraging more careful analysis and lending greater reliability to the results.

5.1 An Overview of Travel Forecasting Methods

The process generally used to forecast travel has two major components. The first describes the transportation system and the accessibility it provides to each subarea of the region. This component is often referred to as "the networks" since it consists of mathematical representations of the highway and transit networks. The second component describes travelers, their travel patterns, and their sensitivities to changes in the transportation system. This component is generally termed "the models" since it includes a series of techniques that attempt to simulate travel behavior.

While the size and complexity of urban areas and their travel patterns dictate the use of large datasets and computer programs for travel forecasting, the basic concepts of the forecasting techniques are not particularly difficult. In project planning, the initial work focuses on representing changes in the transportation system introduced by each alternative. These changes are then used to predict the reactions of travelers and the overall changes in travel patterns -- transit ridership, carpooling, etc. -- that would result.

Thus, the information produced in the analysis is not obscure; rather, it consists of predictions of observable characteristics of urban travel. A key to credible travel forecasts is the checking of important data at intermediate points in the forecasting effort. Can the travel forecasting process simulate current travel patterns with reasonable accuracy? Are the assumptions on population and employment changes consistent with trends in the underlying determinants of urban growth? For each alternative, are the predicted changes in transit traveltimes and fares for important travel corridors consistent with the operations plan? Can the changes in transit's share of individual travel markets be explained in terms of changes in traveltimes and costs?

This section gives an overview of the travel forecasting process in language that is as non-technical as possible. It serves as an introduction to subsequent sections that identify desirable characteristics of techniques used for each step and checks that can be applied to the various pieces of information developed along the way.

5.1(a) Representing the Transportation System

The transportation system is represented by two types of coded networks, one describing the highway system, and the other, the transit system. Each network is "coded" by describing its individual components. The networks are then "processed" to compute the traveltimes between various parts of the region given the highway and transit facilities represented in the networks.

Network Coding An urban highway system is represented as a collection of **links** that are described in terms of their length, type of facility, capacity, and other characteristics determining the time to travel each link. The transit system is represented as a set of **lines** that roughly correspond to the

routes in the system. Lines are described in terms of their service headways, travel speeds, and (in some software packages) the links of the highway network on which the lines operate. Thus, the coded highway and transit networks are both represented as a set of small pieces -- links or lines -- that are tagged with key data describing their service characteristics. In transit project planning, each alternative is represented as a different transit network that reflects its unique new facilities and operating plans as well as the background services common to all alternatives. In cases where some alternatives include significant changes in the highway system, multiple highway networks are also developed.

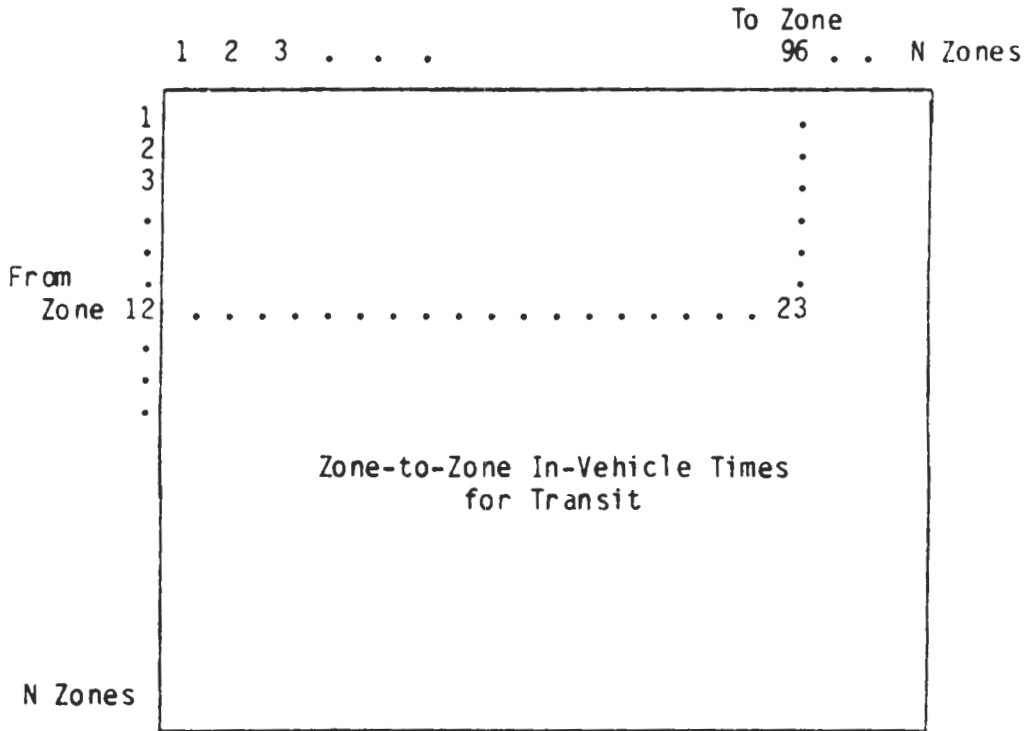
Network Processing The primary purpose of the highway and transit networks is to estimate the times and costs of travel between different points in the region -- home to work, work to shopping, and so forth. To represent the locations of different activities, the region is divided into a set of **zones** that are described in terms of the employment, population, and demographic characteristics. The zones are connected to the networks at appropriate points so that the best (fastest) paths can be traced from each zone to all other zones along the intervening (highway) links or (transit) lines. The highway and transit networks are "processed" to derive travel times and other indicators of travel conditions between each pair of zones in the region. These indicators are developed by computer programs that first attempt to simulate travelers' choices of the highway paths and transit routes through the network, and then sum the traveltimes and costs for the selected paths. The summations have often labeled skims because they are computed by "skimming" the times and costs from each link along the travel paths through a network. More recently, the term "impedances" has been commonly used to describe the estimated times and costs derived from the networks.

Since the programs sum the times and costs between every pair of zones, their output is in the form of square matrices known as **impedance tables**, one of which is depicted in Figure 5-1. Each row of this sample table gives the time spent in a transit vehicle for the best transit path from a given origin zone to all other zones in the region. For example, the 12th row of the table gives transit in-vehicle times to every other zone, and the 96th entry in that row gives the predicted time from zone 12 to zone 96. A separate impedance table is needed for each travel characteristic taken from each network. As the figure indicates, for highway networks a program sums the traveltime, travel distance, and any tolls for the best path between each pair of zones. For the transit network, the summations include times spent walking to, waiting for, riding on, and transferring between transit vehicles, plus fares and transfers encountered along the way. Thus, the products of network coding and network processing are sets of impedance tables for each alternative that predict the revised zone-to-zone times and costs for each option.

5.1(b) Travel Patterns and Traveler Sensitivities

Once the network analysis has established the levels of accessibility within the region, a set of **demand models** is used to predict travel patterns. After these patterns have been checked for reasonableness, they provide a baseline against which changes in the transportation system, regional development, and various transportation policies can be examined.

Format of an Impedance Table



Developing Impedance Tables

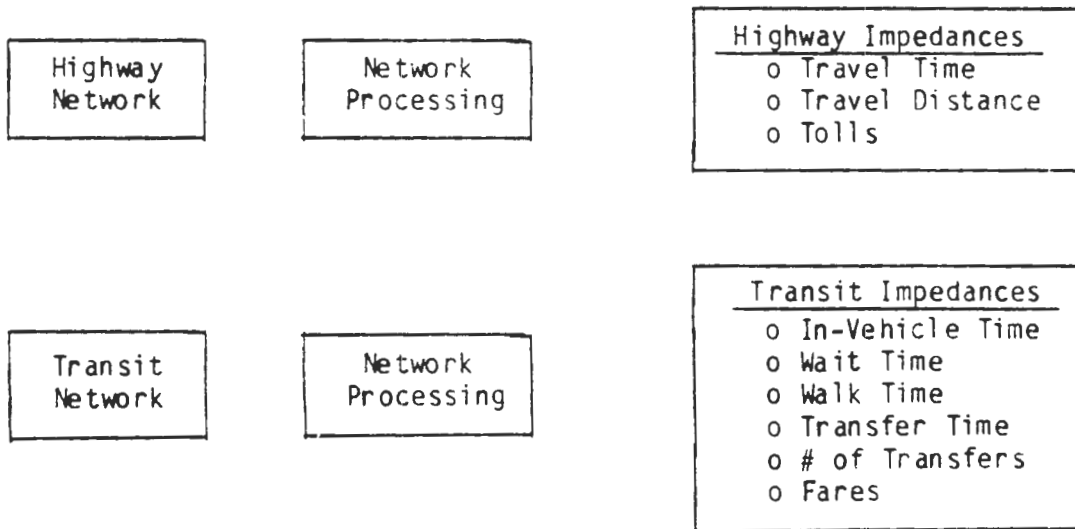


Figure 5-1. Impedance Tables

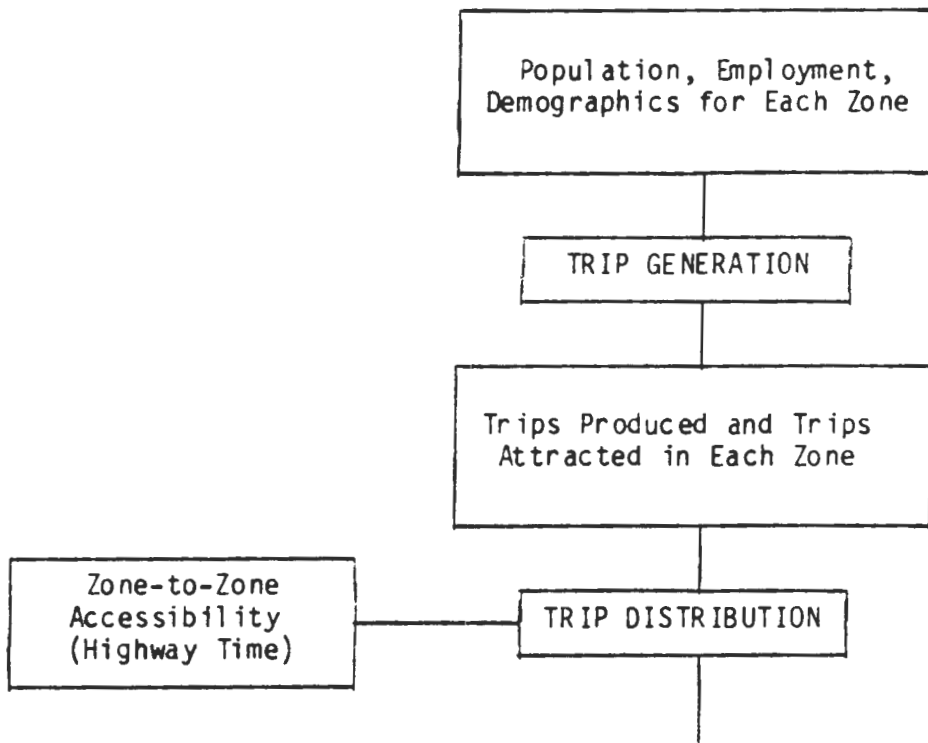
Overall Travel Patterns Total travel by all modes is predicted in an initial phase of the modeling process. The output of this phase is a **trip table** that describes overall travel patterns. Figure 5-2 illustrates a trip table and the two modeling steps that compute it. A trip table is identical to an impedance table in that it has the same number of rows and columns, equal to the number of zones in the region, and differs only in that each cell in the table gives the number of trips between a pair of zones. Thus the entry in the 5th row and 22nd column indicates the number of trips, 155 in the sample table, that are produced in zone 5 and attracted to zone 22.

The two steps used to generate a trip table are trip generation and trip distribution. They are applied separately for each trip purpose -- trips between home and work, home and shopping, etc. -- because the characteristics of these trips are significantly different. The generation step takes estimates of population, employment, and demographics for each zone and predicts 1) the number of trips that will be produced (largely by residents) in the zone and 2) the number of trips that will be attracted to activities (employment, retail, service, etc.) in the zone.

The trip distribution step then links the **trip productions** with the **trip attractions** to form a trip table. These linkages are established by allocating the trip productions in each zone to all other zones based on their attractiveness (the number of predicted trip attractions) and their accessibility (usually the highway traveltime to reach each attraction zone). The trip tables -- one for each trip purpose -- together describe the travel patterns resulting from the distributions of population and employment across the region, plus the accessibility between different parts of the region. Generally, one set of trip tables is used to represent "travel demand" in a given forecast year, implicitly assuming that any of the alternative improvements are relatively small additions to the existing transportation system and will not have a significant effect on overall travel patterns.

Assigning Travel to Modes and Facilities The primary effects of changes in the transportation system are shifts of travel between different modes, facilities, and transit routes. This phase of the travel forecasting process also requires two steps, illustrated in Figure 5-3. First, the "mode choice" step compares the levels of service for each zone-to-zone interchange on the competing modes (driving alone, carpooling, transit, etc.) together with relevant characteristics of the travelers (income, auto ownership, etc.) and predicts the share of trips that will use each mode. These shares are then applied to the appropriate trip table from the distribution step. The outputs from this mode choice step, then, are sets of trips tables, with one table for each mode.

Second, these mode-specific trip tables are then used in an "assignment" step that loads the trips onto the highway and transit networks. These loadings use the same paths established in the earlier network processing step that generated the skim tables. The assignment step yields estimated volumes on individual links of the highway system and routes in the transit system. The process concludes with an "equilibration" step that reviews the match between the highway congestion levels predicted by the assignment step with the assumed speeds used originally to code the highway network. A similar review



Trip Table for Travel by All Modes

		Attraction Zone		
		1	22	N Zones
Production Zone	1		.	
	.		.	
	.		.	
	.		.	
	5155	
N Zones	.			
	.			
	.			

Zone-to-Zone Trips

Figure 5-2. Predicting Overall Travel Patterns

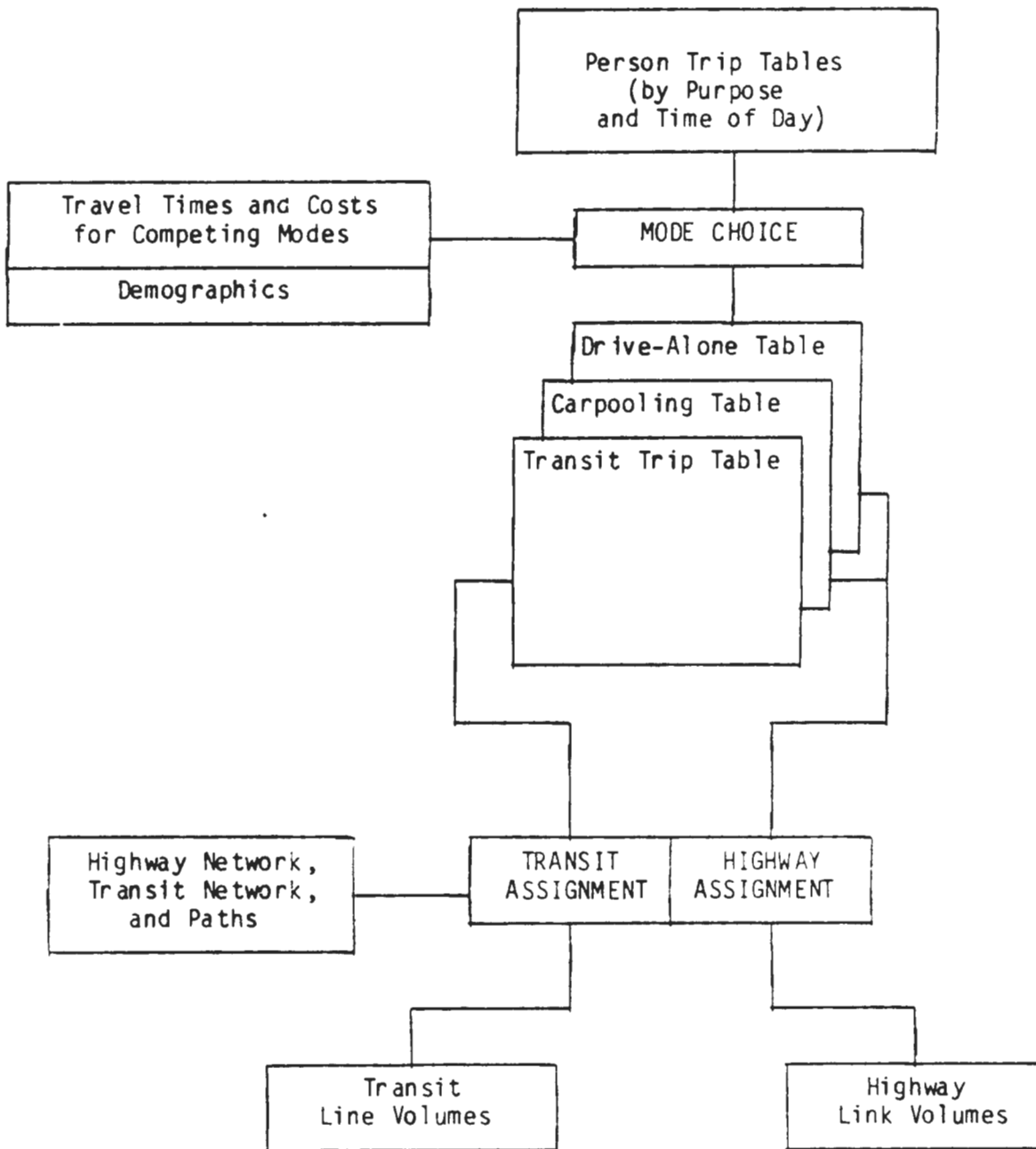


Figure 5-3. Predicting Overall Travel Patterns

is done on the transit travel forecasts to ensure that the levels of service coded into the transit network are reasonable given the resulting demand for transit service. Where the initial network coding assumptions are discovered to compare poorly with the resulting travel patterns, it is sometimes necessary to revise the network coding and reapply selected steps in the analysis.

The resulting transit network and line loadings are the best estimate of the operating plan and patronage implications for each alternative. They provide several kinds of key information: traveltimes for use in computing evaluation measures, line volumes for computing vehicle requirements and sizing facilities, and station boardings for sizing station equipment, bus transfer facilities, and parking lots.

In summary, the travel forecasting process yields four types of important information that provide important indications on the performance of each alternative: **skim tables** that describe the impact of each alternative on transit traveltimes and costs between each pair of zones; **total trip tables** that represent total travel demand in the region; **transit trip tables** that estimate the portion of total travel that would be carried on transit; and **transit line volumes** that measure transit demand on individual components of the transit network. Past practice has tended to focus on the last type of information -- the "bottom line" data on guideway and station volumes. Current practice emphasizes careful scrutiny of each type of information as it is developed, both to assess the reasonableness of the analysis as it is completed and to ensure the credibility of the results.

5.2 Desirable Properties of Travel Forecasting Methods

While the process described above outlines the general approach to travel forecasting, the details of its implementation vary widely from one city to another. Thus, it is impossible to identify a "correct" -- or even "best" -- set of networks and models for use in project planning. A more workable approach is to outline the desirable (and in a few cases, required) properties of the methods used to forecast travel in alternatives analysis.

This approach serves two purposes. First, where new models are being developed, it provides some ideas for features to be included in the model specifications. Second, it alerts users of models with less-than-desirable characteristics to the potential problems in their application. Where possible, corrective measures should be taken to address these potential problems. At a minimum, careful scrutiny should be given to the travel forecasts to detect any of the errors resulting from the specification problems.

5.2(a) Transit Network Coding

The accumulated body of experience with transit network coding for alternatives analysis suggests at least three areas that deserve particular attention:

- o the conventions for network coding and processing used in the application of the forecasting models should be consistent with the conventions used in development of the models;

- o the method used to represent access to transit service, particularly guideway transit service, must be applied carefully; and
- o transit vehicle speeds must be consistent with highway congestion levels.

Conventions There are a large number of parameters that can be varied in the development and processing of transit networks -- the maximum walking distance to transit, the assumed walking speed, the maximum waiting time, the weights placed on different components of traveltime and costs, and so forth. Variations in these parameters can have large and unpredictable impacts on the transit paths and skims used to forecast ridership.

For example, the maximum-wait-time parameter caps the average waiting time for the first transit vehicle used on a trip. While the first-wait time is normally computed as one-half the line's headway, a cap of say 8 minutes assumes that, for longer headway lines, riders schedule their arrival at a bus stop with knowledge of the bus schedule. Thus, no average wait time would exceed 8 minutes, regardless of headways. Processing with no cap on waiting time, alternatively, would represent an assumption that arrivals would be random over the entire range of headways, and wait times could be quite large -- 22.5 minutes for a 45-minute headway route, for example. The skims produced with the uncapped waiting time imply a lower service level than those derived with the capped wait time, even though they are taken from the same network.

Because the sensitivities in a mode choice model directly reflect the skim tables used to develop the model, it is critical that the skim tables used to apply the model be developed with the same coding and processing conventions. Inconsistencies between development and application can lead to significant errors. A model developed with a network that was coded with capped wait times would underestimate transit ridership for an identical network that is processed with uncapped wait times. Because analogous errors can occur for each of the other assumptions used in coding and processing networks, any revision to the coding and processing conventions is risky and, where possible, should be accompanied by a new validation of the forecasting process.

Access to Transit The mode of access to transit services has been shown to be a critical determinant of the likelihood that a traveler will choose transit over an alternative mode. In corridors where the auto-access options (park/ride, kiss/ride) have not been developed, travelers living beyond a reasonable walk distance from the nearest transit service are essentially outside the potential transit market. Even where auto-access options do exist, there is typically a much lower probability of transit use for travelers requiring an auto to reach transit service. Therefore, assumptions on access parameters -- the maximum walking distance, average walking speed, the auto-access "penalty" -- effectively define the potential transit market, an obviously critical step in predicting transit patronage. Past experience in transit project planning has indicated that apparently minor changes in these assumptions can have major impact on estimated transit ridership. The network coding effort, therefore, must provide an accurate description of the accessibility of travelers to the transit network. Coding options and modeling approaches for representing access conditions are covered in Section 5.3(a) below.

Use of Transit Fares in Pathbuilding While travelers certainly weigh the fare implications of alternative paths through a transit network, this effect is usually omitted from the network processing step. The reason often given for this omission is the added difficulty of representing the fare policy in the transit network, though the cause is often simply tradition combined with the lack of a real need for this sensitivity in most cases. The omission of fares in pathbuilding is reasonable in transit systems that provide few path options for most trips. Difficulty often arises, however, when a new transit guideway introduces multiple path options, particularly in and near the downtown. Where the fare policy includes a transfer charge, a pathbuilding effort that ignores fares would overestimate the number of transfers from buses to the guideway. This suggests that fare sensitivity be included where networks are being recoded, and that forecasts from networks that ignore fares be inspected for overestimates of transfers.

Consistency with Highway Congestion Levels The operating speeds of transit services that operate in mixed traffic are directly dependent on highway levels of service. Some relatively new software packages used to represent transit networks specifically recognize this dependence. They overlay the transit network on the highway network and compute transit speeds as a function of predicted congestion levels, estimated transit stop spacing, and vehicle performance. Older software, possibly still the most commonly used throughout the United States, does not make this connection since the transit network is coded independently of the highway network. In areas that are growing rapidly, higher levels of highway congestion in the forecast year can significantly degrade transit service levels, an impact captured automatically in the newer software but left to careful coding of the transit network with the older approach. In either case, but particularly where the older software is used, a systematic review of future highway conditions and their effect on transit speeds is necessary to avoid an overestimate of transit speeds and ridership for services operating in mixed traffic.

5.2(b) Estimating Total Tripmaking -- Trip Generation

While the focus in transit planning has typically been on differences in transit shares for each improvement option, it is also important that total travel demand be estimated accurately. Predictions on the extent to which transit can penetrate the travel market are useful only in conjunction with a good understanding and forecast of the total travel market.

Trip Productions

Methods used to predict the numbers of trips **produced** in specific areas have evolved significantly over the past 10 years or so. Current practice uses a set of household trip production rates stratified by relevant characteristics of households in the region. The stratification is done with at least two of the variables describing households, including income, auto ownership, number of persons, and density. This general approach is substantially better than earlier methods that used regression equations and aggregate zonal (rather than household) data. However, several characteristics of trip production models should be examined prior to their application.

Changes in Important Travel-Related Characteristics Trip rates must reflect several important changes in underlying causes of trip making. In the past 20 years, most urban areas have witnessed significant changes in real household income, auto ownership, household size, 2-worker households, part-time employment, and vacation and sick-leave policies. Some of these shifts -- particularly income, autos, and household size -- can be accommodated readily by using the variables in the models to stratify the trip production rates. Where one of these variables is omitted, a review should be made of the change in that variable since the model was developed, with an eye toward its possible implications for the trip rates. Other trends are not so easily reflected, however. The effect of increasing part-time employment and liberalized leave policies, for example, is to reduce the average number of work trips per job. Many cities have observed this decline between travel surveys collected in the 1960's and surveys conducted recently. Therefore, where a trip production model is based on relatively old travel data, some thought should be given to updating the rates, either with new survey data or by borrowing trip rate information from other urban areas.


Problems with Zone-Level Regression Models Where zone-level regression models are still in use, they should be inspected closely for potential problems. These models often include a distortion of the coefficients that is attributable to the inclusion of several highly intercorrelated zonal characteristics. In an equation of the form

$$(5-1) \quad \text{Work trips produced} = a + b(\text{households}) + c(\text{workers}) + d(\text{autos})$$

where a, b, c, and d are coefficients and all the variables are zonal totals, the large correlation between households, workers, and autos often leads to incorrect coefficients. This can be readily observed in many models by thinking of the coefficients as trip rates so that, for example, c is the trip rate per worker. A coefficient of 0.3 on this variable is illogical since workers produce, on average, 1.5 or so home-based work trips per day (two person trips for each round trip to work, minus absentees and trips that are not home-based). The remainder of the trip rate is captured in the coefficients of the two remaining explanatory variables. Thus, accurate predictions from this equation are possible only when the average numbers of workers and autos per household remain constant, clearly an incorrect assumption.

A second problem can arise in the use of a constant, the "a" term in the equation above. Where large constants are found, significant distortions can occur in the allocation of total trips to individual zones. This occurs because, while the total number of productions is correct, the bias constant causes an over-prediction of trips in zones with few households, and an under-prediction where there are many. This effect is most easily seen by considering a zone with no households: while the correct estimate is zero trip productions, the equation above predicts "a" productions.

Serious consideration should be given to replacement of zone-level regression models where they are still in use.

"Induced" Travel Almost without exception, trip production models do not include any sensitivity to accessibility measures. Estimated total travel, 

Feedback of congested time

therefore, does not change in response to changes in the transportation system. This insensitivity reflects both the lack of success in isolating any relationship between accessibility and trip production rates, and the assumed unimportance of induced travel in most planning situations.

This assumption may be questioned in at least two situations. First, for zero-car households, an obvious hypothesis is that households with good transit service can make more trips than those without. Again, however, this relationship has been difficult to establish from travel data. Second, the dramatic improvement in off-peak service levels provided by new guideway transit has been observed to produce an increase in non-home-based transit trips -- the "lunch bunch" effect. In general, while this effect certainly represents travel benefits, its size and importance has been small, particularly in terms of solving important peak period transportation problems.

One area in which induced travel may be important is the planning of circulation systems. A downtown circulator -- shuttle buses on a transit mall or a guideway technology -- may well have significant effects on trip production rates for non-home-based trips. This occurs for two reasons. One is that there may be a pure trip frequency effect in that people choose to make non-home-based trips more frequently with the improved accessibility provided by the circulator. The second reason is that the typical trip production rate considers only "motorized" trips -- travel by auto or transit but not by walking. Thus, any trips shifted from the walk mode to a circulator system appear to be new trips even though they are really diversions between modes.

Given the possible importance of induced travel for circulator systems, it is important to consider such trips in the assessment of these systems. This is a particularly difficult task because there has been little development of analytical tools that address the kinds of travel behavior that are important in circulation systems. Consequently, UMTA and local agencies have agreed on appropriate methods for these analyses on a case-by-case basis.

In most transit situations, however, the circulation function represents a very small share of the total benefits of a transit improvement. The difficulties involved in an adequate analysis of circulation benefits are usually not worth the minor increments to the estimated total benefits of an improvement. In any case, UMTA can concur in the inclusion of circulation benefits only when they are forecast with a methods based on observed travel behavior. Methods based only on hypotheses or opinions are not acceptable.

Trip Attractions

Methods to predict trip attractions in each zone are similar to those used for trip productions. Trip rates and regression equations are again by far the most common forms of attraction models. Data limitations are often a substantial problem in the development of any trip attraction model, however. While excellent data are available for production models from travel surveys and the Census on the location, nature, and trip-making of households, no similar source of data exists for the employment, floor space, and travel characteristics needed for attraction models. The Census data again provides probably

the best source of employment data through tabulations of workers employed in each zone. These data often need substantial review, however, because of potential coding errors in the location of workplaces and the focus on primary employment. Data on the trips attracted to individual activity locations are even more difficult to obtain. Even the Census provides no information on frequency of work trips, presenting only the residence and workplace of workers. Travel surveys are usually based on households, resulting in good household-level data but sparse information on trips to various work, school, shopping, and other activity locations.

As a result, attraction trip rates are usually developed by a somewhat indirect method that involves expansion of a travel survey to estimate total trips for each purpose in the region. These totals are then divided by appropriate indicators of activities -- usually employment or floorspace classified by industry. Thus, for example, shopping trip attraction rates would be estimated by dividing the total number of daily shopping trips estimated from a travel survey by the number of retail employees in the region. Shopping trips also illustrate a difficulty in using this regional approach to calculating attraction rates. The problem is that the rates may not hold across all areas within the region. For shopping trips, many of the trips to downtown retail locations are made by walking, a mode not explicitly recognized in most modeling approaches. Thus, there are likely to be fewer motorized trips per retail employee in a downtown store than there are in a suburban department store where walk trips are uncommon. This illustrates the importance of careful stratification of the trip attraction rates.

The alternative to attraction rates is the development of regression equations. The concerns outlined above on the use of regression for trip productions also apply here. Bias constants and intercorrelation of very aggregate variables can again be problems. However, while the availability of appropriate data makes rates a much preferable alternative to regressions for trips productions, data problems limit the attractiveness of rates for attractions. Thus, a reasonable argument can be made for the regression approach to trip attractions modeling. Typically, these models have been developed at a higher level of aggregation, using districts that are made up of several zones, to aggregate the data sufficiently to obtain statistical stability. The resulting equations may well have negative coefficients that appear illogical but that capture some of the effects similar to the walk-to-shopping problem outlined above. Thus, the expression

$$(5-2) \quad \text{Shopping attractions} = a + b(\text{retail employees}) - c(\text{office employees})$$

might be expected where the negative sign on the coefficient of office employees reflects the fact that retail space in areas with dense office development have relatively more walk rather than motorized access.

It is also important to note that attraction rates are subject to the same apparent changes in trip production rates attributable to expanded vacation benefits, part time employment, and absenteeism. Updates may therefore be necessary of attraction rates that are based on data from the 1960s.

5.2(b) Estimating Travel Patterns -- Trip Distribution

As with trip generation, the trip distribution step appears somewhat secondary to the comparative analysis of options for transit improvements. Changes in travel modes are the primary emphasis. Nevertheless, in many transit studies, several concerns have arisen on inaccuracies in the trip distribution step and their effect on estimated transit ridership.

Differences among Income Classes A recurring problem in many forecasting situations is the incorrect linking of trip productions from relatively low income areas with trip attractions in locations with relatively high-paying jobs. This effect is most often observed in the linkage between residences in close-in blue collar areas with the predominantly white-collar jobs in downtown. While some trips of this nature certainly take place, the clear tendency of many trip distribution models is to overpredict the interaction. This occurs because (1) the distance to and size of employment concentrations are the two considerations that drive trip distribution models and (2) the downtown is often the nearest and largest concentration of employment for many close-in neighborhoods. In many transit planning efforts, this error can significantly overstate the potential transit market since it inflates the number of modest-income travelers going from relatively dense neighborhoods to the downtown -- a market in which transit is extremely competitive.

Two approaches have been used to correct the potential mismatch of employees and job types. By far the most common is the use of K-factors, a set of correction factors developed with observed travel data, that simply adjust the predicted travel patterns to match the observed patterns. While it is possible to have a unique correction factor assigned to every interchange in the urban area, a more useful approach is to categorize the interchange by the nature of both the production and attraction areas. A blue-collar-to-white-collar interchange, for example, would have a K-factor that makes this connection less likely. In contrast, a blue-collar-to-industrial interchange would have little or no adjustment.

The second approach to the problem is the separate distribution of trips by class. Trip productions and attractions may be stratified by income class, for example, and distributed with separate runs of the trip distribution model. Total volumes are then the sum of the trip tables estimated for each class. An advantage to this approach is that it permits the development of unique models for each class of traveler. Each model can therefore reflect the different distributions of employment types throughout the region as well as the unique sensitivities of different classes of travelers to traveltime. This advantage comes at some cost, however. In addition to the more intensive use of computer runs and data storage, the approach requires the development of trip attraction models that predict attractions stratified by income class. This task is made difficult in most cases by limited data on the distribution of household incomes among employees in different types of industries. However, the potential improvement in the trip distribution step may well make the effort worthwhile.

Representing Travel Times and Costs Every distribution model requires an indicator of the accessibility between production and attraction areas. In

most applications, a simplifying assumption is made that work trips are distributed on the basis of peak travel characteristics and that all other trips are distributed with off-peak characteristics. By far the most common characteristic used in existing models is highway travel time. One consequence of this approach is that predicted overall travel patterns -- total travel by all modes -- do not change from one transit improvement option to another. In some situations, this implicit assumption may not be correct. In areas with significant highway congestion, large downtown employment concentrations, and high levels of transit service, it is likely that transit accessibility has long-term impacts on the distribution of total travel. In addition, circulator systems in high density areas are also likely to have significant distributional impacts on travel within their service areas, impacts that are small in regionwide terms but potentially significant in the analysis of the circulators.

In the few instances where a sensitivity to a wider range of times and costs has been developed, the general approach has been to use a summation of the variables considered in the local mode choice model. This "composite impedance" approach incorporates sensitivity to the wide variety of influences in a typical mode choice model: in-vehicle travel time; walking, waiting, and transferring time; transit fares and auto operating costs; and such traveler characteristics as income and auto ownership. It also bases the relative influence of each mode to the relative quality of service on that mode.

Whether it is worth the effort to include these sensitivities in a local model set is a difficult question. In very large urban areas where transit captures a large share of total travel, the contribution of transit accessibility to the distribution of travel may be sufficient to warrant the effort. The same may be true for circulator systems in major employment/commercial concentrations. However, in areas of moderate size where transit captures only 30 percent of work trips to the downtown and 5 percent of all work trips, the significance of transit on distribution is less certain. Absent any indication that a substantial difference in the forecasts is likely, it is probably not worth the effort to incorporate sensitivity to factors other than highway travel time. Indeed, one of the few cities that has had a distribution model sensitive to transit service levels is currently updating the entire model set and is basing the new distribution model on highway time only.

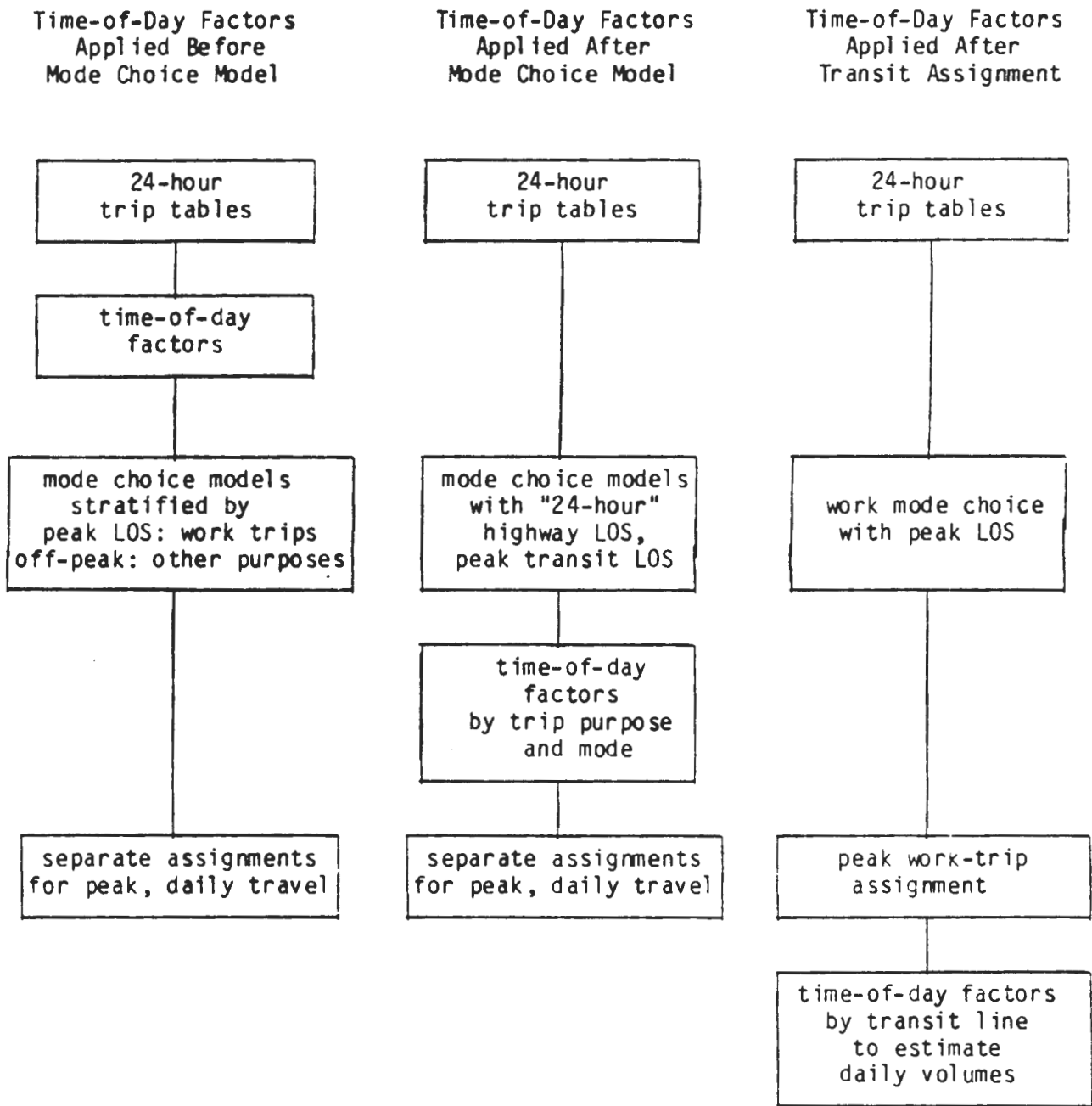
Because of the uncertainties involved in the use of composite impedance measures in forecasting revised overall travel patterns, **UMTA requires that the evaluation of major transit improvements advanced for Federal funding assistance be based on a common set of total person trip tables, rather than on unique sets of tables for each improvement alternative.** This commonality holds constant both the productions and attractions in each zone and the volumes of trips between zones. The only exception has been for circulator systems in which the redistribution of walk trips to more distant destinations may be a key travel impact. In other situations, the additional use of a sensitivity analysis with multiple sets of tables is left to local discretion. A comparison of the two approaches to the analysis would, in fact, be most useful in determining the importance of the issue.

"Balancing" Attractions The trip generation step estimates the number of trips produced by and attracted to each zone in the region. The trip distribution step then allocates the trips produced in each zone to the predicted attractions in all other zones. Once this has been done for all trip productions, the summation of trips allocated to each zone gives a new estimate of the attractions to that zone. For example, the sum of the 22nd column of the trip table in Figure 5-2 gives the new estimate of total trip attractions to zone 22. A question arises when the zonal attractions estimated in the trip distribution step do not match the original estimate derived in the trip generation step: which estimate should control?

Common practice has been to use the trip generation estimate as a control. This is implemented in the distribution step by adjusting the attractiveness of each zone and iterating the distribution model until agreement is reached. This approach is essential for work travel. A likely occurrence in base-year applications of trip distribution models is that the predicted number of work trips to the downtown is much less than existing employment in the downtown. The congestion on radial highway facilities makes access to downtown relatively poor and makes downtown less attractive as a workplace. However, since downtown jobs are filled, it is clear that some workers are constrained by their job locations -- they go where their jobs are. Thus, it is necessary to apply the constraint that all work trip attractions predicted in the generation step must be satisfied in the distribution step.

At the same time, however, this constraint can be misused. One critical misuse can occur where projected land use distributions do not reflect the transportation system. A frequent example is the assumption that downtown employment will grow dramatically without significant increases in radial highway capacity. It is possible to specify a downtown that would not evolve because of limited access -- the attractiveness of a central location diminishes if it is impossible to get there. In this situation, application of the constraint that all downtown attractions are satisfied may serve only to distort travel patterns to match a distorted land use projection. This suggests that a useful procedure in rapidly growing urban areas is to stop the distribution model after the first iteration -- before the constraint is applied -- and look for areas in which a significant mismatch has occurred in the trip attractions. Where the mismatch is greater than any that can be observed in a parallel application to base year data, a review of the land use assumptions for the area is in order.

For non-work trips, the usefulness of the constraint is less clear. There may be a large variation in the number of shop trips per employee at various retail locations, for example, a variation that may well be at least partially related to accessibility. Thus, a single iteration -- that is, with no application of the constraint -- may be a more useful simulation of travel behavior. Where the data are available, this issue can be examined in base-year applications by comparing the trip attractions estimated from generation and distribution steps with count data.



Note: LOS = level of service provided by the highway or transit system, as represented in the highway and transit impedance tables.

Figure 5-4. Analysis of Peaking Characteristics

5.2(c) Predicting Time of Day Choice -- Travel Peaking

To this point in the travel forecasting process, travel has been measured in terms of daily trips, that is trips made at any time during the 24 hours in a day. For several applications in an alternatives analysis, travel must be estimated for discrete segments of the day. Future peak-period highway speeds, for example, are crucial in determining the competitiveness of a transit guideway, and peak transit volumes are necessary in the sizing of transit fleets, vehicles, and facilities.

Figure 5-4 illustrates three approaches that have been used to estimate travel by time of day in transit project planning. Each method begins with the 24-hour trip tables produced by the trip generation and distribution steps. The first method factors the trip tables immediately (and separately by trip purpose), reflecting the time-of-day distribution of all trips. The mode choice step then estimates mode shares for each trip purpose, typically using peak-period travel skims for the work trip analysis and off-peak skims for other trip purposes. The resulting share tables are then used to compute a trip table for each mode, time-of-day, and trip purpose suitable for the concluding assignment step. This approach is preferred because the time-of-day factoring is done (by purpose) for trips on all modes together, reflecting only the influence of activity patterns throughout the day. These factors can be derived from local surveys of travel characteristics and are likely to be reasonably stable over time and across alternatives.

The second approach has been used in areas where the mode choice model has been developed to consider 24-hour trips, rather than peak and off-peak trips separately. Aside from the obvious difficulties in choosing appropriate time and cost measures for "average" highway and transit conditions over 24 hours, this approach requires that the time-of-day factoring be done after the mode choice analysis. In this case, the difficulty is that the time-of-day factors must be specific to each mode, rather than simply for all travel as in the case above. Since each mode's share of peak work travel is different from its share of off-peak work travel, the time-of-day factors are different for each mode. Therefore, the factors must represent individually the portion of (typically) drive-alone, ridesharing, and transit trips in the peak and off-peak periods. Further, the factors may not be stable over major changes in the transit system that affect the quality of service for work trips differently from the quality for non-work travel. Clearly, then, the factors must be selected and applied with great care.

The third approach has been used in cases where non-work mode choice models were not available locally. In these cases, mode choice and assignment results have been available for work trips only, typically peak-period work trips. Factors have then been applied by transit route to convert peak work trip volumes into peak and daily volumes for all purposes. Unfortunately, the factors needed for this step are undoubtedly very unstable across routes, particularly for guideway services. In cases where a new transit guideway is introduced, particularly where there are no similar guideways elsewhere in the region, it is very difficult to identify the appropriate route-specific factors. Therefore, UMTA recommends that this approach not be used. Alternative methods of estimating non-work trips are covered in the next section.

5.2(d) Estimating Mode Usage

Usually in transit project planning, the single most important step in the travel forecasting process is the estimation of mode usage for each of the alternatives. This section covers several approaches that have been used for this task. The discussion for work trips is presented separately from that for non-work trips because there has been a much wider variation in the approach to non-work analysis.

Mode Usage for Work Travel

Two general approaches have been used for the analysis of work travel. The first, and more common, is the application of traditional mode choice models that use descriptions of competing modes -- travel times and costs for driving, taking transit, etc. -- to estimate the share of all trips that will use each mode. The second is an incremental approach in which existing transit shares are modified to reflect the estimated changes in times and costs for each alternative. Each approach has important strengths and weaknesses.

Application of Mode Choice Models In the United States, the predominant method used to forecast mode usage is the "logit" mode choice model. Logit is a mathematical function that predicts the share of all travel that will use each available mode, ideally in a manner similar to the behavior of travelers choosing between modes. The most common formulation considers three modes -- driving alone, ridesharing, and taking transit -- but existing models display a wide variety in the modes they consider. The simplest forms examine two options: auto versus transit. More complex forms consider many modes that include individual levels of auto occupancy and various transit access modes as separate choices.

Inputs to a mode choice model always include descriptions of the service levels provided by each mode (times, costs), usually include indicators of the socio-economic status of the traveler (income, auto ownership), and occasionally include unique characteristics of the trip (whether or not to downtown, whether or not the employer provides carpooling incentives). The logit model converts these inputs into forecasts of the share of trips using each mode for each zone-to-zone pair.

One major advantage of a well-specified and thoroughly validated mode choice model is that it can predict the effects of transit service introduced into new markets. The required inputs are simply the characteristics of the transit service, the competing modes, and the market in which they are competing. Thus, a new guideway that has substantial park/ride capacity in a corridor where no park/ride service exists can be analyzed reasonably well. A second advantage is that the sensitivities of different population groups -- income classes -- can be built into the model quite easily. Subsequent predictions can be made with reasonable assurance that the forecasts are sensitive to the very different reactions of high and low income areas to similar changes in transit service levels.

The major disadvantage of the conventional mode choice model is that it can be -- and often is -- applied without a thorough validation of its performance

against observed travel patterns. An all-too-common attempt at validation, for example, is to match regionwide transit ridership predicted by the model for some recent year with count data for that year. This limited validation overlooks the very real possibility that a good regionwide match can mask large errors in individual corridors that offset each other in the regionwide totals. An application of a model with errors of this nature begins with inherent errors and yields unreliable predictions for each alternative.

While there are at least as many existing approaches to developing a mode choice model as there are mode choice modelers, it is possible to identify several basic characteristics that should be included in a model. Most of these characteristics are found in the equation used to describe the attractiveness of each mode, often called an "impedance equation." A typical impedance equation for a transit mode might be:

$$\begin{aligned} (5-3) \quad \text{Transit impedance} &= 0.500 \\ &+ 0.020 \times (\text{transit in-vehicle travel time}) \\ &+ 0.040 \times (\text{transit out-of-vehicle travel time}) \\ &+ 0.008 \times (\text{transit fare})/(\text{household income}) \\ &+ 1.500 \times (\text{number of autos owned}) \\ &+ 1.000 \times (0 \text{ if walk access, } 1 \text{ if auto access}) \end{aligned}$$

This equation describes the "cost" of taking transit in a general sense. The cost increases as each of the variables increases since all of the coefficients are positive in sign. The coefficients describe the relative importance of each variable and are derived with specialized computer software that analyzes the mode choice behavior of a sample of travelers. Thus, the equation indicates that each added minute of transit in-vehicle time increases transit's impedance by 0.020 units, while an added minute of out-of-vehicle time increases impedance by 0.040 units. An analogous equation for each of the other modes is derived as the model is developed.

Several desirable characteristics of a mode choice model can be illustrated with this sample equation. In reviewing mode choice models proposed for use in alternatives analysis, UMTA bases much of the evaluation on these characteristics.

- (1) The impedance equation includes a "bias constant" (0.500 in this case) that captures the effect of transit characteristics that affect mode choice but are not included in the equation because they cannot be measured and/or predicted (reliability, safety, cleanliness, comfort, convenience, etc.). This "bias" differs across modes because the values of comfort, convenience, and other unincluded variables vary significantly across modes. Models typically include very different biases for driving alone, carpooling, and transit. These biases are computed in the development of the model based on the observed behavior of a sample of travelers. Therefore, any differences in modal biases between transit modes must result from the analysis of observed travel choices, not from untested hypotheses or opinion surveys. To UMTA's knowledge, none of the cities in the United States with existing rail systems has biases in mode choice models that are different between bus and rail technologies.

- (2) The level-of-service variables in the model should include traveltimes and costs for all modes. Because the logit model implicitly compares transit times and costs with the times and costs for other modes, omission of these service variables for other modes renders the model useless. Many models scale the cost component by household income to reflect the higher cost-sensitivity of lower income households.
- (3) Traveltime should be disaggregated into its individual components. The clear result of a substantial number of efforts to develop mode choice models is that travelers value the various components of traveltime differently. The most important distinction between time components is whether or not the traveler is riding in a vehicle. In-vehicle time has been found to be the least onerous component -- with a coefficient typically between 0.015 and 0.030 for work trips -- presumably because the traveler is protected from the weather and (usually) has a seat. In contrast, time spent walking to or from the vehicle, and waiting for or transferring between vehicles, is roughly two to three times more onerous for work trips. Therefore, traveltime should be disaggregated at least to the in-vehicle/out-of-vehicle level. Some models have finer distinctions, representing the various components of out-of-vehicle time separately.
- (4) The coefficients on times and costs should imply a reasonable "value of traveltime." A general conclusion from past efforts at model development is that the implied valuation of traveltime computed from work-trip mode choice models is on the order of one-quarter to one-half of the average wage rate. The value of time is computed by dividing the time coefficient by the cost coefficient (and converting the cents-per-minute result into dollars-per-hour).
- (5) The model and its application should recognize constraints on travel choices. Mode choice models attempt to do what their label implies -- predict the choices travelers make among modes. Many travelers do not have a full range of choices, however. One important constraint is that persons in households without autos are likely not to be able to choose driving alone. Three approaches have been used to represent the auto ownership constraint. The first is an explicit calculation of the share of travelers who are "captive" to transit. This calculation is different for each zone and is based on the auto ownership distribution in the zone. The second approach is to include socioeconomic variables (auto ownership or income) in the model that reflect the auto ownership level of the traveler. These variables act to make auto travel much less likely for travelers with few or no autos available. The third approach is to stratify the data by auto ownership and income levels and estimate separate models for each stratum.
- (6) The model, and the associated transit network processing, must accurately define the potential transit market in terms of service areas and likely access mode. Approaches to this task are discussed in Section 5.3(a).

Application of Incremental Methods The second approach used in transit project planning to predict mode usage has been the application of incremental methods. The most familiar of these are elasticities applied to the changes

in service variables -- fares, waiting times, etc. Figure 5-5 contrasts the setting in which incremental methods are applied. The upper part of the figure depicts the application of a conventional mode choice model, termed "synthetic" because it estimates mode shares entirely from abstract descriptions of times, costs, income levels, and so forth. The lower part of the figure shows the use of an incremental approach, so labeled because it starts with baseline shares and predicts the changes, or increments, in the shares. The major difference, then, between the two approaches is that the incremental method uses existing transit shares as the measure of current attractiveness of each mode, while the synthetic method uses the time and cost measures.

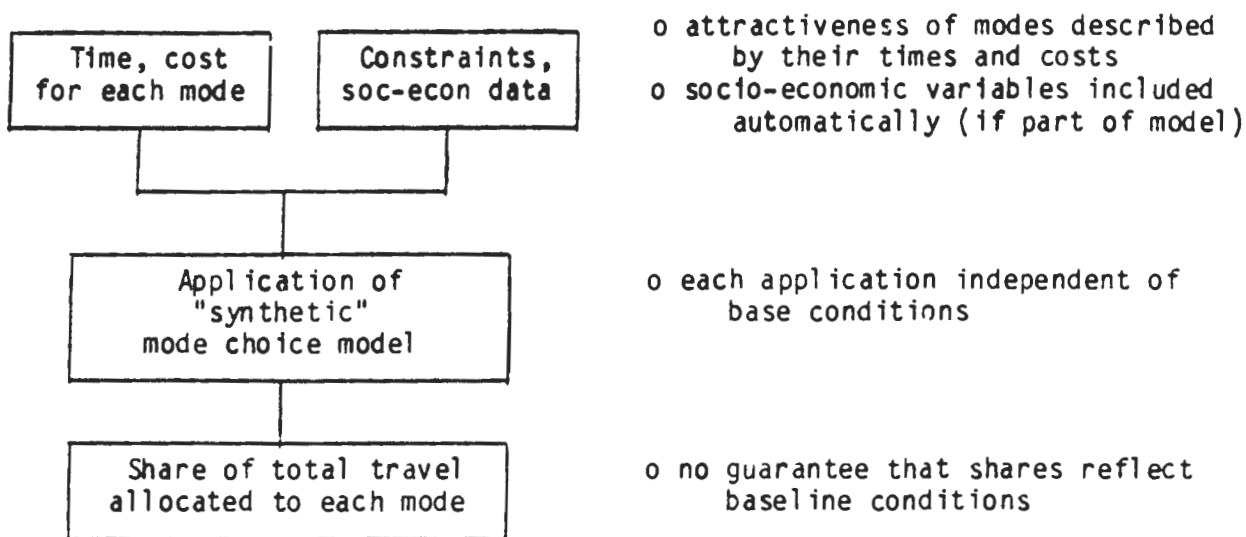
A significant advantage of the incremental approach is that the forecasts are well-tied to reality, as measured by the baseline shares. Since the approach estimates the changes in these shares caused by traveltime and costs changes, the results will almost always pass tests of reasonableness. In contrast, a synthetic approach requires a validation effort to ensure that it can replicate the baseline mode shares. (Once this is done, a synthetic method with the same sensitivities to times and costs as an incremental approach will give identical results.) A second advantage of this approach is that it tends to focus attention on the changes in service levels between alternatives, since these changes are the service-related inputs. Because these changes are the direct cause of ridership differences between alternatives, a clear understanding of service differences is important in understanding the ridership forecasts. In contrast, the synthetic approach uses independent estimates of service levels for each alternative (totals rather than increments) that require some processing to compare across alternatives.

The most common incremental approach is the application of elasticities, the most familiar of which is the "Simpson-Curtin rule" that projects a 30 percent decrease in transit ridership for every 10 percent increase in transit fare, implying a fare elasticity of -0.30. Similar elasticities can be derived for other service variables -- in-vehicle traveltime, wait times, etc. -- from past local experience or from published compilations of transit elasticities.

One difficulty in the application of elasticities is that elasticities vary across different travel markets. For example, high income commuters may be less sensitive to fare changes than middle income commuters, and carless households may be less sensitive to any transit changes than car-owning families because the former have few alternatives to transit travel. A second problem is that elasticities vary for the same group of travelers as the mode shares change. For example, middle income travelers in a zone with relatively poor transit service may have a set of transit elasticities that are quite different from the elasticities of other middle income travelers in a zone with good transit service. Therefore, the correct elasticity for analysis of a particular corridor depends on the nature of the travelers and the current levels of transit service in the corridor. Selection of an elasticity for each service variable must be done with great care, certainly requiring more analysis than the simple use of regionwide values.

A second incremental approach is the use of the incremental form of the logit model. Any existing logit model can be rewritten in an incremental form that uses changes in times and costs to predict changes in mode shares. In

Synthetic Approach



Incremental Approach

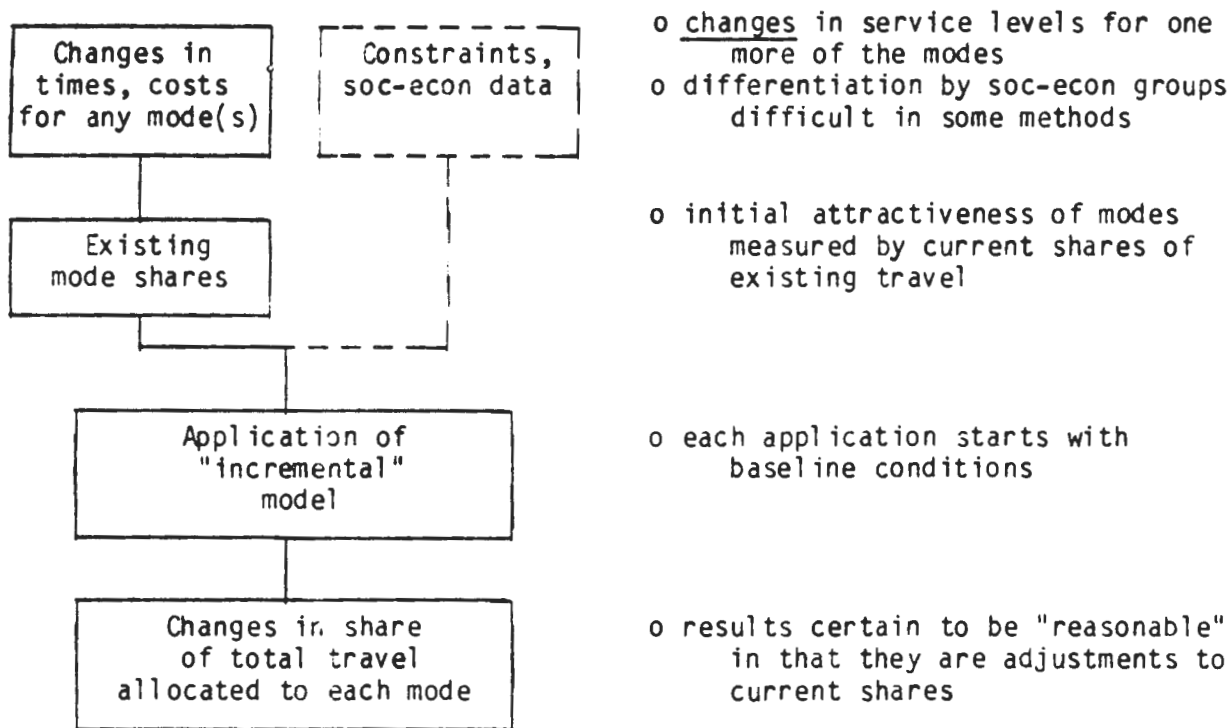


Figure 5-5. Synthetic and Incremental Approaches to Forecasting Mode Usage

addition to the advantages cited above for any incremental form, incremental logit has the added feature that any additional variables in the model -- income or auto-ownership levels, CBD destination, etc. -- are preserved in the incremental form. These variables then differentiate between the various groups of travelers in the corridor. Further, incremental logit permits the predicted sensitivities of travelers to vary as mode shares change, avoiding the limitations of the single value commonly used in the direct application of elasticities.

The largest problem in the application of incremental methods arises when the transit market in a subarea is so poorly developed that the existing shares may not constitute a valid baseline. The most common occurrence of this problem is in prediction of park/ride volumes to stations on a new transit guideway. If travelers in the corridor currently use only walk access to existing bus lines, there is no existing park/ride mode share to use as a baseline. This limitation suggests that incremental methods are best used where all important components of the transit market for any of the alternatives are observable today, and that synthetic methods are more appropriate where the alternatives would develop new markets or components of markets.

Mode Usage for Non-Work Travel

The prediction of mode usage for non-work travel is a particularly difficult task. Some opinion exists that conventional mode choice models do a very poor job in replicating the decisionmaking involved in non-work trips. Other opinion maintains that the conventional approaches are adequate for the task. Since little evidence is available to conclude on a single best approach, this section simply reviews acceptable methods that have been used.

The various approaches used in past transit planning studies for estimating mode usage for non-work trips include:

- o application of synthetic or incremental methods model for non-work travel as well as for work trips;
- o factoring the loadings of work travel on individual transit lines to estimate total daily loadings, and computing non-work trips as the difference between total trips and work trips; and
- o factoring the transit shares for work travel to estimate the non-work share.

The first method is probably the more desirable approach because off-peak times and costs are direct inputs into the non-work mode choice model. This approach is therefore directly sensitive to changes in off-peak levels of transit service that are most important to non-work travel. However, it must be noted that a review of existing non-work mode choice models suggests that these models tend to have large variability in their coefficients and, consequently, very large uncertainties in their predictions. A careful validation of the non-work model against existing count data is particularly important.

The second method -- factoring assigned work-trip volumes on individual transit lines -- potentially has very significant problems. The mix of work and non-work trips on a route depends on the market it serves, its geographic orientation, and its relative peak and off-peak service levels. Factors that relate work volumes to total volumes are difficult to derive for various classes of routes. The task is made particularly difficult because the characteristics of the travelers using each route are effectively lost during the assignment of trips to individual routes. Therefore, in cities without existing guideways, the development of a reliable set of factors for application in alternatives analysis may not be possible.

The third method -- estimating the non-work share by factoring the work share -- may be useful in carefully controlled applications. This method relies on a set of factors, ideally stratified by descriptors of the traveler (income level, for example), the trip (typically its distance), and the type of transit service (local, express, guideway, etc.). In cities with a large and varied transit system that includes both mixed-traffic and guideway routes, these factors can be developed if a sufficiently large data base is available. The most useful data source would likely be an origin-destination survey that includes data on all trips made by sampled households on a given day. If the number of sampled transit trips is sufficiently large, stratification of these trips by the desired indicators can produce the factors quite easily. Without a sufficiently large sample, a statistically sound on-board survey might be used with the person trip tables developed in the trip generation and distribution modeling step to provide the necessary data source.

A potentially significant problem with this factoring approach is that it implicitly assumes preservation of the relationship between the peak and off-peak transit service found in the data used to develop the factors. For example, the data source may reflect a transit system that provides high-quality express service in the peaks, but very low service levels outside the peaks. If the operating plan for a guideway alternative calls for off-peak service that is not such a large reduction in service levels compared to the peak, the ratio between work and non-work transit shares may be significantly different from that in the existing system. Thus, the factoring approach would underestimate non-work shares for the guideway alternative. This effect has been observed in at least one application of this approach where the factors were developed with data collected prior to the opening of major new guideway facilities and validated against count data collected after several years of operation of the new facilities. This observation emphasizes the need to include service-type among the variables used to stratify the factors. It also suggests that this approach may be best applied in cities with existing guideway facilities, where factors can be developed that reflect the ridership patterns on guideways.

In situations where no other options are available, the problems with the third approach might be avoided in a hybrid method to forecasting non-work shares. This approach uses the factoring methods for non-guideway options only, particularly the TSM alternative. The shares established for this alternative could then be used as the baseline for application of elasticities to the incremental changes in off-peak service levels to derive non-work shares for guideway alternatives.

5.2(e) Assigning Trips to Networks

Most of the work needed to assign estimated highway and transit trips to their respective networks has been done in the early stages of network coding and processing. In the early work, the best (usually least time) path between each pair of zones was identified and "skimmed." The task remaining for the assignment step is simply to load the trips projected between each pair of zones onto the best path between the zone pairs. However, two issues have emerged as key concerns in the assignment step.

Transit Assignment A persistent problem in the assignment of estimated transit trips to the transit network is the overloading of travel to routes with high service levels. Even where the total number of transit trips within a corridor is predicted correctly, this error causes overestimates of volumes on transit guideways. The error occurs because virtually all transit assignment routines use an "all-or-nothing" algorithm. For each pair of zones, this method assigns all transit trips to the best path and no trips to any other paths. This approach can cause problems where the second and third best paths between a pair of zones are highly competitive with the best path. While in reality the alternative paths may carry a significant share of the projected volumes, they receive none of the trips between the zone pair. In corridors where local bus services provide reasonably attractive transit paths that parallel new guideway facilities, the result can be a substantial overassignment of transit travel on the guideways. The effect is also important in downtowns where transit travelers from outside the corridor of interest may have a choice of transferring to a guideway for the last portion of their trip within the downtown. Particularly where transit fares are not used in pathbuilding, the clear tendency is to overestimate the transfers to the guideway. Solutions to this problem are not easily applied. A direct solution is the use of a multi-path transit assignment algorithm. Unfortunately, there are few such algorithms available and none that have been applied extensively in practice.

An alternative is the careful application of existing algorithms to identify transit travelers who have a path choice and to analyze this choice explicitly. This approach develops one set of paths that, as in the common approach, may include the transit guideway wherever it is involved in a minimum time path. It also develops a second set of paths that attempt to exclude the guideway except where it provides the only path between a zone pair. This is accomplished by setting the weight on traveltime on the guideway at an extremely high level, making it a very unattractive option for transit travelers. The resulting paths therefore identify the best alternatives to guideway travel where alternatives are available. A "path choice" model is then used to predict the share of travelers that will use these alternative paths, essentially diverting them from the "best" path on the guideway. This model examines the relative service levels provided by the alternative paths, diverts few riders where the guideway is a significantly better option, but shifts more riders if the non-guideway path is nearly as attractive as the guideway.

While at least one urban area conducts such an analysis as a routine step in the forecasting process, this approach would represent a significant addi-

tional effort in most urban areas. Given the time and cost required to develop and apply the method, it may in most cases be appropriate for local analysts to be aware of the problem, try to identify the extent to which it may occur in a particular application, and make adjustments to the results to compensate for any significant errors. The application of the detailed approach may be reserved for later stages of project development, where guideway volumes become critical for sizing vehicle fleets and station facilities.

Highway Assignment In corridors with rapid projected growth in travel volumes, accurate portrayal of future highway conditions can become difficult. The task must be done carefully since accurate forecasts of highway speeds are a particularly important input to the estimation of transit volumes. The problem arises where significant additions to peak period highway volumes are found with little or no increase in highway capacity. Two very different approaches are typically used in highway network processing to estimate future service levels. The simplest method is one that uses classifications of the type of facility and nature of surrounding land use to estimate average peak travel speeds. Since this method is not sensitive to changes in travel volumes, it should not be used where substantial increases in travel volumes are projected.

The second approach is the use of "capacity constrained" assignment techniques that explicitly estimate the congestion effects of increasing highway volumes. A major challenge with this approach is that the distribution of travel within the peak period changes as overall congestion levels increase. Specifically, with increasing congestion, the peak "spreads" as traffic delay stretches the time required for many trips and as some travelers adjust their departure times to avoid the worst of the peak congestion. Currently, there is no mechanism within the travel forecasting process that predicts the net effect of these kinds of shifts on duration and intensity of the peak period. This limitation suggests strongly that the entire peak period should be simulated, rather than a single peak hour. Focus on a single hour alone prevents any recognition of peak spreading and of deteriorating conditions during a larger segment of the peak period as volumes increase.

Because there is no internal method to simulate peak spreading effects, the analyst must anticipate the effect and supply to the assignment step an estimate of the future distribution of travel across the peak period. Quite commonly, the need to address the question of a changed peak is ignored. This results in a peak hour that has a high share of total travel that can occur only with lower overall volumes, an overestimate of highway volumes within the peak hour, and an overestimate of highway congestion levels. This serves as a reminder that capacity constrained assignments must be done with careful attention to the effects of peak spreading. At a minimum, reference should be made to the parameters used in other urban areas that currently experience the levels of congestion that are projected to result locally from rapid development and traffic growth.

5.2(f) Equilibration

A key step that should be -- but too often is not -- a routine part of the travel forecasting process is the equilibration of transportation supply with

predicted travel demand. This step is necessary because the original development of networks for any forecast year is done without an estimate of travel patterns in that year -- the estimate is not available since the travel forecasts for that year are underway. Equilibration involves analogous but distinct efforts on the highway and transit networks. On the highway side, the primary focus of equilibration is to ensure that the assumed highway speeds used in the trip distribution and mode choice steps correspond reasonably well to the speeds obtained in the final assignment of estimated highway trips on the network. In most cases, a single highway equilibration step, applied to the Do-Nothing or TSM alternatives, is sufficient to ensure reasonable highway speed assumptions for all of the transit alternatives. Where substantial changes in highway capacity occur in some of the alternatives -- as with the addition of a two-lane HOV-way for example -- multiple equilibration efforts may be needed.

On the transit side, equilibration usually involves only the examination of headways on each route, comparing the available transit capacity to estimated demand. This comparison must be done within the bounds of consistently applied policies on maximum headways and loading standards. The most frequent adjustment made in transit equilibration is the shortening of headways for routes that would exceed the loading standards at the headways originally coded in the network. In some cases, however, the maximum headways may be found to produce an unacceptable excess of capacity and an adjustment in the policy headways for all of the alternatives may be considered.

5.2(g) Annualizing Transit Volumes

The transit ridership forecasts produced by the modeling effort are in terms of average weekday estimates. It is also necessary to derive estimates of annual total ridership because many of the data items derived from the patronage estimates are useful only in annual terms. Revenue projections and cost-effectiveness measures, for example, require annual ridership totals.

A simple -- but usually incorrect -- method to annualize a daily ridership estimate is to multiply the daily number by a single, systemwide annualization factor derived from current count data. These factors are generally near 300, reflecting full service on the (approximately) 250 normal work days in a year, with reduced service on the 10 holidays and 105 weekend days. Systems with a heavier orientation to commuter trips have lower annualization factors since a larger portion of their ridership is associated with the 250 work days. Systems with lower commuter ridership have higher factors.

This variation suggests the error commonly introduced by applying systemwide annualization factors to project-level forecasts. Most guideway projects are significantly more commuter-oriented than the existing transit system taken as a whole. The guideways are typically downtown-focused, and provide higher service levels with higher fares than the systemwide averages. Thus, ridership changes caused by guideway alternatives tend to have lower annualization factors than the existing regionwide average. Use of this average overstates the annual ridership impact.

A better method for annualizing the daily estimates is to recognize that each trip purpose has a unique annualization factor that is likely to be more stable than the overall average. The systemwide factor can be written as the weighted sum of the factors for work and non-work trip purposes:

$$(5-4) \quad F_{\text{overall}} = (\% \text{ work} \times F_{\text{work}}) + (\% \text{ non-work} \times F_{\text{non-work}})$$

where the F's are the annualization factors. Further, a reasonable estimate for the work factor is 260, allowing for a modest amount of weekend work-related travel. Therefore, if the overall annualization factor and the purpose distribution of current ridership are known, it is possible to solve Equation (5-4) for the only remaining unknown, the non-work factor. For example, if the systemwide annualization factor is 300 and work trips represent 45 percent of total ridership:

$$(5-5) \quad 300 = (0.45 \times 260) + (0.55 \times F_{\text{non-work}}),$$

and

$$(5-6) \quad F_{\text{non-work}} = \frac{300 - (0.45 \times 260)}{0.55} = 333.$$

Thus, both the work and non-work factors are readily computed from data commonly maintained by transit operators. The numbers used above are fairly representative but should not be used in place of locally available data. Depending on the type of transit service and the nature of the urban area, the factor for work trips may be slightly higher or lower than 260 while the non-work factor may vary significantly. Recent experience includes cases where the non-work factor was zero (for express bus service) and greater than 365 (for a corridor with heavy tourist traffic on weekends).

Finally, more complex methods have been used in transit project planning for annualizing transit volumes. These methods recognize the specific peaking characteristics of ridership on individual routes currently found in the corridor. The predicted peaking characteristics of new services are computed from the existing patterns, modified to reflect differences in peak/base ratios between the existing and new services. In an alternatives analysis, these methods, or other approaches more detailed than that outlined above, may be used with prior review by the Technical Advisory Committee and UMTA.

5.3 Key Issues in Travel Forecasting for Transit Project Planning

Two individual topics have emerged as leading concerns in analysis of the travel impacts of improved transit facilities. The first is the accurate representation of the potential transit market -- those travelers who can walk or drive to transit -- and of the access mode used by travelers in the market. The second issue is the analysis of facilities for High-Occupancy-Vehicles (HOVs) and the complex interactions between ridesharing and transit use that occurs with these facilities.

5.3(a) Access to Transit

A critical aspect of transit network coding is the method used to represent the extent to which various transit lines provide service to residential areas and activity locations. Accuracy in this method is important because it defines the travel market in which transit is competing. Major errors in defining the market will certainly lead to major errors in ridership projections.

Several key points should be noted:

- (1) there is effectively a maximum walking distance to transit beyond which travelers either must access transit via an auto trip or, where auto access is not common, simply do not consider transit as an option;
- (2) there is also an effective maximum auto-access distance beyond which travelers are essentially auto-captives;
- (3) all else being equal, travelers who must use an auto to access transit service are much less likely to use transit than those who can walk directly to the service; and
- (4) the impact of auto access on likely transit use is tied to the auto's availability to the traveler -- where auto ownership is high, reliance on auto access does not reduce transit use as much as where auto ownership is low.

The first point is simply a restatement of the common observation that transit directly "covers" only those areas within reasonable walking distance. This distance is typically taken to be one-quarter to one-third of a mile by most transit operators. Thus, the first concern is to represent this effect accurately in transit network coding, using walk access to connect the network only to those residences and activity sites within a carefully defined walk-access area. Beyond this area, residences are connected to the transit network only if auto access options (park/ride, kiss/ride, either formal or informal) are reasonably well developed in the corridor. Activity sites (offices, retail space, etc.) outside the walk area are not connected at all.

The second point is similar in that it implies an outer boundary for auto-access that is analogous to the boundary for walk access. For guideway stations with park/ride lots, the distance to the boundary of the auto-access market tends to be greater for terminal stations than for intermediate stations.

The third point is based on nearly universal experience with mode choice models. In testing for a difference between walk and auto access that is not fully explained by times and costs, local analysts have consistently found that travelers face, for example, a 5-minute drive to a transit station are much less likely to use transit than travelers who are a 5-minute walk from the same station. This effect is typically reflected in mode choice models with a "auto-access penalty" that adds to the impedance of transit where auto access is required on the transit path for any trip. The impact of auto

access on transit use is usually attributed to (1) the need for the auto-access traveler to have a car that can sit in a park/ride lot rather than be used for other household travel, and (2) that the traveler is more likely to take the automobile directly to work once it becomes a necessary part of the trip.

This interdependence with automobile ownership leads directly to the third point. If the importance of the auto-access penalty is tied to auto availability, then the mode choice model should include a penalty that varies with household auto ownership or some closely related descriptor such as household income. Where this sensitivity has been included in mode choice models, the size of the "penalty" for auto access has varied markedly with auto ownership or other wealth-related variables.

Representing Access Conditions in Transit Networks

Figure 5-6(a) depicts the challenge facing the analyst in accurately representing access to a bus line. The figure illustrates the coding of two zones near the line, one entirely within walking distance and the other only partly walk-accessible. Representing the entirely walk-access zone is straightforward: it is simply connected to the transit network with a walk access link whose traveltime is the average walking time from all locations in the zone. However, a similar coding approach for the partially walk-access zone would be inaccurate. To represent the entire zone as walk-accessible, even with a somewhat longer average walk time to reflect the more distant locations in the zone, would overstate the potential transit market. In effect, this approach would incorrectly assume that all residents of the zone consider walk-to-transit as an option, when in fact a portion of these residents do not have this option.

Figure 5-6(b) portrays the more difficult challenge presented by guideway stations. The added difficulty in this case is that there are two classes of walk-accessible locations in the zone -- one with direct walk access to the transit station and the other with walk access to a feeder bus route to the station. The two walk-access markets are similar in the important respect that an automobile is not needed to reach the transit system. They are different, however, in that the service levels provided by the feeder bus may be quite lower than that provided on the guideway. The use of the feeder adds waiting time for a lower frequency service, the in-vehicle time needed to reach the station, and possibly an additional fare.

There are at least two acceptable options for dealing with transit access:

- 1) adjust zonal boundaries to match the boundaries of the different access markets; and
- 2) identify the portion of travel to and from each zone with each type of accessibility to transit and model each condition separately.

The first option keeps the analysis relatively simple. Each zone is uniquely identified as a walk-access or auto-access zone; no residences or employment locations are misclassified because the zone boundaries are redrawn to

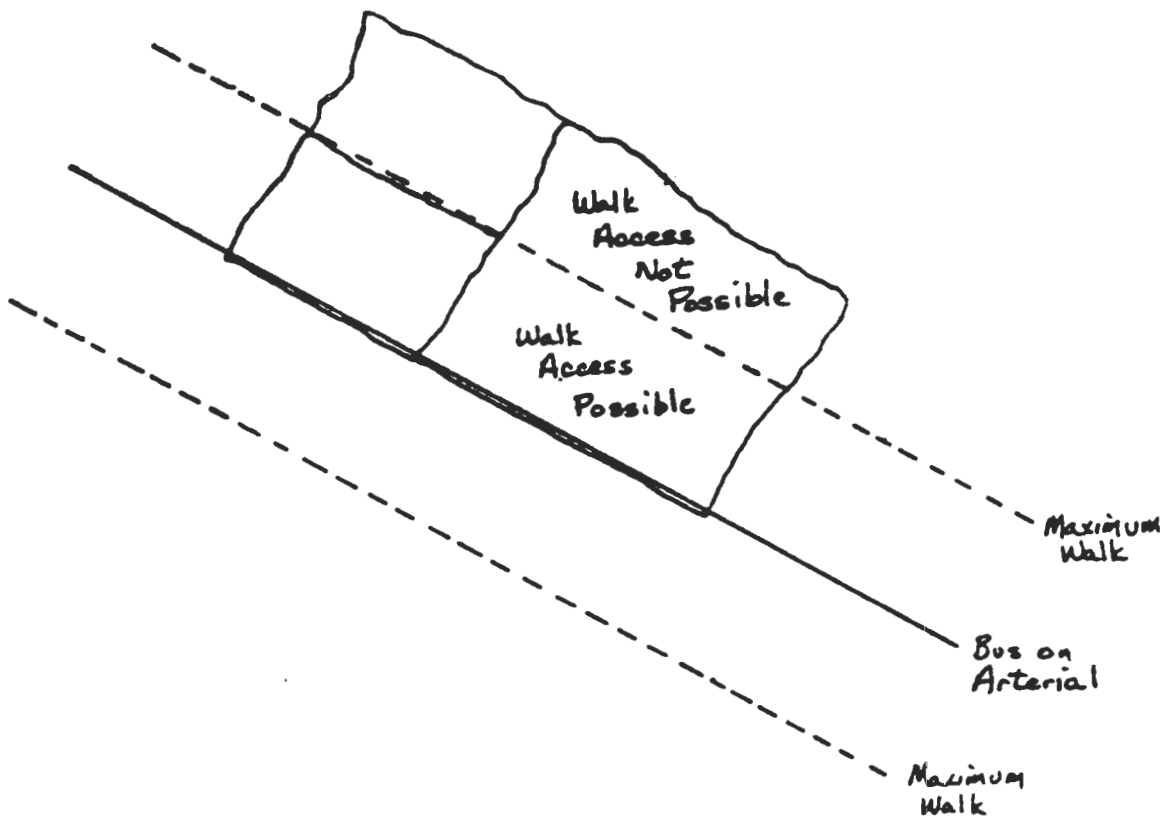


Figure 5-6(a). Access Conditions for a Local Bus Route.

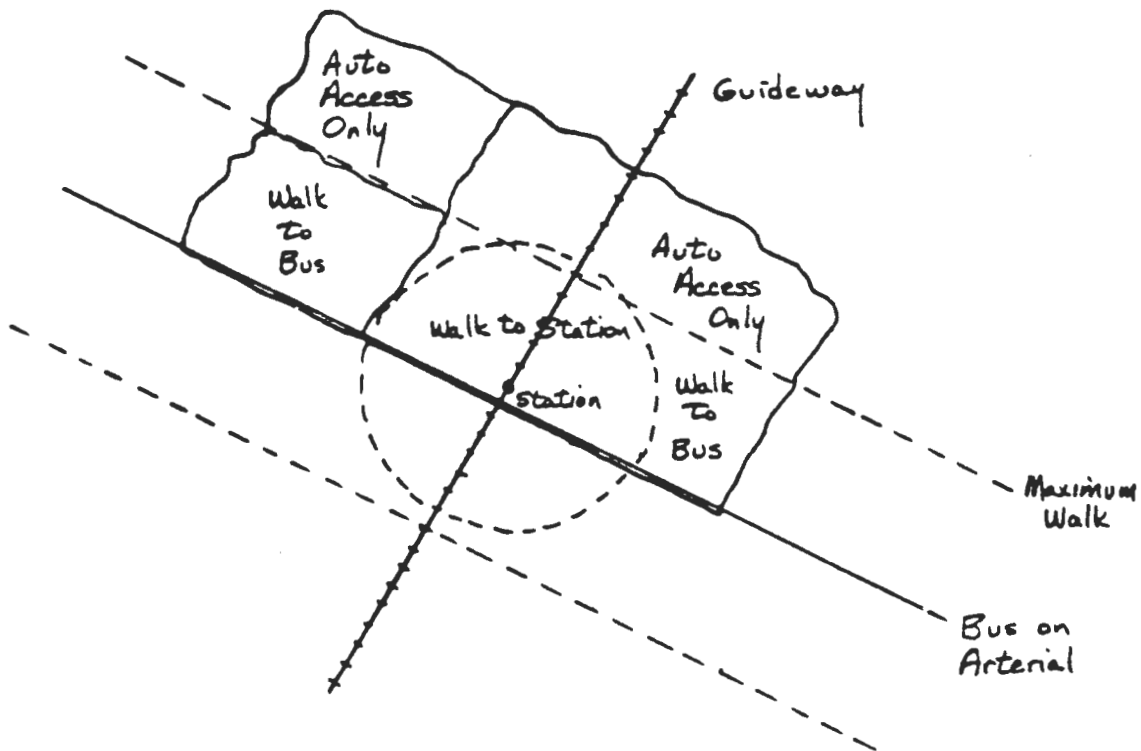


Figure 5-6(b). Access Conditions for a Transit Guideway.

eliminate overlaps across the boundaries of the walk access market. Consequently, a single run of the network processing programs is able to estimate accurately the transit service levels facing all travelers. However, this approach has the distinct disadvantage of tying the region's zone system to the particular transit options that are being analyzed. If the options are few and well-known at the outset of the analysis, this may not present any difficulty. In many cases, though, the locations of guideway stations and the configuration of the feeder bus network are uncertain at the outset -- a more common condition in most transit planning efforts -- it will be most difficult to structure in advance a zone system that accurately portrays the access boundaries to all transit services in all alternatives.

The second option reverses this trade-off: it avoids the need to anticipate accurately all station locations and bus routes but sacrifices computational simplicity. Figure 5-7 illustrates the partitioning of zones that is central to this approach. Each zone is effectively subdivided into the portion that is walk accessible and the portion beyond the walk market. For most zones, the entire area will be within one market -- 100 percent walk or 100 percent non-walk. For many, however, some portions will be in each market. Zones are then connected to the transit network with connector links that correspond to the markets:

- o walk-access-only zones are connected only with walk links;
- o non-walk-access-only zones are connected with auto links if they are within reasonable distance of a park/ride access point on the transit system; and
- o partial-walk zones are connected with both a walk link and (where an auto access location is within reasonable distance) an auto link.

Thus, this approach portrays the access conditions in detail. The detailed data leads to more intensive data processing, however. This occurs because common network processing routines are able to address only one type of access to a zone at a time. Thus, while many zones have both walk and auto access, a single pass of the network processing routines would identify only one of the markets. It is therefore necessary to use two parallel passes of the network processing routines -- one that analyzes all walk markets and a second that analyzes all auto-access markets. Two separate applications of the mode choice analysis are then necessary as well.

Even the greater detail in this second approach does not necessarily solve the most complex access problems, those around guideway stations. While the approach does differentiate between walk and auto access, it does not distinguish between direct walk to stations and walk to feeder buses. The difference between these markets can become important where a substantial number of guideway stations are located in zones that are both geographically large and densely developed. Since large densely developed zones are not desirable in any case, the most direct way of minimizing the potential error is to update the region's zone structure, using smaller zones in outlying areas as they develop more intensely. Given a smaller zone size, it may then be possible to avoid errors in access coding simply by using good judgment.

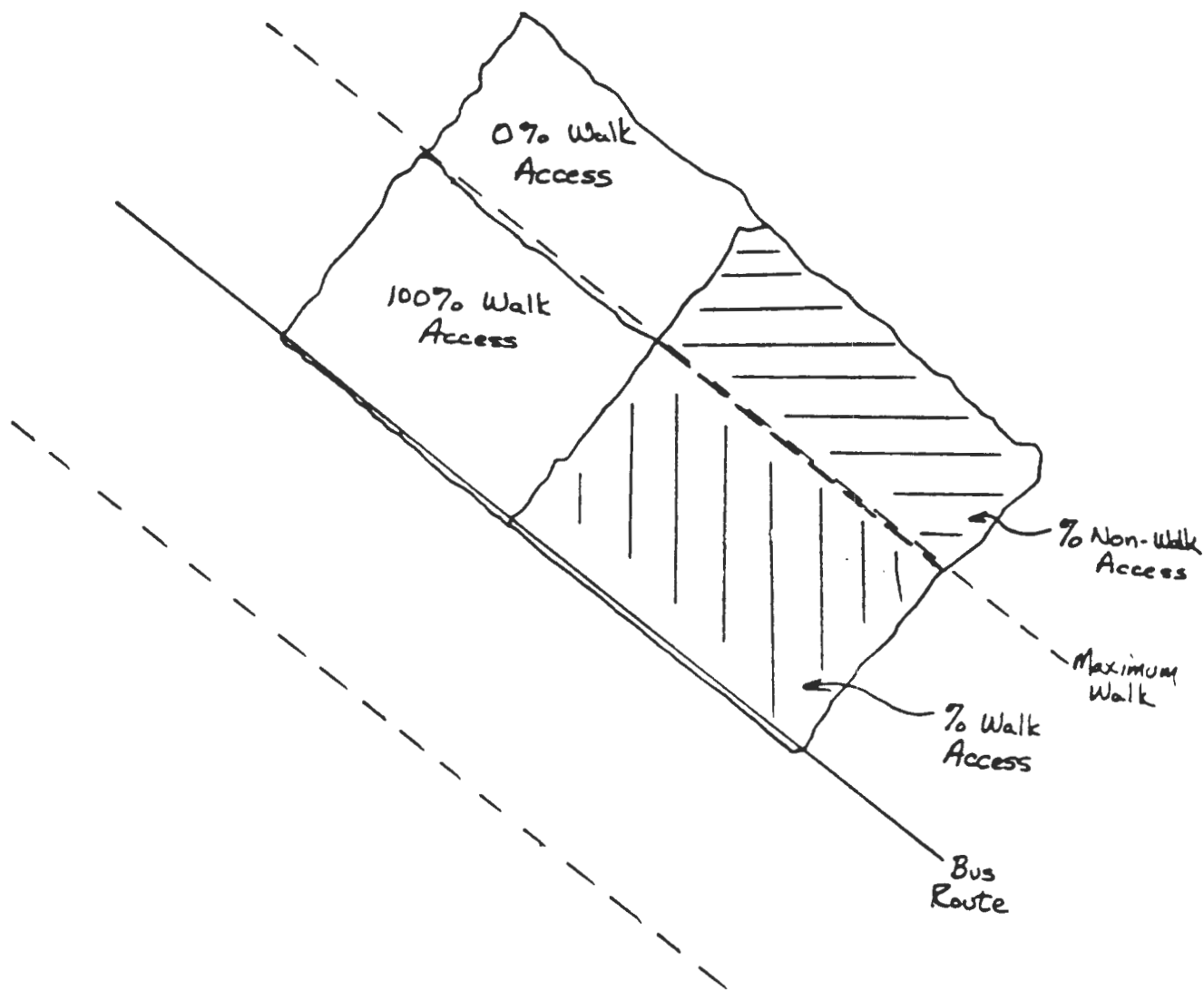


Figure 5-7. Partitioning Zones According to Transit Access Conditions

Where most residences and/or activity locations in a zone are walk-accessible only to feeder bus routes, it may well be appropriate to omit a walk link directly to a transit station in the zone. While this approach underestimates the service levels for the area within walking distance of the station, it represents access conditions more accurately for the zone as a whole than would a connection of the entire walk-access market in the zone directly to the guideway station.

One alternative to this "good judgment" approach to station-area coding is to partition the zone further into walk-to-station, walk-to-feeder, and non-walk areas. Again, this further detail does a better job of portraying the options available in the zone but adds further to the data processing requirements. This approach would require three full passes of the network processing programs and three applications of the mode choice model.

A final approach to the problem has been used in areas that apply the mode choice model to "pseudo-samples" of trips. This approach relies on the coding, for each zone, of the distribution of residences and activities with respect to transit access. For each zone-to-zone interchange, samples are then drawn from these distributions (and from other distributions of incomes, auto ownership, and so forth) to construct a number of representative trips. The mode choice model is then applied for each representative trip and the average transit share is used as the estimate for that zone-to-zone interchange. These two approaches have potential merit in the careful attention they pay to access detail but should be approached cautiously because of the substantial data processing effort they entail.

Representing Transit Access in Mode Choice Models

The representation of access to transit service in mode choice models has been accomplished in a number of ways. Table 5-1 summarizes the relevant parameters from operational mode choice models developed in five cities. All of the models represented are based on the logit formulation. The upper portion of the table presents the variables used in the models and their coefficients, or weights. The lower part of the table facilitates comparison between the models by converting these weights into their equivalent minutes of in-vehicle time. This is accomplished for each city by dividing each coefficient by the in-vehicle time coefficient from that city. Thus, for the Twin Cities model, the coefficient on in-vehicle time indicated that each minute is worth 0.0310 units of impedance. The auto access penalty of 0.8659 is therefore equivalent to $0.8659/0.0310 = 27.9$ minutes of in-vehicle time.

The models from the Twin Cities and Miami illustrate the simplest approach to incorporating access conditions into the mode choice model. Both models add a lump sum impedance to the disutility expression for the transit alternative in cases where auto access is required. The added impedance is the same for all socio-economic classes. The size of the added impedances confirms the hypothesis that, all else being equal, a significant decrease occurs in the likelihood of a transit choice when an auto is required for access.

A dramatic difference exists in the magnitudes of the access penalties between the two models. The added impedance in the Twin Cities model is equivalent to

Table 5-1. Coefficients Associated with Auto Access to Transit
in Selected Mode Choice Models.

Variables:	Urban Area				
	Twin Cities	Miami	Cincinnati	Houston	New Orleans
Transit In-Vehicle Time	0.0310	0.048	0.0190	0.031	0.0145
Auto access IVT In-Vehicle Time	same	same	same	0.170	0.1005
Auto access penalty (0/1 variable)					
group 1	0.8659	8.468	0.5968	1.370	1.1417
group 2	"	"	0.5104	1.190	1.0683
group 3	"	"	0.4238	1.190	0.4943
group 4	"	"	0.3373	1.190	-0.2245
<u>Equivalent minutes:</u>					
Auto access penalty:					
group 1	27.9	176.3	31.4	44.2	97.7
group 2	"	"	26.9	38.4	73.7
group 3	"	"	22.3	38.4	34.1
group 4	"	"	17.8	36.1	-15.5
Added time for for 6-minute access trip	-	-	-	26.9	35.6
Added time for for 10-minute access trip	-	-	-	44.8	59.3

Note: Groups are ordered in terms of increasing income/auto ownership, with group 1 having the lowest levels and group 4 the highest.

about 28 minutes while the Miami model adds 176 minutes. The explanation of this difference lies in the standards used in network coding in the two cities. In Twin Cities, auto connectors are used only to zones that are within a few miles of a park/ride facility while, in Miami, auto links are used to connect a wide area to the transit network. The effect on model parameters is clear. Only a small share of the large number of potential park/ride users (as defined in the transit network coding) can be observed to use transit in Miami. Hence, a large impedance value is associated with park/ride access in calibration of the model. Conversely, in the Twin Cities, higher shares of potential park/ride access users actually choose that option since the network coding restricts the market to those areas in which park/ride access to transit is a competitive alternative. Thus, the model calibration results in a much smaller impedance penalty for park/ride access.

The next level of complexity is represented by the Cincinnati model in which the auto access penalty is specified as a function of characteristics of the traveler's household. In this case, the 0/1 variable is replaced with a set of variables that again introduce zero impedance for walk access trips but add a lump sum penalty for auto access that varies with the ratio of autos to workers in the household. This specification permits the explicit representation of auto competition effects on park/ride trips and is useful in differentiating between high auto ownership areas where park/ride access may become common and low auto ownership areas where park/ride access would be difficult. The equivalent traveltime penalty ranges from a high of 31 minutes for carless households to a low of 18 minutes for households in which each worker has an auto available (drivers/autos = 1).

Finally, the models from Houston and New Orleans illustrate an additional level of complexity that can be introduced. As in the Cincinnati model, both specifications use auto access penalties that are tied to household characteristics (income levels, in these particular cities). However, where the models discussed above include the time spent on the auto access link itself as part of total in-vehicle time for the trip, these models include the auto access time as a separate variable. In both Houston and New Orleans, the coefficient on auto access time is significantly higher than the coefficient of in-vehicle time used elsewhere in the model. This higher weight attached to auto access time adds significantly to the transit impedance for zones that require an auto access trip.

To a large extent, this effect reduces the importance of differentiating in the network coding between areas "in" and "outside" the auto access market. The table shows the substantial time "penalties" that are added for 6- and 10-minute auto access trips compared to the impedance that would result if auto access were to have the same coefficient as transit-in-vehicle time. The total added impedance for auto access in these two models is computed by adding the lump-sum penalties (stratified by socio-economic group) and the increment derived from the higher coefficient on auto access traveltime. Thus, a 6 minute park/ride movement in New Orleans would have a 133 minute penalty for the lowest income group but only a 20 minute penalty for the highest income group.

It is important to note that the differences between these model specifications is in their detail, not in their completeness. The Twin Cities and Miami models include all impedance components represented in the Houston and New Orleans models. The key difference is that the Houston and New Orleans models represent the various components explicitly and permit them to vary from zone to zone while the Twin Cities and Miami specifications employ an aggregate approach in which the same average impedance penalty holds for all zones.

Several conclusions can be drawn from this review.

- 1) A significant additional impedance is associated with auto access to transit as compared to walk access. In the models examined, the added impedance reaches well over 100 minutes for several market segments.
- 2) Approaches that add auto access penalties of only 5 or 10 minutes of travel time as part of the network processing are likely to overestimate park/ride access to transit by a significant margin.
- 3) Specific values for the auto access impedance penalties are meaningful only in conjunction with specific coding rules for centroid connectors in the transit network. A calibration and/or validation process (using observed volumes at park/ride facilities) is necessary to derive parameters appropriate to local conditions and network coding assumptions.
- 4) Significant differences can be found across socio-economic classes in the impedance associated with auto access trips. Stratification by income or auto competition variables appears quite useful.
- 5) The use of a separate variable to represent the time spent in the auto access link is potentially a useful way to relax the strong assumptions that are needed in defining the auto access market.

In reviewing proposed methods for network and mode choice analysis, UMTA places particular emphasis on the treatment of access to transit, using the above observations as a starting point for the review.

5.3(b) Analysis of HOVways

An HOVway is a fixed guideway which carries both transit vehicles and other high occupancy vehicles (carpools and vanpools) which meet an established occupancy requirement. An HOVway saves travel time and cost for existing HOV travelers and encourages the formation of new carpools and vanpools. It effectively represents a new travel mode whose analysis requires modification of the usual highway network processing and mode choice steps described above. Since the earlier discussion of transit network coding and analysis also applies to transit service on HOVways, this section deals mainly with the implications of HOVways on highway analysis.

Highway Network Coding for HOVways The most straightforward method of coding the highway network when two highway modes (HOV and nonHOV) are available is to code two separate networks. The HOV network includes all highway links in the corridor, including the links which represent the HOVway and possibly some HOVway access or ramp links. The nonHOV network is identical except that it excludes the HOVway links.

In some cases, the nonHOV network is identical to the highway network for the TSM alternative, so the TSM network will serve as the nonHOV network. In other cases, the nonHOV network differs from the TSM network. For example, an alternative may involve a new facility with both HOV and nonHOV components, or the HOVway may replace an existing freeway lane. In this case, the nonHOV network is a modification of the TSM network. In either case, the HOV network is produced from the nonHOV by inserting the HOVway links.

Newer software packages accomplish an equivalent result with a single highway network which includes all highway links, both HOV and nonHOV. The HOVway links are "tagged" with a special indicator so that they can be excluded from the network for processing of nonHOV paths and impedances but included for HOV paths and impedances. Since both networks share the nonHOV links, this combined nonHOV/HOV network has an advantage over separate coding of the networks. It allows information (typically link speeds and volumes) developed during processing of the nonHOV network to be used directly in HOV processing. To accomplish this same sharing of data with separate networks, information on the volumes and speeds on the nonHOV links be extracted from the nonHOV network and inserted into the HOV network.

Development of nonHOV and HOV Impedance Tables One new problem posed by the analysis of an HOVway is to identify the origin-destination pairs for which travel times and costs are improved by the HOVway and to determine the magnitude of these improvements. In some past studies, analysts highly familiar with the project corridor have used a zone map to enumerate manually the zonal interchanges which would be affected by the HOVway and to estimate the travel time change for each interchange. The highway travel time and cost tables for the TSM alternative were then modified accordingly to produce HOV and nonHOV impedance tables. These tables were then used in the mode choice model to determine the HOV and nonHOV shares.

While some HOVway alternatives may serve such a compact set of origin and destination zones that this approach would be possible, most corridors with

HOVway potential are so broad and have such complex travel patterns that a network approach is preferable. The network approach relies on the computer to provide the zone-to-zone travel times for the HOVway alternative. Given an estimate of link speeds, the computer builds paths and sums impedances to determine the effect of the HOVway on service levels for every origin-destination pair. Figure 5-8 is a schematic of this network processing.

The link speeds used in this process should reflect any congestion that will occur so that the mode choice analysis is based on an accurate description of the service levels of the competing modes. The effect of congestion on nonHOV link speeds can be adequately approximated by using the auto trip table for the TSM alternative as an estimate of total trips for the HOVway alternative. The TSM trip table is assigned to the nonHOV network to determine where congestion occurs. Paths are then built and impedances summed using the revised, "congested" speeds. A speed function such as the widely used "BPR Formula" is used to revise the link speeds:

$$(5-7) \quad S_c = S_f / [1 + 0.15(V/C)^4]$$

where: S_c = congested speed on the link,
 S_f = freeflow speed on the link,
 V = estimated volume of traffic assigned to the link, and
 C = capacity of the link at service level "C".

It is usually acceptable to represent the total auto volumes on the nonHOV network with the TSM auto volumes for two reasons. First, the impedances used in mode choice will be checked against the final impedances produced in the assignment step. If they differ significantly, adjustments will be made, and the mode choice and assignment steps repeated. Second, if the HOVway greatly relieves congestion on the nonHOV network, the incentive to use the HOVway is lost and carpools would disband. Usually an equilibrium is soon reached with the nonHOV network nearly as congested after the HOVway as before.

If the nonHOV network is identical to the TSM highway network, this process would simply reproduce the final TSM highway impedance tables. Therefore, the TSM highway impedances may be used in the mode choice step as the nonHOV impedances, and it is unnecessary to build nonHOV paths at this point.

Since an HOV traversing a link off of the HOVway is subject to the same delay due to congestion as a nonHOV, in processing the HOV network the same revised speeds are used on all except HOVway links. As previously mentioned, this task is much easier with a combined network since the revised speeds may be used directly. With separate networks, they must be extracted from the nonHOV network and inserted into the HOV network.

Congested speeds must also be calculated for the HOVway links. This is accomplished by assuming a level of service for the HOVway and applying Equation 5-7 (or a similar speed equation). For example, if the HOVway is expected to operate at level of service C, then a freeflow speed of 55 mph translates into a congested speed of 48 mph. After these HOVway speeds are inserted into the network, HOV paths are built and impedances summed to produce the HOV impedance tables for the mode choice step.

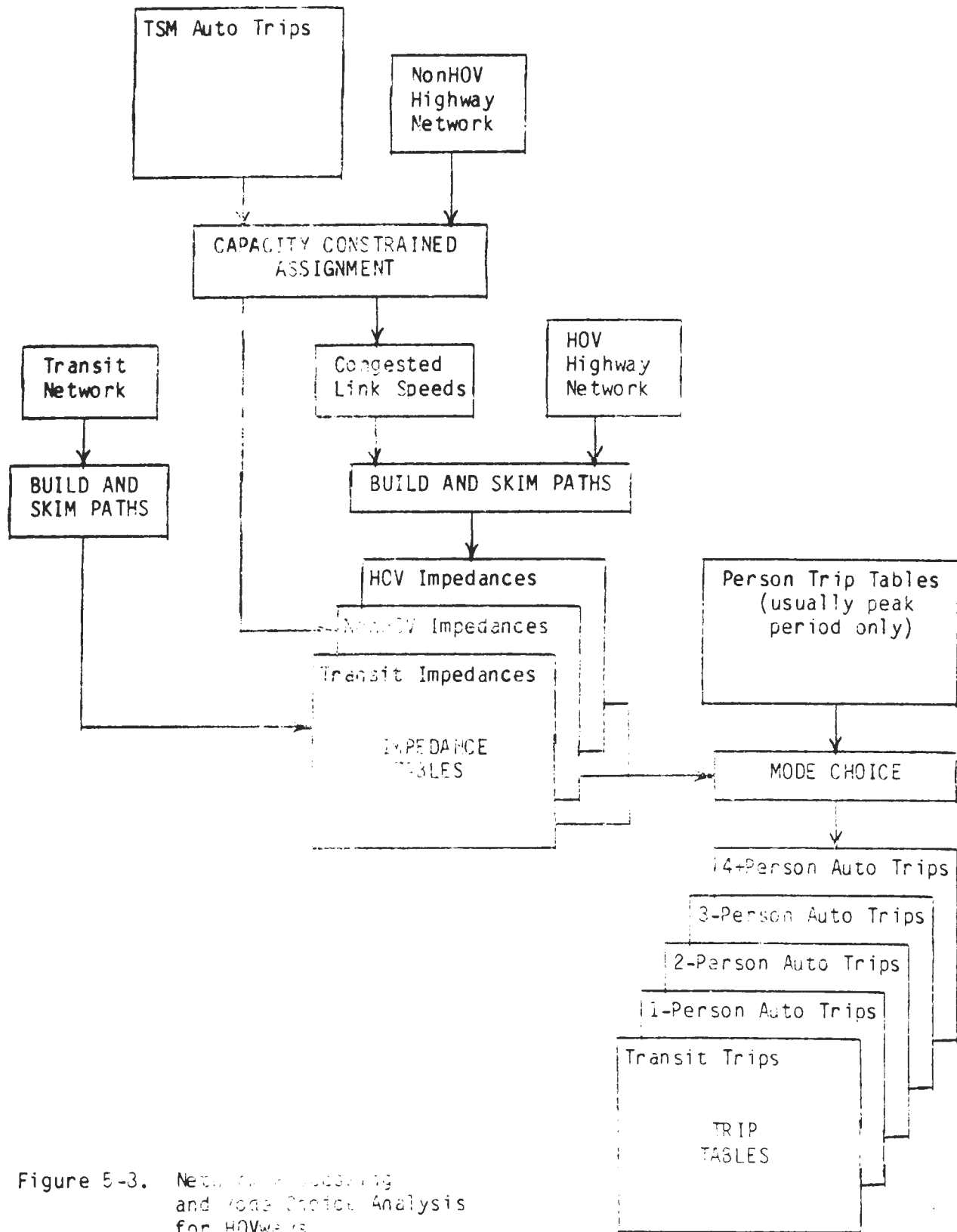


Figure 5-3. Network Loading and Mode Choice Analysis for HOV users

Mode Choice Models for HOVway Analysis The earlier discussion of mode choice models in Section 5.1 generally applies to HOV analysis as well, with the proviso that the alternative travel modes considered by the models must explicitly recognize the HOV option. The HOV, nonHOV, and transit travel times and costs from network processing are used to compute modal impedances for each mode. In recognition of the lower HOV impedance for interchanges served by the HOVway, the mode choice model will increase the HOV share for those interchanges and decrease the transit and nonHOV shares.

Note that the transit modal share is affected by the HOVway as much as, and often more than, the nonHOV share. The mode choice step must adjust the shares of all competing modes, not just the highway modes. Figure 5-9 is a schematic diagram of this mode choice step and the assignment step.

In nearly all situations, HOV analysis is necessary only for peak-period work trips. This simplification is possible because the travel time saved by an HOVway in the off-peak is usually negligible. Further, since most nonwork trips occur during off-peak periods, the mode choice for nonwork trips is usually not significantly affected by an HOVway.

Usually the minimum occupancy level of vehicles permitted on the HOVway is not predetermined, but is an operational issue which the analysis must address. Therefore, the mode choice model must be flexible enough to allow changes in the definition of an HOV. This flexibility is accomplished by defining different auto or van occupancy levels as alternative modes of travel. For example, if the minimum number of occupants in vehicles on the HOVway is not yet decided, but may be set at 2, 3, or 4 persons, then the competing auto modes in the mode choice model should be drive-alone, 2-person carpools, 3-person carpools, and 4-or-more person carpools. The mode choice model may be applied as many as three times, once for each HOV occupancy level being considered. The impedance tables used in each of these three applications of the mode choice model would be:

<u>Minimum HOV Occupancy</u>	<u>Mode</u>	<u>Source of Modal Impedances</u>
2	drive-alone	nonHOV network
	2 person pool	HOV network
	3 person pool	HOV network
	4+ person pool	HOV network
3	drive-alone	nonHOV network
	2 person pool	nonHOV network
	3 person pool	HOV network
	4+ person pool	HOV network
4	drive-alone	nonHOV network
	2 person pool	nonHOV network
	3 person pool	nonHOV network
	4+ person pool	HOV network

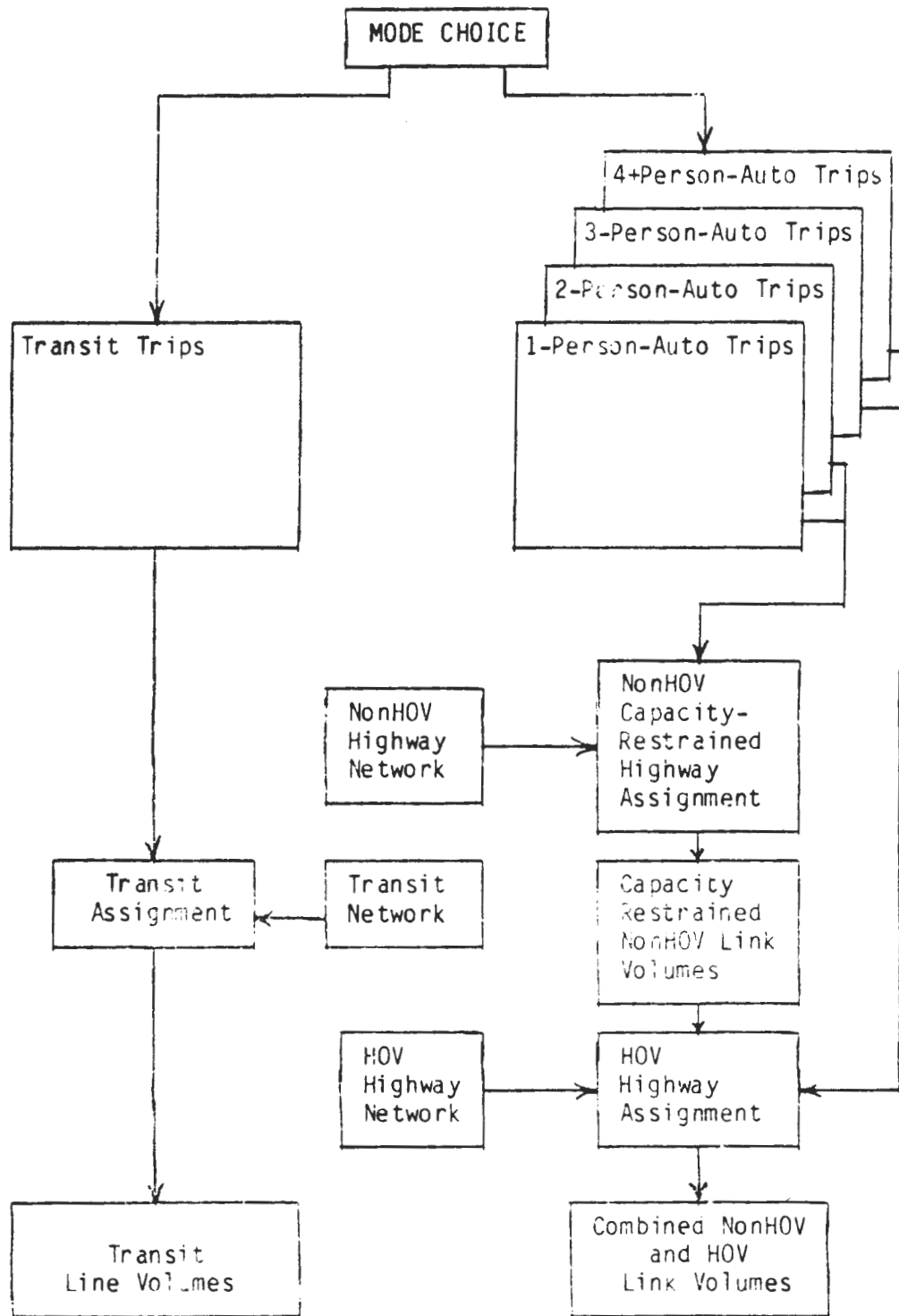


Figure 5-9. Highway Network Assignment for HOVways

For each policy option, the four person trip tables created by this process would then be converted into vehicle trips and then summed into separate HOV and nonHOV vehicle-trip tables for assignment to the network.

Traffic Assignment for HOVway Analysis Two approaches can be used to assign the HOV and nonHOV trips to the highway network. The first can be accomplished with the assignment software available in most of the planning software systems commonly used. The second method is potentially more accurate, but requires one of the software packages that combines the two highway networks. The problem both methods attempt to address is that HOVways often parallel nonHOV high-speed facilities and share arterial approaches to the nonHOV facility. When these access links are congested, the HOV travelers may find faster routes which avoid the congestion and may not even include the HOVway.

In the simpler approach to the problem, the nonHOV trips are first assigned to the nonHOV network. Since the overwhelming majority of trips are usually nonHOV, a significant level of congestion should be expected in this assignment. Therefore, the capacity-constrained assignment approach described earlier in Section 5.1 is generally appropriate at this step.

Following the assignment of nonHOV trips, revised link speeds which reflect nonHOV congestion are computed with Equation 5-7 for use in the HOV assignment. Once again, with separate networks, the revised speeds must be inserted into the HOV network, whereas with a combined network, they may be used directly in the HOV assignment. HOV trips are then assigned to the minimum paths in the HOV network -- an all-or-nothing assignment. Since the minimum paths are based on the congested speeds, they accurately reflect the conditions and path choices made by the HOV users.

In the second, more accurate approach to assignment, the nonHOV assignment is as in the simpler approach just described, but the revised speeds need not be calculated. Rather than using nonHOV speeds in the HOV assignment, the nonHOV link volumes are used. During the HOV assignment, the nonHOV volumes are added to the HOV volumes so that they may be included in the calculation of congestion levels. Equation 5-7 is replaced by:

$$(5-8) \quad S_c = S_f / \left\{ 1 + 0.15 [(V_N + V_H) / C]^4 \right\}$$

where: V_N = nonHOV volume on the link from the nonHOV assignment,
 V_H = estimated volume of HOV traffic assigned to the link, and
the other variables are defined as before.

Now, the HOV assignment can also be a capacity-constrained assignment in which speed revisions due to congestion are based on the total volumes, HOV and nonHOV, on the links. The greater the share of HOV trips, the more important this assignment approach becomes since it considers total traffic in determining where and to what degree congestion will alter the minimum paths.

5.4 Input Data and Assumptions

The "garbage-in-garbage-out" adage applies to travel forecasting as much as it does to the application of any analytical method. Indeed, a casual review of the errors in forecasts for recently opened transit facilities suggests that incorrect assumptions on key input variables played at least as much a role in the overestimates as did incorrect technical methods. This section discusses the key inputs to travel forecasts and attempts to identify some of the errors that can occur in each input, together with some ways to avoid the errors.

5.4(a) Population and Employment Characteristics

Projections of regional population and employment are critical both in terms of regionwide control totals and in their distribution within the region.

Regionwide Control Totals Three observations can be made on projections of the overall size of a region:

- 1) Total employment is the driving force behind the expansion or contraction of an urban area. Therefore, the expected change in total regional employment is the basis for all other projections.
- 2) Regional employment is best predicted as a share of the national and State projections on employment growth. The national and State projections provide control totals on expected growth, by sector of the economy, within which each urban area competes for its share.
- 3) Regional population is determined by regional employment, together with projected rates of unemployment and workforce participation. Net migration into or out of the urban area is the difference between the population that can be supported by projected regional employment and the population that would result from the application of expected survival and fertility rates to the current population.

These observations define a sound approach to regional projections that begins with and reflects estimates made for the national economy. Estimates for the region's economy can then be based on historic data on the relationship between changes in the local economy and growth (or contraction) in each sector of the national economy. As with the use of any historical information, this relationship is most likely to be most stable over relatively long periods, rather than over shorter intervals in which economic cycles can distort long term trends. Where projections are based only on very recent data, it is important to document the reasoning by which the recent trends can be taken as indicators for the long term. Generally, this reasoning must be tied to some structural change in the national and local economies that transcends the normal ups and downs of the business cycle. Finally, local projections of population and employment change should be compared with projections made for each region by the Bureau of Economic Analysis of the U.S. Department of Commerce. In considering the reasonableness of local employment forecasts, UMTA relies heavily on comparisons with the Commerce Department forecasts.

Distributions within the Region Projections of the distribution of localized economic growth and decline are made within the regional control totals. Most often, these projections are made through the judgment of local analysts, though some areas have applied regional land use forecasting models as well. In either case, the forecasts should be examined in terms of at least two key trends in urban areas: the suburbanization of employment and the interrelationship between growth and accessibility.

In a large majority of urban areas, the share of regional employment that is located in the central business district has been declining, even with the development of substantial amounts of new office space in many downtowns over the past several years. The trend is observable both in rapidly growing areas and in areas that are relatively stable in overall employment. The radial orientation of most guideway transit facilities makes downtown employment a key parameter. Therefore, an important check on the projected size of downtown employment is a comparison of the projected share of the regional total against historic trends.

In rapidly growing areas, a significant concern can be the internal consistency of projections of employment locations and consequent congestion levels. Particularly for downtowns, the concern is that the projected employment levels are so large that they overwhelm the planned transportation facilities. The resulting congestion levels may well make the projected development doubtful since declining accessibility to the downtown will tend to reduce its attractiveness for further development. It has been argued that a major increase in transit service quality and capacity to the downtown will support the additional development. Checks on the validity of this argument are made difficult by the lack of forecasting tools that include the effect of transit service on employment locations and overall travel patterns. Some tests that can be made are suggested in Chapter 6.

Finally, there is the frequent question on the impact of transit improvements on the distribution of development. Addressing this potential effect is made extremely difficult by the lack of analytical tools that can predict development changes as a function of the accessibility and other changes introduced by transit improvements. Given this difficulty, the problems in accurately measuring the benefits of any development changes that do occur, and the tendency of projected changes in development patterns to increase what have been consistently inflated ridership estimates, UMTA has not considered added ridership attributable to forecast development changes. Rather, UMTA has recommended that benefits associated with development changes be measured directly with projections of site-specific land development. The potential for added ridership because of this development has been treated as a secondary and uncertain added benefit. Local areas may wish to address this question specifically, through a sensitivity analysis on ridership and fare revenue impacts or other methods. However, **for projects seeking discretionary funding, UMTA will not agree to ridership forecasts that are based on land development patterns that differ across the alternatives.**

5.4(b) Transportation Levels of Service

A wide range of input data in travel forecasting is used to describe the

service levels available on different parts of the transportation system. These data range from the performance standards for new transit vehicles to projected parking costs in downtown and suburban employment locations. Each must be developed carefully with reasonable underlying assumptions that can be defended in terms of past trends, experience in other locations, or likely changes in basic relationships.

Transit Service Levels In general, the service provided by the transit network is determined by local service policies, adjusted where necessary to provide sufficient additional capacity to carry projected demand. The operating plan ultimately derived for each alternative is the product of service policies applied uniformly across all alternatives together with the "equilibration" step that uses consistent loading standards to ensure an adequate match between predicted demand and service levels. Section 2.4. discusses the importance of basing all operating plans on that developed for the TSM alternative. Section 5.2 presents the application of loading standards to compute service headways and vehicle requirements.

Transit Vehicle Performance Characteristics Service levels on transit guideways are determined by four critical factors: rates of acceleration and deceleration, top speeds, and dwell times at stations. Past transit planning studies have tended to be overly optimistic in developing assumptions on each of these parameters. One source of overestimates of performance is the use of vehicle capabilities as indicators of performance in revenue service. In many cases, efforts to reduce power consumption have led operators to reduce operating standards somewhat below the maximum acceleration rate and top speed for the vehicle. Thus, performance characteristics should be based on likely operating standards that may not be the full performance capability of the vehicles.

Dwell times are best computed as a function of boardings/alightings per hour and the number of passenger lanes available for entry to and exit from the vehicle. Together with initial rough estimates of the number of peak period trips using a station, these values permit calculation of reasonable assumptions on average peak and off-peak dwell times for each station.

Transit Fares Assumptions on transit fare policy are made within a closed loop in the sense that their implications for passenger volumes, fare revenues, and operating costs lead to a projected operating deficit that has to be dealt with in the financial analysis. Thus, there is no "correct" assumption on fare policy, so long as the fare policy is applied consistently across alternatives. However, for at least two reasons, it is important to identify a fare policy that is a reasonable starting point for the analysis. First, in most situations, future fare policies will be an extrapolation of current policies. An analysis that implicitly assumes a major departure risks irrelevance. Second, in order to minimize (or avoid if possible) iterations between fare policy assumptions and the financial analysis, the initial fare assumptions should be targeted toward financial and political feasibility. Often, this goal can be achieved simply by adopting current policy that is either explicitly stated or implied in recent decisions. The relationship between general inflation and fare levels tends to be the key to reasonable assumptions on future fares. A statement or track record that fares will

increase in line with inflation, or at some percent of inflation, provide the best indicator of likely future fare levels. Finally, it is important to note that fares (and all other cost inputs) must be discounted for inflation back to the dollar value that prevailed in the year on which the model set was calibrated.

Highway Congestion Levels Areas with substantial growth in employment, population, and travel demand face a particular challenge in the accurate prediction of future highway congestion levels. Section 5.2(e) above discusses the difficulty in estimating future highway speeds with standard classifications of highways by facility-type and surrounding land use. The preferred approach, "capacity-constrained" assignment, is subject to some error if the analyst does not correctly anticipate the degree of "peak spreading" that will occur as congestion levels increase.

This error is of greatest concern where the local modeling process is geared toward the peak hour rather than the peak period. An assumption that the same peaking characteristics will hold into the future can lead to projected volume-to-capacity ratios in excess of 3.0 for the peak hour, with very low estimated speeds as a result. In fact, some of this increase in congestion will be mitigated by a spreading of travel over a larger portion of the peak period. Thus, a strong case can be made for the use of the peak period, rather than the peak hour, as the basis for newly-developed model sets. Where existing models based on the peak hour are used, great care should be taken to ensure that the implicit peaking characteristics recognize the effects of congestion on travel by time of day.

Auto Operating Costs The relevant components of the cost of operating an automobile are usually taken to be the "incremental" costs -- those that are associated with each additional mile of auto travel. This definition includes fuel, maintenance, tires, and, to a limited extent, insurance, while it excludes depreciation and finance costs. The large fluctuations in the price of gasoline over the past 15 years indicate clearly the uncertainty involved in forecasting auto operating costs for 2000. Consequently, a reasonable default assumption is that these costs will increase with general inflation, implying that current prices will prevail in real terms. The choice of a year as the indicator of "current" costs presents a problem, given the substantial downturn in gasoline prices that has occurred in 1986. Assuming that this downturn is an anomaly in the trend caused by short-term market conditions, a reasonable choice for the base year is mid-1985.

It is important to note that automobile operating costs, and all other dollar-valued inputs to the travel forecasting process, must be deflated to the equivalent value of the dollar in the year on which the process was calibrated. Thus, for example, where the model set was developed with travel data from a 1971 survey, all costs must be deflated to equivalent 1971 dollars.

Parking Costs At least two different approaches have commonly been used to forecast parking cost in past project planning studies. First, areas with relatively stable employment densities have often assumed that parking costs would increase in line with general inflation so that prices remain constant in real terms. Alternatively, areas projecting substantial increases in

employment densities have often developed a simple models of long-term (for work trips) and short-term (for non-work trips) parking costs. Typically, the model of long-term costs has attempted to relate average daily parking costs for a zone to the employment density in that zone:

$$(5-9) \text{ Employee parking cost}_z = f(\text{employment}_z/\text{area}_z)$$

where f is a function relating parking cost for employees in zone z to employment density in zone z . The average cost is usually defined across all employees in the zone, both those who pay for parking, those who use free spaces, and those whose parking is either provided or paid by their employer.

The ability of these models to predict parking costs has been limited. At least two reasons can be identified for their marginal performance.

- 1) The focus on individual zones ignores the interdependence between adjacent zones.

Clearly, a zone with a given density in the center of downtown presents the employees in that zone with fewer low-cost parking options than a zone with the same density located near the fringe of downtown. A relatively short walk from the fringe zone may be sufficient to access ample low-cost parking while even a long walk from the center-city zone may not reach the fringe areas. Consequently, a better approach would be to use the average employment density in the surrounding areas, those within walking distance for example, as the explanatory variable:

$$(5-10) \text{ Employee parking cost}_z = f(\text{employment}_W/\text{area}_W)$$

so that parking cost in zone z is predicted by the total employment and total land area across the set W of all zones within the walking distance.

- 2) The absence of any measure of the number of spaces available means that the supply side of the demand/supply equilibrium is omitted.

Given that parking price is determined by both the demand and the supply for space, a model that represents only the demand side ignores possible changes in the supply of parking. In many cities, this can be a serious omission since much of the new development in the downtown is occurring on land formerly occupied by low-price, at-grade parking. Parking supply might be included in the model in several ways. For example, parking costs for employees in a zone might be predicted as a function of the ratio or difference between employment and parking spaces within walking distance of the zone:

$$(5-11) \text{ Employee parking cost}_z = f \left(\frac{\text{employment}_W}{\text{spaces}_W} \right).$$

where the zonal parking cost is a function of total employment and spaces within a fairly wide area.

II.6 Interpretation and Use of Travel Forecast Data

The Seer-Sucker Theory of Travel Forecasting: for every seer who claims the ability to predict the future, there is a sucker willing to pay for the forecast.

- adapted from J. Scott Armstrong,
"The Seer-Sucker Theory" in
Technology Review; June/July 1980

The application of any regionwide travel forecasting process is a large undertaking, requiring careful attention to a large set of computer software, the manipulation of enormous quantities of data, and the presentation of complex results to a wide audience that often includes many non-technical people. In project planning, this hefty challenge is often undertaken in difficult circumstances: forecasting tends to be the longest duration element of the analysis, often must await a sometimes-lengthy preliminary screening of alternatives before it can begin in earnest, and yet must produce a wide variety of information that is subsequently used in many different analyses ranging from financial planning to environmental assessments to cost-effectiveness analysis. Thus, travel forecasting tends to be on the critical path throughout the study, a circumstance often not conducive to careful scrutiny of the information and quiet contemplation of its meaning. Yet it is the lack of this scrutiny and contemplation that permits the large errors in travel forecasts that have occurred in project planning studies.

It is impossible to overemphasize the importance of inspecting the data produced by each step in the forecasting process. Careful examination of the reasonableness of information produced in each step can detect errors early enough to avoid the waste of time and money in further work that would have to be redone with corrected data. It can be invaluable in supporting the credibility of the forecasts, particularly where the results are received with scepticism by local reviewers and, on unhappy but (it is hoped) rare occasion, by UMTA staff. Finally, the intermediate data provide a wealth of information that is useful in explaining the impacts of transit alternatives in terms that are more useful to most officials and the public -- traveltimes to downtown jobs, the share of workers using transit to different workplaces, for example, rather than simply guideway volumes and total numbers of transit trips. Thus, it is likely that the most effective means of improving the reliability and usefulness of travel forecasts lies in the careful examination of intermediate data. The budgets and schedules for each project planning effort should therefore invest the necessary resources in this analysis.

This chapter reviews the setting in which travel forecasts are developed and used, and suggests places in the analysis where checks on intermediate information are important. It then discusses the analysis of travel impacts for particular segments of the population and identifies the kinds of travel-related information that must be produced as inputs to other technical work. The chapter concludes with a summary of the material presented in the reports on the methodology for, and results of, travel forecasting.

6.1 Framework for the Analysis

- o Figure 6-1 presents an overview of travel forecasting work done in project planning
- o most development of forecasting methods occurs outside the project planning effort itself, though some individual components are developed or replaced with some frequency -- particularly where guideway modes are new to the region
- o validation against a base year is crucial step in developing a sound forecasting process; it helps ensure that the process can replicate observed travel behavior in the region
- o ideally, the information on current travel patterns contained in the validation work is used in defining the alternatives, in addition to the information available from previous system planning forecasts
- o the methodology report documents the local forecasting process, input assumptions for the forecast year, the plan for assessing the reliability of output data, and the measures to be prepared for input to other analyses
- o network coding translates the detailed operating plans into representations that can be used by the computer software
- o the service level analysis assesses the changes in transit and, where appropriate, highway traveltimes and other service variables; this analysis may lead to an iteration on the operating plans and coded networks for one or more of the alternatives
- o the demand models estimate the overall travel patterns in the region and the portion of this overall demand that will use each mode and facility
- o equilibration is a key step to ensure the appropriateness of the operating plan given travel patterns in the region; where the initial operating assumptions are incorrect, an iteration (often done with manual adjustments) is necessary on the operating plan and service levels
- o the analysis of travel impacts summarizes the travel forecasts and prepares supporting measures that demonstrate the reliability of individual components of the forecasts
- o these summaries and supporting measures are documented in the results report whose primary function is to permit review and concurrence in the forecasts as early as possible
- o once agreement is reached, the travel forecasts are further processed to derive input data needed for other analyses in the project planning effort; the travel forecasts and information derived for the forecasts are used in a large number of important sections of the EIS or EA that should be reviewed by the staff that produced the travel forecasts

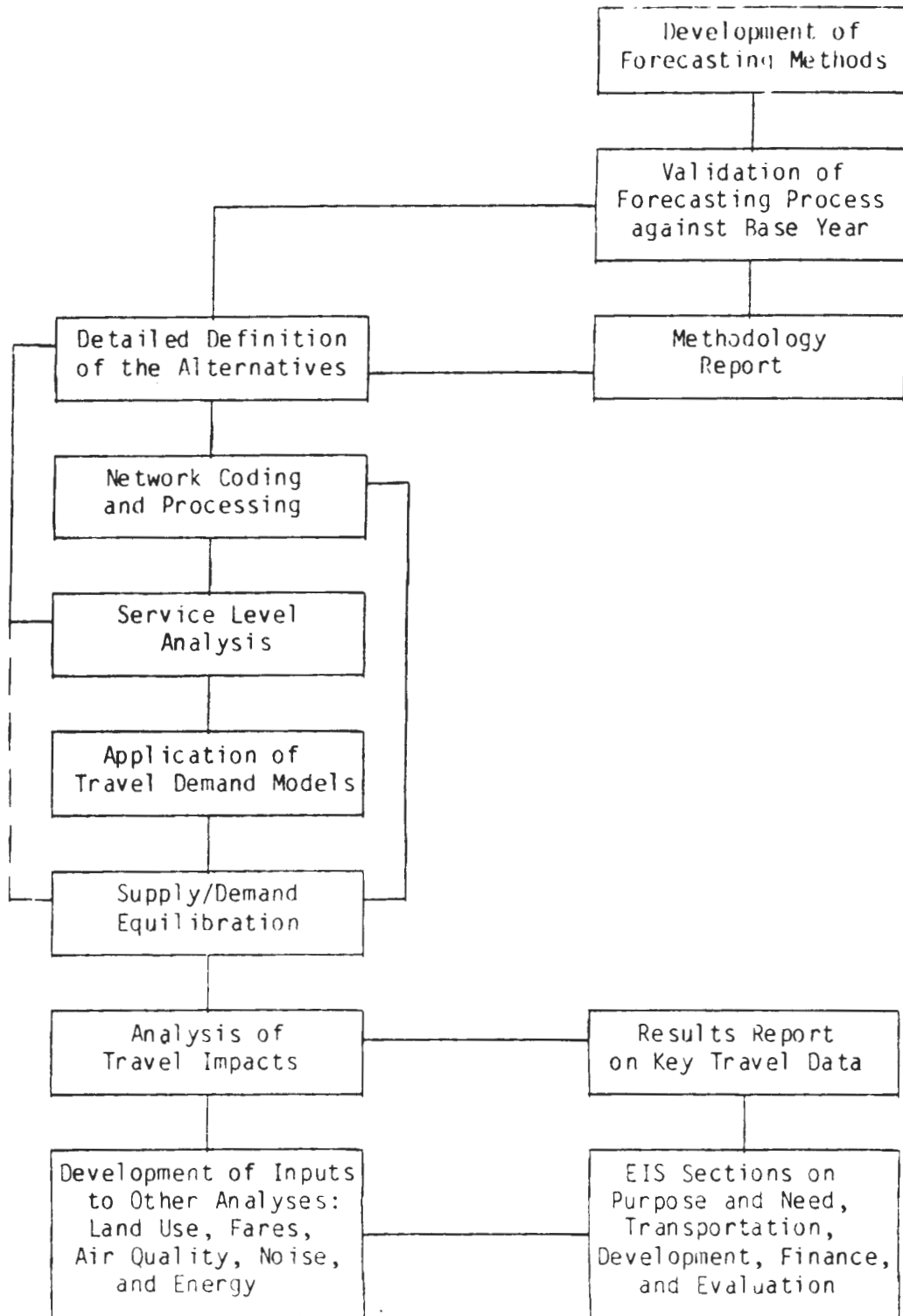


Figure 6-1. Framework for Travel Forecasting

6.2 Validation of Travel Forecasts

Because the most sophisticated network analysis and modeling efforts are no better than the accuracy of their predictions, the ultimate test of any modeling process is the reasonableness of its forecasts. However, tests of reasonableness can be applied in many ways, ranging from rigorous, carefully designed tests of individual components of the forecasts to gross rules of thumb that can detect only the most unreasonable assumptions and methods. This section suggests a series of tests that can be applied to intermediate information developed as the travel forecasting effort proceed in an effort to detect errors as early and as close to their source as possible. These test should be first applied to in a test of the ability of the forecasting process to replicate current observed conditions. Subsequent application to forecasts for each alternative can yield significant insights into the reliability of these forecasts.

6.2(a) Intermediate Data in the Travel Forecasting Process

- o impedance tables
- o trips tables
- o mode share tables
- o volumes on transit lines and highway links

6.2(b) Validation of Travel Forecasting Methods against a Base Year

- o definition: comparison of model forecasts of current (recent) travel patterns against observed patterns
- o roles in ensuring the credibility of travel forecasts
 - ensuring the forecasting process can replicate observed behavior
 - providing an accurate, disaggregate baseline against which forecasts can be checked in detail
- o data sources
 - 1980 Census Journey to Work data
 - counts
 - on-board surveys
 - external sources: compilations of travel characteristics, documentation of models from other urban areas
- o validation tests
 - trip generation
 - trip distribution
 - time-of-day choice -- peaking
 - mode choice
 - assignment

6.2(b) Checking the Results of Network Processing

Often in transit project planning, the tendency has been for the travel forecasting work to be focused exclusively on patronage volumes, particularly volumes on new guideway facilities. This focus has often been harmful in that it has often overlooked other important information developed in the travel forecasting work. Among this often-overlooked information has been the impedance tables, particularly the transit impedances, derived from the network processing work. The transit impedance tables represent the predicted impact of an alternative on the traveltimes and costs between each pair of zones. Careful analysis of these times and costs is invaluable in checking and explaining the travel forecasting results. The analysis should include:

- o the calculation of zone-to-zone speeds for each alternative, computed by dividing the transit distance by the transit traveltime; and
- o comparison of traveltimes, fares, and combined impedances between pairs of alternatives.

These analyses are important in at least four aspects:

- (1) For each alternative, the implied speeds for each zone pair can help identify coding errors in the transit network. Zone pairs with speeds greater than 25 mph or less than 5 mph, for example, should be examined for network problems.
- (2) For each alternative, a comparison of the impedances from all zones to selected important activity areas (including the CBD) can help check the reasonableness of the operating plan proposed for the alternative. This is particularly important for guideway alternatives where radial bus routes in the TSM alternative are turned back as feeders into guideway stations. The calculation of changes in (weighted) traveltimes between the TSM and guideway alternatives can identify any areas in the corridor whose travelers would experience a lower service level with the proposed turnbacks. The operating plan can then be reexamined to ensure that it optimizes the trade-off between operating efficiency and service quality. Parallel analyses can be done with traveltimes separate from transit fares to examine the individual contribution of each to the changes in transit impedances.
- (3) The differences in ridership patterns between alternatives are caused by the differences in traveltimes and costs. Therefore, the ridership forecasts are best explained in terms of these differences. A careful explanation of the service differences between alternatives can be invaluable in helping decisionmakers and the public understand the differences in ridership projections.
- (4) Finally, service changes caused by each alternative are important evaluation measures for many readers of the EIS. While total transit tripmaking or ridership volumes on guideways are important for many purposes, residents of the corridor are likely most interested in what each alternative might do for their trips to work, shopping, or other

purposes, residents of the corridor are likely most interested in what each alternative might do for their trips to work, shopping, or other purposes, residents of the corridor are likely most interested in what each alternative might do for their trips to work, shopping, or other activities. Therefore, a map for each alternative of changes in traveltimes and/or costs compared to the TSM alternative is provides important information for the evaluation of the alternatives. Sample maps of this type are presented in Figures 6-2 and 6-3.

The necessary data processing can be done easily with programs available in software packages designed for travel forecasting (the program UMATRIX in UTPS, for example). For example, control statements with the following logic would produce a list of indicators suitable for use in shading a zone map to indicate changes from each zone to a selected activity area:

```

Out =   IF [ (Inalt - Intsm) > 10 ]           THEN 2
        ELSE IF [ (Inalt - Intsm) > 5 AND (Inalt - Intsm) < 10 ] THEN 1
        ELSE IF [ (Inalt - Intsm) > 0 AND (Inalt - Intsm) < 5 ] THEN 0
        ELSE IF [ (Inalt - Intsm) > -5 AND (Inalt - Intsm) < 0 ] THEN -1
        ELSE IF [ (Inalt - Intsm) > -10 AND (Inalt - Intsm) < -5 ] THEN -2
        ELSE IF [ (Inalt - Intsm) < -15 ]     THEN -3

```

These statements will produce an output table "Out" that is based on the relative values of input impedances (traveltimes in this example) for a particular guideway alternative "Inalt" and the TSM alternative "Intsm." The output table consists of integer numbers ranging from 2 to -3, representing various increments of traveltime. Each column of the table provides a simplified measure of the guideway alternative's impact on traveltime to each individual zone from all other zones. Similar analyses can easily be done for transit fares and total impedances as well.

In many cases, it is more useful to examine all trips attracted to a group of destination zones. Most obvious is the analysis of accessibility changes to the CBD taken as a whole. For each production zone, an overall measure of accessibility to the entire CBD can be computed as a weighted average of the impedances to each zone in the CBD, weighted by an appropriate indicator. For work trips, total employment in each zone would be used as the weights, while for shopping trips, retail employment or floor space would be appropriate.

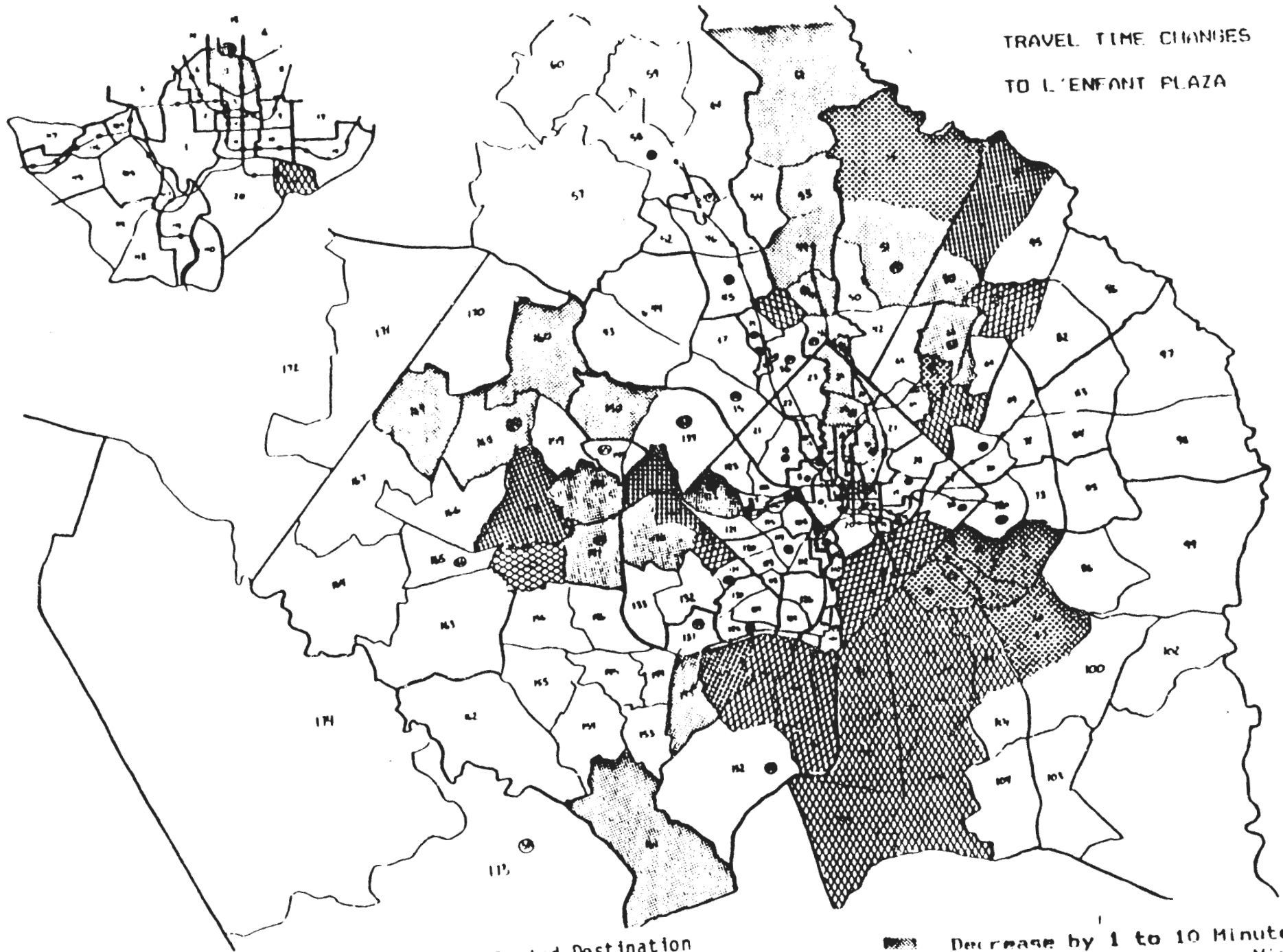


Figure 6-2. Map of Traveltime Changes to a Selected Destination

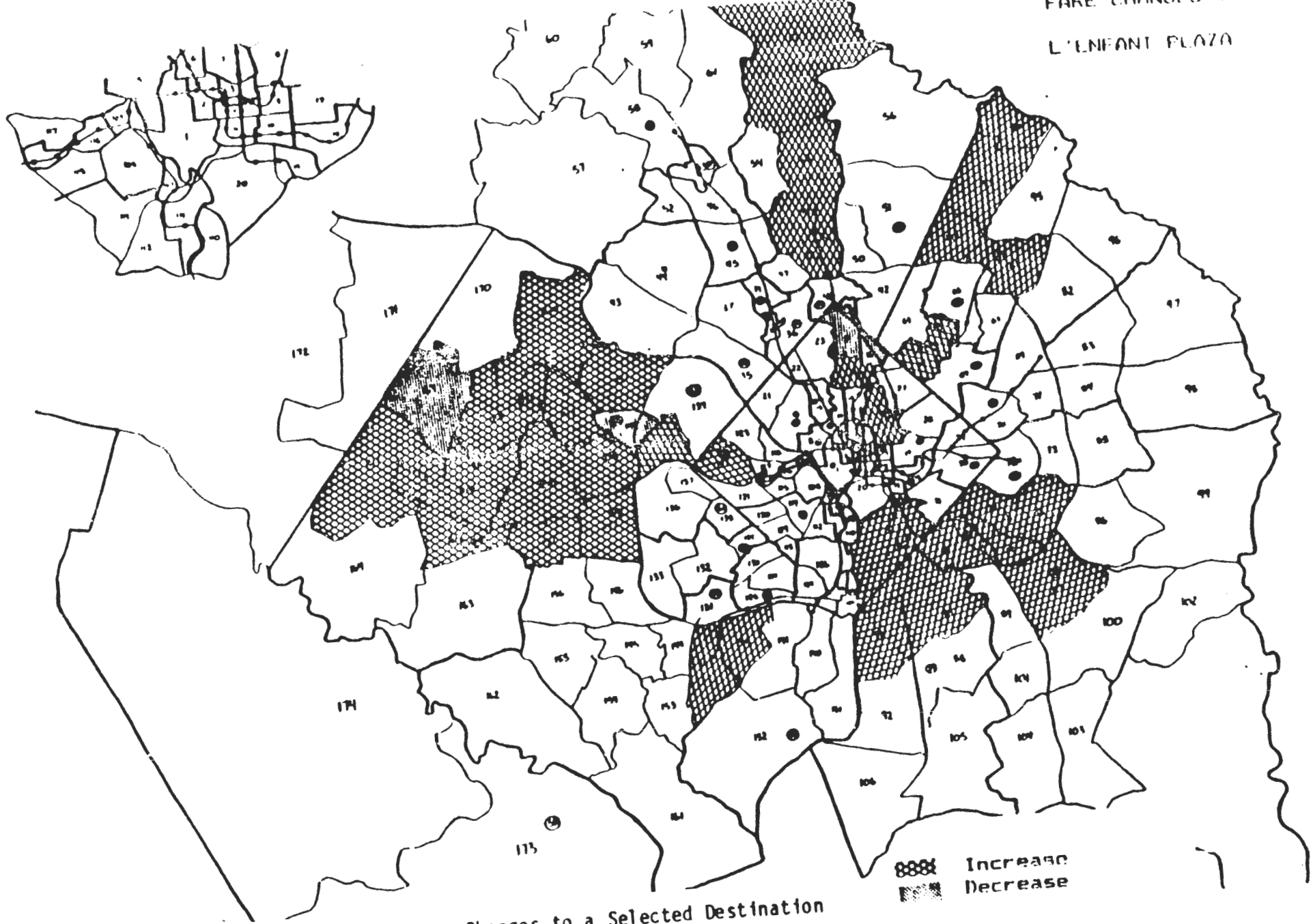


Figure 6-3. Map of Fare Changes to a Selected Destination

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6.2(d) Checking Total Travel Patterns

- o comparisons of base year versus forecast year values:
 - average trip times and trip distances by mode
 - share of trips produced in each area (zone, district, jurisdiction, etc.) that is attracted to various area types (CBD, core, suburban employment centers, other)
 - share of trips in each socio-economic class attracted to each area type
 - percent of predicted CBD attractions satisfied in first iteration of the distribution model

6.2(e) Checking Mode Share Estimates

- o comparisons of base year versus forecast year values:
 - shares of trip productions in each area (zone, district, etc.) estimated on each mode (transit, HOVs, etc.):
(transit productions/total productions) and
(transit attractions/total attractions)
- o consistency between changes in accessibility and changes in transit and HOV shares
- o changes in transit and HOV trip productions by zone, and attractions by zone

6.2(f) Checking Volumes on Facilities

- o equilibration: headways and loading standards
- o changes in peaking characteristics as congestion increases
- o share of transit travel in corridor found on guideways

6.3 Evaluation of Travel Impacts

Since improvements in service levels and travel times are the primary reasons for considering major transit investments, an accurate portrayal of the travel impacts from each alternative is clearly a critical component of the travel forecasts. These estimates must serve a variety of purposes, among which are key roles in the evaluation of the effectiveness, cost-effectiveness, and equity implications of the alternatives.

6.3(a) Measures of Transportation Benefits

A desirable measure of transportation benefits would be sensitive to both changes in travel times and travel costs, and would recognize benefits for both existing transit users and new users diverted from other modes. The measure would put all transportation benefits on common ground and, importantly, permit them to be summed and used as an overall measure of transportation benefits in the evaluation of the alternatives.

Consumer surplus Fortunately, a well-established method for measuring benefits is provided by micro-economic theory. Changes in "consumer surplus" are a direct indicator of benefits to both existing users and new users of transit and yield measures in common units. Figures 6-4 through 6-6 illustrate the application of the consumer surplus technique.

Figure 6-4 depicts the relationship between the generalized "price" of transit and the demand for transit. "Price" in this case means the overall perceived cost, or disutility, of transit and includes travel time, transferring, fares, parking charges at park/ride lots, and so forth. Price P_0 is the price in the Do-Nothing alternative for transit travel between, for example, a suburban community and the downtown. At this price, R_0 riders will be attracted to transit. A transit alternative being considered for the corridor would reduce the generalized price of transit for this suburb-to-city trip to P_1 . This price reduction is largely the result of lower travel times, though it could reflect a lower (or higher) fare as well. Demand forecasts for the alternative indicate that R_1 riders would use transit for this interchange if the project were built.

The impacts on existing riders are fairly obvious in Figure 6-5. Each existing rider currently pays P_0 for the benefits available from making the same transit trip. With the improvements caused by the alternative being evaluated, each existing rider would pay only P_1 for the same benefits. Thus, existing riders each enjoy a savings, or "surplus," equal to $(P_0 - P_1)$. Since there are R_0 existing riders, the total savings to existing riders are simply:

$$(6-1) \quad \text{Benefits to Existing Riders} = (P_0 - P_1) \times R_0.$$

These savings are represented by the shaded rectangle in Figure 6-5. Where price changes consist exclusively of travel time savings, these benefits are exactly equal to "travel time savings for existing riders" used in the current indices.

"Price" of
Transit

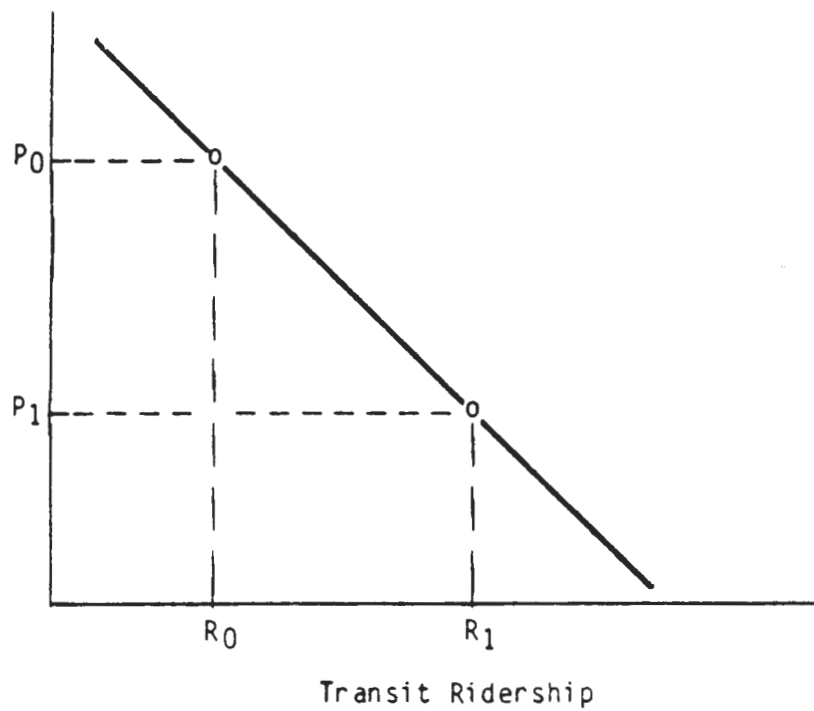


Figure 6-4. Demand for Transit

"Price" of Transit

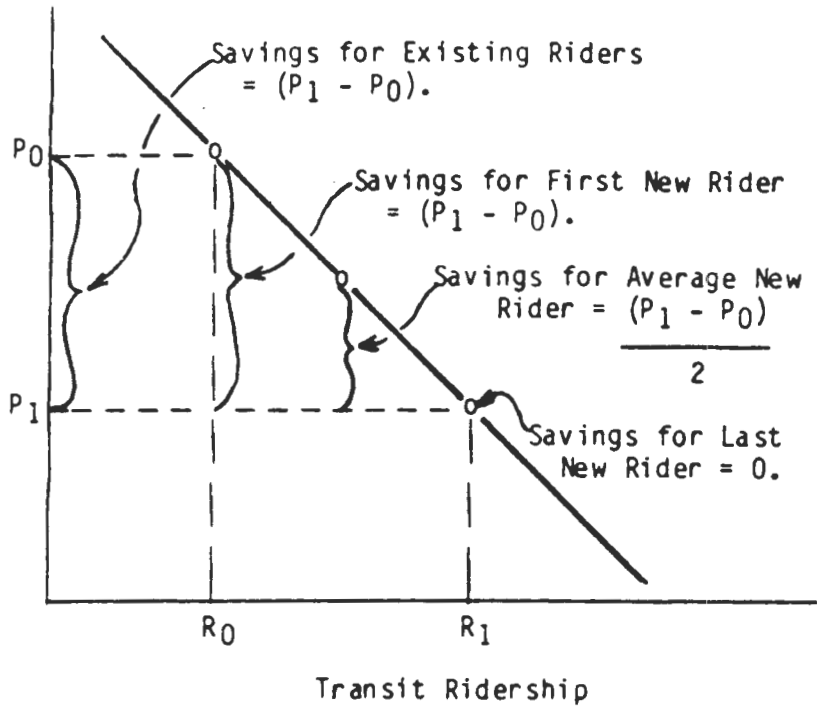


Figure 6-5. Benefits to Three Key Individuals

"Price" of Transit

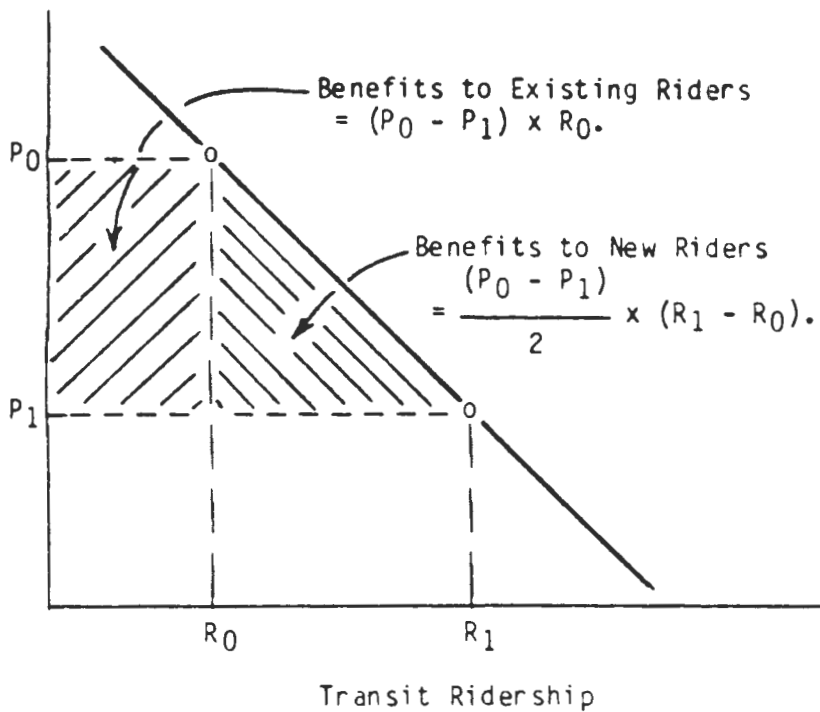


Figure 6-6. Components of Consumer Surplus

Impacts on new transit riders are similar, though less straightforward. They are best illustrated by picturing three individuals in Figure 6-3 who switch to transit as the price decreases. The first new rider might be attracted by a very small price drop, so small, in fact, that the price is not measurably different from P_0 . This new rider is essentially indifferent between the transit and auto alternatives when the transit price is P_0 , indicating that the individual was paying P_0 for the auto trip as well. At the other extreme, the last new rider switches to transit only after the price reaches P_1 , indicating that this individual was paying P_1 as an auto user.

Further, the "average" new rider switches at the point where the transit price is midway between P_0 and P_1 . This indicates that the price of this individual's trip was $(P_0 + P_1)/2$ when made by automobile, since that is the precise point at which the individual is indifferent between auto and transit travel.

When the transit price reaches P_1 , the savings, or increase in consumer surplus, enjoyed by each of these individuals depends on the transit price at which each switched to transit. The first new rider switched at a price slightly less than P_0 . When the price becomes P_1 , this individual enjoys a savings approximately equal to that enjoyed by existing riders, $(P_0 - P_1)$. The last new rider switched when the price dropped to P_1 . Since the price dropped no further, this last new rider enjoys no increase in consumer surplus. The average new rider switches at a price equal to the average between the new and old prices, $(P_0 + P_1)/2$. This average new rider saves an amount equal to the difference between the price at which the individual switched modes and the eventual price, P_1 :

$$(6-2) \quad \frac{(P_0 + P_1)}{2} - P_1 = \frac{(P_0 - P_1)}{2} .$$

Not surprisingly, the savings enjoyed by the average rider is equal to the average of the savings of the first new rider $(P_0 - P_1)$ and the last new rider (zero):

$$(6-3) \quad \frac{(P_0 - P_1) + 0}{2} = \frac{(P_0 - P_1)}{2} .$$

The total benefit accruing to new riders is therefore the average savings per new rider times the number of new riders $(R_1 - R_0)$:

$$(6-4) \quad \text{Benefits to New Riders} = \frac{(P_0 - P_1)}{2} \times (R_1 - R_0) .$$

These benefits are shown graphically as the shaded triangle in Figure 6-4.

Total transportation benefits arising from the transit project are computed as the sum of benefits to existing riders (Equation 6-1) and benefits to new riders (Equation 6-4):

$$(6-5) \quad \text{Total Benefits} = [(P_0 - P_1) \times R_0] + [\frac{(P_0 - P_1)}{2} \times (R_1 - R_0)].$$

Thus, benefits to existing riders and new riders are valued in a parallel fashion that produces a total benefit measure for use in the indices.

Calculation of the Price of Transit To apply the concept outlined above, it is necessary to define the units in which transit price, and therefore consumer surplus, are measured. Since the components of consumer surplus include both times and costs, the choice of a common unit is between dollars and hours. Hours appear preferable for two reasons:

1. While in either case it is necessary to identify a value of time with which to convert hours to dollars or dollars to hours, the importance of the selected value of time can be minimized by applying it to the smallest component of total transit price. Most of the differences between alternatives occur in travel times because alternatives are defined within a consistent fare policy and any differences in fares exist only because of fairly minor fare adjustments (a larger number of transfers, upgrade charges on express services, etc.). Thus, the conversion of fares into their equivalent travel times requires application of the selected value of time only to the smallest component of differences in total transit price, differences that are usually zero.
2. Conversion of benefits into their dollar equivalent would result in unitless indices (costs in dollars divided by benefits in dollars). A unitless "score" for each project is less easily interpreted than a "cost per trip" or "cost per hour" index.

Three assumptions are used in computing the price of transit travel in terms of equivalent hours of travel time:

1. The value of (in-vehicle) travel time for travel to and from work is \$4.00 per hour, based on current wage rates and the relationship between wage rates and travel time values established in the research literature. This value will change as wage rates change over time.
2. The value of travel time for all other trip purposes is half that for work trips, again based on the research literature.
3. The value of out-of-vehicle travel time for either purpose is twice that of in-vehicle time for the same purpose. This value is an average of the ratios between the coefficients of in- and out-of-vehicle travel times found in mode choice models throughout the country.

Of these assumptions, the first is probably the most uncertain but is applied only in a minor role -- converting fares (and therefore fare changes which are small in size and few in number) into equivalent hours of travel time. The second assumption is more robust since it sets a relative rather than absolute level for non-work value of time. The third assumption reflects

a common and generally-accepted relationship between the two components of travel time.

Given these assumptions, expressions for transit price measured in equivalent hours of work trip travel time are

$$(6-6) \quad \text{Work Transit Price} = \text{IVT}_w + (2 \times \text{OVT}_w) + \frac{\text{FARE}_w}{\$4.00/\text{hr.}}$$

and

$$(6-7) \quad \text{Non-Work Transit Price} = (0.5 \times \text{IVT}_{nw}) + \text{OVT}_{nw} + \frac{\text{FARE}_{nw}}{\$4.00/\text{hr.}}$$

where IVT and OVT are in- and out-of-vehicle travel time, respectively; FARE is transit fare, including transfer and park/ride charges; and w and nw are work and non-work trips purposes, respectively.

Computing Consumer Surplus Values The data processing necessary to compute consumer surplus measures is relatively simple, using the tables of trips, traveltimes, and fares developed for each of the alternatives. For each alternative, a single pass of any matrix manipulation program (UMATRIX in the UTPS package) can compute the transit prices, and then compute the price differences between the Do-Nothing alternative and the alternatives in question. Equation 6-5 above computes consumer surplus in the case where price decreases and new transit riders are gained. In cases where price increases, a slightly different calculation is performed:

$$(6-8) \quad \text{Total Benefits} = [(P_0 - P_1) \times R_1] + [\frac{(P_0 - P_1)}{2} \times (R_0 - R_1)],$$

where total benefits are negative because $(P_0 - P_1)$ is negative. In calculation of user benefits with appropriate computer software, each zone-to-zone interchange must be tested with an IF statement to determine whether there is an increase or decrease in service levels and to employ the correct equation (6-5 or 6-8).

Computations of consumer surplus are simplest where the local demand forecasting process stratifies the travel into few markets. The calculations become more involved as more stratifications are used, since the calculations are repeated for each stratum and summed. A reasonably well-planned analysis can keep the number of program runs to one per alternative, however.

Consumer Surplus Computed across Several Modes Where a transit alternative improves service levels on more than one mode -- as with transit and HOVs on an HOVway -- it is necessary to compute consumer surplus accruing to existing and new users of each mode and sum the results. While the analysis of non-transit modes adds to the required data manipulation, it proceeds in exactly the same fashion as the transit analysis outlined above. A simple summation across all modes gives the overall measure of travel benefits.

6.3(b) Travel Measures for an Equity Analysis

- o transit accessibility improvements for, say, the lowest quartile of zones in terms of average income or auto ownership
 - percent of jobs within X minutes of transit travel time of selected zones
 - regionwide (or corridor) distribution of jobs by travel time from low-income/auto-ownership households
- o annual value of consumer surplus (time and fare savings) by income/auto-ownership class

6.4 Development of Input Data for Other Analyses in Project Planning

6.4(a) Travel-Related Indicators of Development Incentives

- o production zone measures of transit, HOV, highway accessibility
- o attraction zone measures of modal accessibility
- o station volumes by access mode
- o changes in vehicle parking requirements in attraction zones

6.4(b) Calculation of Fare Revenues

- o average fare paid is not equal to published fare schedules
 - discounts
 - evasion and losses
- o fare revenues correctly calculated with average fares, typically stratified by mode, service type, fare zones, etc.

6.5 Contents of the Reports on Methodology and Results

Methodology Report

- o descriptions of network coding standards, network processing parameters, and demand models (by reference, if possible, to existing readable documents)
- o summary of validation against base-year data (also by reference if possible)
- o assumption on key input data (Section 5.4 discusses key inputs)
- o measures to be developed for analysis of intermediate data -- impedances and share tables
- o measures to be developed as inputs to other analyses
- o plan for analysis of the alternatives
 - order of the simulation runs if data from one alternative is to be used in assessing other alternatives
 - where appropriate, methods for manual adjustments of forecast data to account for alignment and other variations in the alternatives

Results Report

- o key summary data from individual components of the forecasts
- o supporting measures derived from intermediate data demonstrating reasonableness of the forecasts
- o information derived for use in other analyses can be included later as an addendum so that results report can be circulated as early as possible for review and concurrence

II.7. Analysis of Socio-Economic and Environmental Impacts

The purpose of project planning is to examine a range of mode and alignment alternatives and choose one alternative for preliminary engineering. Socio-economic and environmental impacts can be important considerations in making this choice. During the scoping process (see Chapter II.1), attention is given to identifying those socio-economic and environmental impacts that should be taken into account in a given situation. This chapter provides guidance on a broad range of potential impacts but, in most cases, only some of these impacts will require detailed analysis in any particular project planning study.

Questions often arise regarding the appropriate level of detail for the socio-economic and environmental analyses performed during project planning. The tendency is to limit the analysis to those environmental matters that should influence the mode and alignment decision. The site specific socio-economic and environmental impacts of design options can be assessed during preliminary engineering, when design decisions are being made.

In many cases, however, it may be desirable to anticipate the design options associated with each mode and alignment alternative and to identify their socio-economic and environmental impacts during project planning. The project planning phase includes the initiation of the Federal environmental impact statement (EIS) process, and a draft EIS (or environmental assessment) serves to document the results of the technical analyses performed in project planning. If the socio-economic and environmental analyses performed during project planning are not sufficiently detailed, or do not encompass design options, new or different impacts may be revealed during preliminary engineering, and a supplemental draft EIS may be required later in the process. Due to the time this could require, many local agencies would prefer to avoid the possible need for a supplemental draft EIS, and thus are willing to devote more effort to identifying impacts at the project planning stage than might strictly be necessary for mode and alignment decisions.

This chapter describes the scope and appropriate level of detail for the social, economic, and environmental analyses done at this stage of the project development process. The chapter also provides general guidance on the technical methods that are suitable for these studies. More detailed technical guidance may be found in UMTA's environmental circular and in such reports as the USDOT's Environmental Assessment Notebook Series. In addition, UMTA intends to provide guidance on several socio-economic and environmental impact areas in a series of technical manuals for transit project planning.

The chapter begins with a discussion of land use and urban development impacts. This is done because, in some instances, land development can be looked upon as an integral part of one or more transit alternatives, just like vehicles or stations. Where an alternative includes a specific joint development proposal, for example, the development project should be treated as if it were part of that alternative, and should be subjected to appropriate socio-economic and environmental analyses. In general, the socio-economic and environmental analysis should encompass both the direct impacts of the transit improvement itself and the impacts of any development projects that may be considered to be a direct result of the mass transit investment.

7.1 Land Use and Urban Development Impacts

There are at least four reasons for being interested in the land use and urban development impacts of a mass transit investment:

- o Under the National Environmental Policy Act, Federal agencies are required to consider the impacts of proposed projects and alternative courses of action. This requirement includes the consideration of impacts on land use and economic development. Many States have similar requirements.
- o Cities often tout urban development benefits as a major reason for considering a major investment in transit. In such cases, the magnitude of this benefit needs to be estimated in order to determine, first, if the urban development (together with other benefits) justifies the costs, and second, whether other strategies might bring about the desired development and other benefits at less cost.
- o Projects that have urban development benefits can often be financed, at least in part, through value capture techniques, or they may be built through public/private partnerships that rely on a project's development benefits. Preparing a credible estimate of these benefits can be an essential part of the financial planning work done for the project. This would include the identification of those property owners most likely to benefit from increased property values.
- o Community groups may be concerned about how a project will affect neighborhoods along the line and at station areas. They may oppose, for example, changes in land use that will bring increased activity to quiet neighborhoods, or that will increase local traffic. An urban development impact analysis can help show whether these concerns are valid and, where necessary, help bring about agreement on appropriate mitigation measures.

This section begins with a theoretical discussion on the linkages between land development and transportation. It then goes on to identify a framework and technical approach for assessing the magnitude and incidence of these impacts.

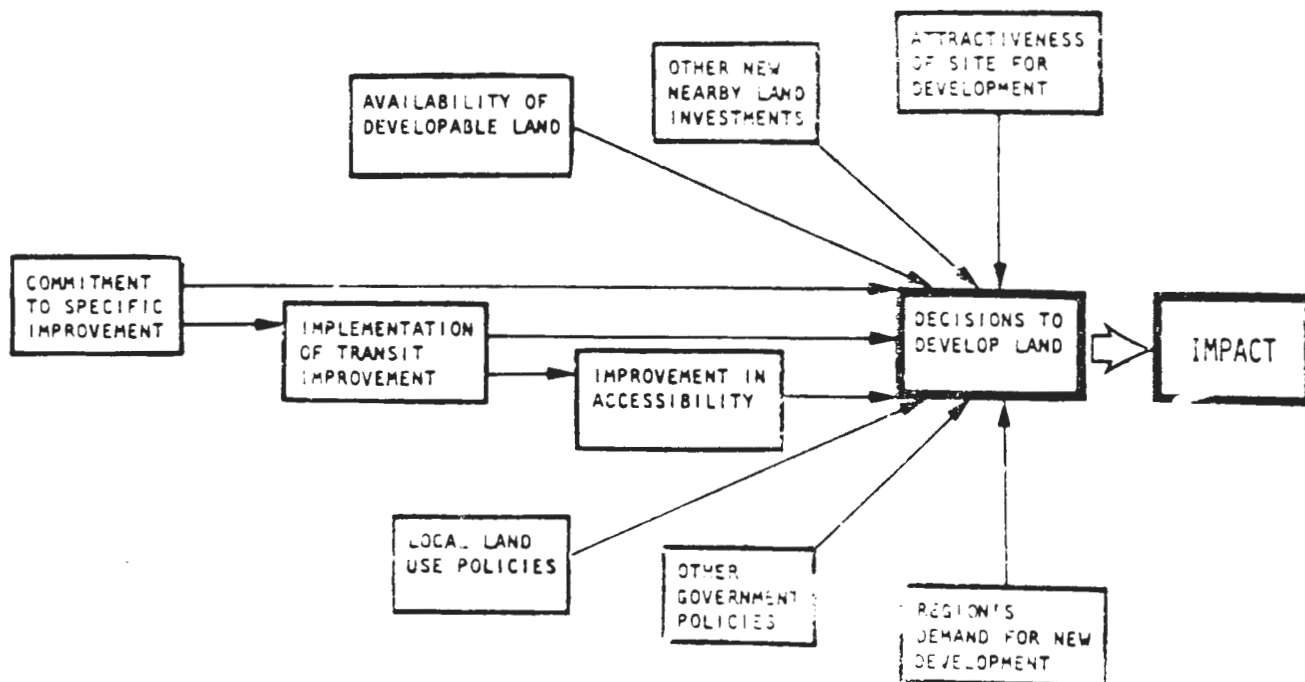
7.1(a) Linkages between Land Use and Transportation

Transportation access is one of several significant factors affecting the development of land. For economic activity to occur at a given site, the site must be accessible to the labor and materials needed to develop a product, and to a market for selling the product. At the national level, cities have developed at places that are highly accessible to the national system of roadways, railroads, or waterways, and at places where goods are transferred from one mode of travel to another (i.e., ports). The same relationships exist within cities. Historically, the central business district has been the most accessible point in the region, and thus has experienced the greatest amount of development and highest land values. More recently, dense nodes of commercial and retail development have been occurring at highly accessible suburban places, such as highway interchanges.

A 1987 survey of the CEO's of the country's largest corporations illustrates the importance of accessibility in business location decisions (see reference ____ at end of this Chapter). Asked to rank order five factors that can affect the location of office facilities, "easy access to domestic markets, customers, or clients" was ranked number one, with 37 percent of all CEO's deeming it "absolutely essential". Ranked fourth was "quality of life for employees" including such factors as good public schools, enough streets and highways, affordably priced housing, and low crime. Executives in organizations involved in wholesale, retail, or manufacturing operations ranked seven factors affecting their location decisions. Top ranking went to "the availability of sites with existing water, sewage, and roads," and second ranking to "access to domestic markets". "Easy access to raw materials" was ranked third and "quality of life for employees" was fifth.

A major new transportation facility should produce a notable change in accessibility. (If not, the justification for the project would certainly be in question.) As travel time between points is reduced, forces are put in motion that can, over time, change the distribution of economic development. Transportation facilities that significantly reduce travel time between an urban region and other parts of the country can eventually lead to new jobs and growth in that urban region. Facilities that change the relative accessibility of certain parts of an urban area can lead to a redistribution of growth within the region, but are unlikely to affect the total amount of regional growth. Urban mass transportation projects would fall into this second category.

Figure 7-1: Major Factors Influencing Land Use Impact



It should be kept in mind that accessibility is not the only factor that affects the amount and location of urban development (see Figure 7-1). Non-transportation factors cited in the survey of CEO's noted above include the climate that State and local government creates for business through tax policy and regulation, the cost and availability of housing and labor, the crime rate, tax rates, good public schools, and good colleges, universities, cultural and recreational facilities. Other non-transportation factors include (a) the strength of the overall economy, (b) the availability and cost of developable land, capital financing and managerial expertise, (c) the attractiveness of a given site for development, and (d) other nearby land investments. Where factors are in place that impede or preclude development from occurring, it is unlikely that an increase in accessibility, in and of itself, can overcome them. Such factors might be referred to as "obstacles" to development.

Before and after studies have examined the land use changes that follow major transit investments. A 1977 study, which examined the impacts of transit investments in a number of cities, is documented in a report entitled Land Use Impacts of Rapid Transit: Implications of Recent Experience. It found that:

- o Recent major rapid transit improvements have been important inducements to intensified development near stations both in CBD's and in outlying areas, although only when supported by other favorable forces.
- o Some recent major commuter rail improvements were found to have led to significant land use intensification, but evidence on light rail and busways was inconclusive.
- o Recent experience provides no evidence that any rapid transit improvements have led to net new urban economic or population growth.
- o The timing of land use impact seems largely dependent on general economic conditions.
- o Local land use policy changes have often been instrumental in facilitating transit's land use impacts.
- o The transit improvement itself has often led to changes in land use policies.

More recent experience has tended to reaffirm these findings.

7.1(b) Identifying Land Use Impacts

The objective of the land use impact assessment is to predict differences in the amount, type, and/or density of land development that would result from the various transit mode and alignment alternatives. To meet this objective, the analyst must isolate the development that is likely to be "induced" by a transit alternative from that development which would happen anyway. Once the induced development has been predicted, the analyst must also try to evaluate its desirability. Given the large number of factors that can influence economic development, as well as the difficulties inherent in all economic forecasting, the best the land use analyst can hope to make is an educated guess. This section describes an analysis framework which should make the land use impact forecast somewhat more educated, and somewhat less of a guess.

The framework suggested below can also be used to help identify joint development opportunities that may be created by one or more transit alternatives. Joint development -- the linking of private real estate development to public transportation services and station facilities -- can benefit the transit operator by increasing ridership on the transit system, providing revenue from the sale or lease of real estate and/or air rights, and reduce land acquisition and construction costs.

In undertaking the land use impact assessment, it is important to:

- o rely on sound analysis rather than wishful thinking for projecting market demand;
- o make sure that the projected land use impacts are consistent with projected changes in accessibility;
- o consider the need for supporting public and private actions; and
- o recognize the difference between temporary and permanent employment changes.

One of the considerations in designing the methodology for the land development impact assessment should be the manner in which interested parties are brought into the process. Local governments should be consulted regarding development trends and adopted land use plans, policies, and ordinances. The business community can provide information on economic trends and the factors influencing the local economy. Local developers, in particular, will have insights into regional growth and development and the potential impact of a new transportation facility. They may also be instrumental in bringing about public/private partnerships to help build the project. Community groups should also be consulted regarding their attitudes toward development.

The assessment will require a considerable amount of data on existing market and extra-market conditions and trends. The identification of market conditions requires data on the direction and performance of the economy, broken down into regional, corridor, and subarea groupings. This would include:

- o population data: number of individuals, household size, income, race, age;
- o land use data: uses and densities including the location of activity centers, areas of growth and decline, the availability and cost of developable land, rents, absorption and vacancy rates, building permits, and the availability and cost of development capital;
- o other data: employment, retail sales.

Much of this information may be readily available, since it is data that is also useful for transportation impact and financial analysis purposes. Extra-market conditions include the powers and policies of public agencies, the availability of public services, concentrations of low income residents, traffic congestion, and land use controls.

The land use impact analysis for major transit projects should be performed on three levels: impacts on the region as a whole, impacts on the corridor, and impacts on specific station areas. The three levels of analysis should produce results that are internally consistent. That is, the sum of all of the land use changes predicted at the local level should add up to the regional total. Where land use impacts are an issue, UMTA urges local agencies to approach the analysis in both a "top down" and a "bottoms up" manner, and then to check the results to ensure consistency.

Impacts on Regional Development. While there is no empirical evidence showing that urban mass transportation investments affect rate of development at the regional scale, urban development is often touted as a reason for pursuing major transit projects, particularly rail. Despite the lack of evidence, some local officials and civic boosters simply assume that transit brings new growth to an area. In such cases, the technical process may need to address development impacts at the regional scale to help ensure that local decisions are not based on false hopes and dreams. Unless convincing evidence to the contrary is produced, the assumption made in all UMTA-sponsored fixed guideway planning studies will be that mass transit investments have no net effect on the amount of regional development.

If an urban area desires to investigate the potential for regional development impacts, one possible approach is to cite empirical evidence from other cities with similar economic conditions and transportation problems. Such evidence can be found in the before and after studies that have been done in a number of cities, including Land Use Impacts of Rapid Transit: Implications of Recent Experience cited above. A second approach consists of examining regional development trends and identifying the factors driving the local economy. In slow growth areas, attention should be specifically directed to identifying the "obstacles" that may be keeping development from occurring at the desired rate. In theory, a local transit investment could help influence regional growth trends if local traffic congestion is a significant obstacle to new development. The land use impact of each mode and alignment alternative would then bear some relationship to how well it relieves congestion. Traffic and travel time forecasts produced in the service and patronage analysis can be useful. Even if traffic congestion is an obstacle, however, a transportation improvement may not lead to increased growth and development unless other contributing factors, such as the health of the local economy, are also positive.

Impacts on Corridor Development. Transit investments are more likely to help bring about a redistribution of that regional growth which is already occurring. In some cases, transit projects serving a central business district may provide the added transportation capacity that is needed for additional growth in the downtown. Transit projects that improve CBD access may also promote development along the line and may contribute to the dispersal of residential development in peripheral areas. These kinds of distributional effects are most likely to occur if inferior access conditions are keeping the CBD and other areas served by the transit improvement from growing as rapidly as other parts of the region. The analysis approach for identifying land use impacts at the corridor level can be similar to the regional analysis methods described above. Empirical evidence from before/after studies may be useful, along with information on development trends and obstacles in the corridor.

At the corridor level, the analysis can begin to consider the types and densities of land use development that are apt to occur with various transit alternatives. Projected market absorption rates for office, retail, hotel, and residential uses should be compared with historic rates to make sure that the forecast is reasonable. Forecasted development should also be compared with the supply of developable land, taking into account local plans and ordinances that affect the use of developable land.

Where corridor impacts are anticipated, the analysis should clearly indicate the extent to which the growth will come from other parts of the region. It is important that decisionmakers understand that corridor impacts tend to be a zero sum game, and that they take the equity and other implications of these impacts into account.

Impacts on Development Around Station Areas. A fixed guideway transit project is most likely to affect land use in areas immediately adjacent to stations. These areas experience the greatest increase in accessibility. Stations with high levels of walk access can also create a new market for retail development targeted to pedestrians. Because of the linkage between development and accessibility, transportation measures can be used to compare alternatives in terms of their potential to induce land use changes. Two measures are particularly useful: changes in travel time to other points in the region, and the number of walk-on riders.

Each alternative's potential to induce station area development might be compared using the following outputs of the travel forecasting process:

- o percentage of the region's population and/or employment within x minutes by transit.
- o changes in transit and highway travel times, weighted by mode share. For this purpose the denominator of the logit model can serve as the analysis variable.
- o number of walk-on riders or, in the CBD, the volume of transit arrivals

As at the corridor scale, the station area impact analysis should try to identify obstacles to development — local economic conditions and land use policies, for example — and the availability of developable sites. Where the necessary conditions for land use change appear to exist, a market analysis should be performed to determine the type and density of development that is most likely to occur. Sample pro formas should be prepared to test the viability of different development types and densities.

Joint Development. Joint development is an important tool that can be used to make transit a part of an overall development strategy, and to help finance the transit system as well. Joint development includes actions to encourage the implementation of desirable land uses in and around station areas or in air rights over or under the transit facility. For example, high density residential developments at outlying stations may be desirable because they can lead to a higher transit share of work and shop trips to high density employment and shopping areas (i.e., the downtown). On the other hand, dense office or commercial activities at outlying stations can actually hinder system use by increasing congestion and degrading access to the system.

Sites where joint development is possible should normally be identified as part of the land use impact assessment. It is unlikely that there will be specific joint development proposals available for consideration at the project planning stage, but land parcels that may be suitable can be identified using the approach described above for station areas. This would include the preparation of sample pro formas. In addition, local and state laws and ordinances concerning joint development should be identified as well as local policies toward it.

7.1(c) Supportive Policies

It is unlikely that the development potential associated with each of the alternatives will be realized unless supportive public policies are put in place. The establishment of such policies would not normally be expected to occur until preliminary engineering. Nevertheless, it is helpful to begin early to think about the kinds of policies that might be necessary. Where appropriate, forecasts of land use changes that are prepared in project planning should make clear the extent to which these forecasts depend upon the adoption of new local policies.

Listed below are some of the kinds of local policies that may be considered:

- o Changes in local comprehensive plans and zoning to permit higher densities in areas within walking distance of stations.
- o If the area is already overzoned (or if variances are easily obtained), it may be desirable to downzone areas away from the stations to give the station area a competitive advantage in the market. One approach may be to transfer development rights from an area where lowered densities are desirable.
- o Commitments to provide, in a timely manner, the necessary infrastructure (roads, water, sewer, etc.) to support increased development.
- o Sale or lease of excess land or air rights at below-market prices.

7.1(d) Assessing the Impacts of Land Use Changes

If one or more transit investment alternatives is expected to affect land use, these land use changes will also have impacts of their own. Issues that often arise include the consistency of anticipated land use changes with comprehensive plans and zoning ordinances, and the effect this development might have on tax revenues and the cost of public services, transit system use, traffic, and parking. These issues can be of considerable local interest, and the analysis of them can become involved and time consuming. The analyst should keep in mind that the land use impact forecast is little more than an educated guess, and be wary of carrying the consideration of these issues to extreme lengths.

Consistency with Planning and Zoning. The analysis should examine whether or not the anticipated development is consistent with adopted local comprehensive plans and zoning. This will help reveal whether or not the anticipated development would be viewed as desirable by the affected community. To do the assessment, forecasts of land use impacts are normally forwarded to local governments with a request that they compare the forecast with adopted plans and determine

consistency. Local governments should also be asked to identify any zoning changes that would be necessary before the development could occur, and to assess the likelihood of such changes being approved. The land use impact forecast should also be examined with regard to Federal requirements designed to protect certain types of land from development. Federally protected lands include the habitat of endangered species, floodplains and costal zones.

Impacts on Services and Tax Base. Induced development can increase the tax base of the affected jurisdiction(s), but may also increase the demand for public services such as schools and law enforcement. In most project planning studies these impacts are not explicitly considered. However, where the fiscal impacts of induced development are thought to be an issue, local governments are probably in the best position to estimate the added revenues and costs. Such estimates should take into account the type of development expected to occur, the kinds of public services normally required for such development, and the possible need for new capital facilities to provide these services.

Impacts on Transit System Use. Station area development can serve specific transportation objectives. First, increased economic activity, represented by commercial office, retail, convention center and hotel developments, particularly at the downtown end of the corridor, can improve ridership. Development of this nature at outlying stations can often have the negative effect of hindering access to transit by increasing congestion in the station area and creating greater competition for parking. Medium and high density residential development at outlying stations can also increase ridership. Such ridership on the transit system can in turn lead to greater system operating revenues.

As noted in Chapter II.5, UMTA requires the use of a fixed total trip table for preparing ridership estimates. Transit ridership estimates tend to be overly optimistic even when induced development is not factored into these forecasts. Furthermore, it must be recognized that any forecast of new development is speculative, and thus should not be given the same weight in the evaluation of alternatives. Nevertheless, UMTA acknowledges that induced development, particularly around station areas, can lead to increased transit ridership, and that some areas may wish to estimate the size of this effect. This is commonly done by means of a sensitivity test.

Impacts on Traffic and Parking. The sensitivity test examining the effects of induced land use change on transit ridership will also identify the impacts of this development on traffic and parking. Impacts on traffic and parking are most likely to show up in the vicinity of stations, where development impacts are likely to be most apparent. The added traffic generated by new development, when added to traffic destined for the transit station, can overload the local street system. In such cases, mitigation measures may be necessary to increase roadway capacity and/or manage travel demand.

7.1(e) Exploring Value Capture Opportunities

The analysis of land development impacts should lead to an explicit assessment of the potential for generating a stream of revenue which may be used to help finance the capital and operating costs of the transit investment alternatives. This assessment should include a review of such public policy and implementation options as joint development, station cost sharing by private developers and public agencies (urban renewal authorities), benefit assessment districts, and

tax increment financing. The results of this assessment would feed into the analysis of financing options (see Chapter II.8).

In assessing the potential for capturing some of this added value, it is useful to distinguish value capture from joint development. Joint development refers to development occurring in conjunction with the transit improvement, and is usually designed for the purpose of fostering urban development in general or of projects to maximize use of the system through compatible land uses involving public incentives for its development. Value capture returns income to the transit property as a primary goal. Value capture can include joint development such as air rights leases, station construction or improvement by developers, but also can include a broad range of activities designed to capture part of the value created by the transit investment. For example, benefit assessments on property owners in station vicinities can capture some of the benefit of the transit project on those who now enjoy higher rents and occupancy rates on their buildings. Another approach is to dedicate to transit the increase in property taxes due to increased land values in the vicinity of the investment.

The establishment of a benefit assessment mechanism to help pay for a transit investment is necessarily a political decision, based as much on negotiation as on technical analysis. But the technical process can provide critical information on the extent and magnitude of anticipated benefits. Given the difficulty of forecasting changes in property values and rents, the technical information used in these decisions is often limited to transportation benefits. Changes in travel time, pedestrian volumes, and other outputs of the travel forecasting process can be useful inputs to benefit assessment discussions. Forecasted reductions in automobile use, if translated into reduced parking requirements, can be regarded as a direct monetary benefit to developers. Sample pro formas prepared as part of the land use impact analysis can also help reveal the assessment levels that may be charged without unduly affecting the economic viability of desirable development.

7.2 Other Economic Impacts

Other economic impacts may result from the construction and operation of fixed guideway systems. An economic impact often included in alternatives analysis is the impact on employment and local economic activity due to the construction and operation of the proposed system. UMTA does not recognize this impact in its evaluation process, assuming that the employment impact of each Federal dollar spent on transit is the same wherever it is spent. However, many local areas find it interesting to determine this impact. There may be additional economic impacts of local interest which can be included in the analysis.

Calculating the local employment impact is straightforward using standard coefficients which should be available in local economic base studies. Once the capital cost of an alternative has been estimated, temporary employment due to construction can be calculated using an estimate of person-years of employment per million dollars of this type of construction. In addition, permanent employment opportunities are created to operate the expanded system. Estimates of permanent employment are available in the operating and maintenance cost analysis. Both the temporary and permanent impacts of this direct employment can then be assumed to multiply as the direct wages and salaries are spent in the local area, generating indirect employment. These local area multipliers

have been calculated for most local areas. In summary, four types of employment impacts can be identified including direct (temporary and permanent) employment and indirect (temporary and permanent) employment.

The impacts of spending large sums of money on the construction and operation of a new transit system are not limited to employment although most of this money is eventually spent on wages and salaries. However some of this money is spent on local taxes which might be of interest to the budget planners of the local governments.

7.3 Impacts on the Social Environment

Transportation systems affect the social environment in a variety of ways, both during and after construction. Potential social impacts include: displacement and relocation, reduced neighborhood cohesion, deterioration in the quality of neighborhoods and lifestyles, and reduced access to vital community facilities and services. These impacts will need to be fully assessed during project planning. Where adverse impacts are anticipated, mitigation measures should be identified, as called for by the National Environmental Policy Act and the joint UMTA/FHWA EIS regulations.

It is important that the local agency conducting the alternatives analysis be sensitive to social issues and identify those that need to be considered in the study. The most useful way to identify potential social impact issues is through the public involvement program. Beginning with the scoping process and continuing throughout the alternatives analysis, the public involvement program will provide opportunities for interested citizens and groups to express their views on the impacts of the alternatives being considered. These opportunities will reveal potential impacts, and will help the lead agency assess the severity of these impacts and possible mitigation measures. UMTA has found that various social indicators that have been developed -- the neighborhood mobility and stability indices, for example, and social interaction analysis -- are generally less useful than public involvement for identifying and assessing social impacts and mitigation options.

UMTA advises local agencies to avoid making judgments as to the significance of social impacts. Impacts should be quantified where possible; for example, the number of displacements can be identified. But the significance of social impacts is largely a matter of perception. The analyst should carefully describe the impact and the public perception of its significance, avoiding his own judgment as to the significance.

In addition, to assessing potential impacts, the analysis of social impact should identify the groups likely to be affected by these impacts. Where social impacts are anticipated, the analyst should develop maps displaying neighborhood boundaries, and prepare a socioeconomic profile of each neighborhood. This information may then be used to assess the distribution of project benefits and impacts among various jurisdictions, transportation users, and socioeconomic groups.

Displacement and Relocation. The development of new transportation facilities frequently requires the displacement of families, businesses, and public

facilities, and it is important that these impacts be identified and fully assessed for each alternative. One important measure of effect is the number of individuals, families, businesses, and facilities that would be displaced. The availability of comparable replacement housing, and significant impacts on the neighborhoods to which relocation is likely to occur, should also be examined. Often it becomes necessary to determine the characteristics of the families to be displaced (race, income, tenure, age, family size) as these may have a bearing on the severity of displacement impacts and the availability of suitable replacement housing.

In alternatives analysis, the amount of displacement is normally determined by use of aerial photographs and conceptual engineering drawings. The specific properties required to be taken for each alternative may not be known, but there should be a fairly accurate estimate of the number of dwellings, businesses, etc. that would be required. For residential displacements, the community profile will provide information on the characteristics of the neighborhood and thus the likely racial and socioeconomic characteristics of those to be displaced. Where businesses may be displaced, the analyst should try to identify the kinds of jobs likely to be affected and whether these might remain in the community.

Families and businesses displaced by transportation projects must be compensated for the cost of the property taken and for relocation costs. Such compensation should be included in the capital cost of each alternative, and should include the cost of land and structures, purchase of business enterprises, relocation expenses, and rent supplements as may be necessary. Guidance on right-of-way acquisition and relocation assistance requirements is given in Uniform Relocation Assistance and Real Property Acquisition Regulations for Federal and Federally Assisted Programs, 49 CFR Part 24, March 2, 1989.

Neighborhood Cohesion. Cohesion -- a somewhat elusive term that refers to an aggregate quality of a residential neighborhood -- is a social attribute that indicates a higher than average sense of community, common responsibility, social interaction within a limited geographic space, an interdependence that serves an assimilating function, or a number of other localized social purposes. The alternatives analysis process should identify potentially impacted neighborhoods that exhibit a strong sense of cohesiveness, and the attributes of that community which make it unique. If cohesiveness is defined explicitly, it may be possible to obtain some empirical evidence with which to judge the degree of cohesion, and thereby to gauge the impacts of proposed projects. Public involvement is likely to prove to be a superior technique for identifying and assessing potential impacts. Impacts on community cohesion can be mitigated by adopting guideway alignments that follow natural neighborhood boundaries.

Neighborhood Quality. Transit alternatives may also affect the overall quality of a neighborhood. Such effects may be reflected in changed property values, for example, or an increase or decrease in the satisfaction which residents derive from living in the neighborhood. Eventually, existing residences might be replaced by new residents with different lifestyles. Such

impacts are difficult to predict, let alone quantify, yet they may be of considerable importance to those residing in the community.

Economic and environmental analyses performed as part of alternatives analysis can help reveal the likelihood of any impacts on neighborhood quality and lifestyles. The assessments of noise and esthetics, for example, should help reveal potential changes in neighborhood quality. Similarly, the economic development analysis may show that an alternative greatly increases a neighborhood's accessibility, and that this could in turn enhance prospects for redevelopment. Overall, such redevelopment may be viewed as a positive impact of the project, but existing residents may prefer that their neighborhood not be changed. The community involvement program should help the analyst determine the extent to which community residents are concerned about impacts on neighborhood quality and lifestyles.

Access to Community Facilities and Services. Fixed-guideway transit facilities may increase or decrease access to such community facilities as hospitals, schools, police and fire stations, shopping, and other service centers. Access may be reduced if the guideway facility requires the acquisition of community facilities for right-of-way, or if the guideway creates a barrier between residents and the facilities. Potential reductions in such access -- particularly for school age children and the elderly -- would be considered a negative impact that should be assessed in the social impact analysis or the transportation impact analysis.

This impact is normally assessed by identifying the location of community facilities and the areas they serve. Guideway projects that follow service area boundaries would tend to have little if any impact on access to community facilities; those that create a physical barrier through a service area would have an impact. In such cases, the analyst should try to determine how many people would be affected by reduced access and whether this barrier would create special problems for them. Mitigation measures that might be explored include changes in alignment, the construction of strategically located pedestrian crossings, or increased transit service by social service agencies. The public participation program, once again, will be the most useful technique for assessing potential impacts and evaluating mitigation measures.

Contents of the Methodology Report. Where social impacts are expected to be a concern, the methodology report on social, economic, and environmental impact assessment should describe the approach to be taken to assess these impacts and to evaluate mitigation strategies. The methodology report should identify the specific impacts to be considered and the neighborhoods that could be affected by these impacts. With emphasis on these specific problem areas, the report should describe the techniques that will be applied.

7.4 Impacts on the Natural Environment

Fixed guideway transit projects can have significant impacts on the natural environment. The project planning study must identify what impacts would occur with each alternative, and the significance of these impacts. As a result, most project planning studies will involve detailed analyses on air

quality, water quality, and noise. In addition some studies will also examine the impacts of the alternatives on wetlands, floodplains, and esthetics. Occasionally detailed studies on endangered species, coastal zones, toxic waste disposal, ocean dumping, navigable waterways, etc. must be undertaken. All project planning studies should consider all of these potential impact areas. However, many of these areas will not apply to the proposed alternatives and therefore can be eliminated from further consideration after a simple examination.

Not only is there a wide range of potential impacts to be considered, but also the impacts may arise from different aspects of the project, including its physical presence, operation, construction and secondary impacts such as induced land use changes. To further complicate this analysis special rules, regulations, and permits may apply to many of these impact areas. Appendix J summarizes the Federal legislation applicable to project planning. State and local legislation and ordinances may contain additional requirements. The result can be an analysis process which is complex, time consuming, and often beyond the experience and expertise of the staff at the local agency.

The requirements for each type of impact cannot be covered in this summary document, so other sources of information must be consulted. One source of procedural guidance is UMTA's circular on environmental procedures (UMTA C 5620.1A). Technical methods are described in the U.S. Department of Transportation's Guidelines for Assessing the Environmental Impact of Public Mass Transportation Projects, 1979 (NTIS No. PB-299 697), and in numerous FHWA reports on assessing specific impacts of transportation projects.

In cases where the local agency has identified possible impacts which are beyond the capability of the local staff to analyze, outside assistance must be obtained. In many cases, consultants are retained; in others, the assistance of other governmental, nonprofit or private organizations and individuals is needed. State Departments of Transportation are usually a good source of expertise and assistance in many areas, especially in noise and air quality. Contacting the following federal agencies (and their local and state equivalents) may be useful: the Army Corps of Engineers, the Environmental Protection Agency, the Fish and Wildlife Service, and the Coast Guard. Further assistance may be obtained through training courses and manuals offered by such Federal agencies as the Federal Highway Administration.

One of the primary goals of the scoping process (see Chapter II.1) is to identify impact areas of concern. Four methods can be used: 1) past studies, 2) consultations with cognizant agencies and groups, 3) citizen participation, and 4) field reconnaissance. Of all of the reports on environmental conditions and impacts for the area, the most useful might be an environmental impact statement for another project in the area. Not only is an EIS likely to reveal the impact areas of concern, but the base data and research is likely to reduce the amount of original research required for the environmental portion of the project planning study.

Through contacts with citizens and other agencies which have been initiated in the scoping process, the most important impact areas of concern should be identified. Furthermore, this process should allow the local agency to utilize the expertise of these groups to: 1) identify the important impact

areas, 2) assess the significance of impacts that are found to occur, 3) identify the specific laws, regulations, and rules which apply when examining and planning mitigation of these impacts and 4) document the lack of impact in specific areas through letters from the agencies responsible for monitoring these impact areas. Field reconnaissance, especially in cooperation with other concerns agencies is usually an excellent method of identifying impact areas of concern.

7.4(a) Air Quality

Many types of urban mass transportation projects can affect air quality. Usually, the effects are localized. Only large fixed guideway projects with the capacity to divert a significant number of auto users to transit have the potential for affecting air quality at the regional scale. Even though rail projects are electrically powered and the vehicles are non-polluting, transit stations with parking for 500 or more cars can be indirect sources of air pollution. The increased traffic near stations and at parking lots during peak periods may create "hot spots" or localized increases in certain air pollutants. Projects such as bus storage and maintenance facilities, downtown terminals, transit malls and other projects that concentrate bus activity in populated areas can also negatively affect local air quality. Air quality assessments performed during project planning address the potential impacts of each alternative from three perspectives: changes in pollutant levels, potential violations of established air quality standards, and conformity with adopted air quality implementation plans.

The Environmental Protection Agency has established National Ambient Air Quality Standards (NAAQS) for pollutants that harm human health and public welfare. Shown in Table II-7.1, NAAQS exist for the following pollutants: carbon monoxide (CO), small particulate matter (PM₁₀), sulfur dioxide (SO₂), hydrocarbons (HC), nitrogen dioxide (NO₂), ozone (O₃), and lead. Places that violate one or more of these standards are called "nonattainment areas". The States, in cooperation with local planning agencies, have developed State Implementation Plans (SIPs) showing how these standards will be attained and maintained. In some cases, the SIP includes transportation control measures.

The NAAQS are the standards used for determining whether a project is likely to have an adverse effect on air quality and the severity of the effect. In areas which also have State air quality standards, the more restrictive standard is used.

Some Federal standards are expressed as hourly averages while others are annual averages. CO, for example, is expressed as a short-term 1-hour and 8-hour standard. The standard for NO₂, however, is expressed as an annual arithmetic mean. This makes it more difficult to assess the effects of a bus project during the short period of greatest use. Although no short-term federal standard exists for NO₂, a 1-hour standard of 0.25 ppm has been adopted by the State of California and can be used as a basis for gauging the air quality effects of some bus projects.

The primary pollutants to be examined for diesel bus projects are nitrogen oxides (NO_x) which represent the sum of nitric oxide (NO) and nitrogen dioxide

Table II-7.1: National Ambient Air Quality Standards

Pollutant	Primary Standard(a)	Averaging Time	Secondary Standard(b)
Ozone (O3)	235 ug/cu.meter (.12 ppm)	1 hour(c)	Same as primary
Carbon Monoxide (CO)	10 mg/cu.meter (9 ppm)	8 hours(d)	Same as primary
	40 mg/cu.meter (35 ppm)	1 hour(d)	Same as primary
Small Particulate Matter (PM10)	50 ug/cu.meter	Year	Same as primary
	150 ug/cu.meter	24 hours(d)	Same as primary
Nitrogen Dioxide (NO2)	100 ug/cu.meter (.053 ppm)	Year	Same as primary
Lead (Pb)	1.5 ug/cu.meter	Quarter	Same as primary
Sulfur Dioxide (SO2)	80 ug/cu.meter (.03 ppm)	Year	---
	365 ug/cu.meter (.14 ppm)	24 hours(d)	---
	---	3 hours(d)	1300 ug/cu.meter (0.5 ppm)

-
- (a) The primary standards are defined as "the level of air quality necessary, with an adequate margin of safety, to protect the public health."
- (b) The secondary standards are the levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant on property, material, vegetation, etc.
- (c) Not to be exceeded on more than 3 days over 3 calendar years.
- (d) Not to be exceeded more than once per calendar year.

(NO₂), hydrocarbons, and small particulate matter. Ozone is a component of photochemical smog that is produced by the action of sunlight on a combination of HC and NO_x. In urban areas, the major factors affecting peak NO₂ concentrations are NO_x emissions from motor vehicles and photochemical production of oxidants, primarily ozone. Where gasoline powered vehicles are the primary concern, the analysis focuses on CO. Most CO pollution and violations of standards are caused by motor vehicles at "hot spots" or areas of heavy traffic congestion.

The level of analysis needed to address air quality impacts, and the kinds of pollutants that need to be addressed, will depend upon the significance of local air pollution problems. A quantitative analysis is needed when a project is located in a nonattainment area or could cause violations of one or more of the National Ambient Air Quality Standards (NAAQS); for rail projects with parking facilities of 500 or more cars; for downtown bus projects, especially in areas where background concentrations are already high; and for any project where there is the potential for adverse effects on sensitive receptors, including hospitals, parks, convalescent or nursing homes, schools, and residential neighborhoods.

Air Pollution Models. Two types of models are used in an air quality analysis — emissions models and dispersion models. Emissions models are used to estimate the amount of a pollutant that is put into the atmosphere. Dispersion models take into account the amount of a pollutant emitted, weather conditions, and the location of a receptor (e.g., a house, playground, store, etc.), and produce estimates of the average concentration over the specified time period. Since the NAAQS are expressed in concentrations, both emission and dispersion models are needed when air quality impacts are of concern.

Emissions models can be used to perform a burden analysis. A burden analysis calculates the contribution of a project to the total quantity of regional pollution resulting in a total emission burden in tons per day or year. There are drawbacks to using this type of analysis: the impact of the project may appear imperceptible when compared to total area-wide pollutant emissions, and there is really no way to compare the emission rate of pollutants calculated in tons per year to the NAAQS which are expressed as concentrations in grams of pollutant per cubic meter of air, or pollutant parts per million (ppm) parts of air. These emission loads are valuable primarily when there will be measurable changes in total VMT. A burden analysis provides for a relative assessment of existing emissions that can be compared to the estimated emissions with implementation of project alternatives.

Input data for an emission model are EPA standard emission factors for specific vehicle types (light-duty and heavy-duty gasoline or diesel powered vehicles) and transportation variables such as vehicle miles of travel (VMT), vehicle mix, average speed, and operating characteristics. An EPA publication, Compilation of Air Pollutant Emission Factors, Volume II: Mobile Sources, 1985, referred to as AP-42, provides diesel powered transit bus emission factors. These factors are given for HC, CO, NO_x, and particulate matter and can be used in modeling. MOBILE3 is EPA's current emissions model and, while primarily a highway model, it can be used to produce emission factors for bus/HOV lanes or busway projects.

It is important to recognize that the transportation variables that affect emissions can depend upon the kind of transportation alternatives being considered. The carbon monoxide emissions of an automobile cruising at 15 mph are more than twice those of the same vehicle cruising at 45 to 60 mph. An accelerating vehicle can produce ten times the emissions of one that is cruising. But oxides of nitrogen emissions -- one of the precursors of photochemical oxidants (smog) -- will increase as travel speed goes up. Thus, transit projects that improve travel speed may help reduce carbon monoxide emissions but increase emissions that produce smog.

The amount of cold start operations is another important variable. During the first few miles of an automobile trip, the car's engine is often cold and produces significantly greater emissions than a warm engine. A transportation alternative that makes extensive use of park-and-ride facilities will entail greater cold start operation and emissions than one relying on feeder buses.

In view of these relationships, it is not sufficient to simply assume that pollutant emissions are directly proportional to VMT. To the extent that the alternatives may affect vehicle speeds, cold starts, operating mode, and traffic volumes in different degrees, these variables should be factored into the air quality analysis.

Dispersion models, used to estimate pollutant concentrations, rely upon the outputs of an emissions model, as well as data on meteorological conditions and receptor locations. There are several types of dispersion models -- line source, intersection, and others that are used for special situations such as tunnels. In addition, indirect source dispersion models are used for area sources such as parking lots. When using dispersion models, worst case conditions are assumed, leading to estimates of the highest pollutant concentrations that could reasonably be expected to occur. Worst case conditions normally include: stable atmosphere, low wind speeds and temperatures, winds parallel to the guideway, and receptors near or on the right-of-way line.

During transit project planning, dispersion models are generally used only for carbon monoxide assessments. For busways, or bus/HOV lanes, average emission factors are calculated and then inserted into a line source (dispersion) model to produce pollutant concentrations. CALINE3 is one line source model widely used by FHWA to predict CO and particulate matter concentrations. It divides the individual highway links into a series of discrete elements whose individual concentrations are summed to form a total concentration estimate for a receptor location. For rail alternatives, the analysis should focus on the impact of increased traffic around stations.

The EPA manual, Guidelines for Air Quality Maintenance Planning and Analysis Volume 9 (Revised): Evaluating Indirect Sources, provides detailed techniques and worksheets for estimating CO concentrations. CALINE4 is a new model that can predict CO levels at critical intersections and open parking lots.

Air Quality Monitoring. Information on current pollutant concentrations is needed for three reasons. First, such data will indicate whether the project area currently exceeds the NAAQS, in which case air quality could be an important consideration in project decisionmaking. Monitoring data will suggest the level of analysis that should be undertaken and the pollutants that need to be assessed. Second, monitoring data is used to establish background concentrations for use in dispersion modeling. Pollutant concentrations depend not only on the emissions from a project, but also on the background concentration levels that already exist, or will exist in the design year. Finally, monitoring data can be used to show how future concentrations under each alternative would differ from those that exist today.

Air quality agencies usually have one or more monitoring stations where air quality data is collected on a continuing basis. This data may need to be supplemented with samples taken in the project area. Air quality monitoring is not normally conducted during project planning, but can be justified if significant impacts are anticipated.

When monitoring is required, it should occur at a time when background concentrations are at their highest. This normally occurs during the winter months for carbon monoxide and particulates, during the summer for ozone. The need for monitoring should be anticipated in advance so that the monitoring program will not disrupt the study schedule.

Meteorological data is also an important input to dispersion modeling. State air pollution control agencies, airports, and the weather bureau are potential sources of monitoring data on meteorological conditions.

Conformity with the SIP. In addition to estimating the impact of transit alternatives on air pollution emissions and or concentrations, the air quality analysis must also consider whether the alternatives being considered are in conformance with the State's air quality implementation plan (SIP), and particularly with any transportation control measures in the SIP. In project planning, the analysis should consider whether any of the alternatives would interfere with the implementation of any adopted control measures. The analyst should also consider whether any of these measures should be worked into the design of the alternatives being studied.

Consultation. In all cases, the air quality analysis methodology should be developed in consultation with the State air pollution control agency (APCA). The consultation process should be used to ascertain the pollutants that need to be addressed, the availability of data on existing pollutant concentrations and meteorological conditions, and the need for monitoring. The State APCA should be consulted regarding the relevance of the SIP to the alternatives and the criteria for assessing conformity with the SIP. The results of these consultations should be presented in the environmental methodology report.

Once the analysis has been completed, the State or regional air quality agency should be invited to give its opinion on whether the alternatives conform to the SIP. This opinion should be documented in the environmental results report and the draft EIS.

EPA regional offices should be consulted when assistance is needed in determining the appropriate modeling technique for a transit project. EPA regional staff can contact air quality modeling specialists in other EPA facilities who can provide guidance for specific UMTA projects. In addition, an EPA publication, Guideline on Air Quality Models (Revised November, 1984), can be used as a reference.

7.4(b) Noise and Vibration

Many types of urban mass transportation projects have the potential to increase noise and vibration levels in a community. Sources of transit noise include: vehicle operating noise, noise caused by diverted or increased traffic due to a transit improvement, and noise generated by fixed transit facilities. While in motion, a major source of transit vehicle noise is the propulsion unit -- exhaust noise of the diesel bus engine, whine of the electric traction motors of rapid transit cars, and the noise from air moving through cooling fans. Tire noise made by rubber-tired vehicles can be significant at high operating speeds. For rail projects, several types of noise can be made by steel wheels on steel rails, depending on the type and condition of the running surfaces. The guideway structure can also act as a noise source when it vibrates under moving vehicles. Some types of equipment continue to run while the vehicle is stationary -- fans, radiators, dynamic brakes, and air conditioning pumps -- and will be heard in stations or in storage yards. In fixed transit facilities, ventilation fans (in stations, subway tunnels, and power stations), chiller plants, and maintenance equipment and operations generate noise.

Vibration refers to two effects: ground-borne noise and perceptible vibration. For people living near a maintenance facility or transit route who may feel vibrations or hear rumbling sounds, vibration is a significant impact.

The purpose of a noise impact analysis for a transit project is to determine and report the change in noise impact on a community expected as a result of the project. The potential for adverse noise impacts is the greatest when noise sensitive receptors are located in the project area. Noise sensitive sites are placed into three categories:

- o Category 1: low density residential areas far from noise sources, buildings and parks where quiet is an important element;
- o Category 2: residential buildings, or buildings with overnight sleeping accommodations such as homes, hospitals, hotels and motels;
- o Category 3: institutional land uses with primarily daytime use including schools, churches and synagogues, libraries, auditoriums, and active parks.

Phased Approach to Noise Assessment. To determine whether a detailed noise analysis is needed, UMTA recommends a phased approach that is dependent on the type of project, its noise producing characteristics, and the proximity of noise-sensitive receptors. To some extent, the level of detail in a noise analysis also depends on the project study phase and the type of environmental

documentation required. Figure II-7.1 shows the noise and vibration assessment procedures as they relate to UMTA's environmental process.

First, for all projects, a screening process is undertaken to determine the need for a noise impact analysis. Noise and vibration sensitive land uses, the characteristics of the project that would generate noise and any potential noise problems are identified. This can be done by walking or windshield surveys, by reviewing current land use maps, or by inspecting recent aerial photographs of the study area. If no noise-sensitive land uses are present then no further noise assessment is necessary.

There are criteria that can be used during this early screening phase to help determine whether further noise analysis is needed. Table II-7.2 gives examples of these criteria, based on the type of project and its distance from receptors in each of the three categories of land use noted above.

The noise characteristics of project alternatives are then reviewed to provide an estimate of the total width of the area in which an impact is likely to occur. While project details may not be fully defined in early stages of project planning, it is possible to identify the width of a noise impact corridor. By plotting this noise impact corridor on land use maps, individual noise sensitive receptors or land uses that could be affected by the project can be identified. These maps and the potential problem areas should be described in the environmental methodology report.

If it is determined, during this first level screening, that there would be no significant increase in noise due to the project, no further analysis is needed. (Refer to the subsection on criteria and standards below for what constitutes a significant increase in noise.)

A level 2 analysis provides more detailed information and covers a narrower study area than the level 1 screening process. It is used during alternatives analysis and for other project planning studies where the Draft EIS is prepared before engineering details are available. This phase picks up where level 1 stops, after sensitive land uses within noise impact corridors have been identified. Existing noise levels at noise-sensitive land uses are characterized through a combination of measurements and estimates. Future noise levels are then estimated, taking into account such factors as vehicle types, speed, traffic volume, and the distance from the noise source to the listener.

Ambient noise levels are compared with projected noise levels to calculate the increase in noise that is due to the alternatives. An inventory is prepared of sensitive building uses within an estimated "vibration corridor" of the alternatives. A list of possible noise and vibration reduction techniques that could be implemented and a discussion of their expected effectiveness, along with the comparison of existing and projected noise levels, are presented in the environmental results report and the Draft EIS.

A level 3 analysis is used for assessing noise impacts where EISs are prepared in conjunction with preliminary engineering. It is a much more detailed analysis of one or more alternatives including site-specific

Figure II-7.1: Noise and Vibration Assessment Procedures
Related to UMTA's Environmental Process

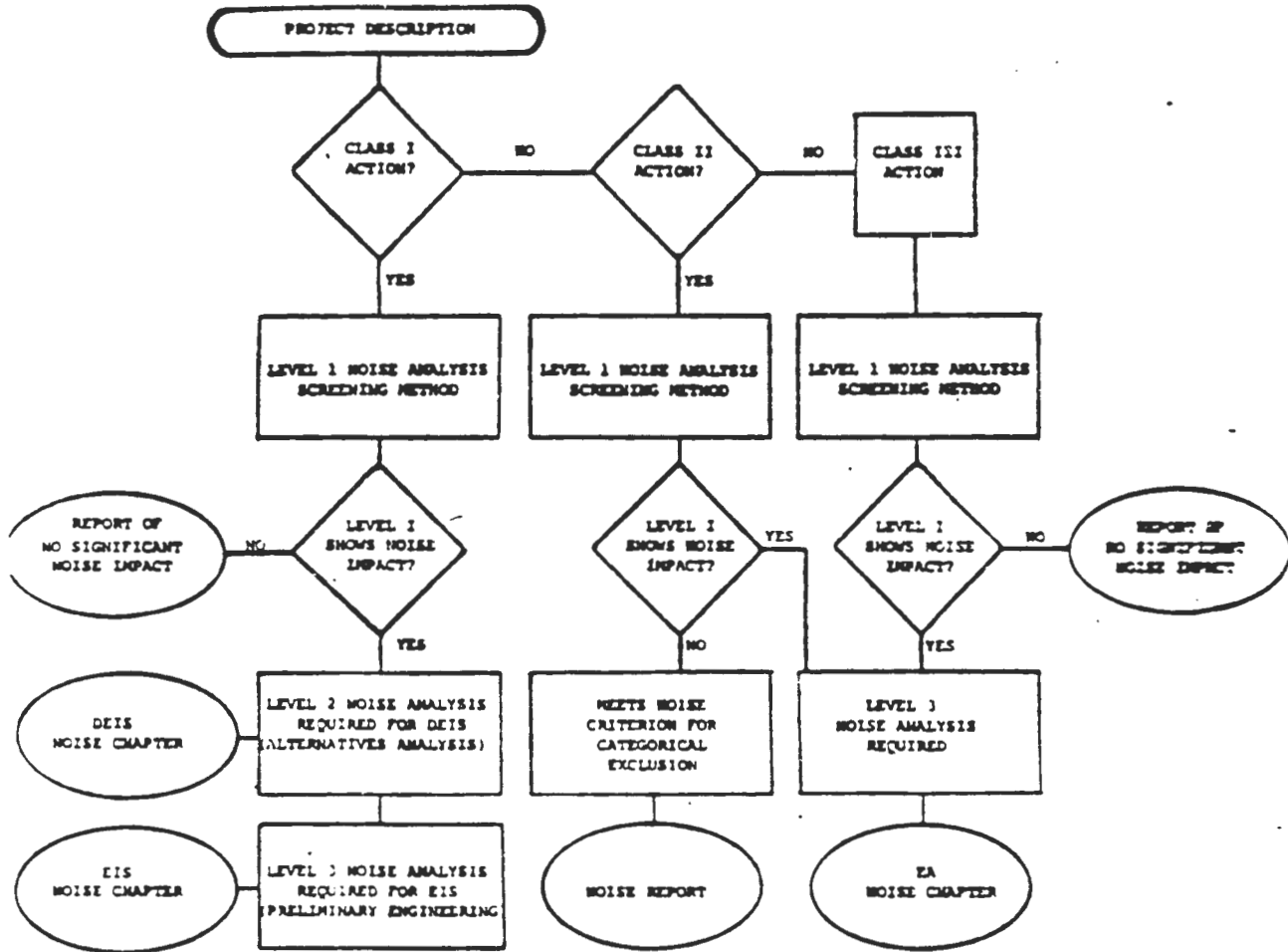


Table II-7.2: Examples of Screening Criteria for Noise Assessments

Type of Project	Critical distance for land use categories (distance in feet from ROW or property line)		
	Category 1	Category 2	Category 3
Rail transit guideway or busway	1,000	750	500
Major new rail or bus maintenance/storage facility	600	500	400
Transit Center or Transfer Facility:			
> 60 buses/peak hour	600	500	400
< 60 buses/peak hour	300	250	200
Park-&-Ride lots	300	250	200
Parking Structures	200	100	100

information about noise and vibration impacts on individual receptors and mitigation measures that are prescribed based on the extent to which the criteria are exceeded.

The three levels of analysis are described in greater detail in UMTA's draft Guidance Manual for Impact Analysis of Transit Noise and Vibration.

Transit noise may impact a community in two ways: the noise may be frequent enough and loud enough to increase the cumulative noise significantly; or the noise may be intermittent, but very loud and of short duration, which may not increase overall noise significantly but is nevertheless objectionable. Noise impact assessment involves two components which are used to determine whether either type of noise impact will occur. An "absolute" criterion compares the predicted noise from a transit project to a standard; it predicts interference from a particular noise source to the exclusion of other sources. The absolute criterion is used for rail rapid transit projects and bus projects on highways. The "relative" approach involves comparing projected noise levels to existing ambient levels. In this approach transit noise is not considered in isolation but is integrated in the overall community noise level. The impact is assessed based on the contribution of transit noise to the overall noise level. The relative approach can always be used. For rail projects, the absolute criterion is based on the maximum level of a single pass-by (L_{max}) while the relative criterion is based on the change in peak-hour equivalent noise level (L_{eq}).

Noise Descriptors. There are several noise descriptors that are appropriate for expressing transit noise. Their use depends on the type of project and, in some cases, the surrounding environment. The maximum noise level of a train pass-by (L_{max}) and the peak hour equivalent noise level (L_{eq}) are the preferred descriptors for rail noise. L_{eq} is also appropriate for most bus projects. L_{max} represents the maximum level of a noise fluctuation, such as the passby of a train. L_{eq} is used to characterize the average noise energy occurring over a designated period of time and is well-suited to represent the noise exposure for hours with considerable transit activity.

The day-night average sound level (L_{dn}) is used only where transit activities are located near residential areas and activities are likely to disturb people early in the morning (e.g., early morning bus start-ups) or late at night (e.g., night shift maintenance activities). L_{dn} is similar to L_{eq} but adds a 10 dBA penalty for all noise occurring between the hours of 10 pm and 7 am.

Criteria and Standards. There are no Federal standards governing noise exposure for rail rapid transit projects. The recommended absolute criteria presented in Table II-7.3 conform closely to the design guidelines published by the American Public Transit Association (APTA) in Table II-7.4. Since some busways and bus/HOV lanes contribute to highway noise, FHWA noise standards can be used as a basis for evaluation.

Relative noise impact is assessed by calculating the future project noise level and adding that level to existing levels to get a new combined peak hour L_{eq} . The existing and projected peak hour L_{eq} at the noise-sensitive site in question is determined. If the new combined peak hour L_{eq} is more than 4 dBA

Table II-7.3: Noise Impact Levels — Absolute Criteria

<u>DESCRIPTION OF LAND USE CATEGORIES</u>	<u>NOISE IMPACT LEVELS</u>		
	<u>L_{max}</u>	<u>L_{eq}</u>	<u>L_{dn}</u>
CATEGORY 1. Buildings & parks where quiet is an important element in their intended purpose. This category includes tracts of land set aside for serenity and quiet and such land uses as outdoor concert pavilions.	70	57	55
CATEGORY 2. Residences and buildings where people normally sleep. This category includes homes hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.	75	62	60
CATEGORY 3. Institutional land uses with primarily daytime use. This category includes schools, libraries, churches, and active parks where it is important to avoid interference with such activities as speech, meditation and concentration on reading material. Offices where quiet is important, such as medical offices and conference rooms, fall into this category. Places of worship or meditation associated with cemeteries, monuments, and historical sites are also included.	80	67	65

Table II-7.4: APTA Criteria for Maximum
Ground-Borne Noise from Transit Operations

COMMUNITY AREA CATEGORY	MAXIMUM SINGLE EVENT GROUND-BORNE NOISE LEVEL DESIGN GOAL		
	SINGLE FAMILY DWELLINGS	MULTI- FAMILY DWELLINGS	HOTELS/ MOTELS
I Low density residential	30 dBA	35 dBA	40 dBA
II Average residential	35	40	45
III High density residential	35	40	45
IV Commercial	40	45	45
V Industrial/Highway	40	45	50

TYPE OF BUILDING OR ROOM	MAXIMUM GROUND-BORNE NOISE LEVEL DESIGN GOAL
Concert Halls and TV Studios	25 dBA
Auditoriums and Music Rooms	30 dBA
Churches and Theaters	35 dBA
Hospital Sleeping Rooms	35-40 dBA
Courtrooms	35 dBA
Schools and Libraries	40 dBA
University Buildings	35-40 dBA
Offices	35-45 dBA
Commercial Buildings	45-55 dBA

above existing levels, the impact is considered significant and mitigation measures should be used. An increase in noise due to the project of 4 dBA or less is not considered significant. If the projected noise increase is 4 or 5 dBA, the significance will depend largely on surrounding land uses and the presence of noise sensitive sites.

The results of the noise analysis are often presented in tables that show existing and projected levels at the sites included in the monitoring program. This approach is perhaps best for identifying potential violations of the noise standards and the number of persons who may be affected. Changes in noise levels are perhaps best portrayed by means of noise contour maps. These are particularly helpful for showing citizens and decisionmakers how sites throughout the corridor will be affected.

The assessment of vibration impacts usually is performed in tandem with the noise assessment. In project planning, this assessment is usually limited to the identification of vibration sensitive buildings. Vibration impacts are assessed on buildings rather than on general categories of land use. Vibration sensitive buildings may not be evident from land use surveys. The type of business or industry housed in the structure must be identified to determine if vibration sensitive processes are in use, e.g., hospital, laboratory research, recording studio, etc. If no vibration sensitive buildings are identified no further vibration analysis needed. If they are, further analyses may be necessary during preliminary engineering, when data on subsurface conditions are used to calculate vibration levels.

Mitigation. The discussion of noise mitigation, including details and level of commitment, depends on the phase of project planning. For corridor studies like alternatives analysis, when different modes are still under consideration, mitigation is discussed in general terms, i.e., the possible need for mitigation and the feasibility and cost of various options. For projects for which preliminary engineering has been done, specific mitigation measures should be described and commitments given to implement them. The Final EIS should contain a complete description of mitigation measures, or options that are being studied, that would be implemented as part of the proposed project.

Generally, mitigation measures can be employed at the source of noise, along the path of the noise and, on rare occasions, at the receiver. There are many ways to reduce rail noise at the source -- resilient wheels, vehicle skirts, wheel truing, rail grinding, undercar absorption. Measures that would reduce bus noise at the source -- exhaust noise, tire whine, cooling-fan noises -- are limited. Along the path of noise, barrier walls close to the guideway are very effective, reducing noise 6-10 dBA, and less effective at the right-of-way line, with a reduction of 3-5 dBA. Ballast can be laid to reduce noise with an expected 3 dBA reduction at-grade and a 5 dBA reduction on aerial guideways. In extremely limited cases, where these other treatments could not be employed, UMTA may participate in funding for the construction of sound barrier walls on a property line or in the installation of special sealed windows. Evidence should show that these proposed mitigation measures will reduce noise to an acceptable level.

7.4(c) Energy

The energy analysis will normally be much less sophisticated than that done for air quality and noise. An UMTA review of previous energy analyses for fixed guideway projects revealed that there is generally no significant difference in energy usage between transit alternatives. It also found that any differences that do exist have little effect on project decisionmaking. There is also a paucity of good data on the energy requirements of transit facility construction and operations. As a result, UMTA no longer encourages local agencies to perform comprehensive energy assessments during project planning. However, the energy requirements of each alternative may be calculated if local officials consider transportation energy to be an important factor in their decisionmaking.

Where energy analyses are performed, they should take into account the energy required to operate and build each alternative. Operations energy is sensitive to many of the same variables as pollutant emissions -- i.e., vehicle speed, operating mode, cold starts, and vehicle type (fuel, weight). These variables should be taken into account to get an accurate comparison between the alternatives. Previous analyses have also considered the supply of energy in the region. They examined, for example, whether existing power plants could provide enough electrical power to operate a rail facility.

The results of an energy impact analysis are normally presented in terms of the payback period of each alternative. Each guideway alternative will require considerable energy to construct the guideway and fabricate the vehicles. This consumption of energy will be offset, in many cases, by reduced energy use for transit and highway operations. The payback period is the time required for the operational energy savings (if any) to offset the construction and fabrication energy consumed in building the facility.

7.4(d) Water Quality

Impacts on water quality can occur by: (1) dredging, discharging fill material or otherwise introducing pollutants into surface bodies of water; (2) increasing runoff or altering surface drainage patterns; and (3) affecting the water table by dewatering or contaminating subsurface waters. If project alternatives do not involve any of these activities, a water quality assessment need not be done.

Wastewater generated by maintenance and storage facilities contains a number of pollutants which, through improper handling or treatment, can be released into city stormwater systems. The environmental analysis should identify the activities that would generate wastewater -- steam cleaning, vehicle washing and floor washdowns. Typical bus garage effluent contains concentrations of oil and grease, detergents, chemicals and metals, and solid materials that pass into the sewer system. Stormwater runoff from bus parking areas may contain harmful pollutants such as lead, zinc and cadmium. The project's potential for increasing runoff and measures that might need to be used to reduce runoff or prevent pollutants from entering stormwater systems should be considered in the environmental analysis.

A National Pollutant Discharge Elimination System (NPDES) permit, required under section 402 of the Clean Water Act, may be required if wastewater is discharged into the stormwater system. EPA sets pretreatment effluent limits for NPDES permits and issues the permits. Localities may have established their own limits and identified specific disposal sites. The environmental analysis should determine whether an NPDES permit is required and whether there are local or state pretreatment requirements.

Discharge of dredged or fill material. Any project that involves the discharge of materials into waters of the United States must comply with Section 404 of the Clean Water Act (33 U.S.C. 1344). Waters of the U.S. means:

- o all waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
- o all interstate waters including interstate wetlands;
- o all other waters such as intrastate lakes, rivers, streams, etc., the use, degradation or destruction of which could affect interstate or foreign commerce;
- o tributaries of waters;
- o the territorial sea; and
- o wetlands adjacent to waters of the U.S. defined above.

The local lead agency should consult with the District Offices of the Corps of Engineers as early as possible when it is thought that a permit may be required so that the information required for compliance with Section 404 can be integrated into the environmental planning process. The information that is needed for the permit application should be included in the environmental document but the permit itself does not have to be obtained prior to UMTA's approval of the EA or Final EIS. Section 404 provides a procedure for issuing permits that allows the discharge of dredged or fill material at specified sites and identifies certain discharges that are exempt from the permit requirements.

The selection and use of the sites, including the criteria for evaluating the impact of the dredged or fill material, are governed by EPA guidelines but it is the Corps' responsibility to ensure compliance with the guidelines and to issue the permits. EPA published "Guidelines for Specification of Disposal Sites for Dredged or Fill Material" in the Federal Register on December 24, 1980. These guidelines, referred to as the 404(b)(1) guidelines, describe the contents of the permit application and the evaluation criteria. Four conditions must be satisfied before a determination can be made to permit the discharge of dredged or fill material:

- o There can be no practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, as long as that alternative does not have other significant adverse impacts.

- o The proposed discharge can not cause or contribute to a violation of:
 - (a) any applicable State water quality standard; (b) any applicable toxic effluent standard or prohibition under section 307 of the Clean Water Act; (c) the Endangered Species Act of 1973; (d) Title III of the Marine Protection, Research, and Sanctuaries Act of 1972.
- o No discharge of dredged or fill material can cause or contribute to significant degradation of the waters of the United States.
- o All appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem.

These requirements need to be recognized in the design and costing of alternatives during the project planning phase. However, since water quality impacts can normally be mitigated, the magnitude of a project's impacts on water quality is not normally a factor in the selection of a preferred alternative. The project planning process does not normally include calculations to quantify the impacts of the alternatives on water quality, only the cost of possible mitigation measures.

7.4(e) Navigable Waterways and Coastal Zones

The River and Harbor Act of 1899 (33 U.S.C. 401 et seq.) requires that the Secretary of the Army issue permits for various activities. Section 9 of the Act pertains to the construction of any dam or dike across any navigable water of the U.S. Section 10 pertains to construction of any structure over, excavation from, or disposal of materials into navigable waters. Navigable waters means those waters of the U.S. that are subject to the ebb and flow of the tide shoreward to the mean high watermark and/or those waters that are presently used, or have been used in the past, or may be susceptible to use to transport interstate or foreign commerce. Certain work performed, or structures constructed, in navigable waters would require permits pursuant to both Sections 9 and 10 of the Rivers and Harbors Act. A project involving dredging in navigable waters would require both a Section 10 and a Section 404 permit because Section 404 of the Clean Water Act pertains to "waters of the U.S." which includes more than navigable waters.

During project planning, the need for such permits should be determined for each alternative. Initial consultations should occur to ascertain the specific requirements that must be satisfied if an alternative requiring a permit is chosen. These requirements should be described in the environmental results report and the draft EIS.

The Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) requires consultation with the U.S. Fish and Wildlife Service (FWS) and the appropriate State wildlife agency when a project will impound, divert, channelize or otherwise control or modify the waters of any stream or other body of water. Generally, if a permit is required under Sections 402 or 404 of the Clean Water Act or Sections 9 or 10 of the River and Harbor Act of 1899, the consultation requirement will apply. Permit applications will be forwarded to the Fish and Wildlife Service which will review them according to their "Guidelines for the Review of Fish and Wildlife Aspects of Proposals in or

Affecting Navigable Waterways," published in the Federal Register on December 1, 1975.

Consideration must be given to preventing damage or loss to wildlife and mitigating any effects caused by a Federal project. An EA or Draft EIS should be sent to the FWS for its review and comment and include an evaluation of how the actions may affect fish and wildlife resources. The discussion should include measures to minimize harm, such as features to reduce turbidity during construction, stabilizing the shoreline with plantings suitable for use by wildlife, or compensation for habitat that may be lost. The U.S. Fish and Wildlife Service issued a mitigation policy in the Federal Register on January 23, 1981 which can be consulted when planning mitigating measures. The results of the consultation should be included in the Final EIS or EA.

If a transit project will directly affect the coastal zone of any State with an approved Coastal Zone Management (CZM) Program, the environmental analysis must consider whether the project will be consistent with the CZM Plan. The Coastal Zone Management Act of 1972 (16 U.S.C. 1451 et seq.), as amended, established the voluntary program in which, of the 35 States with coastal zones, 28 are currently participating. These States have Department of Commerce approved plans and receive Federal money and technical assistance to administer their programs. At this time, approval is pending for Virginia's plan and six States do not have approved plans: Georgia, Illinois, Indiana, Minnesota, Ohio, and Texas.

The State agency managing the program, called the principal 306 agency, usually is the department of natural resources or equivalent agency. This agency should be consulted for procedures that are used to determine consistency with the CZM Plan and its opinion on whether the proposed project is consistent with the State's program. The final environmental document should present the applicant's certification that the project is (or is not, consistent with the CZM program and the views of the State agency.

The Coastal Barrier Resources Act (16 U.S.C. 3501 et seq.) designates a protected network of undeveloped coastal barriers located on the Atlantic and Gulf coasts called the Coastal Barrier Resources System. Section 5 of this Act prohibits Federal expenditures for construction of any facilities, structures, roads, bridges, airports, etc. within the system. Exceptions can be made for some activities such as the maintenance of existing channel improvements and related structures, and the maintenance, replacement reconstruction or repair (not expansion) of publicly-operated roads or facilities which are essential links in a larger network or system. Consultation with the Department of the Interior is required.

7.4(f) Endangered and Threatened Species

Section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.) requires that UMIA, in consultation with the U.S. Fish and Wildlife Service (FWS) or the National Marine Fisheries Service (NMFS), ensure that projects it funds do not jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. During scoping, the FWS or the NMFS or appropriate State agencies should be contacted

for information on whether any species that is listed as endangered or threatened or is proposed for listing may be present in the project area. When a State has a third category of protected species, those that are considered to be rare, they too must be addressed. Generally, marine species are under the jurisdiction of the NMFS and all other species are under the jurisdiction of the FWS. The lists of endangered and threatened wildlife and plants for FWS are contained in 50 CFR 17.11 and 17.12 with the designated critical habitats found in 50 CFR 17.95 and 17.96, and for NMFS, in 50 CFR 222.23(a) and 227.4.

The Section 7 regulation (50 CFR Part 402) sets forth a phased process that may involve early, informal or formal consultation depending on whether a proposed project may affect a listed species. Informal consultation includes all contacts between UMTA, the grant applicant and the FWS or NMFS that take place prior to formal consultation including the initial request for information on endangered species in the project area. If it is determined at this time that no listed species or critical habitat are in the project area, no further consultation is required. If listed or proposed species or critical habitat may occur within the project area, a biological assessment (as defined in the Section 7 regulations) must be conducted to identify probable locations of listed species and determine the probable impacts of the project on the species and its habitat. This study is done in close coordination with the appropriate State wildlife agency. The results of the biological assessment should be included in the Draft EIS or EA and submitted to the FWS or NMFS as part of the informal consultation process.

If the biological assessment indicates that there are no listed or proposed species or critical habitat which may be adversely affected, the consultation process is terminated after review by the FWS. If the assessment concludes that the action would cause adverse effects then UMTA must initiate the formal consultation process. The regulation specifies the information to be included in UMTA's request for formal consultation. The FWS or NMFS will issue, after receipt of the required information, a biological opinion on whether the action is or is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat. If the opinion states that the action is not likely to jeopardize a listed species or destroy or adversely modify critical habitat, the consultation process is terminated with the issuance of the opinion. The opinion may include conservation recommendations. If a jeopardy biological opinion is issued, it will include reasonable and prudent alternatives and conservation recommendations, if any. The biological opinion should be stated in the Final EIS or EA.

When a jeopardy opinion is issued, the formal regulatory process is terminated when UMTA submits its final decision on the project to the FWS or NMFS. While not required, it is strongly encouraged that consultation continue. If UMTA determines that it cannot comply with the Section 7 requirements after consultation, it may apply for an exemption following procedures outlined in 50 CFR Part 451.

7.4(g) Natural Areas

The impacts of fixed guideway alternatives on natural areas can be diverse and numerous. They may involve impacts on wetlands, floodplains, water quality, wildlife, and plants. Federal laws and Executive Orders prescribe the requirements that apply to each of these impact areas. In addition, specific agencies have been given responsibilities for protecting these resources. Specific analysis and coordination requirements are summarized in this section.

In project planning, a generic process is recommended for the analysis of natural areas. The process contains four steps:

- o Identify the location of natural areas (e.g., floodplains, wetlands, wildlife or plant habitat, coastal zone, natural gas field, aquifer recharge areas) that may be affected by one or more of the alternatives. Most of the boundaries of natural areas have been mapped by responsible agencies and it is usually a simple matter to determine if the alternatives pass through or close to these.
- o Identify the functions of the potentially affected natural areas. Functions may include flood control, aquifer recharge, species habitat, recreation, spawning areas, pollution abatement, visual relief, etc.
- o Determine the effect of the alternatives on the functions of these areas.
- o If significant effects are expected, evaluate mitigation options.

The key point to remember is that the impacts of transportation alternatives on natural areas depend on the function of the natural area. For example, the use of an existing transportation right-of-way through a wetland will probably not affect any of its functions. Filling in a wetland, however, could have major impacts on the wetland's ability to serve as a spawning or nursery area for aquatic species.

Wetlands. Wetlands are lowland areas that are inundated or saturated by surface or ground water at a frequency that, under normal circumstances, support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas. They are highly productive areas that provide habitat for many species of plants, fish and waterfowl. Executive Order 11990, "Protection of Wetlands," requires Federal agencies to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

For any transit project that may affect a wetlands area, DOT Order 5660.1A, "Preservation of the Nation's Wetlands," August 24, 1978, requires that an analysis be performed. Activities that occur either upstream or downstream can affect wetland areas and should be studied for possible impacts. If the analysis shows that the project will have a significant impact on wetlands, an EIS usually will be required. The U.S. Fish and Wildlife Service, Corps of Engineers, and State natural resources agencies should be contacted as soon as it is suspected that a project may affect a wetlands area.

The environmental document should include an assessment of the impacts on wetlands and associated wildlife resulting from both construction and operation of the project. It should also include measures to minimize adverse impacts and avoid, to the fullest extent possible, drainage, filling or other disturbance of wetlands and the water resources supplying them. The hydrological resources, fish and wildlife, and recreational, scientific, and cultural uses of wetlands should be considered. Alternatives which would avoid new construction in wetlands must be studied, giving consideration to environmental and economic factors. If the preferred alternative requires new construction in wetlands, the analysis should demonstrate that there are no practicable alternatives to the use of the wetlands, and that all practicable measures to minimize harm have been included. A specific finding attesting to these criteria must be included in a Final EIS or a FONSI.

Floodplains. Executive Order 11988, "Floodplain Management," places special importance on floodplains and directs Federal agencies to avoid conducting, allowing or supporting actions on a floodplain. Maps of the Federal Insurance Administration, a branch of the Federal Emergency Management Agency (FEMA), should be consulted to determine if the proposed project site is located within the 100-year floodplain. Flood insurance rate maps (FIRM) are available for review at local zoning or planning commission offices, or city hall. Regional offices of FEMA can be contacted for assistance but do not maintain these maps. If a FIRM is not available for a particular area, a flood hazard boundary map should be reviewed to get an indication of whether the alternatives are clearly out of the floodplain or whether they may be located in a flood prone area.

If any of the alternatives are located within a floodplain, a detailed analysis should be included in the environmental document as specified in DOT Order 5650.2, "Floodplain Management and Protection," April 23, 1979. The analysis should discuss any risk to, or resulting from, the action; the impacts on natural and beneficial floodplain values; the degree to which the action provides direct or indirect support for development in the floodplain; and measures to minimize harm or to restore or preserve the natural and beneficial floodplain values affected by the project.

Where a project involves a "significant encroachment" on a floodplain, UMTA must determine (at the final EIS stage) that the proposed action is the only practicable alternative. A significant encroachment would involve one or more of the following impacts: a considerable probability of loss of human life; likely future damage associated with the encroachment that could be substantial in cost or extent, including interruption of service on or loss of a vital transportation facility; or a notable adverse impact on natural and beneficial floodplain values (as defined in the Order). Expansion of a facility already located within a floodplain usually would not be considered a significant encroachment.

During project planning, the floodplain analysis should examine whether any of the alternatives entail a significant encroachment. The draft environmental document explains that a floodplain finding would be required if any of these alternatives are chosen. It should also discuss any alternatives to any significant encroachments or any support of incompatible floodplain development.

7.4(h) Contents of the Environmental Methodology Report

Where environmental impacts are expected to be a concern, the methodology report on social, economic, and environmental impact assessment should describe the approach to be taken to assess these impacts and to evaluate mitigation strategies. The report should identify the specific impacts to be considered and the particular parts of the corridor where these impacts are expected to be of concern. It should also explain how these impacts will be assessed. Items to be discussed, for each impact area of concern, include:

- o An assessment of data availability and the need for further data collection, such as air quality and noise monitoring;
- o A description of the monitoring program, including monitoring sites;
- o Models to be used to estimate the impacts of each alternative as well as the variables to be considered in the analysis;
- o Key assumptions; and
- o A list of those agencies and outside experts who will be consulted as part of the analysis.

7.5 Historic, Cultural, and Parkland Resources

Transit projects built with Federal funding assistance are subject to two legal requirements dealing with impacts on resources valued for their historic, cultural, or open-space characteristics. While the specific provisions of the two laws are somewhat different, and they are treated separately, the work addressing each requirement during alternatives analysis is sufficiently parallel to cover them simultaneously here.

Statutory requirements. Section 4(f) of the Department of Transportation Act requires a finding by the Secretary of Transportation that no prudent and feasible alternative exists to any Federal action that has negative impacts on properties covered by the Act, and that all possible planning has been done to minimize harm. Subject properties include significant publicly-owned parklands, recreation areas, open spaces, wildlife and waterfowl refuges, and historic sites.

Section 106 of the National Historic Preservation Act requires that Federal agencies identify and assess the affects of expenditures of Federal funds on historic sites, districts, and buildings, and on archaeological sites. The provisions require the agencies (1) to afford the Advisory Council on Historic Preservation an early opportunity to comment on proposed actions with potential impacts on historic properties, and (2) to mitigate impacts on the properties to the extent possible. Subject properties are defined to include those on or eligible for the National Register of Historic Places.

Therefore, UMTA works within specific requirements that must be satisfied before any funding assistance to begin construction of transit projects. As with many other technical areas, however, it is important to identify the

appropriate nature of the work done in alternatives analysis, distinguishing clearly from work more appropriately done later in preliminary engineering to respond to the requirements. A review of the steps needed to complete the Sections 4(f) and 106 requirements helps put the role of alternatives analysis in perspective.

Steps in the Process. An important component of the analysis of possible 4(f) and 106 impacts is the identification of all potentially affected properties in the corridor. For the diverse kinds of properties covered by the 4(f) requirement, careful contacts are necessary with local, State, and Federal agencies that have responsibilities for parklands, recreation areas, open spaces, and similar properties. This survey should be conducted by a qualified professional. For historic properties, well developed sources often exist. These include the National Register, State registers and other listings, and the files of the State Historic Preservation Officer (SHPO). In many cases, a survey by a professional in the field of historic preservation will be necessary to ensure completeness of the inventory before completion of the Section 106 requirements. This survey uses, as a minimum, the standards of eligibility for the National Register, to examine sites not currently listed on the Register or already identified as eligible for the Register.

The analysis of potential impacts is the second step in 4(f) and 106 work. Potential impacts may be either direct or indirect. Direct impacts are the physical taking of the property or parts of the property, while indirect impacts are effects that impair the use of the property for intended purposes. Indirect impacts usually involve noise, visual intrusion, or obstruction of access to the property. Thus, the analysis must include consideration of the current uses of the properties and examine possible constraints on these uses caused by a project. Further, the consideration of indirect impacts requires that the scope of the survey of potentially affected sites be broad enough to include not only properties that may be physically taken in whole or in part, but also sites adjacent to and within view of the right-of-way. In some cases, the scope may also include sites on access roads to station sites that may experience significant increases in traffic volumes. The processes conclude with determinations by the responsible agencies that proposed actions satisfy the statutory requirements. For the 4(f) requirement, the Final EIS includes a "4(f) statement" that:

- o presents the inventory and description of potentially affected properties;
- o discusses the likely nature of the impacts on the properties;
- o examines alignment variations and other design alternatives for the project that might avoid the impacts; and
- o where these design options are not judged prudent and feasible, identifies mitigating actions that will be taken to minimize the adverse impacts.

Since the UMTA administrator has been delegated the authority to make the Department's finding that the Section 4(f) requirements have been met, this finding is made with the signature of the final EIS. The Department of Interior then reviews and comments on the 4(f) statement.

For Section 106 requirements, findings of adverse effects must be transmitted to the Advisory Council. Mitigation measures are stipulated in a memorandum of understanding among the Council, the SHPO, UMTA, and the grantees.

Appropriate efforts during Alternatives Analysis. The general recommendation on level of effort in this area parallel the recommendations for other technical areas. That is, the work should be sufficient to identify considerations that may be significant in the selection of a preferred alternative. In effect, the purpose of the effort is to identify any likely problems in meeting the 4(f) and 106 requirements for each alternative. Thus, actual completion of the requirements is not necessary and -- given the number of alternatives and degree of uncertainty typical of an alternatives analysis -- probably not possible. This general guideline provides substantial latitude for determining the level of effort, depending on the degree of potential impacts in the corridor, the amount of existing information on subject properties, and the degree of local concerns.

In most cases, the work on 4(f) and 106 requirements during alternatives includes:

- o a review by a qualified professional of existing inventories, supplemented with additional data collection where necessary;
- o brief descriptions of potentially affected sites and their current uses;
- o preliminary analysis of the nature and severity of the likely impact, with cross-references to other sections of the environmental analysis (noise, water quality, etc.);
- o a review of possible changes in the design or alignment of the alternative to avoid the impact (including costs and other implications); and
- o identification of measures to mitigate the impacts.

Most importantly, efforts during the alternatives analysis should include close coordination of the inventory, analysis, and findings with the SHPO and other agencies with jurisdiction over subject properties. The DEIS must document this coordination and demonstrate the concurrence of these agencies in the findings.

7.6 Mitigation of Adverse Impacts

The various social, economic, and environmental studies conducted during alternatives analysis often reveal potential adverse impacts that need to be mitigated. However, the studies performed during alternatives analysis are not normally detailed enough to assess the costs and effectiveness of various

mitigation options. UMTA advises against making premature commitments to specific mitigation measures. At this stage in the process, it is often sufficient to identify potential impact areas and mitigation options that will need to be studied further during preliminary engineering.

The results report on social, economic, and environmental impacts, as well as the draft EIS, should clearly define those impacts that require mitigation. In addition, they should contain estimates of the range of costs that may be necessary to mitigate adverse impacts. These costs are then factored into the cost estimate for the project. The information developed here will be important to policy makers who will have to make trade-offs in the selection a preferred alternative.

7.7 Construction Impacts

The previous sections of this chapter have dealt with the impacts from the existence and operation of the proposed alternatives which are long term in nature. Construction impacts usually differ from the long term impacts discussed above in three significant ways: 1) duration, 2) type, and 3) level of detail. Furthermore, the significance of the construction impacts may be opposite in degree from the long term impacts of an alternative. For example, the construction impacts of a subway are usually severe, but the long term impacts from operations in a subway are usually negligible. In addition, while air quality is impacted during construction and in the long run, the impacts are different in nature and location. during construction air quality is likely to be degraded because of impaired traffic flows, the operation of construction equipment, and increased particulates (dust). On the other hand, air quality could actually improve in the region during subway operations from improved traffic flows due to auto diversions to transit although at station locations air quality may decline.

The Draft EIS will discuss the construction impacts in less detail than long term impacts. Detailed discussion of the construction impacts will be contained in the Final EIS, which will contain the results of Preliminary Engineering on the preferred alternative.

Major Impacts and Level of Detail. Construction impacts can be divided into two types: direct and indirect. Direct impacts result from the construction impacts themselves and will include air and noise pollution, and the temporary taking of land, streets, and sidewalks etc. Indirect impacts usually result from the impacts of the temporary takings and will include traffic congestion, impaired access to buildings, parks, transit delays, etc. In many cases, especially when construction requires the closure of major streets, the indirect impacts can be very significant.

Although a detailed discussion of the construction impacts is not possible until an alternative is selected and preliminary engineering performed, the major impacts must be noted. Even at the modest level of detail available during alternatives analysis, the major direct and indirect construction impacts can be identified including their location, importance and duration. The differences between alternatives should be highlighted.

Mitigation Possibilities. The earlier mitigation of construction impacts is considered, the easier it is to incorporate mitigation measures into the process. At this point in the project development process, the mitigation possibilities are limitless and the most cost-effective approach to mitigation can be identified. All should be mentioned at least in general terms. If the construction impacts are severe, the possibility of not building the project should be mentioned. However, there are likely to be other mitigation methods which can be implemented to minimize the negative impacts during construction. Mitigation possibilities to be considered will include: 1) alternative construction techniques, 2) alternative construction equipment, and 3) scheduling to minimize impacts (consider restrictions on construction activity by time of day and time of year -- e.g to avoid the Christmas shopping season), etc.

II.8. Financial Analysis

Prudent public management and trends in transportation finance suggest that local officials consider the financial consequences of major urban mass transit capital investments. Undertaking a major transit investment can represent a significant financial commitment by a transit agency and its funding partners. Such commitments are particularly important in light of the out year operating, maintenance, replacement and rehabilitation costs of providing transit services, facilities and equipment. Deferred maintenance can have a crippling effect on system effectiveness, efficiency and financial stability.

The results of a financial analysis can play two important functions. First, managers are provided with information for deciding what investments to make. It is important that decision-makers make investments with knowledge of the risks and uncertainties associated with the investments. Second, financial analysis results assist decision-makers in determining how best to raise capital for investments.

The importance of financial analysis is heightened by changes in the macro economy, and funding sources. Tax reform and declines in Federal funding sources have altered the feasibility of many financing strategies. Many localities have responded by considering new financing options. These new options include private equity, capital leasing, utilization of assets, short term debt financing, and more traditional pay-as-you-go approaches. These financing options are being combined with innovative implementation strategies to produce cost savings.

A range of revenue sources is being used to secure financing. Broad base taxes, user fees and benefit sharing strategies are examples of widely used sources of revenue. Benefit sharing strategies are among the most widely used sources of revenue for transit capital investments. In developing these sources, localities are acknowledging the benefits that private land owners and developers derive from major mass transit improvements. Empirical studies have demonstrated that improved transportation accessibility can produce a variety of benefits. For example, accessibility improvements may increase the value of affected property, reduce the cost of doing business, increase revenue generated by impacted business, and improve overall competitive advantage. These benefits may result from improved travel times between key origins and commercial areas experiencing development, more foot traffic for business establishments, reduced cost of commercial development from lower parking requirements, and better access to labor markets.

Cost saving opportunities are possible through private sector implementation, operation, and maintenance of transit services, facilities and equipment. Turnkey and franchise implementation are some examples of mechanisms through which private involvement in transit projects is possible. Cost saving strategies, innovative financing approaches and public/private partnerships in general place more of challenge before those

responsible for performing the financial planning and analysis for major transit capital investments.

This chapter describes the context in which financial analysis is conducted. The overall approach is described, and guidance is offered for analyzing annual capital costs, operating and maintenance costs, farebox revenues, and non-farebox revenues, the four streams of costs and revenues. This chapter also offers guidance on defining financing options, evaluating cash flows associated with the financing options and transit alternatives, preparing the financing plan for the locally preferred alternative, and documenting the analysis methodology and results. References are made throughout to other chapters in the guidance.

8.1 Context

Financial analysis is an integral part of the transportation planning, programming and implementation process with specific applications in the project development process described in UMTA's Major Capital Investment Policy. Financial information is required for decisions made at the end of system planning, alternatives analysis, preliminary engineering and final design.

In system planning, the financial analysis is designed to, first, assess the financial condition of the region and its transportation agencies and, second, to assess the area's financial capacity to undertake new investments. In many cases, this assessment will identify the need for new or more stable funding sources for transit capital and/or operations. In such cases, an evaluation of alternative funding sources at the system level would ensue. Where resources are constrained, system planning may lead to trade-offs between investment proposals in different parts of the region, or between higher and lower levels of service.

The financial information developed in project planning builds upon the system level assessments of financial condition and capacity. The system level assessment can be viewed as, in effect, establishing an "envelope" of costs and revenues within which project planning is performed. As more refined estimates of cost and revenue become available during project level studies, the system level assessment is reviewed to see if the alternatives remain within this envelope. If not, the system level analysis may need to be revisited and additional trade-offs made. For example, if project studies lead to cost estimates that exceed those assumed in system planning, decisions may need to be made to seek additional funding, or to scale back or delay proposed investments in other parts of the region. In cases where project planning is undertaken without the benefit of these basic system level assessments, some or all of the system level planning financial analysis may need to be performed in conjunction with the project planning effort.

Necessary funding sources are often not in place at the time that project planning studies are done. In such cases, a range of financing options is defined and evaluated with respect to such factors as legal and

institutional issues, yield, and sensitivity to economic, political, and administrative conditions. Guidance on the technical aspects of these analyses can be found later in this chapter. The financial aspect of project planning concludes with the adoption of a financing plan for the locally preferred alternative.

Preliminary engineering produces three kinds of information that are key to financing the preferred alternative. First, it yields more precise estimates of project capital and operating costs. There should be sufficient confidence in these estimates to establish annual funding requirements by source. Second, during preliminary engineering non-Federal funding agreements are developed in final form and executed. Where necessary, referenda for new sources of revenue and for bond issues should be held during preliminary engineering, and public and private funding entities should enter into any necessary financial agreements. Third, preliminary engineering is the time to finalize local supportive actions such as zoning changes as adjuncts to joint development initiatives, preliminary franchise agreements (where vendor financing is part of an investment option), security pledges, and subordinations in instances where debt financing is part of an investment option. If private providers are involved, preliminary engineering would include establishment of an organization for developing and operating the system.

8.2 Financial Analysis Approach in Project Planning

Financial analyses performed in project planning tend to have three primary objectives. The analysis provides an opportunity to develop and analyze financing options which are comparable among all of the major transit alternatives. In addition, the analysis allows decision-makers to choose a transit alternative with knowledge of its financial implications. Finally, the financial analysis provides the basis for a financing plan for the locally preferred alternative.

Figure II.8-1 illustrates the steps involved in the financial analysis process. Major steps are explained in the following paragraphs and in later sections of this chapter.

In the work plan for the project planning study, the financial analysis is described in sufficient detail to determine the scope, approach, level of effort, and schedule for the different tasks. Particular attention is given to the interrelationship of the financial analysis tasks to each other and to other work elements in the alternatives analysis or project planning activity.

The financial analysis methodology report describes the methods, procedures and assumptions to be used in assessing financial condition, adjusting the cost and farebox revenue estimates for inflation, projecting non-farebox sources of revenue, conducting sensitivity analyses, defining financing alternatives, accounting for financial risk, analyzing cash flows, and evaluating financing alternatives. A range of techniques are available for forecasting non-farebox sources of revenue.

The revenue sources are packaged into financing options for each transit alternative and, if appropriate, coordinated with implementation strategies (franchise, turnkey, or conventional procurement) into three dimensional investment alternatives. The financing options may include one or a combination of pay-as-you-go, bonding, leasing, or private equity contributions. The process of defining the financing options is likely to be an iterative one.

The financial analysis proper starts with the cashflow analysis. In this step, sources and uses of funds are adjusted for inflation in the cashflow analysis, and tested for their sensitivity to changes in key independent variables. The objective is to determine if the sources of funds have enough capacity to meet specific future financial requirements of first the base system and second the incremental costs created by the major investment alternatives. If funding shortfalls exist, new sources of funds are identified, analyzed, and evaluated. The results of the financial analysis are documented in the "Financial Analysis Results Report", used in the AA/DEIS, and incorporated in the "Financing Plan" for the locally preferred alternative.

8.3 Assessment of Financial Condition

The assessment of financial condition employs historical data on the measures listed in Table II.8-1, results of public opinion polls if referendums are required, and stated policy on land development, and incentives for transit use. The economic vitality measures provide an indication of the general economic health of the subject community. The debt management indicators measure the efficiency with which debt is handled and the capacity of the area to issue more debt. The fiscal burden measures establish the degree to which transit expenditures in the region are growing or declining. The trend lines of local revenues are compared with the trend lines of transit expenditures to determine relative growth or decline in each.

Outstanding bonds will necessitate a bond debt capacity analysis of the subject revenue source(s). This analysis makes use of the debt management measures in Table II.8-1. The bonding capacity analysis considers coverage levels and burdens placed on the revenue stream by on-going system operations and maintenance requirements. The bond rating agencies typically look for a coverage ratio of 1.5, and assurances that the debt service requirements will be met by the revenues regardless of on-going operating requirements.

The investment options are evaluated on the basis of significant differences in bonding capacity as reflected in the assessments of financial conditions, in legal and political feasibility and in revenue source capacity. Some candidate measures for use in evaluating the financial feasibility of the alternatives include farebox recovery ratio, deficit as a percentage of a dedicated revenue source, and debt coverage ratio.

Figure II.8-1: Financial Analysis Process

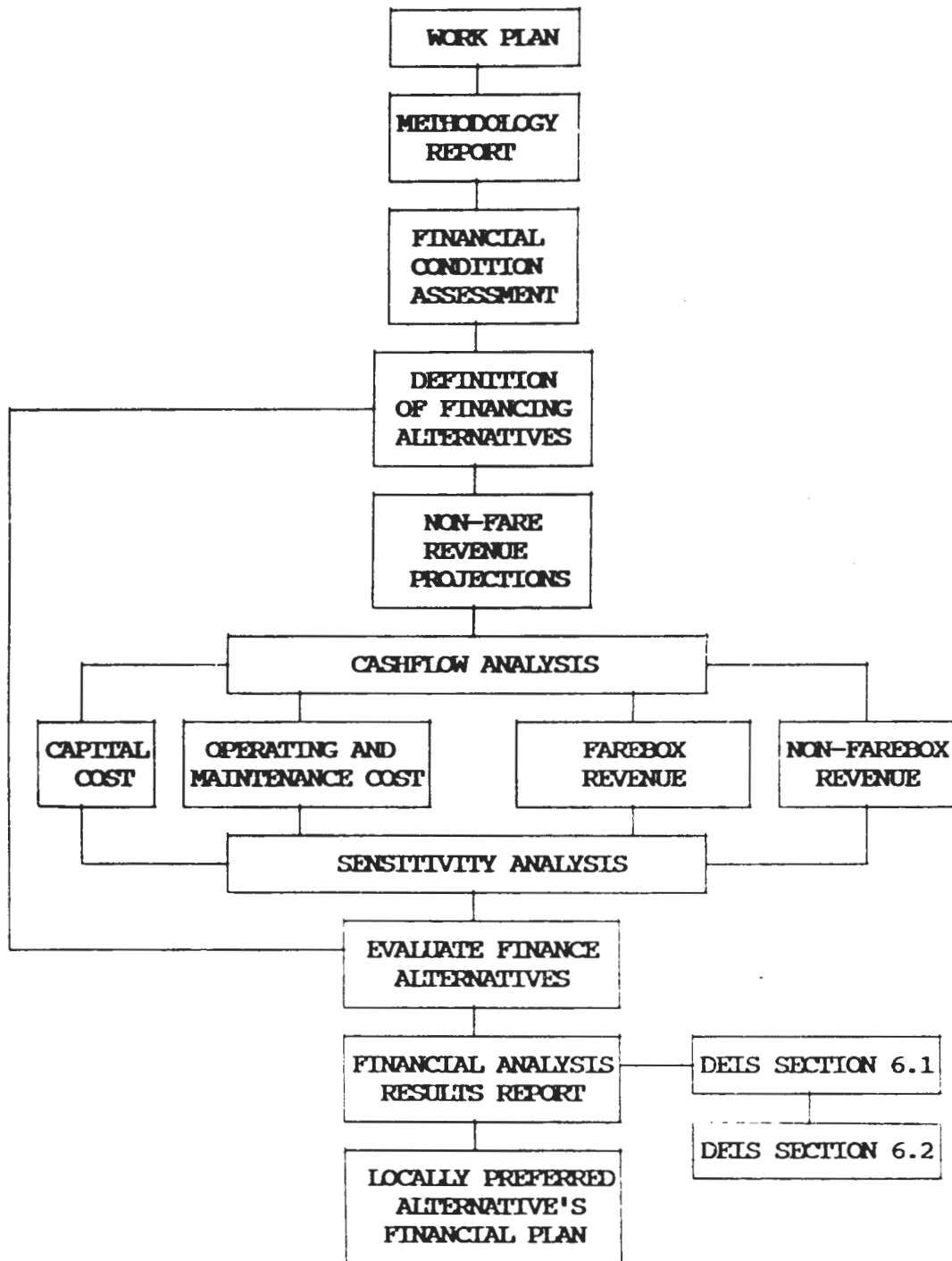


Table II.8-1: Typical Indicators of Financial Condition

A. Measures of Economic Vitality

1. appraised value of real property
2. number of building permits issued
3. number of business licenses issued
4. value of retail sales
5. personal income per capita
6. total revenues
7. total operating expenditures
8. total capital expenditures
9. bond ratings (moody's or standard and poors)

B. Measures of Debt Management

1. long-term debt as percent of total assets, e.g. real property assessed value or value of transit assets
2. long-term debt per capita
3. debt service as percent of revenue
4. coverage ratio

C. Measures of Fiscal Burden of Transit Expenditures

1. personal income per transit operating deficit assistance and total subsidy
2. earnings per transit operating deficit assistance and total subsidy
3. taxable property values per transit operating deficit assistance and total subsidy
4. total operating expenditures per transit operating deficit and total subsidy
5. total annual expenditures per total annual transit subsidy

If private sector participants are expected to be involved, they are also subjected to an assessment of financial condition. The assessment will consider management practices, amount of financial leverage, and profitability of the private sector participants. Annual reports, budgets and other financial statements of the subject companies are used in the assessments of financial condition. In addition to information provided by the private participants, the Securities and Exchange Commission has other useful information for those firms that are publicly traded.

8.4 Definition of the Financing Alternatives

The definition of the financing alternatives is based on the assessment of financial condition, financial requirements of the transit alternatives, and opportunities for private sector involvement. The financing options will

typically include different levels of Federal participation including zero percent, and for the local share one or a subset of pay-as-you-go, leasing, bonding, or private equity. The financing option should be consistent with the security which is provided through the non-Federal sources of revenue. If deficiencies are identified in the existing revenue base, new sources of revenue would be identified and matched with a financing option. In defining the financing alternatives, an objective should be the identification of financing alternatives that minimize risk and uncertainty.

UMTA is encouraging transit agencies to give serious consideration to private sector initiatives for implementation, operation, and maintenance of capital improvements. Franchises and turn-key development are examples of alternative implementation strategies to more conventional approaches. Where these strategies are applicable, they should be closely coordinated with the financing strategies. For example, an implementation/financing option might consist of a franchise with vendor equity contributions, proceeds from tax-exempt bonds and export credits. Together the transit financing, and implementation alternatives become investment alternatives.

8.5 Non-Fare Revenue Projections

Annual forecasts are developed to the horizon year and through the life of the longest lived financial instrument. Techniques typically used for forecasting revenues include professional judgement, trends analysis, simple regression analysis, and econometric modelling. The technique selected will depend upon the revenue source being studied, the number of independent variables, the availability of local data for calibration and validation purposes, and the ability of the technique to produce reasonable estimates over a 15-30 year period. Variables typically used in a financial forecast are personal income, employment, population, retail sales, value of real property, fuel consumption, vehicular traffic, tolls, and inflation rates. The specific variables will depend upon the local economy and the source of revenue.

The forecasting technique should pay close attention to the secular (constant rate of change over the long run) and cyclical (periodic change over the short run) nature of the revenues being forecasted. It is unreasonable to assume constant compounded economic growth since the economic business cycle historically experiences downturns. All assumptions should be supplemented with an analysis of past trends. One approach is to compare past revenue forecasts with actual experiences.

Revenue forecasts for both capital and operating purposes are checked for reasonableness. The forecasts are checked for extremes based on a comparison with historical changes. For example, a sales tax forecast might be considered extreme if its growth rate exceeds the projected population or personal income growth rate for the subject metropolitan area. Broad-based taxes tend to be more responsive to inflation than motor vehicle user fees.

Forecasts are also required for proceeds from joint development, special assessments, tax increments, and impact fees. These forecasts will be based primarily on market studies of station areas. For joint development opportunities, station sites are assessed for vacant land, development potential is examined for existing zoning, and if zoning changes are being discussed in the effected community, development potential is examined for changes in zoning around the transit stations.

A number of steps are required when forecasting revenue potential of benefit sharing strategies like special assessments and tax increment financing. The recommended steps are:

- o identify the assessment area and classes of assessable property;
- o estimate current and future assessable property;
- o determine transit benefits, e.g., travel time savings from representative origins to the assessment areas;
- o identify basis for assessment rate;
- o estimate revenue potential for alternative rates;
- o assess the impact of the different assessment rates on returns on investment in the effected properties; and
- o select an assessment rate.

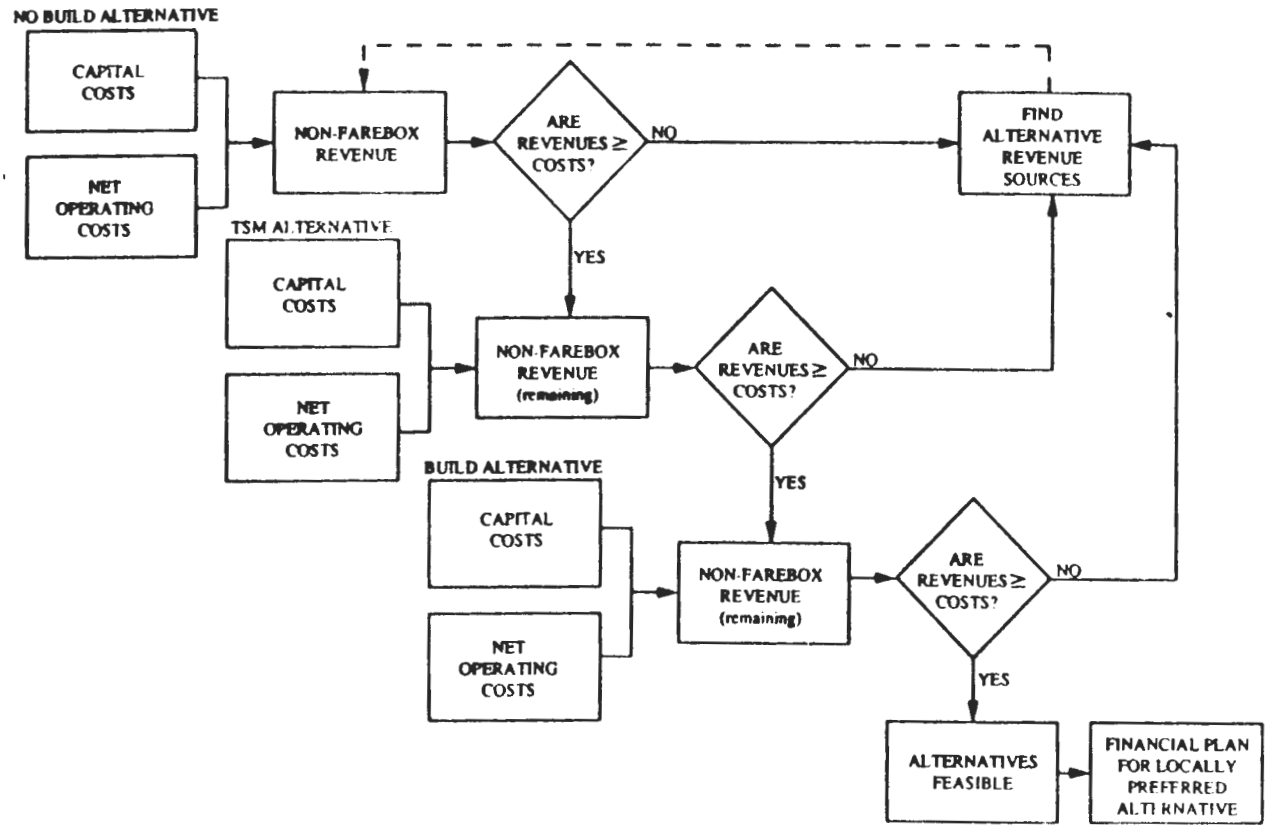
Additional guidelines on the analysis of economic and development impacts can be found in Chapter 7 of Part II.

8.6 Cash Flow Analysis

The framework for the the cash flow analysis (i.e., the comparison of revenues and costs) is shown in Figure II.8-2. First, the capital costs and deficits (net operating costs) of the No-Build alternative are compared to available sources of revenue. If working balances are available, they are applied to the costs in the TSM alternative. New sources of revenue are identified if gaps are disclosed. Otherwise, working balances from the TSM alternative are applied to the major investment alternatives. The cash flow analysis continues along these lines until all transit alternatives are assessed. The results of the cash flow analysis and the assessment of financial condition provide inputs to the evaluation of the financial feasibility of the alternatives. Table II.8-2 and Figure II.8-3 provide examples of ways to present the results of the cash flow analysis.

Capital Costs. The capital cost estimates are adjusted for inflation, and analyzed for risk and uncertainty. Chapter II.3 provides guidelines for developing the capital cost estimates. Annual capital cost estimates are based on tentative procurement and construction schedules. These schedules

Figure II.8-2: Framework for Cash Flow Analysis



should cover the years between the start of construction and through the study horizon year or if bonds and long term contracts are involved, through their maturity. For financial analysis purposes, the capital cost estimates will reflect Gross National Product inflation.

Annual capital cost estimates are expressed in current year (year of expenditure) dollars. They are presented for the same line items as those used in developing the horizon year estimates. The only difference is that the costs of replacing aging assets and capital investments outside the subject corridor are shown as specific line items. Replacement costs are provided for vehicles and facilities. The objective is to develop capital cost estimates which will allow assessment of the financial impact of the transit alternatives on other capital demands of the transit system.

Operating and Maintenance Costs. Annual systemwide operating and maintenance (O&M) costs are considered. Particular attention is given to the incremental increase resulting from the major capital investments. The O&M costs estimates are based on service and maintenance plans described in the final definition of each alternative. The approach for developing these estimates are described in Chapter II.4. For financial analysis purposes, annual O&M costs are calculated in current year dollars. Current year estimates are adjusted in the costing analysis for any increases due to real price changes. However, the financial analysis will adjust the cost estimates based differential inflation derived from the Consumer Price Index.

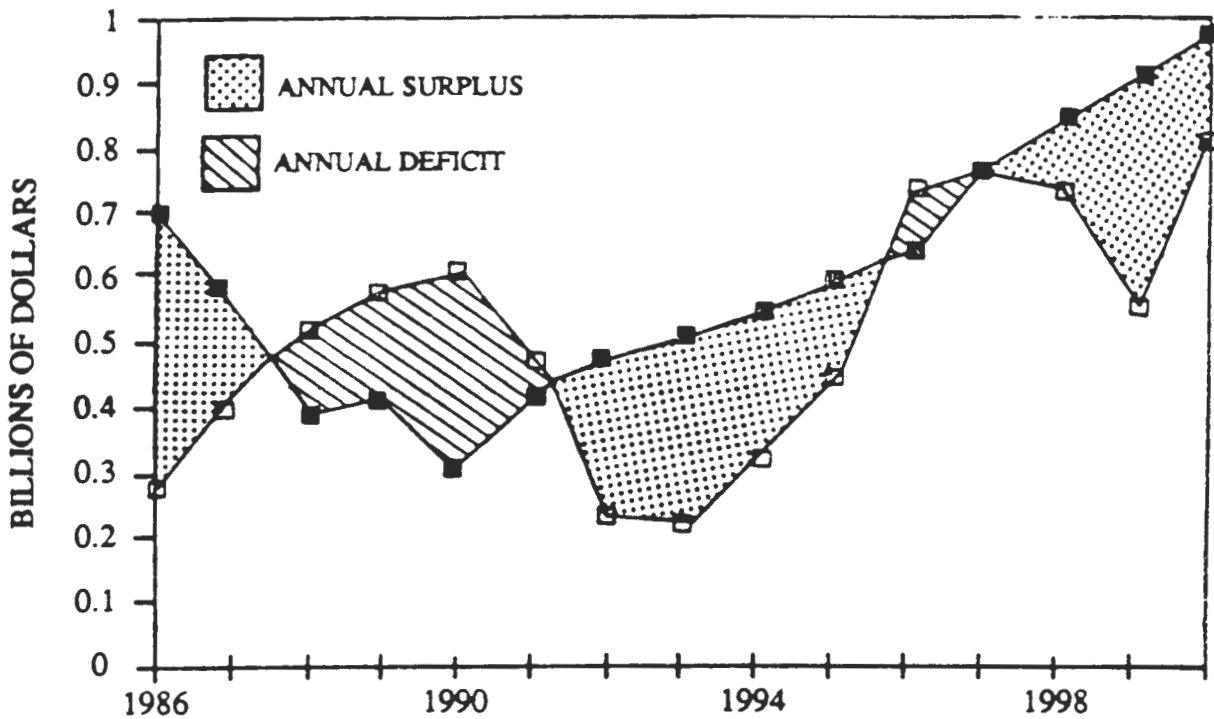
The analysis of differential inflation rates are important because of the uncertainty in estimating future inflation rates. Past alternatives analyses have used several approaches in developing these rates. One approach is to use historical trends in local inflation as the basis for future inflation rates. Other approaches are to consult with local economists or financial institutions or to seek support from econometric forecasting firms. Once developed, the alternative differential inflation rates are tested for their impact on the annual O&M cost estimates.

A number of cost cutting measures can also be considered. Many transit agencies have found contracting with private firms to be an effective means for reducing system O&M costs while continuing to provide a high level of service. Others have examined labor practices, like use of part time drivers for peak time operations, as a means of lowering the operating deficit. A specific example, will more clearly illustrate the latter point. One of the transit alternatives may include several new express bus routes which only operate during the peak periods. These routes are excellent candidates for testing the impact of part time operators on the O&M cost estimates. Service reductions is another area for testing impacts of alternative assumptions on O&M costs. This test is particularly relevant when the patronage forecasts for the transit alternatives show lightly used routes.

Table II.8-2: Cashflow Analysis Results

Date:	Constant Dollars (1985):									
	(Yes=0; No=1)									
25-Jan-87	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
REVENUES										
Sales Tax Revenues:										
Dedicated to Capital	82.5	88.4	95.6	103.4	111.8	120.6	129.8	139.4	149.3	159.6
Remaining from Operations	0.0	0.0	4.9	11.1	18.2	13.8	20.6	23.3	23.3	9.5
Investment Income	12.7	9.0	7.0	6.4	8.6	10.8	14.2	17.2	19.1	17.8
TOTAL NON-OPERATING REVENUES	95.2	97.4	107.4	120.8	138.6	145.2	164.6	179.9	191.7	186.9
Federal Grants:										
Section 9 Funds	11.1	14.2	23.5	19.6	12.5	12.5	12.6	13.1	13.6	14.2
Less: Amount used for Subsidy	0.0	0.0	(7.4)	(7.1)	(7.4)	(7.7)	(8.0)	(8.3)	(8.6)	(8.9)
Section 9 Available for Capital	11.1	14.2	16.1	12.5	5.1	4.8	4.6	4.8	5.0	5.2
Section 3 Funds	7.9	9.7	9.9	0.0	2.0	3.1	0.0	0.0	0.0	0.0
TOTAL FED FUNDS FOR CAPITAL	19.0	23.9	26.0	12.5	7.1	7.9	4.6	4.8	5.0	5.2
State Grants	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Local Grants	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL GRANT FUNDS	19.0	23.9	26.0	12.5	7.1	7.9	4.6	4.8	5.0	5.2
Joint Development Funds/Credits:										
Negotiated Investments	0.0	7.3	8.2	8.8	8.8	9.2	9.9	10.1	10.5	0.0
Air Rights	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.6	0.6	0.5
Connector Fees	0.0	0.0	1.6	1.7	1.7	1.8	1.9	1.9	2.0	0.0
Public Increment Tax Districts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL JOINT DEVELOPMENT	0.0	7.3	9.7	10.5	10.5	11.1	12.3	12.5	13.1	0.9
TOTAL CAPITAL REVENUES/CREDITS	114.2	128.6	143.2	143.8	156.3	164.2	181.6	197.3	209.8	193.0
EXPENDITURES										
Bus System Expenditures:										
Vehicles	13.9	8.8	14.4	16.0	5.4	13.5	14.9	16.0	13.2	15.8
Bus Transit Facilities	37.3	24.4	16.8	10.4	4.7	4.6	4.8	16.8	18.1	11.6
Other	0.0	0.0	0.0	0.0	0.0	6.4	13.3	13.8	21.5	22.4
TOTAL BUS FACILITIES	51.2	33.2	31.2	26.4	10.1	24.5	32.9	46.6	52.8	49.8
Rail System Expenditures:										
Rail Capital	77.1	129.9	163.7	155.1	222.8	234.4	291.9	312.0	327.0	217.8
TOTAL RAIL FACILITIES	77.1	129.9	163.7	155.1	222.8	234.4	291.9	312.0	327.0	217.8
Other Capital (i.e. Office)	1.6	1.1	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7
Support Costs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewal & Replacements	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
TOTAL CAPITAL EXPENDITURES	130.0	164.3	195.4	182.1	233.4	259.5	325.4	359.3	380.5	269.8
SURPLUS/(DEFICIT)	(15.8)	(35.7)	(52.3)	(38.4)	(77.1)	(95.3)	(143.8)	(162.0)	(170.7)	(76.8)
Beginning Cash	223.7	182.5	121.0	77.2	87.7	96.0	105.0	109.7	115.6	107.0
Net Financing Requirement	0.0	0.0	37.8	68.6	103.5	134.6	196.6	237.6	255.8	180.8
Debt Service	(25.4)	(25.8)	(29.4)	(19.7)	(18.1)	(30.3)	(48.1)	(69.8)	(93.7)	(112.5)
Ending Balance	182.5	121.0	77.2	87.7	96.0	105.0	109.7	115.6	107.0	106.6

Figure II.8-3: Cashflow Analysis Graph



■ Capital funds available from all Federal, State and local sources.

□ Capital requirements for all rail and bus projects.

This figure reflects:

- a) Agency's own operating revenue estimates
- b) Agency's estimates of state and local capital support
- c) Agency's estimates of capital requirements
- d) Levels of Federal funding consistent with the the President's proposed budget and transit program
 - UMTA "New Start" funding limited to amount appropriated in FY 1984-86
 - No Federal operating subsidies after FY 1986
 - Federal capital allocations for FY 1987 and beyond consistent with the Administration's Urban Mobility Block Grant Proposal

Farebox Revenue. Annual farebox revenue estimates are provided as inputs to the financial analysis from the travel demand forecasting work. For the purpose of the financial analysis, it is appropriate to provide estimates of farebox revenue by market segment (e.g., downtown versus suburban areas) and by type of traveller (e.g., full fare paying riders versus discounted fare riders). The farebox revenue estimates are also adjusted for inflation, and assessed for uncertainty.

Non-Farebox Sources of Funds. New sources of revenue for operating deficit funding or capital investments are identified if deficiencies were found in current or proposed sources. A wide range of revenue mechanisms are available for consideration. The mechanisms might include broad based taxes (retail sales, property, payroll, income or occupancy taxes); charges on motor vehicle users (motor fuels, motor vehicle and commercial parking taxes or tolls); charges on benefitting property (service charges, special benefit assessments or taxes on incremental value) and income from jointly developed properties. The objective should be to select and evaluate stable and reliable sources of revenue which make maximum use of private sector opportunities.

The number of mechanisms can be narrowed through a comparison of advantages and disadvantages. Criteria to be used include: expected yield; sensitivity to changing local economic conditions, ease of implementation, collection and disbursement; and equity. The emphasis, however, is on systemwide, stable and reliable sources of revenue for operations and capital investments. The operating deficit revenues may be dedicated to the transit system or derived from general sources. The dedicated revenues should be described as to source, legal limits, level of commitment, and collection and disbursement arrangements. If derived from general sources, information will be needed on past trends in transit appropriations by source. The idea is to demonstrate a willingness to continue the appropriations in the future. If a formula is used to allocate the deficit among jurisdictions, the formula should be clearly documented. Sources of revenue for capital investments are viewed within the context of their ability to produce funding at desired times.

8.7 Sensitivity Analysis

Sensitivity analysis is a critical step in the Financial Analysis process. It is an acknowledgment of the risk and uncertainty in the cost and revenue estimates produced at the alternatives analysis stage of project development. Tests are made of the key driving variables for the capital cost, O&M cost, and revenue forecasts.

For the capital cost estimates, there are three areas where sensitivity tests are warranted: the construction schedule, inflation and interest rates. The objective of the first sensitivity analysis is to assess the possibility and usefulness of an accelerated or stretched out implementation schedule for each alternative. Opportunities for cost savings are identified and so are the potential for cost increases absent inflation. Second, inflationary trends for different price factors are determined for

the subject area. These trends are then used to identify and test a range of inflation rates on the capital cost estimates of the alternatives. Third, different interest rate assumptions are tested for their impact on borrowing options and associated debt service requirements.

Sensitivity tests for O&M costs might include variables like service levels (vehicle miles, operating hours), labor productivity and cost escalation rates. The service and productivity variables can be expressed as frequency distributions for the purpose of establishing probability confidence intervals around expected values or variances. Sensitivity analysis of service levels are particularly relevant for transit alternatives where major changes are proposed in levels of bus service.

In many instances, the annual operating deficit may be too high given the current non-fare revenue base and the possibilities for new sources of revenue. These instances warrant the examination of strategies to reduce the deficit across all of the alternatives. Examples include analysis of alternative fare policies, service reductions, changes in work rules and contracting with the private sector for providing services and maintaining facilities and vehicles. Fare and/or service level changes will require an evaluation of their impact on patronage. One approach is to use historical trends in local inflation as the basis for future inflation rates. Other approaches are to consult with local economists or financial institutions or to seek support from econometric forecasting firms. Once developed, the alternative differential inflation rates are tested for their impact on the annual O&M cost estimates.

Simple elasticity based techniques can be used rather effectively to assess the impact of alternative fare policies. Alternative fare policies might include premium fares for premium service, distance based fares or time based fares when they differ with current policy. It is important to note that the need to analyze different fare policies be identified early on so that the travel demand forecasting methodology provides for it.

The determination of the sensitivity of the revenue forecasts to changes in the key input assumptions (e.g., personal income, population, inflation and interest rates) will help establish the level of confidence in the forecasts. Broad-based taxes and value capture from joint development are examples of revenue sources that are more sensitive to economic downturns. The impacts of a downturn non-fare revenue can be determined through sensitivity analysis. The analysis might test the impact of changes in inflation, interest rates, retail sales, employment growth, personal income, property values, auto usage and other independent variables of the forecasts.

Emphasis is placed on those variables for which the revenue sources are most sensitive to. For example, sales tax revenues are highly correlated with personal income, and payroll tax revenues are highly correlated with employment in the dominant industries in the subject area. Development fees, and special assessment fees are sensitive to interest rate changes. If the forecasts and sensitivity tests suggest cash flow problems in any of the out years, back-up measures should be identified.

8.8 Evaluating Financing Alternatives

The financing options are evaluated in terms of the efficiency of the option and capability of the funding partners. It is important to compare on an equivalent basis financing alternatives that have different interest rates, costs of capital, maturation periods, and, in the case of private sector strategies, depreciation methods and tax rates. This evaluation will require sufficient disaggregation in the cash flow line items to account for factors which influence the time value of money. Capital cost items like fixed assets and rolling stock will appear as separate line items. Similarly, each source of fund will be presented as a separate line item.

The analysis of financial capability will address, the economic vitality of the area, financial leverage, burden of transit investments on other local government expenditures where appropriate, and operating performance. Upon completion, the analysis results are documented in the Financial Analysis Results Report, summarized in Section 6.1 of the DEIS, and used in Section 6.2, Evaluation of the Alternatives.

8.9 Documentation

Financial Analysis Methodology Report. The methodology report will identify the range of revenue sources being studied, roles and responsibilities of the agencies involved in the financial planning process, financial forecasting approaches, input assumptions, criteria for determining financial capability and sensitivity test to be made. Table II.8-3 provides a format for the Financial Analysis Methodology Report.

The existing revenue sources will be described in detail. Any new revenue sources proposed but not approved prior to initiation of the alternatives analysis will also be described in terms of source and stage of development. Documentation is an extremely important activity. It provides the participating agencies with information on existing and new sources of revenue, and it allows them to evaluate the financial analysis process, techniques and assumptions to be used in generating the revenue forecasts, in developing the financing options and in assessing the financial feasibility of the transit alternatives.

Financial Analysis Results Report. The Financial Analysis Results Report contains information on: 1) the financial condition of the funding agencies and affected community, 2) stability and reliability of the sources of revenue, 3) legal limits of the revenue sources, 4) political willingness of the community to levy taxes if new taxes are required or if a bond referendum needs voter approval, 5) the relative burden of additional transit expenditures and the cash flow analysis results.

Table II.8-4 is an outline of the results report. The report is particularly important because it is the one place where the detailed analysis is contained. Section 6.1 of the DEIS only summarizes the results. Section 6.2 of the DEIS uses the results to assess the financial feasibility of the transit alternatives. The results report could be made available on an as needed basis rather than attaching it to the DEIS.

Financing Plan for the Locally Preferred Alternative. The results of the financial capacity and sensitivity analyses and the evaluation of the financing options for both capital and operating purposes are used in developing the financing plan for the locally preferred alternative. The more reasonable mechanisms would be packaged along with proposed State and private sector funding sources. The financing plan will identify sources and uses of cash at a minimum for the horizon year and five years beyond service inauguration.

The financing plan for the locally preferred alternative is prepared after the DEIS has been circulated and the comment period is closed. In developing the financing plan, the best elements of the investment alternatives are brought together. Detailed cash flows are included for both capital and operating purposes. These cash flows will cover systemwide costs and revenues. The financing plan represents the best combination of development strategies and financing options for the preferred transit alternative. The financing plan will clearly identify steps needed to secure financing for the preferred alternative, and implementation issues related to construction and operation. The Financial Analysis Results Report and the Financing Plan for the LPA provides the information necessary for UMTA's rating system and decision on preliminary engineering.

Other Resources

Individuals involved in performing the financial analysis for transit project planning studies may find additional guidance in the following selected references:

Federal City Council. Transit in the Nation's Capital: What Lies Ahead? Urban Mass Transportation Administration (Washington: 1986)

Fleischman, Connors, Pearson and White. Financial Planning Guide for Transit. Urban Mass Transportation Administration (Washington: 1989)

MTA PB 90 219270 W1100

Joint Center for Urban Mobility Research. Transportation Revenue Forecasting Guide. Federal Highway Administration and Urban Mass Transportation Administration (Washington: 1987)

MTA PB 87 235404 W1100

Rice Center. Alternative Financing for Urban Transportation: The State of the Practice. Federal Highway Administration and Urban Mass Transportation Administration (Washington: 1986)

Table II.8-3: Outline of Financial Analysis Methodology Report

A. Introduction

1. Description of Existing Transit System
2. Current Roles and Responsibilities of Existing Agencies

B. Financial Planning Process

1. Principal Features
2. Roles and Responsibilities for Financial Analysis Inputs
3. Major Sources of Data
4. Definition of Investment Alternatives
 - (a) transit alternatives
 - (b) implementation alternatives
 - (c) financing alternatives
5. Methods for Forecasting Non-Farebox Revenue

C. Sources of Funds

1. Existing Sources of Revenue
2. Potential New Sources of Revenue

D. Uses of Funds

1. Systemwide Replacement and Rehabilitation Costs
2. Annual Capital Costs of the Transit Alternatives
3. Annual O&M Costs of the Transit Alternatives

E. Assessment of Financial Condition

1. Economic Vitality
2. Fiscal Burden of Transit Expenditures
3. Debt Management

F. Cash Flow Analysis and Evaluation of the Alternatives

1. Structure of Sources and Uses of Funds Analysis
2. Sensitivity Analysis
3. Evaluation of Financial/Implementation Alternatives

Table II.8-4: Outline of Financial Analysis Results Report

- A. Introduction
- B. Assessments of Financial Condition
 - 1. Public Agencies
 - (a) economic vitality
 - (b) fiscal burden of transit expenditures
 - (c) debt management
 - 2. Private Agencies
 - (a) management practices
 - (b) financial leverage
 - (c) profitability
- C. Description of Financing and Implementation Alternatives
 - 1. Implementation Strategy
 - 2. Non-Federal Sources of Funds
 - 3. Assumptions Regarding Federal Funding
- D. Forecasts of Non-Farebox Revenues
 - 1. Results
 - 2. Evaluation of Results
- E. Sensitivity Analyses
 - 1. Capital Costs
 - 2. Operating and Maintenance Costs
 - 3. Farebox Revenue
 - 4. Non-farebox Sources of Funds
- F. Cash Flow Analysis and Evaluation Results
 - 1. Sources and Uses of Funds
 - 2. Evaluation of Financing Alternatives

II.9. Evaluation

The nature of project planning -- a detailed assessment of complex projects in several technical aspects -- risks an overabundance of information that loses its usefulness in decisionmaking. Thus, the evaluation of alternatives is a critical part of the analysis, and of a Draft Environmental Impact Statement, in which the information is sifted and organized, and key differences between the alternatives are highlighted.

This chapter outlines a framework for the evaluation that attempts to structure the information in a way that can be understood by the many non-technical readers of the DEIS. It must be noted that the framework suggested here simply provides a skeleton on which the evaluation is built. The goals, objectives, evaluation criteria, and discussions that make up the evaluation are necessarily determined by local officials and staff to focus on the local decisions that must be made.

9.1 Framework

There are several possible approaches that might be considered for the evaluation of major transit alternatives. They range from a free-form discussion of the options to a very structured and elaborate analysis complete with weighting and scoring of project attributes. A review of the evaluation efforts in previous alternatives analyses suggests two conclusions. First, the lack of some basic structure for the evaluation risks a rambling, unfocused discussion that more often repeats rather than interprets the data. Second, complex "weighting and rating" schemes tend to confuse rather than illuminate the issues and are often only tenuously related to the realities of decisionmaking. As a result, UMTA recommends an approach that takes the middle ground, offering some structure for the analysis, but relying on the informed judgment of local project staff and Technical Advisory Committees to focus the evaluation on the key issues.

The approach is simply to identify and display the key evaluation measures in which the alternatives differ significantly. A summary of the alternatives and key measures can often be done in a small, one-page table. The measures are organized in a fashion that focuses the evaluation on four perspectives of the alternatives. These perspectives have been derived through a review of past project planning studies whose statements of goals and objectives typically call for four characteristics in a desirable project:

- effectiveness - that it yields benefits in terms of mobility, environmental protection, urban development, energy conservation, and so forth;
- cost-effectiveness - that the costs of the project, both capital and operating, be commensurate with its benefits;
- financial feasibility - that funds for the construction and operation of the alternative be readily available in the sense that they do not place undue burdens on the sources of those funds; and

- equity
- that the costs and benefits be distributed fairly across different population groups.

Thus, the evaluation framework is to examine each alternative from each of these three perspectives. Table 9-1 illustrates the differences between the perspectives with examples of typical goals and objectives for major transit projects. Where this structure is to be used for the evaluation, it should be reflected early on, beginning with the statement of goals and objectives for transit improvements. Where existing statements are available, they should be organized into the structure that will be used for the evaluation. Where new or revised statements of goals and objectives are prepared, the four perspectives provide a useful starting point for identifying and organizing local concerns.

It is useful to recognize that the evaluation phase of project planning — and of any assessment of complex options — is not restricted to the final phase of the analysis. Rather, it is a continuous and comprehensive process within which the technical work proceeds. The process is continuous in that there is a series of decisions that must be made throughout the analysis — alignment variations, design standards, operating policies, etc. — that together shape the nature and performance of each alternative. It is comprehensive in that the final evaluation of an alternative considers a broad range of criteria — transportation, environment, costs, finances, etc. — that require a broad perspective in the assessment of design decisions. Clearly then, the ongoing decisionmaking should be carried out with regard to its ultimate impact on the evaluation of each alternative and should be reviewed by the Technical Advisory Committee in that light.

It is also important to reemphasize that the evaluation is primarily focused on local decisionmaking. While this should be obvious, particularly for projects that are not subject to UMTA's Major Investment Policy, there have been cases in which the entire evaluation has focused on "qualifying" for Federal funding rather than on identifying transportation needs and solutions. For example, several recent alternatives analyses have produced initial drafts of evaluation chapters focused on UMTA policy, nearly to the exclusion of local considerations. This emphasis on the Federal decision is not consistent with the intent or nature of UMTA's Major Investment Policy. The policy recognizes that legitimate differences often exist between the local and Federal views of major transit projects. It specifically identifies the Federal interest in transit and outlines the standards against which funding proposals will be measured. The intention is that local officials examine the transit alternatives against their own objectives, so that, ideally, an agreement can be reached on the aspects of a project that are consistent with Federal goals (and attractive for Federal investment) and those that are primarily local objectives that should be funded locally. Therefore, the evaluation process should consider all perspectives from which the alternatives will be examined.

9.2 Effectiveness

Goals and objectives related to effectiveness both establish the reasons for which major transit improvements are being considered, and identify ancillary concerns that constrain the options. Transportation concerns — congestion,

Table 9-1. Typical Goals and Objectives, Summarized by Perspective

Effectiveness

- Reduce highway congestion.
- Focus economic development.
- Reduce automobile pollutant emissions.
- Conserve energy.

Cost-Effectiveness

- Keep operating costs at less than \$x.xx per rider systemwide.
- Provide an acceptable return in benefits on capital funds invested.

Financial Feasibility

- Maintain an xx percent recovery of operating costs from the farebox.
- Keep operating deficit less than xx percent of dedicated tax revenues.
- Keep capital program with remaining dedicated tax revenues (including bonding), plus additional funds from joint development and other value capture efforts.

Equity

- Provide improved mobility to the transit dependent.
- Obtain participation in project costs from groups benefiting from the public investment.

mobility, etc. -- are the primary basis for consideration of a major action in the corridor. Other concerns -- typically urban development -- often are identified as motivating factors as well. Goals and objectives that constrain the options are primarily environmental concerns -- noise, intrusion on parklands and historic sites, visual impacts, and so forth.

There are several considerations in the selection of evaluation measures related to the effectiveness of alternative investments:

- 1) The measures should be developed early in the analysis with appropriate input from local decisionmakers.

This review is an obvious step to ensure the relevance and usefulness of the information. The evaluation methodology should be a high priority item in the early stages of the analysis. Development of a written explanation of the evaluation process is often the catalyst for local officials to come to grips with the specific measures that are of importance for local decision making.

- 2) The measures should be comprehensive in that they address all of the stated objectives, but they should be structured to avoid simple restatements of the same benefits.

Many potential effectiveness measures are highly interrelated. In some cases, there is good reason to include measures of the same impact that portray the impact from different perspectives. For example, the increased development potential of an area may be due primarily to the improvement in transit accessibility to that site. While including both measures of accessibility and measures of development potential likely double-counts some benefits, both may be of sufficient interest to warrant their use in the effectiveness analysis. Double-counting at this point is permissible because there is no summation of total benefits in the effectiveness analysis. This is in contrast to the subsequent cost-effectiveness analysis in which a summation is necessary and double-counting would be an error. In other cases, two candidate measures can be purely redundant. For example, it is unnecessary to include both "total transit trips" and "transit trips diverted from autos" since the second measure is a direct mathematical derivation from the first.

- 3) To the extent possible, the measures should quantify the impacts rather than express subjective judgments on the nature of the impact.

Many of the important objectives of an improvement can be difficult to quantify and the consequent temptation is to use subjective evaluation measures: significant or not significant, desirable or not desirable, and so forth. However, it is usually more useful to provide measurements rather than judgments to local officials and the public. There is an adage to the effect that the relocation of a single residence for a major project is not "significant" unless it is your residence. Useful quantified measures can usually be identified for most objectives. For example, the impacts of street closings on neighborhoods can be addressed with such measures as the number of local streets closed to traffic and the number of residences and businesses relocated.

- 4) The measures should also provide the proper perspective on the magnitude of the impacts.

Many of the impacts of a transportation improvement occur in terms of numbers that are large in an absolute sense but are relatively small when placed in perspective. For example, the relocation of one million square feet of new office space to station areas may appear quite significant when presented by itself, but is more meaningful when also shown as the percentage (say three percent) of total development expected in the corridor over the study period. Similarly, pollutant reductions expressed in terms of thousands of pounds per day is misleading in terms of regionwide air quality impacts if the reduction constitutes less than 0.1 percent of total emissions in the region.

- 5) Finally, discussion of the measures should reflect the magnitude of differences in the measures compared to the likely error levels they may contain.

Varying degrees of uncertainty exist in all information used in project planning. The presentation of effectiveness measures should be accompanied by a well-written discussion that both highlights the major differences between alternatives and indicates where the differences are small given the levels of uncertainty. Minor differences in transit patronage, for example, are usually within the error of the estimates.

Within these general guidelines, the identification of specific measures of effectiveness depends only on the locally identified goals and objectives, together with the judgement of local analysts and officials on the most useful ways of portraying the effectiveness of each alternative.

9.3 Cost-Effectiveness

The definition of cost-effectiveness that has been applied to major transit projects is the extent to which an alternative returns benefits in relation to its costs. Given this definition, this evaluation criterion might more accurately be termed "efficiency." However, the longstanding use of the term "cost-effectiveness" by the transit industry, Congress, and UMTA suggests that it be retained.

Three primary issues arise in any attempt to fashion measures of cost-effectiveness:

- o the overall structure of the analysis and resulting measures;
- o the baseline against which the alternatives are compared; and
- o the measures used to quantify costs and benefits.

Over the past several years, UMTA has sifted through the various options for each of these issues and has identified an approach used to support Federal decisionmaking. Local officials may choose a different approach, so long as it is technically sound and can accurately measure project merit. In alternatives analyses, it is required that the UMTA measures be computed in addition to any

measures that may be proposed locally and approved by UMTA. The results of both approaches are presented in the environmental document produced by the study. Ideally, where local measures are developed, they build upon those used by UMTA so that both sets of measures are consistent in their structure and differ only in the set of benefits that they consider.

Structure of the Cost-Effectiveness Analysis

A major question in evaluation is the way in which the trade-off between costs and benefits is portrayed. One option is the standard cost-effectiveness approach in which a required performance level is stated and alternatives are evaluated for the least cost option that achieves this performance. This approach is very useful where the performance requirements are easily stated and measured. Unfortunately for transportation planning, the objectives for urban transportation investments are usually so many, so varied, and perhaps so unclearly defined that they defy statement in terms of specific performance levels.

Alternatively, there are a number of "classical" approaches to comparing costs and benefits. These approaches attempt to count carefully all costs and benefits of the alternatives, convert the various benefits into their monetary equivalents, and assess the "bottom line" for each alternative in terms of whether its benefits exceed its costs. The benefit/cost ratio, net present value, and the internal rate of return are three measures based on a strict accounting of all costs and benefits. These measures are usually computed as

$$(9-1) \quad \text{Benefit/Cost Ratio} = \frac{\$PV \text{ of Benefits}}{\$PV \text{ of Costs}},$$

$$(9-2) \quad \text{Net Present Value} = (\$PV \text{ of Benefits}) - (\$PV \text{ of Costs}),$$

and

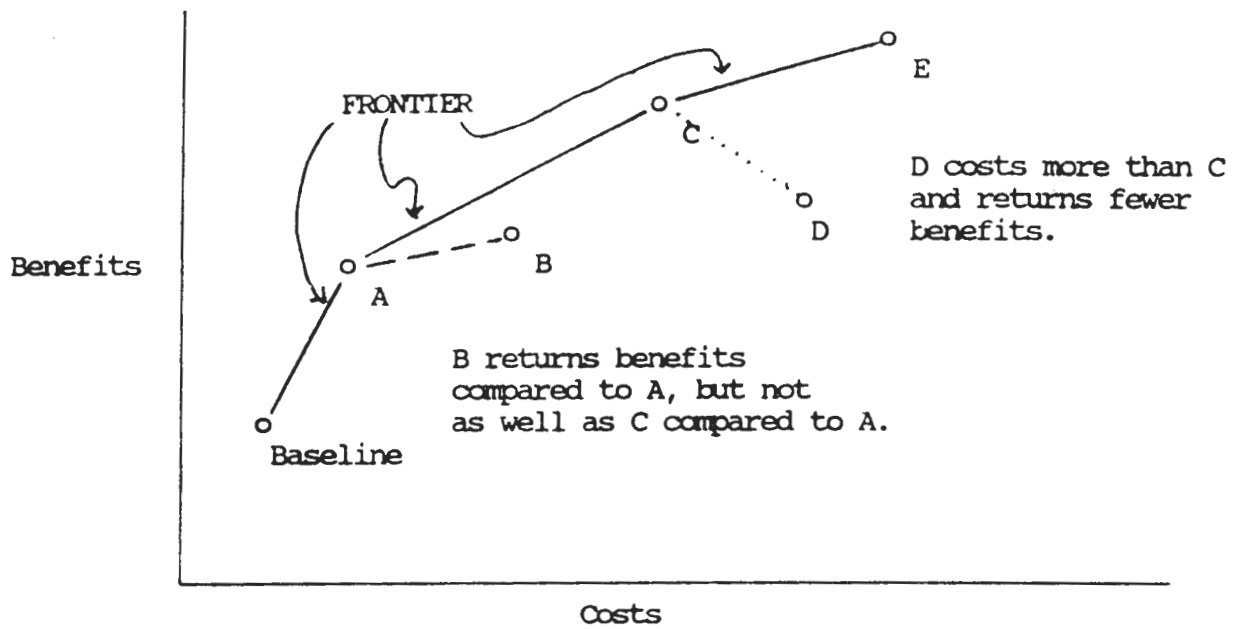
$$(9-3) \quad \text{Internal Rate of Return} = \text{discount rate such that} \\ (\$PV \text{ of Benefits}) - (\$PV \text{ of Costs})$$

where \$PV is the present value over the life of the project and d is the discount rate.

Another option is to select a measure of benefits that captures, both directly and indirectly, as large a share of the expected benefits as possible. A ratio between this measure and a measure of costs then provides an index of the cost-effectiveness of an alternative. For example, an index expressed in terms of cost-per-unit-of-benefit can be computed as:

$$(9-4) \quad \text{Cost-Effectiveness Index} = \frac{\text{Cost measure}}{\text{Benefit measure}}$$

where the benefit measure is not valued in terms of dollars.



Basis for Comparison
of Incremental Cost-Effectiveness
of Increasing Investment

Alternative	Compared to	Result
A	Baseline	Added benefits
B	A	Added benefits, but at lower rate than C
C	A	Added benefits
D	C	Fewer benefits than less costly C
E	C	Added benefits

Figure 9-1. Graphical Analysis of Incremental Costs and Benefits

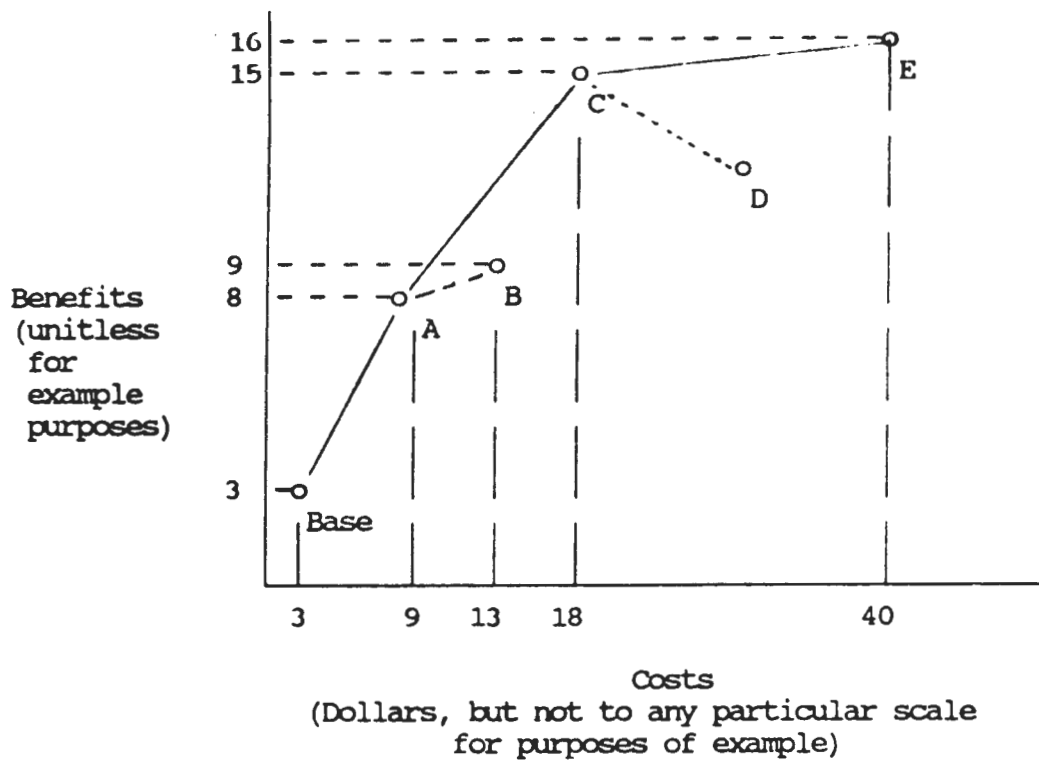
Regardless of the specific method used, it is clear that the approach should examine the incremental costs and benefits of alternatives. One very illuminating approach to an incremental analysis is shown in Figure 9-1 in which the alternatives are arrayed graphically in terms of their costs and benefits. Much can be discovered on the relationship between the alternatives by starting with the baseline alternative and examining the productivity of increasing levels of investment. This analysis reveals three kinds of alternatives in the example. First, alternatives A, C, and E yield the maximum return in benefits with increasing levels of investment. A line connecting these three alternatives might be termed the "frontier" since it represents the best return available at each possible level of investment. Second, alternative B is not on the frontier but does provide additional benefits compared to alternative A, the next lower cost alternative. Therefore, while alternative C is somewhat more cost-effective, alternative B has potential merit, particularly if fiscal constraints make it difficult to meet the higher expenditures required for alternative C. Finally, alternative D is not on the frontier and provides fewer benefits at higher cost than alternative C. This indicates that, at least from the cost-effectiveness perspective, D is not a competitive option.

This graphical analysis suggests a method for computing measures of incremental cost-effectiveness. Each alternative is compared to the next lower cost alternative that lies on the frontier, as summarized in the figure. Each of the measures in Equations 9-1 through 9-4 can be computed for for each pairwise comparison of alternatives. For example, Equation 9-4 becomes

$$(9-2) \text{ Incremental Cost-Effectiveness}_{n-m} = \frac{\Delta \text{ Incremental Costs}_{n-m}}{\Delta \text{ Incremental Benefits}_{n-m}}$$

where n and m are the alternatives and n is more costly than m. Comparisons are made only against alternatives on the frontier in order to avoid distortions. For example, given that A is judged to be a cost-effective alternative, the next question is whether B or C is the better next increment of investment. The answer lies in comparisons of B to A and then C to A. Clearly from the graph, C is the better option. Thus, a direct comparison of C to B is not useful since it only demonstrates what is already known -- that alternative C is the better next increment of investment. This direct comparison of C to B would also overstate the incremental cost-effectiveness of C since this comparison would be against an alternative that is clearly less competitive.

A remaining question is whether the incremental measures are sufficient indicators of cost-effectiveness. Both considerations suggest that they are not. Figure 9-2 presents a situation in which both concerns arise. In this example, alternatives A and B are fairly similar in terms of costs and benefits. Thus, the incremental cost-effectiveness of alternative B is based on fairly small differences between its and alternative A. The first concern is that potential errors in the estimates are very large in relation to the differences between the alternatives. There is consequently a large degree of uncertainty in any measure based on the incremental differences between the



Measures of Incremental and Average Cost-Effectiveness

Alternative	Incremental Measures		Average Measure
	Compared to	$\frac{\Delta \text{ Costs}}{\Delta \text{ Benefits}}$	
A	Baseline	$6/5 = \$1.20$	\$1.20
B	A	$4/1 = \$4.00$	\$2.32
C	A	$9/7 = \$1.29$	\$1.25
D	C	**	**
E	C	$22/1 = \$22.00$	\$13.59

** indicates that alternative D both costs more and produces fewer benefits than alternative C; thus the incremental investment in alternative D is not cost-effective.

Sample calculation of average measure: the average for E is computed across the incremental investments in A, C, and E.

$$\text{Average Measure E} = \frac{(1.20)(6) + (1.29)(9) + (22.00)(22)}{6 + 9 + 22} = 13.59$$

Figure 9-3. Average Measures of Cost-Effectiveness

options. Second, in evaluating alternative B against alternative A, the analysis focuses on a relatively small part of the total investment required by alternative B. In the example, the relatively small added investment that B requires beyond A does not appear cost-effective since it produces relatively few additional benefits. While this is important, an additional consideration is that both A and B represent cost-effective investments compared to the baseline.

Both concerns suggest that a measure is needed for the overall cost-effectiveness of each alternative. One method for computing such a measure is shown in the lower part of Figure 9-3. The method computes an "average" cost-effectiveness measure that is a weighted average of the incremental measures. The weights for this calculation are the incremental investment in each alternative. This method can be used with incremental measures that are based on either the internal rate of return (Equation 9-3) or the cost-effectiveness approach (Equation 9-4). It is not meaningful, however, for either benefit/cost ratios (Equation 9-1) or net present value calculations (Equation 9-2). The average measure can be computed as:

(9-5) Average Measure_n =

$$\frac{(IM_{a-base})(COST_{a-base}) + (IM_{b-a})(COST_{b-a}) + \dots + (IM_{n-m})(COST_{n-m})}{(COST_{a-base}) + (COST_{b-a}) + \dots + (COST_{n-m})}$$

where n is the alternative in question,

IM_{q-p} is the incremental measure of alternative q compared to p,

COST_{q-p} is incremental cost of q compared to p, and

a ... m are the alternatives on the frontier that are less costly than alternative n.

Thus, for those incremental measures that can support this approach, the calculations in Figure 9-3 can provide decisionmakers with information on both the cost-effectiveness of each additional increment of funding and on the overall, or average, cost-effectiveness of each alternative. In the example, the average measures add significantly to the usefulness of the data, particularly for alternatives B and E. Regarding B, the average measure reflects the relative closeness of A and B much better than does the incremental measure. It is possible to conclude that, while the incremental investment in B compared to A is not particularly cost-effective (\$4.00 per unit of benefit), its overall cost-effectiveness is reasonably good (\$2.32 per unit). In contrast, the incremental investment in E compared to C is both so large and so unproductive (\$40.00 per unit) that the average measure for E is very poor (\$24.29 per unit).

A similar approach can be used to compute an average internal rate of return as well. Again, a weighted average is computed as in Equation 9-5, but using the internal rate of return for IM_{q-p} rather than the ratio of costs to

benefits used in the example. The average measure cannot be computed across benefit/cost ratios because the incremental cost terms $COST_{q-p}$ cancel out the denominators of the benefit/cost measures used for the IM_{q-p} terms. Thus, the numerator of Equation 9-5 collapses to the sum of the incremental benefits and the equation reduces to

$$(9-6) \quad \begin{array}{l} \text{"Average"} \\ \text{Benefit/Cost} \\ \text{for Alt n} \end{array} = \frac{(BENEFIT_{a-base}) + (BENEFIT_{b-a}) + \dots + (BENEFIT_{n-m})}{(COST_{a-base}) + (COST_{b-a}) + \dots + (COST_{n-m})}$$

$$(9-7) \quad = \frac{(BENEFIT_{n-base})}{(COST_{n-base})}$$

This result is simply the incremental benefit/cost ratio of the alternative in question computed against the Baseline alternative. This measure ignores the presence of the intermediate alternatives and would, for example, substantially overstate the cost-effectiveness of alternatives D and E in the Figure 9-3 example. It is not therefore a particularly useful measure of cost-effectiveness.

The average measure also cannot be computed across incremental net present values. This limitation occurs because the nature of the net present value -- a difference rather than a ratio -- means that an overall measure must be a sum rather than an average:

$$(9-8) \quad \begin{array}{l} \text{Summed} \\ \text{Net Present} \\ \text{Value for} \\ \text{Alt n} \end{array} = \begin{array}{l} (BENEFIT_{a-base} - COST_{a-base}) \\ + (BENEFIT_{b-a} - COST_{b-a}) \\ \cdot \\ + (BENEFIT_{n-m} - COST_{n-m}) \end{array}$$

$$(9-9) \quad = (BENEFIT_{n-base} - COST_{n-base})$$

The overall measure in Equation 9-9 is simply the net present value of the alternative in question computed versus the Baseline. Again, since this measure also ignores the intermediate alternatives between the Baseline and alternative m, it too is not a particularly useful measure.

Recommendation In UMTA's view, the preferred measures of cost-effectiveness are based on Equation (9-4), a simple ratio between incremental costs in the numerator and incremental benefits in the denominator, where the benefits are not valued in monetary terms. Both incremental and average measures are important to the evaluation and should be developed and presented in a fashion similar to Figure 9-3. This approach is preferable because it is the only approach that both (1) permits calculation of an average as well as incremental measures, and (2) avoids the need to value all benefits in dollar

terms. Where local officials and staff propose an additional approach to the cost-effectiveness analysis, the proposal should demonstrate the way in which both of these concerns are adequately addressed.

Choice of a Baseline Alternative

All comparisons of costs and benefits necessarily begin with some baseline alternative that provides a starting point for the analysis. There are two candidates for use as a baseline: the Do-Nothing and TSM alternatives. Much discussion has occurred on the merits of each option as the baseline. This section discusses the advantages of each and presents UMTA's recommendation.

Three advantages can be cited for using the Do-Nothing alternative. First, it has intuitive appeal as a baseline since the alternative is usually defined as an extrapolation of current operating policies and improvement programs. Thus, it is a logical baseline on which all improvements will be based. Second, its use as the baseline makes clearer that the TSM alternative is a real option for solving problems and is not simply an artificial construct invented to serve as a baseline. The TSM alternative therefore would be a more competitive alternative for consideration by local officials. Third, an evaluation that uses the Do-Nothing as the baseline can detect proposed TSM alternatives that are not cost effective. Thus, errors in development of the TSM alternative can be identified and corrected so that the final definition of that option in fact represents an attractive, low-cost alternative.

The advantage of using the TSM alternative as the baseline is that it better isolates the benefits and costs of the major investment alternatives. In many cases, the TSM alternative presents an opportunity to identify improvements that are desirable today. Therefore, potentially large benefits are available from making changes in a Do-Nothing alternative that is largely based on today's situation. Since these benefits are independent of any major investment, they should not be attributed to the guideway options. This miscounting of benefits cannot be avoided if the Do-Nothing is used as the baseline since the average measures of cost-effectiveness would include the benefits of the TSM improvements over the Do-Nothing alternative. This problem is avoided if the TSM alternative serves as the baseline since the benefits produced by the TSM actions do not enter into the calculations.

Recommendation In UMTA's view, the careful accounting of benefits possible with the TSM baseline is crucial in assessing cost-effectiveness. While the TSM baseline is therefore preferred, this conclusion is clearly a difficult choice between two reasonable options. Recognizing the arguments for use of the Do-Nothing baseline, it is important to treat the TSM alternative in a way that emphasizes its role as a real option, and that detects TSM alternatives that are not competitive. Two steps can be taken towards this end. First, the TSM alternative should be described simply as a viable, low-cost option. References to its role as a baseline should be made only where it is necessary in the cost-effectiveness analysis. Second, as in the example in Figure 9-3, the TSM baseline should be treated only as another alternative that has both costs and benefits compared to the (Do-Nothing) origin of the graph. While the frontier begins with the TSM baseline, the extent to which the TSM option is cost-effective is readily apparent from its location on the graph.

Quantification of Costs and Benefits

Given a structure and baseline for the assessment of cost-effectiveness, it remains to select the specific measures of costs and of benefits. Calculations on the cost side are reasonably simple in that all measures are expressed in a common unit -- the dollar -- and basic techniques of engineering economics are available to put one-time capital costs and recurring operating and maintenance costs on a common annual basis. Section 3.5 outlines a direct method for translating capital costs into their uniform annual equivalent. This annualized cost can then be summed with the operating cost estimated for the forecast year to represent the total annual cost of the alternative.

However, calculations on the benefits side are made quite difficult by the wide range of benefits associated with major transit projects -- congestion relief, improved transit travel times, energy conservation, pollutant reductions, economic development, and so forth. No single measure of benefits is readily apparent. The classical approach to this measurement problem -- computing either a benefit/cost ratio, net present value, or internal rate of return -- is to convert all of these benefits into the dollar-valued equivalents. The problem here, however, is selecting the "correct" dollar values for travel time, fuel savings, pollution reductions, and relocations of new development. This problem is avoided through use of a proxy measure of benefits that captures as wide a range of the benefits as is necessary.

Since the major purpose of transit investments is improved mobility, it is clear that the most useful proxy measures are travel related. There are several measures of travel impacts that might be considered for use as an overall indicator of benefits. Changes in total transit ridership, travel times, ridesharing, highway congestion, and so forth are all possible candidates. The challenge is to select a measure that represents, either directly or indirectly, the wide range of benefits and that avoids a systematic bias towards or against any particular kind of alternative.

Transit User Benefits One potentially useful measure can be termed "user benefits", though it is more commonly called "consumer surplus" in microeconomic theory. In its most direct form, this measure can be focused on transit users alone. It is computed simply as the aggregate difference in "user costs" between a pair of alternatives, summed over all existing and new transit riders. User costs are defined in terms of a generalized price of transit, including both out-of-pocket costs -- fares, parking fees at park/ride lots -- and time costs -- walking, waiting, riding, and transferring. Thus, this generalized transit price is a measure of the level of mobility provided by transit for individual users, and total user benefits indicate the overall improvement in regional mobility provided by an alternative. Happily, an excellent measure of transit price is used routinely in the mode choice analysis done as part of patronage forecasting. Thus, the evaluation can proceed using data already developed in the study. Chapter 6 outlines the calculation of a measure of user benefits in terms of hours of travel time.

A concern arises in many situations on the exclusive focus on transit user benefits. At least two situations give rise to potential miscounting of

user benefits if the analysis focuses only on existing and new transit users. First, where HOV ways are considered, many of the user benefits accrue to travelers in carpools and vanpools as well as to transit riders. Second, in cases where additional highway capacity is provided in some alternatives, drivers of single-occupant automobiles may also enjoy user benefits. A third, less direct, case is where the diversion of auto users to transit and HOVs is so large that it, arguably, reduces highway congestion and provides a benefit even to remaining highway users. It is at least theoretically possible to estimate the user benefits that become important in each of these situations.

HOV User Benefits In studies that include HOV alternatives, the need to estimate HOV volumes already requires that the mode choice analysis be capable of isolating HOV service levels and travel demand. Therefore, in these studies, there is also available a measure of HOV price that is directly analogous to the measure of transit price discussed above. Chapter 6 discusses a method for calculating the combined measure of user benefits (for both transit and HOV users) that is expressed in hours of travel time.

Highway User Benefits Methods for isolating travel benefits to non-transit, non-HOV users are less straightforward. The added complexity occurs in the recalculation of highway times and costs necessary to represent the effects of added highway capacity or lower highway demand. One concern introduced in this effort is that the changes in highway volumes, capacities, and speeds are relatively small — particularly where the effect is limited to diversions of auto users to transit — and cannot be accurately predicted by available analytical tools. This concern is magnified by the high volumes of highway users for whom this measurement error might occur. An average 30-second error in travel time estimates for highway users may not appear problematic, but its summation over several hundred thousand highway trips may lead to a large error in the aggregate estimate of user benefits.

A second concern is that savings in highway travel time may not be the actual consequence of increased highway capacity or lower demand. It is often argued that short-term reductions in highway congestion are offset by changes in travel patterns in response to the lower levels of congestion. Among these changes may be the generation of new travel and the shift of former off-peak trips to the peak period. The net effect, then, may be no net change in highway congestion levels. Unfortunately, the benefits of changes in total travel and peaking characteristics are well beyond the ability of conventional travel forecasting methods. Thus, at most, it may be possible to compute a measure of user benefits that includes time savings for remaining highway users, but only as a proxy for the more likely shifts in travel patterns. Again, Chapter 6 discusses a method for computing this measure.

User Benefits as a Proxy Measure Obvious questions arise on the extent to which a single measure, no matter how broadly defined, can capture the wide variety of benefits resulting from a major transit investment. Two considerations are key to the use of user benefits as a proxy measure. First is the recognition that the direct benefits of a transit improvement are improvements in travel times and increases in transit ridership, and that the indirect benefits are consequences of these mobility and ridership changes. For example, where significantly improved transit service attracts substantial

numbers of new riders, there will be associated benefits -- less highway congestion, lower energy consumption and pollutant emissions, and so forth -- whose magnitude depends directly on the magnitude of the ridership gain and associated user benefits. Further, the analysis of user benefits accruing to different travel markets within a region can provide excellent indicators of improved mobility for the transit dependent and increased accessibility to employment locations.

Even such an indirect impact as economic development is related to changes in user benefits. The likelihood that a transit project will have significant impacts on development patterns is largely determined by its ability to provide significant increases in accessibility and patronage. As a result, a project with little or no service and ridership impacts will likely have similarly modest development impacts. Thus, the proxy measure does reflect, at least in a general sense, differences between alternatives in terms of their overall impacts on development. Development impacts at individual sites, of course, require site-specific analysis of changes in accessibility and other incentives for development.

The second key is that in most cases, the purpose of the evaluation is to rank alternatives against each other. This task requires only the ordering of projects according to their relative merits rather than calculation of their absolute merits. Since the transportation benefits of an alternative are proportional to its overall benefits, the ordering of alternatives based on transportation benefits alone is very likely to be the same ordering that would result if the secondary benefits were measured as well. Consequently, the indirect measurement of secondary benefits is quite adequate for the purposes of the evaluation. Direct measurement of the secondary benefits would become critical only if the evaluation were designed to judge the absolute merits of each alternative -- whether its total benefits exceed its costs.

Recommendation In UMTA's view, user benefits are far to superior to other candidate measures of the overall benefits of an alternative. This measure can be defined broadly so that it captures directly a large share of likely transportation benefits. It is also a good proxy measure of a wide range of indirect benefits, since many of the secondary impacts of a transportation improvements are directly dependent on the degree to which it increases mobility.

Regarding the specific definition of the user benefits measure, UMTA's view is that it should be defined as broadly as necessary to capture all expected travel benefits. Therefore, in studies that include only transit alternatives that are not expected to have measurable impacts on the highway system, transit user benefits are a sufficient measure. Where HOVway alternatives are also included, a combined measure of benefits to transit and HOV users is necessary. Finally, where significant highway improvements are examined, or where substantial reductions in highway congestion are anticipated, a combined measure of transit, HOV, and highway benefits is necessary. In these last two cases, it is also useful to examine separately the benefits to users of each mode, particularly where funding may be sought from different modal agencies for an alternative that includes highway and transit investments.

Summary of the Recommended Approach to Cost-Effectiveness Calculation

Cost-effectiveness can be adequately addressed with two measures that are based on a simple ratio between the costs of building and operating an alternative, and the user benefits accruing from that alternative. These measures are computed with the aid of a graphical representation of the costs and benefits of the alternatives, illustrated in Figure 9-3 above. The calculations use the TSM alternative as a baseline for the assessment.

The first measure is incremental in that it examines the cost-effectiveness of each alternative in comparison with the next less costly option:

$$\rightarrow (9-10) \text{ Incremental Cost-Effectiveness Measure} = \frac{\Delta \$CAP + \Delta \$O\&M}{\Delta \text{USER BENEFITS}}$$

where the Δ 's represent incremental costs and benefits between the pair of alternatives considered, and

$\$CAP$ = total capital costs, annualized over the life of the project;
 $\$O\&M$ = annual operating and maintenance costs;
 USER BENEFITS = annual benefits, expressed in terms of hours of travel time, for both "existing" and new users of the modes on which significant changes in service levels are expected.

This incremental measure is therefore expressed in terms of \$/hour of user benefits. The second measure examines the overall cost-effectiveness of an alternative, reflecting the total investment in each alternative rather than the last increment only:

$$(9-11) \text{ Average Measure}_n =$$

$$\frac{(IM_{a-tsm})(COST_{a-tsm}) + (IM_{b-a})(COST_{b-a}) + \dots + (IM_{n-m})(COST_{n-m})}{(COST_{a-tsm}) + (COST_{b-a}) + \dots + (COST_{n-m})}$$

where n is the alternative in question,

IM_{q-p} is the incremental measure of alternative q compared to p ,

$COST_{q-p}$ is incremental cost of q compared to p , and

$a \dots m$ are the alternatives on the frontier that are less costly than alternative n .

Equation 9-10 defines what might be termed a measure of "societal" cost-effectiveness since it considers the cost-effectiveness of the entire capital investment, regardless of funding source. Similar measures can be constructed to examine cost-effectiveness from the perspectives of individual sources of capital. For example, a local government providing funds for a share of the capital costs of a project might use a "local" cost-effectiveness measure:

$$(9-12) \quad \text{Local Cost-Effectiveness Measure} = \frac{\Delta \$\text{LOC} + \Delta \$\text{O\&M}}{\Delta \text{USER BENEFITS}}$$

where \$LOC is the annualized value of the local capital contribution. Similarly, the cost-effectiveness of any Federal funds required for an alternative can be represented as

$$(9-13) \quad \text{Federal Cost-Effectiveness Measure} = \frac{\Delta \$\text{CAP} - \Delta \$\text{LOC} + \Delta \$\text{O\&M}}{\Delta \text{USER BENEFITS}}$$

where the variables are as defined above. Changes in O&M costs appear in all three equations, including those for both the local and Federal perspectives, since O&M cost savings are one of the potential benefits of the capital investment. Equation 9-11 should also be used with these incremental measures to compute average measures for potential source of capital funds. The method for annualizing capital costs and local funding to derive \$CAP and \$LOC is presented in Part II, Chapter 3 of this guidance.

It should also be noted that these measures can also be used to assess the potential contribution of benefits beyond those accruing to travelers. A "backsolving" approach can help identify the likelihood that these indirect benefits might substantially improve the apparent cost-effectiveness of each option. For example, if an alternative has an incremental cost-effectiveness measure of \$20 per hour of travel time, it may be useful to examine the necessary value of indirect benefits to improve the measure to, say, \$5 per hour. The problem can be stated:

$$(9-14) \quad \$5.00/\text{hour} = \frac{\Delta \$\text{CAP} - \Delta \$\text{LOC} + \Delta \$\text{O\&M} - \Delta \$\text{IND}}{\Delta \text{USER BENEFITS}}$$

where \$\IND is the increment in the (annual) dollar value of the indirect benefits necessary to achieve the \$5.00/hour result. After solving this equation for \$\IND, it is then possible to assess the likelihood that this increment might occur. For example, if urban development is thought to be a major indirect benefit and \$\IND must be \$100 million per year, then a useful comparison would be between the necessary \$100 million benefit and the expected value of total office, retail, and hotel construction in the region. If total annual construction is \$500 million, then this analysis might suggest that the redistribution of this development is not likely to yield a benefit (20 percent of the total value of construction) that would improve the cost-effectiveness to \$5.00 per hour.

Indices Required by Current UMTA Policy

In a policy statement and accompanying documentation issued in May 1984, UMTA identified a specific set of indices that it uses to rate transit projects advanced for Federal funding assistance. To some extent, the design of these indices was limited by the data available at that time to rate projects being considered for Fiscal Year 1985 funding. Several compromises were made in

formulating the indices so that it would not be necessary to ask, with a very short lead time, that local agencies redo calculations of transportation benefits. Instead, the indices were constrained to use only the information routinely available from the Environmental Impact Statements previously developed for the projects. Since a revision to the May 1984 policy has not been issued, the indices set forth in the policy remain in effect and must therefore be developed as part of the cost-effectiveness calculations. Appendix F provides a detailed description of these indices and their use in UMTA's evaluation of projects.

The policy defines indices of cost-effectiveness that UMTA uses to assess proposed major investments. The indices are analogous to the measures defined in Equations 9-10 through 9-13 above in examining the total, local, and Federal perspectives on the investment. The indices differ from the measures recommended above only in their representation of travel benefits. The indices take the form:

$$(9-15) \quad \text{Incremental Index} = \frac{\Delta \$CAP + \Delta \$O\&M + \Delta \$TT}{\Delta \text{RIDERS}}$$

where the Δ 's represent incremental changes in costs and benefits compared to the TSM alternative, and

$\$CAP$ = total capital costs, annualized over the life of the project;
 $\$O\&M$ = annual operating and maintenance costs;
 $\$TT$ = annual value of traveltime savings for existing riders;
 RIDERS = annual transit ridership, measured in "linked" trips.

The local and Federal perspectives are represented in analogous indices that substitute, respectively, the annualized local share and the annualized Federal share for $\$CAP$.

Several weaknesses are readily observed in the current methods used to compute the "per-trip" indices:

1. The use of "new transit trips" is not an accurate measure of the benefits associated with a trip diverted to transit. Differences between alternatives in terms of average trip distances can introduce distortions when these differences are ignored. The most extreme example of this distortion would occur in comparing a very long trip diverted to commuter rail alternative with a very short trip diverted to a downtown people mover alternative.
2. A denominator consisting only of "new transit trips" makes the indices highly volatile for those projects with small gains in transit ridership. Where few new riders are expected, small changes in this value can change the overall index substantially.
3. Some alternatives may have no impact on transit ridership but provide a large improvement in service for existing riders. Indices cannot be computed for these alternatives because the denominators are zero.

4. Benefits are valued in two different units, making it difficult to judge the overall benefits of an alternative. Benefits to existing riders are valued in terms of "hours of travel time saved," while benefits to new riders are valued simply as "new trips."
5. Because the value of travel time savings can become quite large, it is possible for the numerator of the indices to be negative. When this occurs, the indices behave poorly and preclude comparisons between alternatives that have negative indices (though it remains clear that these projects are more cost-effective than those with positive indices).
6. In cases where some alternatives include HOVway components, the definition of a "new trip" becomes a problem. Since the formation of new carpools and vanpools is an important effect that should be included, new trips are defined to include new HOV trips as well. The equivalence between transit and HOV trips is not complete, however. A thousand persons carried on 25 peak-period buses are likely to have different travel impacts from the same thousand travelers carried in 333 carpools, at least in terms of parking requirements and off-HOVway congestion.

Therefore, UMTA recommends that the primary measures of cost-effectiveness for alternatives analysis be the user-benefits measures defined earlier, with the "per-trip" measures used only in the interim pending a change in UMTA's Major Investment Policy.

9.4 Financial Feasibility

Chapter 8 of this part of the guidance outlines the financial analysis appropriate to this stage of project planning. The financial analysis establishes 1) the funding requirements for both the capital and operating costs of each alternative, 2) the projected yields from existing sources of funds used to support transit, 3) the potential yield from other possible funding sources in cases where existing resources are not sufficient, and 4) measures of the feasibility of the alternative financing packages assembled for each guideway alternative.

The task remaining for the evaluation of the alternatives is to use the measures of financial feasibility to examine the likelihood that sufficient existing and, where necessary, additional funding sources would be available to cover the capital and operating costs of each alternative. The selected measures should be a relatively few key indicators of financial impacts. Three kinds of indicators can be used in this analysis. First, for existing sources that are dedicated entirely to transit, the surplus or deficit of projected funds compared to projected needs is likely the best indicator of financial capability. For new sources, discussion of the steps necessary to develop the source is a primary concern. This discussion would identify the necessary major actions -- referenda, local legislation, State legislation, etc. -- and, to the extent possible, the likelihood of success given past experience with similar efforts. Finally, for new sources or for existing sources that are not dedicated entirely to transit, ratios can be constructed

to illustrate the size of the transit requirement in comparison with various measures of financial capability. For example, where transit is currently funded as a budget line item of local government, a useful measure is the current and projected percentage of the total budget necessary for transit. This measure reflects the need for transit assistance, the total resources available to the local government, and the needs of other local governmental functions. A second example would be measures of the financial feasibility of value capture mechanisms that indicate the fractional change in profitability of development within a value capture district.

In sum, the evaluation of financial feasibility presents measures of the impact of projected transit assistance needs on existing and potential sources of funds. While the measures themselves are rarely conclusive indicators of financial feasibility, they help to define for local and Federal decision-makers the financial context in which the selection of an alternative is made.

9.5 Equity

Equity issues are those concerned with the distribution of the costs and benefits of an alternative across the various subgroups in the region. Equity considerations generally fall within three classes. First is the extent to which the transit investments improve transit service to various population segments, particularly those that tend to be transit-dependent. Second is the distribution of the costs of the project across the population through whatever funding mechanism used to cover the local contribution to construction and operation. Third is the incidence of significant environmental impacts.

Each of these classes of impacts should be pursued to the extent that they are identified as areas of concern by the Technical Advisory Committee or by other groups contacted through the study's public participation process. Where appropriate, there are analytical techniques available to quantify several measures of the distribution of costs and benefits. For the distribution of service improvements, the demographic data and transit network information developed in the travel forecasting work provide a wealth of data on service changes for individual market segments. Processing of this information for an equity analysis is straightforward and is outlined in Chapter 6 of this document. The tax-burden implications of any funding mechanism can be explored to the extent necessary with standard financial analysis techniques described in Chapter 8. Finally, the environmental analysis provides an inventory of likely impacts on neighborhoods, residences, and businesses that can be used to quantify the extent to which specific population groups would be adversely affected by any of the alternatives.

9.6 Trade-Off Analysis

Thus far, the evaluation has proceeded sequentially through four perspectives, examining each alternative in turn. The purpose of the trade-off analysis is to pull together the key differences among the alternatives across all of the perspectives. It is designed to take the broadest view possible, highlighting for decisionmakers the advantages and disadvantages of each option and pointing out the key trade-offs of costs and benefits that must be made in choosing a course of action.

As in much of the evaluation, the content and approach to the analysis is dependent upon local goals and objectives and the alternatives considered. Perhaps the most important component of a successful trade-off analysis is its assignment to an analyst who is able to take a broad perspective on the purpose of the transportation improvement and the merits of the alternatives, and who has strong writing skills. Together with reviews by the Technical Advisory Committee, the analyst's insight and reasoning are indispensable to a result that aids local officials in the choice of an alternative.

Several examples can be used to illustrate the kinds of trade-offs that might be found in a set of alternatives. One frequently-found trade-off is that between effectiveness and cost-effectiveness. One alternative may yield a modest level of transit improvement at a highly cost-effective return on the investment, while a second may yield greater improvements at such a high cost that its overall cost-effectiveness is lower. In this case, the trade-off analysis should point out that the second alternative provides a higher level of benefits, but that the marginal benefits are purchased at a relatively costly rate of return.

Another frequent example is the trade-off between effectiveness and financial feasibility. Often, the alternative providing the greatest improvements in transit service is also the most costly and would require a significant increase in the annual investment made by the local area in transit. The trade-off analysis should highlight the additional commitment by the local governments — and possibly the equity implications of the means used to finance this commitment — necessary to implement this alternative.

The major task of the trade-off analysis, then, is to reduce (to the extent possible) the vast amount of information developed during the analysis to those essential differences between the alternatives. Its purpose is to frame the decision on a preferred alternative in terms of the advantages of choosing one option compared to the foregone advantages of options not chosen.

9.7 Contents of the Report on Evaluation Methodology

The purpose of the evaluation methodology report is simply to outline the measures that will be used to quantify the degree to which each alternative meets the stated goals and objectives. The report presents each objective, identifies the measure(s) proposed for that objective, and describes the source of the measure. The report provides a means for local decisionmakers and technical staff to agree on a meaningful set of measures, and alert the responsible technical staff of the evaluation data needed from the analysis.

Where local officials propose an additional approach to cost-effectiveness analysis, beyond that needed for UMTA's evaluation, the methodology report must address the soundness of the proposed method. This requires demonstration that the method addresses both incremental and average cost-effectiveness, isolates the benefits attributable only to the major investment alternatives, and uses a measure of benefits that is accurate and unbiased.

PART III

The Decisionmaking Process

REVIEW DRAFT

September 1986

Urban Mass Transportation Administration

Office of Planning

Office of Methods and Support

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III.1. The Draft Environmental Impact Statement

Under the National Environmental Policy Act (NEPA) of 1969, Federal agencies must prepare an environmental impact statement (EIS) for any major action they undertake which may have a significant effect upon the human environment. Requirements established under NEPA and other environmental laws have been merged into UMTA's planning and project development process. The draft EIS — or, on occasion, an environmental assessment (EA) — summarizes the results of the various technical analyses conducted as part of the alternatives analysis. The environmental document is then circulated for public review and comment. Following the circulation period, local officials select their preferred alternative and transmit a preferred alternative report to UMTA, usually with a request to proceed into the preliminary engineering phase. The final EIS is prepared during preliminary engineering.

This chapter provides guidance on the development and circulation of the draft EIS or EA.

1.1 Background

FHWA and UMTA have published joint regulations (23 CFR Part 771) that spell out requirements for the preparation of EIS's and EA's (Appendix C). The regulation incorporates the requirements of DOT Order 5610.1C, Procedures for Considering Environmental Impacts, and sets forth procedures for complying with other environmental laws, principally section 4(f) of the Department of Transportation Act. The regulation establishes the specific requirements that must be followed by FHWA and UMTA, and by applicants for grants, permits, and other actions from those two agencies.

The Council on Environmental Quality (CEQ) has also promulgated regulations for Federal agencies to follow when implementing the procedural provisions of NEPA (Appendix D). These regulations are an integral part of FHWA's and UMTA's environmental requirements. The FHWA/UMTA regulation does not paraphrase the CEQ provisions. Thus, local agencies performing an alternatives analysis should consult both the CEQ regulations and the UMTA/FHWA regulations for requirements applicable to the preparation of environmental documents.

Paragraph 771.115 of the UMTA/FHWA regulations identifies three classes of actions which prescribe the level of documentation required in the NEPA process:

Class I: actions that may significantly affect the environment, and which require an EIS;

Class II: actions which do not individually or cumulatively have a significant effect on the the environment. These are called categorical exclusions, and neither an EIS nor an EA are required.

Class III: actions in which the significance of the impact on the environment is not clearly established. An environmental assessment is prepared leading to a decision to prepare an EIS or to issue a finding of no significant impact (FONSI).

New guideway systems or extensions to existing systems are generally considered to be Class I. Accordingly, nearly all alternatives analyses include preparation of a draft EIS. However, an EA has been prepared in a few cases where the only guideway alternatives considered involve the construction of busways in the median of existing freeways.

Draft EIS's and EA's prepared during alternatives analysis will usually differ from those prepared for UMTA projects that do not involve fixed guideways. The alternatives analysis EIS or EA serves as a decision document for the selection of a preferred mode and general alignment alternative. It presents the kinds of technical information that are germane to decisions at this scale. Often, detailed analyses of site specific environmental impacts are not included because such impacts depend more on the final alignment of the guideway than upon the mode and general alignment. In most cases these impacts can best be considered during the preliminary engineering phase when specific alignment and design options are considered. For the same reason, mitigation options are not usually analyzed in great depth during alternatives analysis, and commitments to specific mitigation measures may be premature at this stage. Draft EIS's that do not involve fixed guideways will normally contain more site specific information on anticipated impacts and mitigation options.

When site specific environmental impacts are not analyzed until preliminary engineering, however, the process must accommodate the need for public review and comment on site specific environmental impacts and alignment/design options. It may then be necessary to prepare a supplemental draft EIS during preliminary engineering. Local agencies may want to consider, during the scoping process, whether to consider alignment options and site-specific environmental impacts during alternatives analysis. While such analyses may add to the complexity, cost and duration of the alternatives analysis study, they may possibly reduce the need for a supplementary draft EIS during preliminary engineering.

1.2. Development of the Draft EIS or EA

NEPA and CEQ Guidance. CEQ's regulations set forth a number of principles that should guide the development of environmental documents. With regard to the timing of the EIS or EA, CEQ requires that environmental information be made available to public officials and citizens before decisions are made and before actions are taken. The NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment. This is best accomplished if the NEPA process is integrated with other planning at the earliest possible time.

As to content, the EIS or EA should contain information that is of high quality, based on accurate engineering and technical analyses. It should focus on the issues — transportation needs and benefits as well as social, economic, and environmental impacts — that are truly significant to the action in question. That is, the EIS should be analytic rather than encyclopedic. In order to define issues sharply, the EIS should focus on presenting the impact of the various alternatives in comparative form, providing a clear basis for choice among options by the decisionmaker and the public. To help the decisionmaker and the public understand what are, in many cases, complex issues and tradeoffs, the EIS should be written in plain language, and should be no longer than absolutely necessary to comply with NEPA and CEQ regulations. Length will be a function of the magnitude of the issues to be covered, but CEQ suggests that most EIS's should be less than 150 pages long. Proposals of unusual scope or complexity — as is often the case with a fixed guideway transit project — may require an EIS of as many as 300 pages.

CEQ stresses the importance of a clear format, one that will encourage good analysis and clear presentation of alternatives. Its regulations provide a recommended format consisting of:

- a. cover sheet
- b. summary
- c. table of contents
- d. purpose of and need for action
- e. alternatives including proposed action
- f. affected environment
- g. environmental consequences
- h. list of preparers
- i. list of agencies, organizations, and persons to whom copies of the statement are sent
- j. index
- k. appendices (if any)

UMTA Outline. Since UMTA has merged the NEPA process with the project planning process, we have developed our own outline for EIS's prepared as a part of alternatives analysis. This outline is provided in Appendix L and summarized in Figure III-1.1. As shown, UMTA's outline adds two chapters to the ones recommended by CEQ: transportation impacts and evaluation. The transportation impacts chapter reflects the importance of travel benefits to the choice of an alternative. The evaluation chapter recognizes that alternatives analysis often involves a large number of complex technical issues, and that decisionmakers may be overwhelmed with information on the pros and cons of various alternatives. The evaluation chapter organizes this information and highlights the most important differences between the alternatives, so as to help decisionmakers select the preferred alternative.

The UMTA outline reflects CEQ's guidance on the principles that should guide preparation of the EIS. It calls for a strong focus on alternatives, emphasizing key issues and trade-offs. Since the EIS is meant to be the decision document for the selection of mode and alignment, the document

brings in all factors that have a bearing on that decision, not just those of an environmental nature. Specific provision is made for the development of supporting technical documents.

Enhancing the Effectiveness of the EIS. Care should be exercised in developing the EIS to make the document effective in informing decisionmakers and the public, and promoting an informed decision by local decisionmakers. Based on CEQ's guidance and on UMTA's experience in developing EIS's as part of alternatives analysis, listed below are several principles that should be kept in mind during development of the EIS to help make the document as effective as possible:

- o Keep the document as short as possible, focusing on key differences between the alternatives and trade-offs to be made. This helps reduce the information overload that may occur if the EIS is used to document all technical findings of the study. The series of results reports is better suited to providing detailed documentation.
- o Pay particular attention to providing clear and effective graphics. Maps should clearly illustrate the location of the alternatives in relation to its surroundings. Environmental impact areas — i.e., parklands, flood plains, sensitive noise receptors — should also be portrayed on maps to enhance the readers understanding of potential impacts. Thoughtful use of charts and graphs can convey a lot of information while reducing the volume of the document.
- o Avoid recommending an alternative in the draft EIS. The primary purpose of the draft EIS is to solicit public comment on the alternatives and their impacts before a decision is made on the preferred mode and alignment. When one of the alternatives is recommended in the draft EIS, the reader may easily get the impression that a decision has already been made and that public comment will have no effect. In order to encourage constructive input through the EIS process, the draft EIS should not identify a recommended alternative. However, the evaluation chapter of the draft EIS should clearly spell out the criteria likely to be used to choose an alternative and describe how well each alternative satisfies these criteria.

Where a consensus on one of the alternatives clearly emerges before the draft EIS is circulated, the EIS may note that one of the alternatives is favored by local officials. Otherwise, the draft EIS would not provide all of the information needed for informed public comment. In such cases, however, the EIS should clearly state that a final decision on the locally preferred alternative has not yet been made, and will occur only after the public hearing and completion of the circulation period.

UMTA Reviews. The draft EIS is a Federal document and cannot be circulated until such time as UMTA is fully satisfied with its contents. UMTA is responsible for ensuring that the draft EIS fulfills Federal requirements and presents a complete and objective basis for mode and alignment decisions.

Figure III-1.1: Summary Outline for Draft Environmental Impact Statements
Prepared during Alternatives Analysis

S. Summary

- S.1 Purpose of the DEIS
- S.2 Need for Action
- S.3 Alternatives Considered
- S.4 Costs and Significant Impacts
- S.5 Evaluation

1. Purpose and Need

- 1.1 Need for Transportation Improvements
- 1.2 Planning Context

2. Alternatives Considered

- 2.1 Screening and Selection Process
- 2.2 Definition of Alternatives
- 2.3 Capital Costs
- 2.4 Operating and Maintenance Costs

3. Affected Environment

- 3.1 Land Use and Economic Activity
- 3.2 Transportation
- 3.3 Neighborhoods
- 3.4 Visual and Aesthetic Conditions
- 3.5 Air Quality
- 3.6 Noise and Vibration
- 3.7 Ecosystems
- 3.8 Water
- 3.9 Historic and Cultural Sites
- 3.10 Parklands

4. Transportation Impacts

- 4.1 Transit
 - a. Service
 - b. Patronage
 - c. Farebox Revenues and Operating Deficits
- 4.2 Highway
 - a. Congestion
 - b. Access to Stations
 - c. Parking
- 4.3 Freight Movements

Figure III-1.1: Summary Outline for Draft Environmental Impact Statements
Prepared during Alternatives Analysis (Continued)

5. Environmental Consequences

- 5.1 Land Use and Development
- 5.2 Displacements and Relocation of Existing Uses
- 5.3 Neighborhoods
- 5.4 Visual and Aesthetic
- 5.5 Air Quality
- 5.6 Noise and Vibration
- 5.7 Ecosystems
- 5.8 Water
- 5.9 Energy
- 5.10 Historic, Archeological and Cultural Impacts
- 5.11 Parklands

6. Financial Analysis and Evaluation of Alternatives

- 6.1 Financial Analysis
- 6.2 Comparative Benefits and Costs

To ensure that the document is acceptable to UMTA, local agencies should give UMTA staff opportunities to participate in the development of the document. The Purpose and Need chapter is drafted during the scoping phase and transmitted for UMTA review and comment. For other chapters, UMTA involvement normally begins once agreement has been reached on the technical results of the study. Local agencies are urged to transmit individual draft EIS chapters as they are developed so that UMTA input can be obtained early in the preparation process. Once UMTA comments on individual chapters have been addressed, the entire document is assembled and submitted for review and comment. Once comments are received, the final draft is prepared and transmitted for approval of circulation. On occasion, additional iterations are necessary where the final draft is not fully responsive to UMTA comments.

In most cases, UMTA's review of the EIS will focus on the format and content of the document, since technical issues should be resolved as part of the results reports. This serves to streamline the process for developing and obtaining approval of the EIS. The draft will summarize the results reports and draw attention to key findings.

Once UMTA is satisfied with the draft EIS, the Regional Administrator signs the document and authorizes the local lead agency to authorize distribution. The draft EIS is then filed with the Environmental Protection Agency, and a Notice of Availability is published in the Federal Register. Guidance on these subjects is provided in Section 1.3 below.

Schedule. The process of developing and distributing the draft EIS frequently requires more time than anticipated by local agencies unfamiliar with the EIS process. Table III-1.1 presents a typical schedule for the completion, printing, and circulation process. Two to three months are normally required between the time when UMTA receives the complete draft EIS and the public hearing on the draft EIS. Additional time would of course be required if the draft EIS is not fully responsive to UMTA comments on the individual chapters, or if additional iterations of review and comment are required.

1.3 Circulation

Distribution. During preparation of the draft EIS, the local lead agency should prepare a list of those who will be provided copies of the document. The list should include public officials, private interest groups, members of the public having the potential to be directly affected, and others expressing an interest. Copies should also be provided to government agencies expected to have jurisdiction or responsibility over or interest or expertise in the alternatives. Public libraries in the project area and A-95 clearinghouses should also receive copies. Appendix K lists the Federal agencies that should receive copies of the draft EIS, and provides their addresses and number of copies desired.

Printing and mailing of the draft EIS is normally the responsibility of the local lead agency.

Table III-1.1: Typical Schedule for DEIS Completion,
Printing, and Circulation

Activity	days		cumulative days	
	min.	max.	min.	max.
Local lead agency transmits to UMTA (HQ 5 copies, region 5 copies) a final DEIS that responds to comments UMTA and other participating agencies made on review draft.	1	1	1	1
UMTA reviews, then transmits any final comments to local agency	7	14	8	15
Revised DEIS is prepared and submitted by local lead agency	0	14	8	29
UMTA prepares DEIS package for signature and transmits signed cover page to local agency	5	7	13	36
Local agency prints and distributes DEIS while UMTA files 5 copies with EPA	7	14	20	50
EPA publishes Notice of Availability in Fed. Register.	7	13	27	63
Circulation period before public hearing.	30	30	57	93

Note: The duration estimated for each activity is based on recent experience in the completion of alternatives analyses and circulation of the resulting DEIS's. Unforeseen circumstances may lengthen the time needed for one or more of the activities.

Filing with EPA. The UMTA regional office is responsible for filing the signed EIS with the Environmental Protection Agency. Five copies should be filed at EPA Headquarters in conjunction with the local distribution. The address is:

Environmental Protection Agency
Office of Federal Activities (A-104)
401 M Street, SW
Washington, DC 20460

EPA will provide a receipt if a self addressed envelope is provided with the transmittal package.

Upon receipt of the draft EIS, EPA publishes a Notice of Availability in the Federal Register. Such notices are always published on the second Friday after EPA receives the document. This means that, to get the notice published on a certain Friday, the DEIS must be received by EPA no later than the previous Friday. The date the Notice of Availability appears in the Federal Register marks the beginning of the DEIS circulation period.

Circulation period. The draft EIS circulation period is normally 45 days. On occasion, however, requests for an extension of the circulation period are made by public officials, agencies, or private citizens. The local lead agency and UMTA then confer on the need for an extension and, if an extension is deemed appropriate, UMTA will ask EPA (at the above address) for an extension. EPA must receive the request with enough lead time to publish a new notice in the Federal Register before the current circulation period ends. As with the Notice of Availability, the request must be received at least one week before the Friday when publication is desired.

Comments on the draft EIS may be addressed to either the local lead agency or to the UMTA regional office. Although the Draft EIS cover sheet will indicate which agency should receive the comments, often some comments are addressed to one agency, some to the other. The local lead agency and UMTA regional office should make arrangements to ensure that both have a complete set of comments by the end of the circulation period. UMTA should also receive a copy of the public hearing transcript (see Section 2.3) no later than the time when the preferred alternative report is transmitted.

A definitive response to all comments received will appear in the final EIS prepared during preliminary engineering. As noted in the following chapter, the preferred alternative report should contain a summary of the comments and responses to those of particular significance.

1.4 The Public Hearing

Under current regulations, a public hearing must be held no sooner than 30 days into the draft EIS circulation period. UMTA has proposed that a 15-day minimum period be adopted, but this proposal has not yet been adopted. If the new UMTA environmental regulation is released, they should be consulted to determine if this change has been made.

The location of the public hearing and its timing should be convenient to the public and agencies involved. In cases where distance or geography make no one location convenient to all concerned, the local agency should consider two or more public hearing sessions at different locations.

Local notices of the hearing should appear concurrently with the Federal Register notice. These advertisements should be prominently displayed in general circulation local newspapers and in local newspapers that are widely read by corridor residents. The notice should describe the alternatives and their significant impacts; a map of the corridor and alternatives should be included if possible. Each local notice should state the date, time, and place of the public hearing and invite public and agency comments. Where a significant number of corridor residents do not speak English, non-English advertisements should be seriously considered.

The preparation for the public hearing is similar to that for the scoping meeting. Adequate staff should be available as well as a stenographer to prepare a verbatim transcript. Handouts, maps, visual aids, and oral presentations should be prepared in advance.

The hearing is conducted by the local agency with the optional participation of UMTA. The formal presentation should summarize the major points of the DEIS in a concise manner. Included in this presentation should be a summary of the problem, alternatives, impacts, the next steps in the project development process and the local decision process. Procedures for the presentation of written and oral comments are left up to the local agency.

III.2. Selection of the Locally Preferred Alternative

After the circulation of the draft EIS and after the public hearing, local officials select their preferred alternative from among those presented in the draft EIS. The selection is then documented in a Locally Preferred Alternative (LPA) Report, which is transmitted to UMTA with a request to approve the initiation of preliminary engineering. Transmittal of the LPA report to UMTA completes the alternative analysis phase.

This chapter provides guidance on the local decision process and preparation of the locally preferred alternative report. It also explains the process UMTA follows in deciding whether to advance the locally preferred alternative into preliminary engineering.

2.1 Local Decision Process

The locally preferred alternative is chosen after the end of the 45-day draft EIS circulation period. At this point in time, all of the technical information needed to support an informed decision has been completed and interested agencies and the public have had a full opportunity to review and react to this information.

The decision process will vary from place to place. Normally, the policy body of the local agency conducting the alternatives analysis will take a position on the preferred alternative, as will the policy body of the agency that will be responsible for implementing the project. Depending on local procedures, jurisdictions along the route may also need to endorse the decision. The only applicable UMTA requirement is that funds for the subsequent preliminary engineering phase must appear in the region's transportation improvement program (TIP). Hence, agencies that have a say in what projects will be included in the TIP should be involved in selecting the locally preferred alternative.

Similarly, the criteria on which the local decision is based will vary from place to place. If the alternatives analysis study has been properly designed and carried out, the technical information presented in the draft EIS and the results of the circulation/hearing process should provide a sound basis for the decision. The Financial Analysis and Evaluation of Alternatives chapter of the draft EIS should be particularly useful. Of course, local decisionmakers will want to consider the technical findings of the analysis in the context of their own objectives and values. The selection of a locally preferred alternative is a political decision, not a technical one.

2.2 The Locally Preferred Alternative Report

The LPA report informs the public, UMTA, and other interested parties of the local decision to choose an alternative, and presents the basis for that choice. It briefly responds to comments received during the circulation/hearing process, explaining how these comments were taken into account in the decision process. In addition, the report presents a financing plan showing how local officials expect to obtain funds to build and operate the project.

The LPA report is transmitted to UMTA together with a request for approval to initiate preliminary engineering. Accordingly, it should contain all of the information UMTA will need to decide whether or not to participate in preliminary engineering (see Section 6.3). Of particular importance to this decision is the project's cost-effectiveness when compared with lower cost alternatives. In nearly all cases, this information can be drawn directly from Chapter 6 of the draft EIS.

The LPA report should also contain the information UMTA would need to evaluate the project under UMTA's new starts rating system. The two primary criteria for this evaluation are cost-effectiveness and local financial effort. The cost-effectiveness information needed for the ratings is the same as that used to address the threshold criteria. To evaluate local financial effort, UMTA will need information on the proposed non-Federal capital contribution, the strength of the proposed capital financing plan including provisions to fund potential project cost overruns, and the stability and reliability of sources of operating deficit funding. A description of the information UMTA requires to evaluate local financial effort is provided in Appendix G.

The LPA report should not be lengthy. While the report should stand alone as documentation of the local decision, it need not reiterate all of the information contained in the draft EIS. Summaries of the draft EIS, together with appropriate references, are preferable. Information that is not covered in the draft EIS -- such as the financing plan -- would of course be presented in more detail.

There is no standard format for a LPA report. However, the outline shown in Figure III-2.1 has been used several times and has been found to meet UMTA's needs. Local agencies may modify this outline to suit their needs, but should consult with UMTA before making major changes.

2.3 UMTA Decision Process

Once the LPA report has been submitted, UMTA is in a position to decide whether or not to participate in preliminary engineering phase. Preliminary engineering may not be initiated without the prior approval of the UMTA Administrator. To cause this decision to occur, UMTA staff prepares a technical assessment of the locally preferred alternative's cost-effectiveness and financial plan, paying particular attention to

Figure III-2.1: Outline of Locally Preferred Alternative Report

Executive Summary

I. Background

- A. Need for Action
- B. Development and Description of Alternatives
- C. Public Involvement Program

II. Description of the Preferred Alternative

- A. Physical Description
- B. Operations Description
- C. Summary of Major Characteristics
- D. Capital and Operating Costs

III. Selection of the Preferred Alternative

- A. Selection Process
- B. Evaluation Criteria
- C. Rationale for Choosing the Locally Preferred Alternative

IV. Project Financing Plan

- A. Multi-Year Schedule of Outlays
- B. Existing Revenue Sources to be Used
- C. New Revenue Sources to be Obtained
- D. Stability and Reliability of Existing and New Revenue Sources

V. Project Implementation

- A. Project Development Process
- B. Outstanding Issues
- C. Implementation of the Financing Plan
- D. Required Approvals
- E. Schedule

Appendices

- A. Summary of Comments and Responses
- B. Letters and Resolutions Endorsing the Preferred Alternative
- C. Drawings of the Preferred Alternative
- D. Supporting Materials on Local Financial Effort

the threshold criteria established under the major capital investment policy. An action memorandum is then written to the Administrator presenting options and recommendations.

Two threshold criteria apply at the end of alternatives analysis:

- o The locally preferred alternative must produce a gain in transit ridership, compared to the transportation system management (TSM) alternative. This threshold is designed to ensure that potential major Federal capital investments provide transportation benefits above and beyond those that can be achieved through lower cost (TSM) improvements.
- o The locally preferred alternative must not have an excessive cost-effectiveness index. The threshold value for the total cost-effectiveness index for the FY 1986 rating was set at \$6.00 per new daily transit rider. (The threshold value was based on a generous estimate of the annualized operating cost, parking cost and travel time savings for a typical auto commuter who shifts to transit because of the fixed guideway project. The cost estimate was then multiplied by a factor of two primarily to recognize the presence of indirect social and environmental benefits of transit.)

In addition, although not a threshold test, UMTA requires a "buy-back," or increase in the local capital contribution, if a project does not produce more benefits than a less costly guideway alternative. UMTA will check to see if this "buy-back" has been reflected in the project financing plan. A thorough discussion of the buy-back feature is contained in Appendix F, "A Detailed Description of UMTA's System for Rating Proposed Major Transit Investments."

When the locally preferred alternative achieves the threshold tests, local officials can normally expect that the UMTA Administrator will approve the initiation of preliminary engineering. But approval is not automatic. The decision could be affected by the amount of Federal construction funds reasonably expected to be available over the near term and the merit of other competing projects. UMTA may, in approving preliminary engineering for the locally preferred alternative, request that one or more additional alternatives be studied concurrently with the locally preferred alternative. Or, UMTA may suggest that other possible options be pursued instead of the locally preferred alternative. Even with a favorable action on approval, the decision to initiate preliminary engineering should not be construed to represent an UMTA commitment to final design or construction.

With transmittal of the locally preferred alternative report, UMTA will also begin to evaluate the project under its new starts rating system. The rating system is a tool UMTA uses to compare candidates for Federal discretionary funding and to identify those most worthy of UMTA support. Under UMTA's Major Capital Investment Policy, ratings are to be developed each year to guide budget decisions for the succeeding fiscal year. Initial ratings are based upon cost-effectiveness and local financial effort data developed by local agencies during alternatives analysis. These ratings are

subsequently updated as the project moves through preliminary engineering. At the conclusion of preliminary engineering, the ratings are used in making a decision on the allocation of discretionary program funds for final design and eventual construction. The UMTA rating system is further described in Appendices F and G.



Appendix A

UMTA's Major Capital Investment Policy



DEPARTMENT OF TRANSPORTATION**Urban Mass Transportation Administration****Urban Mass Transportation Major Capital Investment Policy**

AGENCY: Urban Mass Transportation Administration, DOT.

ACTION: Notice of policy and request for comments.

SUMMARY: The Urban Mass Transportation Administration (UMTA) is issuing a policy statement regarding Federal financial support for major urban mass transportation capital investments. This policy statement sets forth UMTA's criteria for evaluating proposals for new fixed guideway systems and extensions of existing systems. The statement supersedes previous policy guidance published in the *Federal Register* on September 22, 1976, March 7, 1978, and October 30, 1980, and relates the evaluation criteria contained herein to existing regulations concerning the project development process and procedures for major capital investment projects.

DATE: This policy is effective May 18, 1984. Comments on this policy statement should be received by July 17, 1984.

ADDRESS: Comments on this notice should be submitted to UMTA Docket Number 84-B, Urban Mass Transportation Administration, Room 9228, 400 Seventh Street SW., Washington, D.C. 20590. Comments may be inspected by the public at this address, Monday through Friday between 8:30 a.m. and 5:00 p.m.

FOR FURTHER INFORMATION CONTACT: Mr. Charles H. Graves, Director, Office of Planning Assistance, Room 9311, (202) 426-2360. Kenneth Butler, Associate Administrator for Budget and Policy, Room 9310, (202) 426-4050.

SUPPLEMENTARY INFORMATION:**Requests for Comments**

This policy is being made effective immediately in order to permit potential applicants for major capital investment projects and the public the greatest possible notice of the policy UMTA will follow in evaluating requests for Federal financial assistance. However, UMTA is aware that changes, clarifications, and refinements may be necessary to this policy.

Therefore, UMTA will accept comments for sixty days from the date of the publication of this notice. Following the end of the comment period, UMTA will review the comments and publish another notice in the

Federal Register. This notice will respond to the comments and, if appropriate, make changes to the policy statement.

Notice of Proposed Rulemaking

The material in the "Project Development Process and Procedures" section of this notice sets out in detail the process applicants should follow in order to be eligible for Federal financial assistance for major capital investment projects. In order to maximize the availability of this information to the public, UMTA will propose that it be published in the Code of Federal Regulations. Accordingly, UMTA will publish for comment a notice of proposed rulemaking (NPRM) in conjunction with the notice responding to the comments on the policy notice being published today.

Issued at Washington, D.C., this 15th day of May 1984.

Ralph L. Stanley,
Administrator.

MAJOR URBAN MASS TRANSPORTATION CAPITAL INVESTMENTS STATEMENT OF POLICY**Purpose**

This policy defines the process applicants must follow in developing major urban mass transportation investment projects so that they can be considered for capital grants from UMTA. It also defines the process UMTA will follow in evaluating proposals and in allocating discretionary funds for such projects.

Scope

The policy is applicable in particular to proposals for discretionary grants authorized by Section 3 of the Urban Mass Transportation Act of 1964, as amended, and 23 U.S.C. Section 103(e)(4) (Interstate Transfer Program). In addition, it applies to grants under the authority of Sections 5, 9 and 9A of the Act, and 23 U.S.C. Section 142 (Federal-Aid Urban System Program) if they supplement discretionary grants; if not, the policy only applies as to the project development process described herein and the threshold criteria for approval of fixed guideway projects.

For purposes of this statement, a "major urban mass transportation investment" is any project that involves the construction of a new fixed guideway segment, or extension of an existing fixed guideway, for use by buses or rail vehicles. A "fixed guideway" is a facility which utilizes and occupies a separate right-of-way, reserved lanes, or rails. This includes

but is not limited to, rapid rail, light rail, commuter rail, automated guideway transit, people movers, and exclusive facilities for buses and high occupancy vehicles. The construction of short busway facilities for the purpose of localized operational improvements, or to enhance access to terminals or stations, will not be considered major urban mass transportation investments. Typically, the cost of a major investment will be in excess of \$100 million.

Projects to rehabilitate or modernize existing fixed rail lines are outside the scope of this statement. However, major elements of modernization programs (e.g., electrification of existing services) may be financed under full funding contracts, and be subjected to similar evaluation to ensure the cost-effective use of Federal discretionary funds.

Background

The Federal Government has provided a large share of the Nation's capital investment in urban mass transportation since the early 1970's. By the mid-1970's, because of the magnitude and scheduled duration of commitments being proposed, the Department found it useful to publish a statement of Federal policy to ensure that available Federal resources would be utilized in the most prudent and effective manner. Such a statement was issued in 1976, and was supplemented and revised in 1978 and 1980. Today, the need for a restatement of principles and improvement in procedures is even more urgent. Despite the passage of the Surface Transportation Assistance Act of 1982, which earmarked one cent of the increased motor fuel tax to the Mass Transit Account of the Highway Trust Fund, the amount of Federal funding available to support major fixed guideway transit investments will continue to be limited. For example, the full demand for projects currently earmarked by the Congress exceeds the amount of money available within current authorizations by a factor of approximately four, and the demand for other projects undergoing study exceeds available authorizations by a factor of more than ten. A brief review of the elements of the earlier statements, and of the current statement, puts the problem in perspective.

Earlier Statements

The 1976 policy statement established a process-oriented approach, designed to allow each urban area to take into account its unique characteristics in the planning, design and implementation of transportation improvements. It required as a condition of eligibility for Federal

assistance that alternative investment strategies be considered in order to determine which investment best served the locality's transportation needs, promoted its social, economic, environmental, and urban development goals and supported national aims and objectives. Cost-effectiveness was defined in these general terms and a demonstration of cost-effectiveness was required for projects to be advanced for Federal funding assistance. The 1976 statement stressed the need to consider combinations of transit modes and technologies appropriate to the transportation service requirements of specific corridors, and required major fixed guideway systems to be implemented incrementally, with priority given to the most immediate needs of the locality. It called for a comprehensive Transportation System Management (TSM) alternative to represent the best that can be done to improve transit service without making a major capital investment. It also called for actions to enhance a project's accessibility and convenience, and to improve the quality of transportation service in other parts of the metropolitan area which would not be served by the fixed guideway project. These TSM actions typically include expanded bus service, paratransit, ridesharing, traffic engineering and regulatory and pricing strategies, but not fixed guideways, to facilitate transit and high-occupancy vehicle flow on existing highway facilities. Finally, the 1976 statement emphasized the importance of public involvement throughout the development process.

The 1978 policy reinforced the 1976 policy and added further considerations. It explicitly stated that approval of a preliminary engineering grant would not imply any commitment to finance construction of a project. It required the development of a stable and reliable source of funding to cover operating deficits, and specified that construction grant contracts would be negotiated with a fixed ceiling on the Federal contribution, subject to a defined method of adjustment for inflation (the full funding contract). The 1978 statement suggested that the formal pledge of assistance known as the Letter of Intent be considered after preliminary engineering. Finally, it required commitment to a program of local supportive policies and actions to enhance prospects for economic viability of fixed guideway projects; for example, zoning policies and development incentives to stimulate high density private real estate

development around selected transit stations.

The 1980 revised policy linked project development procedures more closely to the environmental impact statement (EIS) process. It allowed conceptual engineering studies during the preparation of the alternatives analysis and draft EIS, and completion of the final EIS during preliminary engineering rather than before that stage. It specified that a Letter of Intent would be considered only upon completion of circulation of the final EIS, and that it had to be based upon a comparison of the proposed project with other projects than pending. However, neither this statement nor the earlier ones specified how such an intercity comparison of projects might be made, describing only a process for sorting out alternatives within each urban area.

Current Statement

The basic policy tenets and processes of the earlier statements are essentially retained and described anew in the section below, entitled Project Development Process and Procedures, which also takes into account recent legislation. The important addition, however, is that UMTA's own evaluation process is made more explicit. The policy describes an intention to use more quantifiable techniques for evaluating proposals. This is done in the section entitled Description of Rating System. In other sections, the policy identifies threshold criteria to be met before a project can be advanced into the alternatives analysis phase. It also sets threshold criteria that must be met before a project can be advanced from the alternatives analysis to the preliminary engineering phase. In these respects, this statement is an attempt to make more operational the policy framework developed in earlier statements. It also responds to the legislative history of the Surface Transportation Assistance Act (STAA) of 1982 which speaks to financing cost-effective fixed guideway projects and to extra local fiscal effort being taken into account. Finally, this statement reflects language in the 1984 Senate Appropriations Report adopted in the Conference Report, suggesting that factors to be considered should include: the results of alternatives analysis, cost-effectiveness, and the degree of local financial commitment including evidence of stable and reliable funding sources to maintain and operate the system; also the degree of local government support, private sector support, community support, and participation of minority business.

The position being taken in this statement is that if these policy tenets are given better definition and clarity in an operational rating system, fixed guideway investments have a place in the array of projects which can be considered for Federal transit funding. The alternative of trying to cope with unconstrained local demand without a clear evaluation system is unworkable.

Description of Rating System

Fixed guideway projects are to be developed in four phases prior to actual construction: systems planning, alternatives analysis, preliminary engineering, and final design. This process is described fully in the section of this statement entitled "Project Development Process and Procedures". Projects contending for discretionary grants are evaluated at two points in this project development process. The first evaluation takes place at the conclusion of the alternatives analysis to provide preliminary information about the relative merits of projects in the pipeline and to make a decision about whether or not to advance a project into preliminary engineering. For those which are advanced, a second and more critical evaluation occurs at the conclusion of preliminary engineering, at which time a decision may be made on the allocation of discretionary program funds for final design and eventual construction. To facilitate allocation decisions in the budget cycle, these evaluations are compiled in the first quarter of each fiscal year to guide decisions for the succeeding fiscal year. At that time the Secretary, the Office of Management and Budget, the Congress and the public will be provided information indicating which projects have completed alternatives analysis and which have completed preliminary engineering and their ratings. An explanatory narrative will accompany the ratings.

Statutory Objectives and Federal Interest

The rating system described below is based on statutory objectives. One such objective, expressed in Section 2 of the Urban Mass Transportation Act, is "to encourage the planning and establishment of areawide urban mass transportation systems needed for economical and desirable urban development . . ."; another is "to provide assistance to State and local governments and their instruments in financing such systems, to be operated by public or private mass transportation companies as determined by local needs."

To make such general objectives operational, the Federal interest expressed in the rating system is the provision of an essential level of urban mobility for the public by financially assisting the development of efficient urban mass transportation networks. It is not an interest in networks which may provide maximum comfort, convenience, amenity and other such benefits. The rating system does not preclude local authorities from proposing projects which tend to maximize such benefits, but it identifies the extra costs and accounts for them in the rating process.

Rating Criteria

The rating system is driven by two primary criteria called out in the 1984 Appropriations Conference Report, cost-effectiveness and local financial commitment. Implicit in the consideration of cost-effectiveness is consideration of the results of alternatives analyses, a third major factor. The Conference Report also recommended four other criteria for evaluating fixed guideway projects. Two of these (the degree of local government support and private sector support) are to a considerable extent subsumed under the local financial commitment criteria; and the remaining two (community support and the participation of minority business) can be considered requirements accounted for respectively during the required public hearing process and by meeting the 10 percent goal specified in Section 105(f) of the STAA of 1982.

Because the two primary criteria, cost-effectiveness and local financial commitment, are quantifiable, it is possible to formulate numerical indices of project merit based on them, as a primary guide to ratings. These two criteria and their use in such indices are therefore given further definition as follows.

Cost-Effectiveness

Cost-effectiveness is represented by the incremental costs and effectiveness of fixed guideway alternatives compared to the Transportation System Management alternative. The TSM alternative consists of improvements to the existing transportation system including such actions as expanded bus service, paratransit, ridesharing, traffic engineering and regulatory and pricing strategies, but does not include fixed guideway investments. Costs and effects are discounted to reflect the different time streams of capital and operating expenditures, ridership, and service improvements as well as the different expected lifetimes of each alternative.

Effectiveness is measured in terms of new riders, travel time savings for existing riders, and operating cost savings.

Additional ridership is used as one measure of effectiveness (or benefit) because it is a good indicator of how well a transit facility will serve future urban travel needs. It is also an accurate index of many of transit's potential secondary benefits, including the structuring of urban development patterns and reductions in congestion, pollutant emissions and energy consumption.

Travel time savings to existing riders is used as a second effectiveness measure since it represents improved travel conditions for existing transit users. In many corridors the principal objective of a major improvement is, in fact, better service for existing transit riders. Where large volumes of transit riders exist, the service improvements which could be enjoyed by these riders constitute a large benefit not accounted for by the additional ridership measure. Improvement in service to existing riders is also a good indicator of improved mobility for the transit dependent and increased accessibility to employment locations. The benefits derived from these time savings are converted to their monetary equivalent using an average value of time.

Savings in operating and maintenance costs also are included in the cost-effectiveness calculations to reflect the potential for improvements in efficiency introduced by new transit facilities.

Together, the attraction of new riders, time savings for existing riders, and operating cost savings are good measures of the benefits that are of primary Federal interest as well as general indicators of a wide range of other benefits associated with major investment projects.

In order to rate major transit projects in terms of their Federal investment worthiness, two cost-effectiveness indices are computed. The first reflects incremental ridership, travel time savings and the operating cost savings noted above, and focuses on the capital costs of specific interest to the Federal Government; namely, total capital costs offset by funds provided by State and local governments and the private sector to match (or overmatch) Federal funds. Overmatch means funds in excess of that required by Federal law. The second cost-effectiveness index is computed on the basis of total operating and capital costs and reflects project merit irrespective of the source of funding.

These indices can be computed as ratios in which capital costs and offsets to cost (e.g., the value of time savings, operating cost savings and non-Federal funds) comprise the numerator, and the number of added riders is the denominator. It should be noted that increases in operating and maintenance cost and increases in travel time of existing transit users will be dealt with as increases rather than as offsets to cost.

In computing both indices of project merit, UMTA will consider the extent to which the alternatives analysis has indicated that another guideway alternative in the corridor would be more cost-effective than the locally preferred project. Where there is a more cost-effective guideway alternative, the rating of the locally preferred project will be reduced.

Furthermore, where there is a lower cost guideway alternative which produces more benefits than the locally preferred project, a larger local capital contribution will be required for an applicant to be able to construct the locally preferred project.

Local Financial Effort

The degree of local financial effort is a particularly important criterion because it will encourage communities to make an extra fiscal effort. Large local capital match will stretch scarce Federal dollars and permit Federal support for a larger number of worthy projects. The development of stable and reliable sources for operating costs will reduce the risk that after making a very large Federal capital investment, local resources will not be available to adequately maintain and operate the transit system. Private sector urban development is also taken into account if private sector commitments to value recapture have been made to financing transit capital or operating costs. This is an indication that developers actually believe in the project.

Local financial effort is incorporated into the rating system in two ways. First, local capital match is valued to the extent that it improves the project's cost-effectiveness index computed in terms of the Federal financial interest. For a given total project cost, a higher local match reduces the Federal capital cost in calculating the index. The second way local financial effort is reflected in the rating process pertains to the stability and reliability of the financial resources to operate and maintain the system once it is built. This will require a judgmental assessment by UMTA and its financial advisors. Among projects which rate similarly in terms of cost-

effectiveness, preference will be given to projects which have long-term, dedicated sources of local funds committed to defray operating deficits; that is, where the community has an established resource stream commensurate in time with the life of the capital asset, or approximating this objective. By contrast, the sharing of a general revenue stream with other municipal services would not enhance a project's standing. Until Federal operating assistance is phased out, any proffered agreement for a long-term limit on the amount of Section 9 funds used for operating assistance would be favorably viewed.

With respect to the source of funds to provide the local share of net project cost, applicants utilizing a cash rather than an in-kind source would be judged to be making the greater local fiscal effort. In any case, in-kind local share would not qualify for overmatch credit.

The stability and reliability of the local commitment to financing the maintenance and operation of fixed guideway projects, including the supporting bus system, will be included in the terms and conditions of the full funding contract (FCC). The local commitment of dedicated sources of local funding to defray operating costs, as well as any agreement to limit the amount of Section 9 funds used for operating assistance.

The Federal Decision Process

The decision process will identify those projects which are clearly superior, those with some merit and

those which are obviously least worthy. Those which rate well on both indices will be placed in the top group and projects which rate poorly on both indices described above in the discussion of cost-effectiveness will be placed in the lowest group. All others will be placed in an intermediate group or groups. The final position of projects within each group will then be determined on the basis of the degree of local financial commitment, particularly the degree to which dedicated local funding sources would be used to maintain and operate the transit system. Projects, however, may ultimately get a better rating as the result of enhanced local financial efforts and/or changes in the project scope, such as changes in project length and design.

This rating system extracts from the technical information two objective indices of project merit. However, it recognizes the margin of error implicit in any forecast and avoids an automatic, discrete ranking of projects on the basis of a single, composite criterion. By avoiding a mechanical reliance on forecast data, it permits the application of informed judgment and emphasis on selected policy objectives. This approach to rating potential investments is similar to that used by private financial institutions to evaluate or grade investment options and assess risk. Private institutions typically use a set of objective criteria to place investment options into broad groups with similar worthiness and then apply judgmental criteria to determine the final ranking of projects within the groups. In the UMTA acting system, the two cost-effectiveness indices are the

objective measures of project merit or investment worthiness, and the degree of stable and reliable financing for operating costs is the judgmental criteria.

As a set of projects is selected annually for Federal support, consideration will be given to the amount of uncommitted funds in the UMTA budget authorization allocated for fixed guideway projects. A Letter of Intent or a full funding contract will not be issued to a single project which would consume all, or substantially all, of UMTA's unobligated budget authority. In addition, the sum of all the Letters of Intent and full funding contracts cannot exceed the unobligated authority.

A detail description of the rating system is available from UMTA's Office of Planning Assistance, 400 7th Street SW., Washington, D.C. 20590, and from UMTA's ten regional offices.

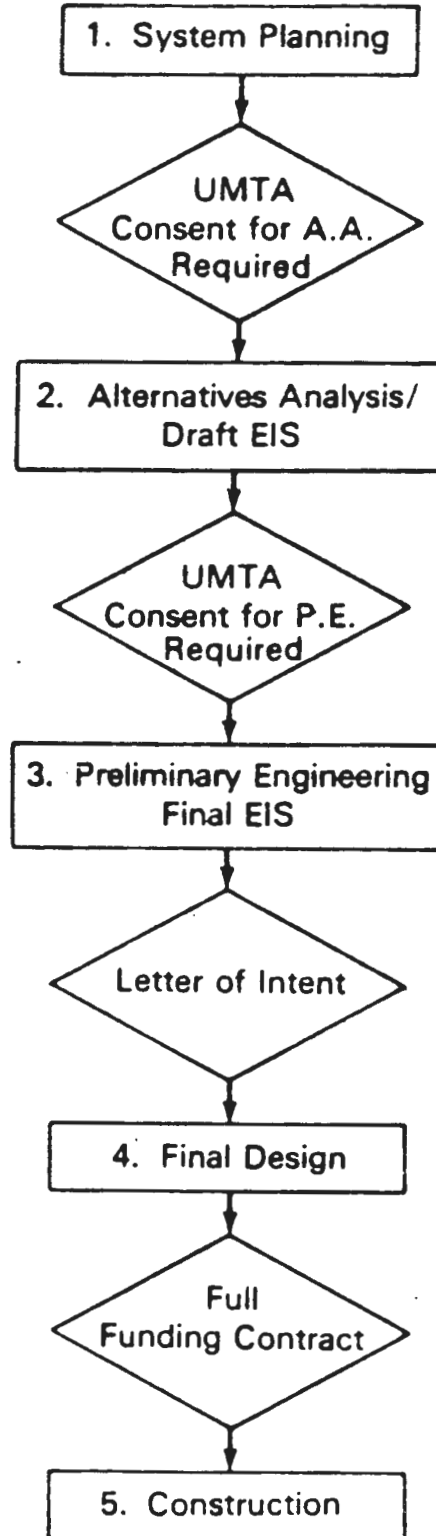
Project Development Process and Procedures

General Description

The process for developing major transit investments includes four general phases prior to actual construction: systems planning, alternatives analysis, preliminary engineering, and final design. Work may not begin on one phase of the process until the prior phase is completed. Approval by the UMTA Administrator is required for a project to advance from one phase to the next. Figure 1 graphically illustrates the development process.

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Figure 1
UMTA Project Development Process
Major Investments



□ Denotes local activities funded by UMTA

◇ Denotes UMTA decision

As proposals are advanced through these phases, estimates of their costs, effects, and impacts (as well as the costs, effects, and impacts of alternative courses of action) are developed and refined. Also, financing plans are developed and local commitments are obtained. This allows local officials and UMTA to identify the options that are most cost-effective and rank well in terms of local financial effort. The application of a similar process for the past several years has shown that a careful and systematic analysis of present and future transportation needs, followed by a detailed analysis of the relative costs and benefits of alternative courses of action for addressing them, does improve the quality of both local and Federal decisionmaking.

Experience with these policies has shown that fixed guideway transit systems are not, in many cases, as cost-effective as less capital intensive solutions to local transportation problems. Nevertheless, rail transit and bus guideway projects may be efficient and cost-effective solutions to local transportation problems in heavily traveled corridors found in some densely populated cities with large concentrations of employment and retail activities.

There should be a full opportunity for the timely involvement of the public, private interest groups, local elected officials, and all levels of government in the planning and project development process for major urban mass transportation investments. This involvement should be initiated early, so that all affected groups have an opportunity to influence the process in a timely and constructive fashion, particularly as to the alternatives to be considered, priority actions for implementation, and the actions to be taken to avoid or minimize adverse environmental effects.

Systems Planning

This first phase of project development is financially assisted mainly by UMTA's Section 8 planning grants together with planning funds provided by the Federal Highway Administration. The grants are made to metropolitan planning organizations (MPO's) to carry out a continuous, comprehensive, and cooperative transportation planning process in each urbanized area. During this phase, local officials examine long-range urban development trends, collect travel data, forecast needs, and evaluate regionwide transportation policies and investment options. Based on their preliminary assessments of travel patterns and problems, local officials select a broad

range of potential solutions for each corridor. If one or more corridors may require a major transit investment, these corridors are ranked by local officials in order of priority, and a small set of potentially cost-effective alternatives for the highest priority corridor is identified for detailed study in subsequent project development phases.

Proposals for major mass transportation investments must be consistent with an urban area's comprehensive plan which articulates the overall direction for metropolitan development and identifies major transportation corridors. The comprehensive plan should reflect an awareness that different levels and types of transportation service may be needed in different portions of the metropolitan area. The comprehensive plan should also recognize the need for local community-level transit service as well as for express line-haul connections that foster regionwide accessibility. Each major corridor should be considered individually to determine the level and type of service that will best meet its projected requirements. Corridors which do not require fixed guideway transit service should be provided with levels and types of service appropriate to their needs, with the level of service being progressively upgraded as demand develops.

The comprehensive plan should be revised periodically as part of the continuing transportation planning process. Plan revisions will allow local decisionmakers to reflect changes in local goals, priorities, and long-range forecasts; respond to new land development and travel patterns; adapt to new technologies as they are developed; and adjust to the impact of previously implemented actions.

Although the comprehensive plan may identify the need for major new transportation facilities in several corridors, a regional system should be developed in stages, one operable segment at a time. Each segment should be capable of independent justification on its own merits. This incremental approach is intended to ensure that the most cost-effective segments receive priority attention, that the burden of financing the system is spread out over time, that the benefits of the public investment begin to accrue as soon as possible, and that maximum flexibility is preserved to modify the system in response to subsequent advances in technology, changes in growth patterns, and other unforeseen circumstances. Case-by-case exceptions may be given where local officials propose to advance

more than one low cost busway at the same time.

Alternatives Analysis

This phase of project development may be financially assisted by Section 8 planning grants, supplemented as necessary by Sections 9 and 9A formula grants. Section 3 funds will not be used for alternatives analysis.

Following systems planning, any metropolitan area which intends to apply for UMTA assistance for a major urban mass transportation investment must next perform a corridor-wide analysis of transportation alternatives in its priority corridor. Approval by the UMTA Administrator is required before such an alternatives analysis may be undertaken. If Section 8 funds are to be used, approval will be given where the results of systems planning demonstrate that there is a reasonable possibility that the fixed guideway alternatives proposed for study will be shown to be cost-effective. Further, as a guide to local authorities, UMTA approval to proceed into this phase can be expected only if certain threshold criteria are met. One such criterion is that a corridor to be studied should be experiencing more than 15,000 existing daily transit trips. In addition, alternatives with excessive costs compared to added benefits may not be advanced into alternatives analysis. More detailed definitions of these and other criteria will be published periodically. If Section 9 or Formula Interstate Transfer funds are to be used, grantees may nevertheless proceed with proposals which do not satisfy the threshold tests. In this case UMTA will transmit a letter of exception to forewarn a grantee that although formula funds may be used for the alternatives analysis phase, it seems unlikely that fixed guideway transit investments in the study corridor would prove to be cost-effective and able to qualify subsequently for UMTA funds. Therefore, UMTA would take exception to the funds being used for the alternatives analysis, although permitting it.

In the alternatives analysis phase the priority corridor is studied in detail, with respect to alternative solutions to the transportation problems identified in system planning. In addition to any high cost options that show promise, the alternative must include both medium- and low-cost options addressing identified transportation problems in the corridor. Each alternative should include TSM actions to increase the efficiency of the existing transit and highway system. One alternative should consist solely of such TSM actions in order to

provide a baseline that represents the best that can be done without major investments in the corridor. TSM actions typically consist of improvements to the existing transportation system including such actions as expanded bus service, paratransit, ridesharing, traffic engineering and regulatory pricing strategies, but not include fixed guideway investments. The range of alternatives typically will include one or more rail options, a bus guideway alternative (often with provisions for use by carpools), plus combinations of these modes. Early in the alternatives analysis phase, local officials and UMTA will reach agreement on the range of alternatives to be included in the analysis.

The analysis must also assess each alternative's capital, operating, and maintenance costs; anticipated ridership; and impacts on congestion and travel times. Social, economic and environmental impacts of importance to a decision on mode and alignment should be evaluated along with other factors considered important by the local community. The financial feasibility of each alternative should be assessed in terms of local, State, and private sector funding options and the availability of stable and dependable resources to cover the predicted operating and maintenance costs of the transit system. The analysis should also include an evaluation of the relative cost and effectiveness of the alternatives, where effectiveness is measured by the degree to which each alternative accomplishes local and Federal objectives. The primary measures of Federal objectives, as described earlier, will be the attraction of new transit ridership and the reduction in transit travel time for existing riders, compared with the Transportation System Management (TSM) alternative. Costs include capital and operating costs over the lifetime of the proposed investment. Local agencies should provide UMTA an early opportunity to review and concur in the methods and results of these analyses.

During the alternatives analysis phase, UMTA and the applicant will prepare a draft Environmental Impact Statement (EIS) or Environmental Assessment (EA) in accordance with published regulations (23 CFR Part 771) and guidelines. UMTA is responsible for ensuring that the environmental document fulfills Federal requirements and presents a complete and objective basis for mode and alignment decisions. After completion of the draft EIS and a formal public hearing must be held covering both the analysis of

alternatives and the environmental document.

Following the public hearing, local officials will select a preferred alternative and adopt a plan for financing its capital and operating costs. If local officials select a major investment, UMTA will evaluate the local financing effort, evaluate the cost-effectiveness of the locally preferred alternative, and consider advancing the locally preferred alternative into preliminary engineering.

An evaluation of projects which have completed the alternatives analysis phase and meet the threshold criterion for undertaking preliminary engineering will be undertaken in the first quarter of each fiscal year in accordance with the rating method described above. The results of this evaluation will be shared with local officials, the Secretary of Transportation, the Office of Management and Budget, and cognizant congressional committees. No formal pledges in the form of Letters of Intent (LOI) authorized in Section 3(a)(4) of the Urban Mass Transportation Act may be issued at this stage, nor will Letters of No Prejudice (LONP) be considered except in emergency or unique situations. The LONP is not even a pledge of assistance, but does permit a local authority to be reimbursed for eligible expenses incurred from the date of the letter should a grant ultimately be approved.

Preliminary Engineering

This phase of project development must be financed henceforth from Section 9 and 9A formula program funds, except for the very largest projects which may be financially assisted with Section 3 grants.

Written approval of the UMTA Administrator is required before fixed guideway projects may be advanced into preliminary engineering. This approval can be expected where UMTA finds that the locally preferred alternative is cost effective. One threshold test for this finding is that the proposed project must produce greater benefits (in terms of new riders and travel time savings for existing riders) than the TSM alternative. In addition, alternatives with excessive costs per additional rider may not be advanced into preliminary engineering. More detailed definitions of these and other threshold criteria will be published periodically. If threshold tests are not met, no UMTA funds may be used for the preliminary engineering phase. Approval to initiate preliminary engineering is not a commitment to final design or construction.

During the preliminary engineering (PE) phase, local project sponsors refine the design of the proposal, taking into consideration all reasonable design alternatives. The PE process results in estimates of project costs and impacts which have a high confidence level. In addition, environmental requirements are completed. This will typically involve preparation of a final EIS (and in some cases, a supplemental draft EIS). UMTA is responsible for ensuring that the EIS fulfills Federal requirements and provides a complete and objective basis for decisions on the design, operations, and mitigation measures for the guideway facility. UMTA will review and concur in the technical work performed by local agencies and participate in the preparation of the EIS consistent with its responsibilities under the National Environmental Policy Act.

Project management concepts also are finalized during preliminary engineering. The project management concepts define the scope of project implementation during the final design, construction, and start-up operation stages, including the establishment of policies for activities such as quality assurance, quality control and safety. Also, agreements are reached on the allocation of existing financial resources, required new taxes are put in place, and private financing commitments are obtained.

Preliminary engineering encompasses not only the locally preferred and the TSM alternatives, but also may include one or more lower cost alternatives found to be cost-effective in the alternatives analysis phase. As necessary, estimates of the capital cost of each cost-effective alternative will be refined, together with forecasts of transit ridership and travel time. Estimates of future operating and maintenance expenses of cost-effective alternatives will also be updated. Localities are also encouraged to incorporate into their planning at this stage, and to implement, a program of local supportive policies and actions designed to enhance the proposed project's cost-effectiveness and financial feasibility.

i. Zoning policies and development incentives to stimulate high density private real estate development, particularly joint development, around transit stations. Such development activities should include value recapture mechanisms which finance the planned transit system.

ii. Land use plans that support or reinforce the development impact and shaping influence of the transit system.

iii. Coordinated bus and/or paratransit feeder services to the guideway system, especially to low density suburban transit station.

iv. Pricing, regulatory, or traffic control measures aimed at managing the peak-period use of automobiles within transit guideway corridors (e.g., traffic metering, higher parking fees, elimination of employer subsidized parking).

v. Financing mechanisms which make use of taxes and/or fees paid by developers and property owners benefiting from the transit investment.

vi. Coordinated bus and/or paratransit feeder services to the guideway system, especially to low density suburban transit stations.

Localities seeking Federal assistance for a major urban mass transportation investment will, in the course of preliminary engineering, be expected to develop an early and systematic approach to promoting the participation of small, disadvantaged, and women's business enterprises (DBE's and WBE's). In addition to addressing the requirements of UMTA's DBE regulations (49 CFR Part 23), they should revise their existing DBE and WBE plans in accordance with the nature of the proposed project, establishing specific policies and procedures designed to maximize the opportunities for DBE's and WBE's in the entire range of transit activities, from planning to final design, construction, and operations. Intensive outreach and technical assistance programs, contract specifications for DBE and WBE awards, and professional staffing to identify opportunities for DBE and WBE participation and qualified firms are some of the strategies that should be considered.

Early in the first quarter of each fiscal year, UMTA will rate the projects which are performing or have completed the preliminary engineering phase, and recommend an allocation of Section 3 funds among projects for the succeeding fiscal year. The rating will be assigned pursuant to the method outlined in this statement, and will be shared with local officials, the Office of the Secretary of

Transportation, the Office of Management and Budget and cognizant congressional committees. Ratings also will be assigned to projects completing PE after the first quarter as PE is completed. The allocation of uncommitted funds will be re-evaluated, if feasible, at subsequent points in the Federal budget cycle.

Funding commitments will be given ultimately to those highest rated projects that have completed PE and can be funded to the completion of an operable segment within available program authorization. When a project has been selected for funding with Section 3 funds, UMTA will normally issue a Letter of Intent and approve funding for final design following the successful completion of preliminary engineering. The Letter of Intent is a formal pledge which documents UMTA's intention to obligate funds for a particular project, but is not a Federal obligation or administrative commitment. The total amount of potential Federal obligations covered by all outstanding Letters of Intent will not exceed the amount allocated for new starts for Section 3, less an amount necessary for other grants not covered by Letters of Intent.

Local officials may use their formula allocated Section 9 and Interstate Transfer funds for fixed guideway projects without regard to the project's rating relative to other pending Section 3 projects, if they enter into a contractual agreement that supplemental Section 3 discretionary funds will never be sought. However, approval from UMTA must be obtained before the applicant may commence right-of-way acquisition or construction. Approval will depend upon the grantee certifying that:

i. No future Section 3 discretionary assistance will be required either for that new start project or for other routine capital needs, which may be constrained by a decision to use formula funds for new construction.

ii. Sufficient funds are available to operate and maintain the project.

iii. The project is cost-effective based on the results of alternatives analysis.

iv. The project will meet minimum design criteria to ensure safe system construction and operation.

In addition, right-of-way acquisition, vehicle procurement, and construction may not be undertaken until the completion of an environmental document in accordance with the National Environmental Policy Act.

Final Design

This is the last phase of project development prior to construction and is typically financed with Section 3 or Interstate Transfer funds. Upon receipt of the Letter of Intent, local agencies normally proceed with right-of-way acquisition, utility relocation, and the preparation of final construction plans including construction management plans, detailed specifications, estimates and bid documents. During the final design of a fixed guideway project, UMTA and the grantee will negotiate a construction grant contract (i.e., a full funding contract) with a fixed ceiling on the Federal contribution, subject to a defined method of adjustment for inflation. Localities will be required to complete construction of the project, as defined, to the point of initiation of revenue operations, and to absorb any additional costs incurred, except under certain specified extraordinary circumstances. The full funding contract will also include a mutually agreeable schedule for anticipating Federal contributions during the construction period. Specific annual contributions under the Letter of Intent and full funding contract will be subject to the availability of budget authority and the ability of the grant recipient to use the funds effectively.

The full funding contract will incorporate any local commitments to fund the non-Federal capital match (including the overmatch used to rank the project), to dedicate resources to finance projected operating deficits, and to forego the use of Section 9 for operating assistance.

[FR Doc. 84-13520 Filed 5-17-84; 8:45 am]

BILLING CODE 4910-57-M

Appendix B

UMTA Policy on Private Enterprise Participation in the
Urban Mass Transportation Program



**Urban Mass Transportation
Administration**

(Docket No. 83-D)

**Private Enterprise Participation in the
Urban Mass Transportation Program**

AGENCY: Urban Mass Transportation
Administration, DOT.

ACTION: Notice of policy.

SUMMARY: In response to President Reagan's call for a greater private sector role in addressing community needs, the Urban Mass Transportation Administration (UMTA) announces its policy regarding private enterprise participation in the development of plans and programs to be funded under the Urban Mass Transportation Act of 1964, as amended ("the UMT Act"), and under the provisions authorizing use of Federal-Aid Highway Funds for public mass transit projects. The policy provides interim guidance to grantees and private sector providers on specified private enterprise provisions of the UMT Act. It is UMTA's intention to promulgate a regulation to implement these provisions in the near future. This statement addresses two provisions of the UMT Act that concern private enterprise participation, Sections 8(e) and 3(e), for the purpose of identifying: (1) The factors UMTA will consider in deciding whether local planning processes meet the requirements of Section 8(e); and (2) the procedures UMTA will employ in the event the Secretary of Transportation must make the findings required by Section 3(e) of the Act. UMTA does not intend to dictate specific ways to address the factors set forth in this policy statement. Similarly, failure to address any one of these elements may not necessarily undermine the validity of a grantee's planning process or disqualify grantees from receiving Federal assistance. However, UMTA's evaluation of an applicant's efforts to maximize private enterprise participation, as required by the Act, will be based largely upon the factors which UMTA has identified in this statement as effective measures for ensuring that the capabilities of private providers are fairly considered. If experience demonstrates that private providers are unfairly excluded from the plans and programs funded under the

UMT Act, notwithstanding this policy statement, then more direct Federal measures than those contained herein may be necessary. Comments by all interested parties are invited on this statement.

DATE: This policy will become effective October 22, 1984. However, UMTA is interested in receiving comments on this policy. Comments must be received on or before December 21, 1984.

ADDRESS: Comments on this policy should be submitted to UMTA Docket Number 83-D, Urban Mass Transportation Administration, Room 9228, 400 Seventh Street, S.W., Washington, D.C. 20590. All written communications received on or before the comment period closes will be considered in determining whether adjustments to this policy may be warranted.

All comments and suggestions received will be available for examination at the above address between 8:30 a.m. and 5:00 p.m., Monday through Friday. Receipt of comments will be acknowledged by UMTA if a self-addressed, stamped postcard is included with each comment.

FOR FURTHER INFORMATION CONTACT: Kenneth E. Bolton, Office of Policy, Room 9300, Telephone (202) 426-4080; or Gerald Musarra, Office of the Chief Counsel, Room 9228, Telephone (202) 426-1938, UMTA, 400 Seventh Street, S.W., Washington, D.C. 20590.

SUPPLEMENTARY INFORMATION: Private transportation providers have frequently voiced their concern that, in spite of statutory requirements, public decisionmakers do not fully or fairly consider the capacity of private enterprise to provide mass transportation services. The private providers, their representative organizations, and the General Accounting Office have all urged UMTA to articulate the agency's view on meaningful compliance with the private enterprise provisions of the UMT Act. In 1982, Congress amended the UMT Act to include a new section 8, Block Grants. Section 8(f) directs recipients of grants under section 8 to employ a process whereby private transportation providers are consulted and their views fully considered in developing the program of projects to be funded under

section 9. It is UMTA's view that the process of consultation and consideration called for in section 9(f) is related closely to the underlying policy objective of section 8(e), that of maximizing private sector involvement in the planning activities conducted pursuant to section 8.

Although only section 9 recipients are required to adhere to the procedures of section 9(f) (UMTA C 9030.1, "Section 9 Formula Grant Application Instructions," June 27, 1983), this policy seeks to encourage reliance on an approach based on section 9(f) as a means of achieving compliance with the requirements of section 8(e). Grantees are by no means precluded from developing alternatives of their own in order to achieve such compliance.

To the extent that this policy statement imposes paperwork burdens, it is subject to the Paperwork Reduction Act of 1980 (44 U.S.C. 3507). UMTA intends to submit this policy statement under the Paperwork Reduction Act to OMB for approval. Comments on the paperwork impacts of the policy and possible ways to reduce them are requested.

Issued: October 16, 1984.

Malcolm L. Stanley,
Administrator.

Urban Mass Transportation Administration, Private Enterprise Participation in Federally Assisted Programs

Purpose

This policy statement has been developed to provide guidance in achieving compliance with the requirements of section 8(e) and section 9(f) (1) and (2) of the UMT Act. It is also UMTA's intention through this policy statement to promote greater reliance on the private sector in the provision of mass transportation services both as an independent private sector activity and through competitive contractual arrangements with public bodies.

Scope

This policy identifies the principal factors UMTA will take into account in determining whether local proposals for federal assistance under sections 3 and 9 of the Urban Mass Transportation Act (as amended ("the UMT Act"), 49 U.S.C. 1601 et. seq.) and 23 U.S.C. 101(f) and 142 meet the statutory requirements of sections 3(e) (1) and (2) and 9(f) of the Act.

Background

The provisions in the UMT Act emphasize the role of private enterprise generally or private

transportation providers specifically in UMTA's assistance programs. These provisions are: section 8, which focuses on the conduct of the local planning process; section 3(e), which provides safeguards to existing mass transportation companies from unwarranted acquisition or competition resulting from a grant of assistance; and section 9(f), which sets out the manner for developing the program of projects to be funded under the Formula Grant Program (section 9). More specifically, section 8(c) of the UMT Act requires the Secretary to find that a program of projects, to be eligible for assistance, has been based on a planning process conducted in conformance with the objectives set out in section 8. One such objective, identified in section 8(e), directs UMTA grantees to encourage the maximum feasible participation of private enterprise in the plans and programs funded under the Act. Further, when UMTA has been requested to provide assistance which will have an impact on an existing mass transportation company, as specified in section 3(e) of the Act, the Secretary is required, prior to approving such assistance, to find: (1) That the project or program is essential to the local program of projects, and (2) that the local program provides for the maximum feasible participation of private mass transportation companies. Finally, as a precondition to the receipt of funding under section 9, recipients must develop a program of projects in accordance with the procedures set out in section 9(f). Section 9(f) clearly envisions a participatory approach to program development, commencing with notice to the public and followed by a consultative process involving interested parties and, in particular, private transportation providers. Once a detailed proposed program has been developed, recipients must allow a reasonable time for comments by affected citizens, private providers and local officials. At some point after the proposed program has been developed, the recipient must also provide an opportunity for a public hearing. The final program of projects submitted to UMTA must reflect the consideration that was accorded to the comments and views, especially those of private providers, garnered during the program development process. The final program, modified as appropriate by this consideration, must be made available to the public.

Beginning in FY 1984, grants under section 9 will constitute the largest portion of UMTA's assistance program, with the result that most grantees will be charged with responsibilities under

both sections 8(e) and 9(f). Recognizing this, UMTA has relied upon section 9(f) as a congressionally formulated model for guidance on section 8(e). The policy strives to achieve a streamlined process for developing the plans and programs to be funded under the Act and to eliminate the possibility that grantees would be burdened with duplicative procedural requirements. Additionally, early reliance on the section 9 model should narrow the range of issues to be addressed in the course of developing a final program of projects under section 9, and thereby make for expeditious grant delivery.

4. Policy

The joint UMTA/FHWA planning regulation (48 FR 30332, June 30, 1983) requires that the local planning process be consistent with sections 8(e) and 3(e) concerning the involvement of private transportation providers.

This policy is intended as an amplification of UMTA's view that private sector participation is most meaningful when initiated early in the planning process. When developing federally assisted mass transportation plans and programs, UMTA grantees should give timely and fair consideration to the comments and proposals of interested private enterprise entities in order to achieve maximum feasible private participation.

As a general matter, UMTA recognizes that local decisionmakers should be afforded maximum flexibility in developing plans and programs to meet local transportation service requirements. At the same time, UMTA is obligated to ensure that local decisionmakers fully and fairly consider the private sector's capacity to provide needed transportation services.

In determining whether the local planning process conforms to the private enterprise requirements of the UMT Act, UMTA will consider a number of factors derived from the procedure set out in section 9(f). UMTA's determination of compliance will be made as part of the Secretary's finding under section 3(c) that the Transportation Improvement Program (TIP) is based on a planning process being carried on in conformance with the objectives of section 8, and, when appropriate, pursuant to the requirements of section 9(e). Specifically, UMTA will consider the factors set forth below:

I. Consultation With Private Providers in the Local Planning Process

A. *Notifications.* It is UMTA policy that local entities, as part of their transportation planning process, provide

reasonable notice to private transportation providers and possible new business entrants regarding proposed services and opportunities for private transportation providers in order that they may present their views concerning the development of local plans and programs. To the extent possible, it is also desirable to make known in advance the criteria which will be taken into account in making public/private service decisions.

B. Early Consultation. It is UMTA policy that a fair appraisal of private sector views and capabilities be assured by affording private providers an early opportunity to participate in the development of projects that involve new or restructured mass transit services. Private providers should be given opportunity to present their views concerning the development of local transportation plans and programs and to offer their own service proposals for consideration.

II. Consideration of Private Enterprise

A. Development of the Transportation Program. It is UMTA policy that private providers be afforded an opportunity to participate in and have their views be considered in the development of the annual (biennial) element of the TIP before MPO endorsement.

B. Provision of Service by Private Operators Without Public Involvement. It is UMTA policy that when new service needs are developed, or services are significantly restructured, consideration should be given to whether private carriers could provide such service in a manner which is consistent with local objectives and without public subsidy. Moreover, existing transit services should be periodically reviewed to determine if they can be provided more efficiently by the private sector. Public officials should examine possible adjustments in local regulation or existing service requirements in order to permit private carriers to perform service without subsidy in the free market.

C. Opportunities for Private Carriers to Provide Assisted Services. It is UMTA policy that where it is determined that public assistance is required, consideration should be given to the capability of private providers to provide such new or substantially restructured mass transportation services.

UMTA does not consider it acceptable for localities to foreclose opportunities for private enterprise by simply pointing to local barriers to their involvement in federally assisted local transportation programs. In general, a simple reference in the public record to public agency

labor agreements or a local policy that calls for direct operation of all mass transportation providers, would not satisfy the private enterprise requirements of the Act.

D. True Comparison of Costs. When comparing the service proposals made by public and private entities, all the fully allocated costs of public and non-profit agencies should be counted. Subsidies provided to public carriers, including operating subsidies, capital grants and the use of public facilities should be reflected in the cost comparisons.

III. Section 3(e)—Documentation

Section 3(e) of the Act affords safeguards to existing private mass transportation companies when proposed projects compete with or supplement the services they provide or when a federally assisted acquisition of a private mass transportation company, equipment or facilities is to occur. In these situations, section 3(e) requires the Secretary to find that the project in question is essential to the program of projects, and that the program provides for the maximum feasible participation of private mass transportation companies. Should it be necessary for these findings to be made, UMTA will request, and the grantee should provide, the necessary documentation upon which the section 3(e) findings will be based. Public records are expected to be in place that document the participatory nature of the local planning process, and the rationale used in making public/private service decisions.

IV. Compliance

Pursuant to the UMTA/FHWA joint planning regulations, the State and the MPO, at the time the annual or biennial element of the Transportation Improvement Program (TIP) is submitted to UMTA, will certify that the planning process is being carried on in conformance with all the requirements of section 8, including section 8(e).

UMTA is considering conducting periodic Federal planning management reviews to ensure that all the planning requirements of section 8 are being met by recipients of Federal funds. In addition, compliance with the private enterprise provisions of the Act will be monitored as part of the annual audits and triennial reviews by section 9 of the Act.

V. Complaints

Since the underlying spirit of the UMT Act is to afford communities maximum flexibility in local decisionmaking, it is appropriate that questions dealing with the fairness of local procedures and

decisions be addressed at the local level. Accordingly, a discrete local mechanism, preferably independent, should be devised for resolving disputes in a manner which assures fairness to all parties.

UMTA will entertain complaints from private enterprise organizations only upon procedural grounds that the local planning and programming process has not established procedures for the maximum feasible participation of private transportation providers consistent with section 8(e) and the spirit of this policy; or that local procedures were not followed; or that the local process does not provide for fair resolution of disputes. Accordingly, UMTA will not review disputes concerning the substance of local decisions regarding service or the appropriate service provider. Nor will UMTA entertain procedural protests prior to a disposition of complaints at the local level.

(FR Doc. 84-27721 Filed 10-16-84; 845 am)
BILLING CODE 4910-67-01



Appendix C

UMTA/FHWA Final Rule, Environmental Impact
and Related Procedures



DEPARTMENT OF TRANSPORTATION

Federal Highway Administration

Urban Mass Transportation Administration

23 CFR Parts 635, 640, 650, 712, 771, and 790

49 CFR Part 622

[FHWA Docket Nos. 85-12 and 83-20]

Environmental Impact and Related Procedures

AGENCIES: Federal Highway Administration (FHWA) and Urban Mass Transportation Administration (UMTA), Department of Transportation (DOT).

ACTION: Final rule.

SUMMARY: The FHWA and the UMTA are issuing a joint final regulation governing the preparation of environmental impact statements (EISs) and related documents under grant programs administered by FHWA and UMTA. The amendments contained in this final rule will streamline the project-development process and provide increased decisionmaking authority to agency field offices. The amendments are consistent with the directives of the National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ) regulations, and other Federal statutes and incorporate the requirements of DOT Order 5610.1C, "Procedures for Considering Environmental Impacts." The documents and actions to which this regulation applies are described more fully in § 771.109 of the regulation. By this final rule, the FHWA is also eliminating duplication in its public involvement regulations by rescinding 23 Code of Federal Regulations (CFR) Part 790 and amending a section of 23 CFR Part 771 to make it the agency's single public involvement regulation. This action will contribute to the establishment of a streamlined, one-stop environmental process in which public involvement is fully integrated with the other project development and environmental procedures.

EFFECTIVE DATES: The amendments to 23 CFR Parts 640, 712 (see the amendatory instruction number 4), and 771 are effective on November 27, 1987. The amendment to Subpart A of Part 622 of 49 CFR is effective on November 27, 1987. The amendments to 23 CFR Parts 635, 650, 712 (see the amendatory instruction number 8), and 790 are effective August 29, 1988, in order to allow States which conduct public

hearings under Part 790 to adopt public involvement/public hearing procedures that satisfy the requirements of Part 771.

ADDRESSES: Copies of comments received, together with the regulatory evaluation required by DOT policies and procedures, are available for public inspection in the public docket room of FHWA, Room 4205, HCC-10, 400 Seventh Street SW., Washington, DC 20590, between the hours of 8:30 a.m. and 3:30 p.m. EST, Monday through Friday. These materials are filed under FHWA Docket Nos. 83-20 and 85-12.

FOR FURTHER INFORMATION CONTACT:

(1) For FHWA: Mr. Frederick Skaer, Office of Environmental Policy (HEV-10), (202) 366-0106, or Mr. Edward Kussy, Office of the Chief Counsel (HCC-40), (202) 366-0791, FHWA, 400 Seventh Street SW., Washington, DC 20590, between the hours of 7:45 a.m. and 4:15 p.m., EST, Monday through Friday; (2) For UMTA: Mr. A. Joseph Ossi, Office of Planning Assistance (UGM-22), (202) 366-0096, or Mr. Scott A. Biehl, Office of the Chief Counsel (UCC-5), (202) 366-4063, UMTA, 400 Seventh Street SW., Washington, DC 20590, between the hours of 8:30 a.m. and 5:00 p.m., EST, Monday through Friday.

SUPPLEMENTARY INFORMATION: The regulation being issued today applies to both FHWA and UMTA actions. Thus, it will amend Part 771 of Title 23 of the CFR with a cross reference at Part 622 of Title 49 of the CFR.

Introduction

This final rule amends the regulations utilized by FHWA and UMTA to comply with the CEQ's regulations and other environmental requirements. The FHWA and the UMTA first published regulations implementing CEQ requirements in 1980. (See 45 FR 71968; October 30, 1980.) On August 1, 1983, FHWA and UMTA published changes to their joint environmental regulation (48 FR 34894) as a part of the departmental effort to streamline regulations and reduce red tape. In response to that Notice of Proposed Rulemaking (NPRM), Docket 83-20, 51 comments were received from various Federal, State, and local agencies. Twenty-six of these comments were from State highway agencies (SHAs) or State DOTs. Eleven comments were received from transit or planning agencies. Seven comments were received from interested cities or counties. Two comments were received from State Historic Preservation Officers (SHPOs). The National Trust for Historic Preservation provided comments as did the following Federal agencies: The Environmental Protection

Agency, the Department of the Interior, the Advisory Council on Historic Preservation, and the U.S. Coast Guard. On January 31, 1985, the FHWA published another NPRM to rescind 23 CFR 790 and to amend 23 CFR 771.111(h). (See 50 FR 4526, Docket No. 85-12). This final notice combines both rulemakings. Comments on Docket No. 85-12 are discussed below as the last item under the heading "Section-by-Section Analysis."

General Comments

The majority of comments received in Docket No. 83-20 were generally supportive of the streamlining proposals made in the NPRM. This is especially true of the greater flexibility built into the categorical exclusion (CE) process. Many of the comments requested more flexibility, but, as will be discussed below, we were unable to make major changes given current statutory constraints. Another major source of comments was a proposal in the NPRM to require written reevaluations before each major project step. Substantial changes to that proposal have been made here. These are addressed in greater detail below.

It should be noted that most sections of the regulation have been renumbered from the NPRM, although the section headings have been retained. Section 771.127 of the NPRM has been subdivided into two sections (771.129, Reevaluations, and 771.130, Supplemental Environmental Impact Statements).

As with the 1980 regulation, this regulation has been approved by the Office of the Secretary of Transportation as being consistent with DOT Order 5610.1C. Applicants and Administration field offices should not normally need to consult DOT Order 5610.1C.

There were a number of editorial changes made throughout the document to make it more readable. Only the major changes made to each section of the regulation are discussed in this preamble.

Section-by-Section Analysis

Section 771.101, Purpose. This section has been amended to include a reference to 23 U.S.C. 129. Section 128 contains the FHWA public hearing requirements and describes the environmental report needed as a part of the public hearing requirements.

Section 771.105, Policy. This section sets forth basic Administration policy regarding the consideration of environmental impacts of Administration actions. Sections 109 and 128 of Title 23 and sections 3, 5, and

14 of the Urban Mass Transportation Act (UMT Act), 49 U.S.C. 1602, 1604, and 1610 require both FHWA and UMTA to consider social, economic, and environmental impacts of proposed projects. The documentation developed pursuant to this regulation is intended to satisfy both NEPA and the above sections.

It is the policy of FHWA and UMTA to make the process set forth in the regulation the primary vehicle for all environmental approvals of Administration actions by all Federal agencies. This can only be accomplished if both applicants and Federal agencies are committed to the development of procedures and cooperative arrangements which take advantage of the opportunities presented here to create as complete an environmental record as possible.

Administration policy on the funding of efforts to mitigate the impacts of Administration actions remains the same. The intent is that Federal funds be available to assist in complying with Federal requirements, as well as State and local requirements which do not conflict with Federal requirements. However, in those situations where State or local requirements differ from Federal requirements, the decision to use Federal funds will be made on a case-by-case basis, after considering the reasonableness of the applicant's request and the costs and benefits of Federal participation in the request.

Several commenters questioned the "status" of FHWA's Technical Advisory T6640.8 and requested clarification. The Technical Advisory was developed by FHWA for the purpose of providing the best available guidance to its field offices and applicants regarding the types of information needed to comply with NEPA, section 4(f) of the DOT Act of 1968, and other environmental requirements, such as Executive Order 11990, "Protection of Wetlands." The Technical Advisory is available for inspection and copying as prescribed in 49 CFR Part 7, Appendix D. The FHWA expects the Technical Advisory to be used to the fullest extent possible. However, FHWA also recognizes that each project must be evaluated on its individual issues and merits. When circumstances dictate, there is sufficient flexibility to tailor the content of the environmental document to the needs of the individual situation. A revised Technical Advisory has been prepared and will be issued as T6640.8A on October 30, 1987.

The UMTA also has developed supplementary guidance on the NEPA process for applicants. UMTA Circular C5620.1, "Guidelines for the

Environmental Protection Process", provides information on the assessment of environmental impacts for major transit projects, and the preparation and processing of environmental documents. This circular is available from UMTA Headquarters and field offices.

Section 771.107. Definitions. In the 1980 regulation, the term "action" was defined as the Federal approval of construction of highway and transit projects. The CEQ regulations use the term "proposed action" in a broader context. There, actions include projects and programs that are proposed for Federal assistance as well as proposed plans, policies, and legislation. For consistency with the CEQ regulations, a new definition for "action" has been added. As used throughout the regulation, actions are highway or transit projects proposed for Federal funding or activities such as joint and multiple use permits which require Federal approvals. The actual Federal approval of the construction of a highway or transit project or of a permit is now covered in the new definition of "Administration action." The difference between an "action" and an "Administration action" as defined under the regulation is the difference between a proposed project and an actual Federal commitment to fund construction of the project.

The DOT Act of 1966 included specific provisions providing special protection to publicly owned parks, recreational areas, wildlife and waterfowl refuges, and all historic sites. This provision was set forth at section 4(f) of the DOT Act, and printed in the United States Code (U.S.C.) at 49 U.S.C. 1653(f). A similar provision is found at 23 U.S.C. 138. In 1983, as part of a general codification of the DOT Act, 49 U.S.C., 1653(f), was formally repealed and recodified with slightly different language in 49 U.S.C. 303. However, the substantive requirements remain unchanged. Given that over the years, the whole body of provisions, policies, case law, etc., has been collectively referenced as "section 4(f)" matters, we have continued this reference in this regulation, even though section 4(f) of the 1966 DOT Act has been technically amended. To change the popular reference to "section 4(f)" would confuse needlessly the public and the Federal, State, and local agencies that participate in "section 4(f)" matters on a recurring basis.

The only other changes to this section were minor editorial changes to make it more readable.

Section 771.109. Applicability and responsibilities. This section deals with the documents and actions to which this regulation applies, the status of prior

approvals, and the responsibilities of both the Administration and grant applicants for the preparation of the documents required by this regulation.

Paragraph (b) deals with the responsibility for carrying out mitigation measures that have been described in the Administration's environmental documents. One commenter suggested that language be added to the regulation to specify that the Administration monitor projects during and after construction to ensure that mitigation measures that have been described in the Administration's environmental documents are implemented. The Administration meets its responsibility set forth in paragraph 1505.2(c) of the CEQ regulations (40 CFR Parts 1500-1508), and the regulation has been modified to make this clear. Paragraph (b) now states that mitigation measures will be incorporated by reference in the grant document and UMTA will follow up with reviews of designs and on-site inspections to ensure that mitigation measures are implemented as called for in environmental documents and grant agreements. It should be noted that the mitigation measures referenced in an executed grant agreement become contractual obligations on the part of the applicant and cannot be changed without the express written approval of UMTA. FHWA assures that mitigation measures are implemented by reviewing and approving the plans and specifications for the project and by conducting periodic construction inspections. On projects processed under an approved certification in accordance with 23 CFR 640, FHWA ensures the implementation of mitigation measures by conducting program management reviews and a final construction inspection.

In paragraph (c), different levels of responsibility for applicants preparing EISs are defined depending on whether section 102(2)(D) of NEPA or a State law comparable to NEPA applies. Several local transit agencies asked what role they would assume if a State requirement comparable to NEPA applies. In such cases, the transit agencies will have a joint lead responsibility with UMTA and will take a substantial role in preparing the environmental document. It is intended that a single document satisfy all Federal and State requirements.

Section 771.111. Early coordination, public involvement, and project development. The FHWA and the UMTA regard early coordination and public involvement as critical to the successful completion of the processes required by this regulation. Scoping, a

major innovation of the CEQ regulations, is accomplished in this phase. Many potential difficulties confronting particular actions can be most conveniently identified and, in many instances, resolved at this stage.

Public involvement as discussed in this regulation, may mean not only public hearings, but a series of less formal informational meetings which begin after the planning phase and help affected persons and local governments learn about agency actions and identify potential difficulties at the earliest possible time. Very often, the persons most affected are those who must be relocated from their homes or businesses by the agency action. Appropriate relocation planning and studies should be done as part of initial project planning, usually during the course of preparing documents required by this regulation, to ensure that the rights and concerns of potentially affected residents and businesses are fully addressed and considered in the development and timing of agency actions. Very often, project location, design, and right-of-way problems are particularly sensitive where certain ethnic, social, or economic groups are affected to unusual or disproportionate degrees. Where this might be the case, these issues should be considered very early in the process. Notification of any project related hearings, meetings, or opportunities for public involvement should be placed in newspapers or publications most likely to be read by affected groups. This would include minority or foreign language newspapers where appropriate.

One commenter asked that paragraph (b) be dropped. This paragraph identifies an early point in project development, the Transportation Improvement Program (TIP) review, where the Administration will consult with an applicant on environmental requirements. This was done in response to paragraph 1505.1(b) of the CEQ regulations which requires Federal agencies to designate major decision points in their programs and ensure that the NEPA process corresponds with them. The TIP is a local planning document identifying projects to be implemented over a 3-5 year time frame. Not all listed projects are subsequently constructed, but inclusion in the TIP is an early indication that Federal funding may be pursued. It is expected that applicants will initiate environmental impact work first on the high-priority projects in the TIP. When adequate site-specific information is available at the TIP review stage, FHWA and UMTA will determine whether an EIS, EA, or

CE is appropriate and whether other environmental requirements apply. The 3-5 year time frame of the TIP will allow ample lead time for document preparation, public involvement, and agency review. This provision has been retained because it supports early consultation in the environmental review process without placing unnecessary burden on prospective applicants. However, this paragraph was modified to indicate that FHWA would, where appropriate, indicate the possible class of action at the later, formal 105 program approval stage. This technical change was necessary since FHWA reviews, but does not approve, the TIP.

Paragraph (d) adopts the suggestion to change the word "should" to "must" in the second sentence.

Paragraph (g) describes the tiering of EISs as an optional approach which may have benefits when considering large, complex transportation projects. This paragraph stimulated a mix of comments. Several commenters expressed the concern that two sets of EISs do not lead to improved decisionmaking regarding major projects and are not justified considering the additional cost and time involved. Others supported the tiering concept and noted that it had been used successfully when incorporated with early planning at the local level. Tiering of EISs may be beneficial under certain limited circumstances, but a tiered approach can only be effective if the initial EIS is prepared very early in the planning process. The focus would be on a broad comparison of key environmental factors which may have a bearing on early decisions concerning, for example, the type of project, the general location, and major design features. This approach is consistent with the CEQ regulations which encourage agencies to consider environmental effects at an early stage before decisions on major alternatives are foreclosed. A second-tier EIS (or EA where no new significant impacts are expected) would be appropriate at the stage where a preferred alternative has been identified and project details have been developed.

Commenters asked for clarification as to how the Administration determines the need for tiered EISs. The decision to use tiering will be made in consultation with the applicant and will depend on the scope and complexity of the alternatives under consideration, the status of planning, and the need to address environmental considerations at an early stage in the local planning process. Generally, the Administration

would not direct an applicant to prepare tiered EISs but, instead, would employ tiering to accommodate an applicant's planning or environmental review requirements.

It should be noted that this progressively, more focused look at a project embodied in the concept of tiering may also be accomplished with a supplemental draft EIS. If project details are developed before a final EIS has been issued (e.g., during preliminary engineering), site-specific environmental effects can be addressed in a supplemental draft EIS. In this case, the process would be concluded with a final EIS responding to comments on both the general and the site-specific draft EISs. Thus, the process of tiering EISs is most appropriate where a project concept is still in the formative stages and the applicant is actively seeking information from agencies and the public in helping to reach early decisions. Tiering is accomplished with two complete EISs; however, alternatives and environmental concerns fully considered in the first-tier statement need not be restudied in the second-tier EIS.

Paragraph (h), which discusses the FHWA public hearing requirements, has been addressed in a separate NPRM (50 FR 4525, January 31, 1985). A discussion of final revisions as well as comments submitted to the public docket appears later in this document as the last item in the section-by-section discussion.

A new paragraph (i) has been added discussing public involvement for UMTA's projects. No new requirements have been established, however, coordination of any public hearings with NEPA process is emphasized with special reference to the preparation of EAs and environmental studies. It should be noted that although these hearings and the FHWA hearings are coordinated with the NEPA process, they are not required by NEPA itself; the requirement for public hearings is found in FHWA and UMTA legislation. Under these statutes, questions such as the need to hold hearings during the preparation of a NEPA document and the type and scope of those hearings are within the Federal agency's discretion.

This new paragraph also refers to the scoping process as a means of inviting public and agency comments on a project proposal. Providing this opportunity for input at an early stage frequently helps the applicant and UMTA to focus on important environmental effects and to determine whether reasonable alternatives exist to avoid or mitigate those effects. For example, in regard to sections 9 and 9A of the UMT Act, UMTA intends that the

new paragraph (i) will generally apply to the program of projects proposed for Federal funding. If practicable, EAs should be prepared, where required by this regulation, before the notice of an opportunity for a public hearing on the program of projects. At a minimum, the notice announcing the opportunity for a hearing should indicate those projects requiring EAs, the timetable for preparing those documents, and how copies may be obtained. If, after releasing the EA, UMTA or the applicant becomes aware of strong community concerns or controversy on environmental grounds, or if UMTA determines that an EIS is necessary, the applicant will hold a separate hearing on the project to receive public comment. The UMTA will continue to require early contacts with affected agencies and the public in defining the scope of environmental documents.

Section 771.113. Timing of Administration Activities. This section describes the timing of various project development activities in relation to the completion of the environmental process. It places limits on the actions which the Administration and the applicant may take to develop a project prior to the completion of the NEPA process.

The language in paragraph (a) supports, and should be read in conjunction with, section 1506.1 of the CEQ regulations, "Limitations on actions during NEPA Process." These provisions ensure that the Administration's decision whether to implement an alternative under consideration in the environmental document will not be influenced by a previous commitment to a particular course of action. As such, the strictures apply not only to the Administration and applicants, but also third parties acting under a contractual agreement. Furthermore, the Administration or the applicant cannot prematurely enter into a contract which irrevocably binds it to the future performance of this work. This limitation on actions supports one of the primary purposes of NEPA—that Federal agencies consider environmental effects fully, including alternative courses of action, before reaching a decision to proceed with major Federal actions.

The wording in this paragraph has been revised to make clear the kinds of activities that will be allowed prior to the completion of the NEPA process. This will include any impact studies and engineering work needed to complete the environmental document. Normally, preliminary design will provide all the project information needed to satisfy

environmental requirements. In certain cases, more detailed design work will be needed to satisfy a specific environmental requirement and this additional design work is allowed. This paragraph has also been changed to expand on the kinds of activities which may not occur prior to completion of the NEPA process.

It is important to note that the limitations on premature commitments in the CEQ regulations and this regulation apply to projects or activities that may be proposed entirely for local funding by an applicant or prospective applicant. If the action in question is an integral part of a larger project which is the subject of an environmental document, that action cannot be "segmented" from the overall proposal and funded separately before the environmental process is completed. Segmentation of a project might involve the early acquisition of property or the purchasing of rolling stock, construction materials, or other equipment needed during the construction phase. Segmentation could also entail separate development by the applicant of an entire portion of a project, e.g., a segment of highway or transit guideway that should be considered as part of a larger project for which Federal assistance is being sought.

A number of commenters suggested revisions to this section to permit the applicant to proceed with final design activities after the receipt and evaluation of comments on the draft EIS and prior to approval of the final EIS. The commenters contended that the EIS approval process delayed the start of final design work and, therefore, induced delays in all subsequent phases of the project development process. They suggested that if no environmental concern were raised during the draft EIS circulation period, final design of the preferred alternative should be allowed to proceed. The Administration has carefully considered these comments and continues to believe the environmental process must be completed and the EIS approval made before it is in a position to permit the applicant to proceed with final design activities. We recognize the need to develop preliminary designs in order to more accurately assess impacts in the environmental document. However, granting approval to proceed with final design at this stage would be a premature commitment to one alternative at a time when other alternatives, including the alternative of taking no action, are still being actively considered by the Administration in the environmental process.

However, the Administration recognizes the need to proceed with detailed design activities where such work is necessary to permit the full evaluation of environmental impacts and to permit the consideration of appropriate mitigation measures, e.g., impacts to wetlands, section 4(f) areas and resources covered by section 106 of the National Historic Preservation Act (section 106). The regulation provides for those situations by allowing the applicant to complete all necessary design work needed to complete the EIS or to comply with other environmental laws during the NEPA process. This should not be construed as an authorization to proceed with final design for the entire project, but only for those aspects of the project necessary to consider specific environmental concerns.

The possibility of acquisition of land for a project before completion of the NEPA process was raised by several commenters. The UMTA received comments in favor of both expanding and restricting the scope of advance land acquisition allowed under the regulation. Several commenters suggested that UMTA expand the scope of advance land acquisition because the Surface Transportation Assistance Act of 1982 (STAA) amended section 3(a)(1)(A) of the UMT Act by adding a provision specifically addressing UMTA's discretion to make grants or loans for the acquisition of rights-of-way and relocation for fixed guideway corridor development for projects in advanced stages of alternatives analysis or preliminary engineering. On the other hand, one commenter expressed the opinion that "no acquisition should be allowed prior to completion of the NEPA process," arguing that hardship or protective buying cannot be accomplished without influencing or limiting the choice of reasonable alternatives.

In weighing the arguments, UMTA considered how to implement the STAA amendment consistently with the agency's responsibilities under NEPA and with the results of pertinent case law governing advance land acquisition, *National Wildlife Federation vs. Snow*, 561 F.2d 227 (D.C. Cir. 1976). The UMTA has concluded, in light of these considerations and a review of the pertinent legislative history, that this amendment was not intended to override the requirements of NEPA.

For UMTA's major fixed guideway projects, the draft and final EISs are developed during alternatives analysis and preliminary engineering. Any authorization for advance land

acquisition during alternatives analysis or preliminary engineering would create a conflict with NEPA if the acquisition could result in a substantial commitment to a particular course of action before the NEPA process was completed. In addition, since UMTA's major investment procedures are integrated with the NEPA process, this would also prejudice the major investment decisionmaking process.

After careful review, FHWA and UMTA still believe that some advance land acquisition may take place on a case-by-case basis without resulting in a substantial commitment to a particular course of action before completion of the NEPA process. Therefore, in this regulation, FHWA and UMTA are maintaining the current practice: that is, the only types of advance land acquisition that FHWA and UMTA will approve before the completion of the NEPA process are "hardship" and "protective" acquisitions. These terms are defined in § 771.117(d)(12) of this regulation.

As in the past, this type of land acquisition is reserved for extraordinary or emergency situations involving a particular parcel or a limited number of parcels within the proposed transportation corridor. It has been FHWA's and UMTA's recent experience that the number of hardship and protective acquisitions on a given project are so few as to not result in a substantial commitment to a particular course of action. The purpose of protective acquisition is to preserve the status quo. Since it serves to protect valuable property and can be easily undone, such acquisition generally will not tilt the balance toward a particular alternative.

Another question is whether acquiring an option to purchase land before completing the environmental process would be an acceptable alternative to assure the availability of land for project purposes. It would be less costly and arguably would constitute a smaller commitment than the actual purchase of land. Generally, UMTA and FHWA maintain that acquiring options to purchase land for a project would tend to bias fair consideration of other project alternatives and violate basic principles of Federal environmental law. Therefore, the same standards apply to options to purchase as to outright purchase of land: before completing the environmental process, only acquisitions for hardship and protective purposes are acceptable.

To obtain approval for hardship or protective acquisition, the applicant should apply for a CE under paragraph 771.117(d)(12). In addition, for FHWA

actions, hardship and protective acquisition activities must be processed in accordance with 23 CFR 712.204(d). It should be noted that a CE for advance land acquisition applies only to the purchase of property and does not permit further project development. The restrictions of paragraph 771.113(a) will apply until the Administration completes the NEPA process for the entire proposed action. The FHWA has issued guidelines and UMTA is preparing similar guidance describing the documentation needed to support requests for hardship and protective buying. Documentation supporting these claims will continue to be reviewed in the field offices of FHWA and UMTA.

One commenter suggested that any advance land acquisition be noted in the subsequent EIS or EA. The FHWA and the UMTA have no objection to noting this information in environmental documents, but do not believe it is appropriate to require it under the regulation.

Paragraph (a)(3) has been added to emphasize that in addition to environmental requirements, certain programming requirements must be satisfied prior to the initiation of FHWA funded final design, acquisition, and construction activities. This paragraph is a cross reference to 23 CFR Part 450 and 23 CFR Part 630 and does not create any additional requirements.

Paragraph (b) has been revised to indicate that FHWA approval of the final environmental document is considered acceptance of the general project location and project concepts such as type of facility, interchange locations, and other major features which may be indicated in the environmental document. This paragraph is an indication that FHWA normally will approve for Federal funding a project of the type noted in the final environmental document. However, it does not commit the Administration to fund any specific project or any features identified therein. Final approval of the EIS does not constitute a commitment to fund the project, as noted in this paragraph and in § 771.125(e) of this regulation.

Section 771.115 Classes of actions. Actions treated under this regulation fall in one of the classes outlined in this section. Class I actions are those which typically require an EIS. Class II actions are those which typically are classified as CEs. If it is uncertain whether a particular action requires an EIS, and it requires an EA to establish the significance of the impacts, the action is grouped under Class III. A change in this section was the shifting of the list of examples of CE activities to § 771.117.

This has been done in order to group all activities related to CEs in § 771.117.

One commenter suggested deleting the list of Class I actions that remains in § 771.115(a) and, instead, focusing on the definition of significance as applied to environmental impacts in the CEQ regulations. Examples of specific Class I actions are included in the regulation in accordance with § 1507.3(b)(2) of the CEQ regulations. We have referenced the section of the CEQ regulations that addresses the significance of impacts rather than repeating it.

One commenter suggested that the wording be changed in paragraph (a) to indicate that the projects listed under Class I may not in all cases require EISs. The CEQ regulations require that Federal agency procedures include specific criteria for and identification of those typical classes of action which normally require EISs. While there may be individual projects listed in Class I that because of unusual circumstances would not require an EIS, such projects are exceptions to the rule. The wording in paragraph (a) has been changed to parallel the CEQ regulations (40 CFR 1507.3(b)(2)). The intent of dividing projects by class is to provide guidance on the environmental review process that will be followed normally for projects in the class. The FHWA and the UMTA will continue to review individual cases whenever applicants describe circumstances which may have a bearing on the choice of environmental process. The final decision on class of action will be made by the Administration.

In the NPRM, UMTA proposed eliminating exclusive busways as Class I actions because of the potential to construct and operate a busway on or within an existing highway without significant environmental impacts. A number of commenters supported this change. Busways are frequently established by dedicating an existing highway lane for exclusive bus and high occupancy vehicle use and the regulation affords the flexibility to handle such projects with an EA instead of an EIS. The NPRM noted UMTA's intention to continue to require an EIS for construction of a new roadway for buses which is not integrated in an existing highway. This type of project is now listed in the regulation as a Class I action. Other types of busway projects will be reviewed individually to determine the appropriate environmental document, e.g., busways on existing lanes or medians which have off-line facilities such as stations, park-and-ride lots, transfer points, etc.

The UMTA also proposed eliminating "major transportation-related developments" as Class I actions. These were joint public/private urban development projects that were tied into transit terminals or stations. These types of projects normally required an EIS. They were dropped from the list of Class I actions because they are no longer a significant part of the UMTA program.

Several commenters who supported the proposal to remove busways constructed on existing highways from the Class I list suggested that rail lines built in highway medians should be accorded the same treatment. However, the environmental effects associated with the fixed facilities of a rail line—stations, parking lots or structures, storage and maintenance yards—and the changes in travel patterns and land use associated with such projects are normally significant and warrant evaluation in an EIS. Greater variability exists in constructing a busway on an existing highway. Thus, the regulation provides the flexibility to handle the simpler busway projects with a simpler environmental process, while mandating an EIS if the EA shows significant impacts.

Another commenter, noting the change proposed for busway projects on existing highway facilities, argued that the initiation or increase of rail passenger service on rail lines already in use was analogous and should, therefore, not require an EIS. Reference was made to an exemption from State environmental requirements for such projects in California. The UMTA recognizes there may be some cases where a rail rapid transit project proposed on an existing railroad right-of-way can be built and operated with minimal environmental impact. In such cases, the fact that displacement of residences and businesses is avoided or minimized alleviates one potentially significant concern. However, these projects are exceptions which would not warrant a change in emphasis in the regulation. Sometimes rail projects are proposed on railroad rights-of-way that are abandoned or lightly used for freight. In these situations, the rapid transit project may intensify some effects associated with existing railroad operations, e.g., wayside noise, and could introduce new impacts at proposed station locations, such as traffic congestion and parking demand. It should be noted that listing as a Class I action does not preclude the handling of specific cases with EAs. The FHWA and the UMTA will continue to review individual project proposals to establish the appropriate environmental

document and level of environmental analysis.

Section 771.117. Categorical Exclusions. CEs are types of actions which in the Administration's experience have normally been found not to have significant environmental effects. Designation as a CE speeds the Administration's approval process by eliminating the need for an EIS or EA on an activity proposed for Federal funding. The FHWA and the UMTA proposed several important changes to the process of classifying and approving CEs in the NPRM and many comments were made on the changes. It is important to note that these changes have been made in response to the CEQ's latest guidance to Federal agencies on this subject (48 FR 34283, July 26, 1983). Agencies were encouraged to add the flexibility to their implementing procedures to allow new types of actions to be classified as CEs with minimal documentation required. They were to do this by developing more broadly defined criteria as well as providing examples of typical CEs, rather than a comprehensive list, so that specific actions not previously listed by an agency could be considered for CE status on a case-by-case basis. This regulation generally adopts this approach.

We have amended §§ 771.115 and 771.117 to clarify FHWA's and UMTA's role in reviewing CE designations for proposed projects. These amendments are designed to speed the approval of many smaller projects while focusing attention on projects with particular environmental concerns. This change in procedures is one of the several steps taken by FHWA to comply with the requirements of section 129 of the STAA of 1982.

The FHWA and the UMTA have examined the existing list of categorically excluded actions and separated it into two groups. The first group includes actions which experience has shown almost never involve significant impacts. The second group contains examples of projects which usually have been found appropriate for CE classification but may, depending upon the circumstances, have significant adverse effects (e.g., increased noise, wetlands encroachment, historic site impacts) which would preclude the use of the CE classification. Site location and the surrounding land use are often key factors. Thus, the Administration will require all appropriate information on the area immediately surrounding the proposed project site and any specific impact studies which may be needed to

determine whether CE status is appropriate.

It should be noted that projects approved on an individual basis will not be added to the list or examples in the regulation. Reviews of individual projects for CE status on a case-by-case basis will be at the field office level, although there will be coordination with Headquarters. Where a pattern emerges of granting CE status for a new type of project, rulemaking will be initiated to determine whether to add such projects to the list of CE examples in the regulation. Section 771.117(e) has been added to the regulation to describe these procedures.

Some commenters objected to the intent of splitting the original CE list into two groups and suggested that the Administration give a one-time designation to all CEs with no further review. This view contrasts sharply with the comments of others who felt the one-time designation for certain CEs would allow some projects with adverse consequences to escape scrutiny. The FHWA and the UMTA believe that this regulation strikes the proper balance. Only those actions which normally have no effect or minimal effect on the environment are included in the first group of CEs. Furthermore, in unusual circumstances, even these actions must undergo an environmental review if an EIS could be required, as provided in § 771.117(b).

Several commenters expressed the concern that specific environmental laws and administrative requirements might be overlooked if a project qualified as a CE in the NEPA compliance process, particularly in the first group of CE projects, which do not require individual Administration approval. One commenter noted that many of the actions listed in the second group of CEs could have significant effects depending on the location of the activity; thus, they should be subject to the more thorough analysis of an EA.

The final regulation is an effort to strike a reasonable balance between environmental concerns and the reduction of excessive procedures and paperwork. In adopting this approach, it is not the intention to exempt the first group of actions from any appropriate Administration review. Experience has shown that the actions placed in the first group almost never cause significant impacts to the environment and, from the standpoint of NEPA, are properly classified as CEs.

This prior approval with respect to NEPA compliance in no way implies that a project is exempt from the requirements of other laws. All other

laws and procedures still apply. For example, minor modifications to a historic building may require a review pursuant to section 106 or the proposed use of a minimal amount of land protected by section 4(f) may require review under that statute. We believe that these cases will be identified from information in the grant application and in other pertinent planning and programming documents available to the Administration. If there is any doubt over the applicability of a related environmental law or regulation, the Administration will request additional information to help determine whether such requirements apply. These determinations can usually be made with only a brief description of the area immediately surrounding the proposed project site.

The second group of CEs is composed of projects which normally do not involve significant environmental effects when carried out under the conditions or criteria set forth. They generally involve more construction than projects in the first CE group, and their designation as CEs is more dependent on proper siting. Projects in the second group will require documentation from the applicant to clearly establish that there are no significant impacts.

Several commenters expressed concern that the documentation required for the second group of categorically excluded projects defeats the purpose of the CE concept. We believe that this documentation, focused on particular areas of concern, is the only way to proceed while ensuring that federally assisted projects do not cause environmental harm. We expect that the documentation will be briefer than an EA since it will be focused on a limited number of environmental concerns and usually will not include an evaluation of alternatives as is often contained in an EA. Under this approach, projects which appear to meet the general criteria for CEs in paragraph (a) but are not specifically mentioned in the regulation may be approved on a case-by-case basis as provided in § 771.117(d).

Also with respect to CEs, there were numerous suggestions to: (1) Delete certain actions from the CE lists altogether, thus requiring preparation of EAs at a minimum, and (2) move certain CEs from the first group to the second group, requiring some level of supporting documentation, and move some from the second group to the first group. As a result, FHWA and UMTA reassessed all the CEs to determine if their present status was appropriate. Certain

refinements are reflected in this final regulation.

One commenter requested that CE status be given to all projects funded under sections 16 and 18 of the UMT Act which deal with elderly and handicapped access to transportation facilities and assistance for non-urban areas, respectively. A new CE has been added to cover modifications to facilities or vehicles for the express purpose of elderly and handicapped accessibility. Many of the projects funded with grants under section 18 are covered by existing CEs, e.g., new bus maintenance facilities, reconstruction of existing buildings, and vehicle purchases. However, a blanket CE for any project that might be proposed under section 18 is inappropriate.

A number of commenters asked for changes to clarify the description of certain CEs. One suggestion dealt with the CE for rehabilitation of rail or bus buildings in which "only minor amounts of additional land are required." We agree with the commenter that the ultimate concern is not the amount of additional land but whether significant environmental effects are involved. However, limiting this CE to situations where only minor amounts of additional land are needed draws a distinction between a rehabilitation or renovation-type project and a major expansion of an existing facility generally requiring more land. We have retained the existing language because there is greater confidence that the project as described would qualify as a CE.

A number of commenters suggested that weigh-station and rest-area construction should be in the first group of CEs. After considering these comments, it was decided to divide weigh-station and rest-area activities into two groups. The reconstruction and/or rehabilitation of existing facilities were added to the first group of CEs. However, because of the issues likely to be involved in the case of new rest areas or weigh stations, it was decided to leave these types of activities in the second group of CEs which requires approval on a case-by-case basis.

A number of commenters also suggested that traffic control devices be moved to the first group of CEs. Because of the wide range of activities that may take place under the broad category of "traffic control devices," the Administration has decided to divide those activities into two groups: (1) Traffic signals in the first group of CEs and (2) ramp metering controls in the second group (which requires Administration approval).

On commenter questioned whether the proposal to categorically exclude the promulgation of rules, regulations and directives which require a regulatory impact analysis was properly conceived, since the need for regulatory impact analysis seems to have little bearing on the possible environmental effects of the rule, regulation, or directive. The Administration agrees and has removed the phrase that refers to a regulatory impact analysis. Furthermore, because the vast majority of Administrative rules, regulations, and directives have not had significant environmental impacts, this action was moved from the second group to the first group of CEs. However, in unusual cases an environmental review will be conducted as required by § 771.117(b).

One commenter objected to removing the prohibition, that is in the 1980 regulation, against categorically excluding bridges on or eligible for the National Register of Historic Places and bridges providing access to barrier islands. This prohibition was removed because it is too general. Projects involving historic bridges or bridges to barrier islands may be properly categorically excluded or may require the preparation of an environmental assessment or an environmental impact statement depending on the severity of the anticipated impacts. The criteria for categorical exclusions presented in § 771.117(b) and the procedure for evaluating "unusual circumstances" in § 771.117(b) provide a suitable mechanism for determining whether, based on specific information regarding project impacts, a categorical exclusion is proper. In addition, since bridges are in the second CE category, historic bridges would always require some documentation that should reveal whether further environmental review is needed. The commenter's concern that historic bridges be adequately protected is addressed by § 771.117(b)(3), that relates to properties protected by section 4(f) or section 106. The barrier island issue is addressed by § 771.117(b)(4), that focuses on inconsistencies with environmental laws and requirements, such as the statutes that protect barrier islands.

In the proposed rule, § 771.117(b) limited the need for further environmental review to "extraordinary" cases. The historic bridge example illustrates that actions on the CE list may sometimes require a full environmental review, depending upon the circumstances. Such cases are unusual, but are not necessarily extraordinary. They indicate the need for environmental review in these and other

similar cases, § 771.117(b) has been revised to describe them as "unusual," rather than extraordinary.

Several comments concerned advance land acquisitions. We believe advance land acquisitions require more documentation than a project description. Therefore, this CE has been included under the second group of CEs in paragraph (d).

Clarification was requested as to whether construction could occur after the land was acquired. This CE is intended to cover the very limited cases where advance land acquisition as set forth in § 771.113(a) is appropriate. The CE does not cover the entire project. Thus, in these cases, even though the land is acquired early, project development cannot occur until the NEPA process is completed and the Administration reaches a decision on whether to implement the proposed project. The CE for advance land acquisition has been modified to clarify this point.

In the 1980 regulation, the CE for advance land acquisition covered hardship and protective acquisitions, as defined in 23 CFR 712.204(d), and acquisitions under section 3(b) of the UMT Act. However, because hardship and protective acquisitions were not specifically referenced in the CE, some applicants have interpreted it as establishing a category of advance land acquisition in addition to hardship and protective acquisitions. The CE has been modified to clarify this point. Thus, the CE for advance land acquisition in the final regulation continues the Administration's existing practice for advance land acquisition. A definition of these terms has been added to the regulation.

It should be noted that the number of acquisitions under section 3(b) of the Urban Mass Transportation Act to date has been very limited and is expected to remain so. The purpose of section 3(b) is to allow the acquisition of land that may or may not be used for mass transit in order to preserve that land before land speculation caused by transit development inflates the price of the land. The UMTA will approve loans under section 3(b) only for unique circumstances, such as acquisition of abandoned rail right-of-way and only where there are no immediate plans for a project. UMTA will review each case separately to determine whether the action requires and environmental review. Where the grantee has definitely planned a mass transit project, section 3(a) is the appropriate section of the UMT Act under which to proceed. Under section 3(a), any major land

acquisition requires full compliance with NEPA.

Another commenter asked UMTA to distinguish more clearly the difference between small passenger shelters and bus transfer facilities. The CE for bus shelters covers the separate small shelters typically found throughout a transit system. The bus transfer facility CE refers to local points of bus activity where several bus routes connect. It includes construction of passenger shelters, loading bays, layover areas, and related street improvements. The primary environmental concerns are the noise, traffic, and safety consequences of frequent bus movements in a new area. However, this CE does not apply to the construction of new bus terminal buildings.

In the NPRM, comments were invited on the specific conditions or criteria which should apply to a CE for rail car storage and maintenance facilities. One commenter recommended against establishing specific criteria for new rail yards since they are typically constructed in areas with compatible land uses and zoning. It was suggested that a project-by-project review would be satisfactory to identify those infrequent cases where a CE may not be appropriate. We agree that rail yards are usually located in areas characterized by industrial or transportation use. However, land-use compatibility, increased traffic, and noise have been issues where non-conforming residential land use is close by. These concerns have arisen with new facilities as well as the expansion or established rail yards. The existing wording has, therefore, been retained to describe the conditions under which approval as a CE is most likely.

There were other suggestions for new types of projects that should be categorically excluded. If, in the Administration's view, the proposal would have insignificant effects on the environment in the great majority of cases, the proposal was adopted. For this reason, as noted earlier, a CE has been added for alterations to make buildings and vehicles accessible to elderly and handicapped patrons. Other suggestions for CEs were not added as examples in the regulation because it was difficult to describe specific conditions or criteria which would provide assurance of no significant environmental effects. However, applicants may still submit new projects that they believe meet the criteria of § 771.117(c) accompanied by documentation supporting the CE designation. If the applicant's proposal for a CE involves new technology or

presents environmental impacts with which the Administration has little or no experience, it is likely that an EA will be required to examine the full range of environmental effects from such an action. In introducing flexibility in the CE process, the goal has been to speed the process for projects where there is the greatest confidence as to the insignificance of the impacts. However, this approach also requires a careful look, in the form of an EA, where greater uncertainty exists concerning environmental effects. Under paragraph (d), the Administration has the discretion to review all proposals for categorical exclusions on a case-by-case basis.

A number of comments were also received on paragraph (b) which sets forth the instances when unusual circumstances make it appropriate to require further studies to determine if the CE classification is appropriate. The level of additional study required by this paragraph will vary. In the occasional or rare case where significant impacts are caused by a normally excluded action, an EIS is required. In some cases, only a minor environmental review would be necessary and, in other cases, a full EA may be needed.

One commenter objected to the statement that "substantial controversy on environmental grounds" should trigger the requirement for an environmental study. Both the CEQ regulations and DOT Order 5610.1c list "substantial controversy" as a circumstance when a CE may not be appropriate for a normally excluded action. Substantial environmental controversy over a minor project may indeed indicate the presence of problems requiring further study.

Another commenter objected to the inclusion of significant impacts on properties protected by section 4(f) and section 106 as an example of "unusual circumstances." The point was made that some projects do not involve significant environmental impacts but may still cause effects which must be considered under section 4(f) and section 106. The commenter felt that the applicability of those laws should not automatically trigger a requirement for further NEPA documentation. The proposed language has been retained. Significant impacts on these statutorily protected sites are a clear indication of impacts not appropriately considered as a CE. This mandates a review of impacts better accomplished in an EIS or an EA rather than a separate section 4(f) evaluation. The requirement for an environmental document also underscores the importance the DOT

places on the protection of section 4(f) lands. A provision similar to paragraph (b) is contained in the DOT Order 5810.1c.

Section 771.119. Environmental Assessments. An EA must be prepared for all actions which do not qualify as a CE and do not clearly require an EIS. Studies undertaken solely to determine whether a project qualifies as a CE are not EAs. The purpose of an EA is two-fold. First, an EA should resolve any uncertainty as to whether an EIS is needed. Should the need become evident at any time in the course of the EA process, an EIS should be started. If no EIS is required, the EA process is completed with a finding of no significant impact (FONSI) (§ 771.121). Secondly, to the extent practicable, the EA should contain sufficient information to serve as the record for all environmental approvals and consultations required by law for the action and should include approvals by and consultations with other agencies, as well as those of the Administration. The EA must be made available to the public, although circulation requirements are considerably simpler than those required for an EIS.

One commenter suggested that the notification/distribution requirements for EAs be modified so that interested Federal agencies can be notified directly of the availability of EAs. Our aim is to streamline the environmental review process, particularly for those highway and transit projects that typically do not involve significant environmental impacts and are processed with EAs or as CEs. The EA is a public document, available on request from the applicant or Administration field offices. The applicant must publish a notice of its availability to ensure proper notification to the public. Notice of availability of the EA shall also be sent by the applicant to affected units of Federal, State and local government. The State agency responsible for intergovernmental coordination pursuant to Executive Order 12372 will also be notified. Beyond such notification, we do not intend to require a formal distribution process for EAs. Those agencies and interested parties participating in the early coordination/scoping process should be notified of the availability of an EA and a subsequent FONSI, should either be approved. Projects normally requiring EISs which are processed with EAs will be subject to the full, early coordination and public involvement requirements described in § 771.119.

On commenter raised a question about § 771.117(e) of the NPRM under

which the Administration encouraged applicants to prepare the EA and make it available prior to any public hearing that was required to be held on a proposed project. The concern was that the applicant must shoulder the cost of preparing an EA to satisfy a Federal requirement and would not be reimbursed for the cost of preparing the document if the grant application was subsequently disapproved. Environmental analysis is frequently funded in grants for planning or preliminary engineering which precede any Federal decision on construction funding. Thus, the possibility exists that an applicant may receive Federal funding for environmental analysis on a proposed project which, for a variety of reasons, does not advance to construction. Acceptance or approval of an EA by the Administration should not be construed as a conditional approval of the project. Lacking an earlier grant for planning or design, the applicant may have to bear the cost of preparing an EA. In most cases, however, preparation of an EA, in contrast to an EIS, does not entail a major investment of staff time and money.

When a public hearing is to be held, the EA should be prepared and made available for a reasonable period of time prior to the hearing. We will continue to encourage applicants to coordinate the EA and public hearing requirements in order to meet our responsibilities under section 1506.6 of the CEQ regulations. The preamble discussion for paragraph 771.111(i) treats the coordination of public hearings and EA preparation for transit projects funded under Sections 9 and 9A of the UMT Act.

One commenter suggested that the regulation be amended to give the Administration the option to hold a public hearing upon request. This comment has not been adopted because making this decision optional would fall short of the requirements of FHWA and UMTA statutes which mandate that an opportunity for a public hearing be afforded (see paragraphs 771.111 (h) and (i) of this regulation).

In paragraph (f), the former reference to a "shorter" time period than 30 days for comments has been changed to a "different" time period. This change was made to cover the situations where the State or local applicant or the Administration may feel a longer time period is appropriate.

The NPRM required that after any public review period for an EA, the applicant provide the Administration with a summary of any comments received. The final rule provides, instead, that the actual comments be

transmitted. This change eliminates the need to prepare a summary and avoids any possibility of misinterpreting comments.

Paragraph (g) also states that an EA, like an EIS, should be the vehicle for compliance with all applicable environmental laws and regulations. This addition merely restates in the EA section the long-standing DOT policy of a "one-stop" environmental process.

Section 771.121. Findings of no significant impact. This section remains unchanged from the NPRM except for some minor editing to improve the readability of the section.

Section 771.123. Draft environmental impact statements.

Paragraph (a) of this section and § 771.119(i) have been clarified to underscore the fact that an environmental impact statement need only be prepared when significant impacts on the environment will be or are likely to be caused by the proposed action. The environmental studies defined in § 771.107(a) or the EA discussed in § 771.119 would provide the basis for an informed judgment if there is any doubt about the magnitude of the environmental impact.

Paragraph (d) has been revised to clarify the requirements when a consultant is involved in the EIS process. This paragraph is now consistent with the definitions contained in paragraph 771.109(c) of this regulation. The FHWA deals only with SHAs and State Departments of Transportation. Accordingly, all FHWA applicants qualify as "Statewide agencies." The FHWA approval of consultants is needed only when Federal funds will be used to reimburse the consultant. In those situations, other FHWA regulations govern the consultant selection process. In the case of UMTA-funded activities, UMTA should be appraised of the possible use of consultants before work is undertaken. Although UMTA will not normally participate in the consultant selection, staff will advise applicants if there is a need for interdisciplinary capability in preparing an environmental document and will, when necessary, jointly evaluate consultants' qualifications. The UMTA will appraise applicants of paragraph 1506.5(c) of the CEQ regulations, governing work by consultants and possible conflict of interest.

Paragraph (h) has been amended to indicate that the draft EIS shall be available at the public hearing as well as a minimum of 15 days in advance of the public hearing. As expected, there were comments favoring the shortening

of the minimum period to 15 days and comments objecting that this is unreasonably short. The statutes governing FHWA and UMTA programs require only that adequate notice of any public hearings be given. The change was made to be consistent with the CEQ regulations (section 1506.6(c)). We recognize, however, that the typical EIS with a 45-day circulation period would allow a 30-day notice for a public hearing with no delay in the environmental review process. We will encourage applicants to give greater than 15-day notice whenever possible in order to foster public involvement in the NEPA process.

One commenter asked that FHWA and UMTA specify in the regulation their time for reviewing EISs. Setting time limits for the major steps in the EIS process is a task accomplished in the scoping process. The time periods will vary from project-to-project depending on the size and complexity of the project and other factors set forth in section 1501.8 of the CEQ regulations dealing with time limits.

Section 771.125. Final environmental impact statements. As with the section dealing with draft EISs, few changes were proposed to our final EIS procedures. There was support for the proposed change in paragraph (a) eliminating the requirement to describe in the final EIS the procedures to be followed to assure that all environmental mitigation measures are implemented. The FHWA and the UMTA's general approach to ensure that mitigation is carried out has been outlined in paragraph 771.109(b). Any further details would be developed on an individual project basis by the applicant and Administration. This does not represent a change in the Administration's commitment to take all practicable steps to mitigate any adverse environmental consequences caused by transportation projects.

There also was support for the proposed change to identify, rather than describe, mitigation measures. However, UMTA and FHWA have decided that the requirement of describing mitigation measures should be retained. Accordingly, the final regulation continues the existing practice of a full description of mitigation measures in the final environmental document, to the extent permitted by the level of design. When details on mitigation measures have not been developed at the time the final EIS is being prepared, the final EIS should describe the measures in as much detail as possible and give an assessment of the effectiveness of such measures in reducing environmental

harm. When there is uncertainty over the choice of mitigation measures, the range of measures under consideration should be fully described, and the final EIS should address mitigation in terms of the results that will be achieved, e.g., conforming to governmental standards or plans or meeting criteria developed for specific projects. These measures will be summarized in the Record of Decision (ROD) for projects requiring EISs.

Many commenters supported the change eliminating the need for prior concurrence by the Administration Headquarters on certain EISs. There was a dissenting view that Headquarters oversight was needed to ensure that DOT environmental protection responsibilities were being fully met. The delegation of greater EIS responsibility to field offices is an important change from the standpoint of streamlining the environmental review process. This provision allows routine EISs to be completed more quickly. Internal procedures in the FHWA and the UMTA will ensure that EISs for projects with major unresolved issues are reviewed by Headquarters. The regulation specifies those circumstances in which Headquarters' concurrence will normally be required.

The provision for legal review of final EISs has been retained. Experience has shown this to be an important requirement.

Paragraph 771.123(d)(2) of the NPRM which deals with FHWA actions on programmatic documents has been dropped from the final rule. The FHWA has issued internal operating instructions that all programmatic environmental documents will be sent to the Administration Headquarters for action. Since this is an internal Administration practice, not a requirement imposed by the Administration on its applicants, it was decided to eliminate that provision from the regulation.

Paragraph (e) concerning the significance of the Administration's approval of the final EIS has also been modified to better emphasize that approval does not constitute a present or future commitment of funds to the preferred alternative.

Section 771.127. Record of decision. The basic mechanism for the ROD remains unchanged. The ROD lays out the basis for the decision as specified in 40 CFR 1506.2 and summarizes the mitigation measures that will be incorporated in the project. The last sentence of paragraph (a) of the NPRM has been eliminated. That sentence indicated a ROD was not required for

projects where the draft EIS was filed with EPA prior to July 30, 1979. We believe that this "grandfather" clause is no longer appropriate and have eliminated it in response to comments.

The ROD is a public document and will be made available to the public on request. However, FHWA and UMTA will not routinely distribute RODs to all those who received the final EIS, nor will we distribute RODs on all projects to an individual agency. One commenter asked that we seek outside consultation and review whenever the Administration changes the proposed action and a revised ROD has to be prepared. If the proposed action changes to an alternative fully evaluated in the final EIS, but not identified as the preferred alternative in that document, the Administration will issue a new ROD and distribute it to everyone who received the final EIS. The regulation states that this distribution will be made to the extent practicable, meaning that documents will be sent to the addresses of record, but the Administration cannot ensure that people who have changed addresses will be reached.

Section 771.129. Reevaluations. This section directs the applicant to consult with the Administration prior to proceeding with major project activities, such as land acquisition and construction, to assess any changes that have occurred and their effect on the validity of the environmental document.

After the environmental process has been completed, the Administration is free to make a funding decision and proceed with construction of a project. The decision to implement a project may occur soon after the final environmental document is approved and circulated or it may be deferred for various reasons. Where a substantial period of time has elapsed since the initial environmental review process, the Administration needs to determine whether existing environmental documents and findings remain valid before moving ahead with construction. The Administration must also ensure that mitigation measures stated as commitments in environmental documents have been incorporated in appropriate contract documents, plans, specifications, and estimates.

Many commenters objected to the proposal in the NPRM for a written evaluation, required in all cases, to assess whether the final EIS was still current. Based on these comments, the Administration has agreed that a written evaluation of the final EIS should not be required before every major project approval or filing for a Federal permit. Instead, the Administration has substituted two

paragraphs. One of these requires a written evaluation of the final EIS if major steps to advance a project have not been taken within 3 years of final EIS approval or the last major Administration approval or grant. The purpose of this paragraph is to require a careful look at proposed projects which have not gone to construction and have been inactive for a relatively long time since the final EIS or last major step in project development. A similar paragraph appeared in the 1980 regulation but was deleted in the NPRM.

The second paragraph, paragraph (c) in the final regulation, requires consultation in all cases not covered by paragraphs (a) and (b), but leaves discretion to determine on a case-by-case basis whether a written report is required. The Administration will determine whether the changes are significant enough to warrant a supplemental EIS (as outlined in § 771.130). The Administration believes the fixed time period of paragraph (b) and the flexibility of paragraph (c) would accomplish the purpose of the NPRM, without imposing the burdens objected to by the commenters.

Normally, the reevaluation requirements apply at the right-of-way authorization stage and at the construction stage. However, on the more complex projects, the Administration may identify additional points at which it would be appropriate to reevaluate the status of the previously approved environmental document. The regulation is structured to ensure that the Administration has a current and valid environmental document on file prior to permitting the applicant to proceed with any subsequent phase of the pending project.

Section 771.130. Supplemental environmental impact statements. Paragraph (a) retains the provisions in the 1980 regulation that a draft or final EIS may be supplemented at any time. This provision had been included in § 771.127(a) of the NPRM. In addition, it makes clear that a supplemental EIS may be supplemented at any time.

Paragraph (a) also identifies those situations in which a supplemental EIS must be prepared. A supplemental EIS is required where changes in the proposed action or new information or circumstances relevant to environmental concerns and bearing on the proposed action would result in significant environmental impacts not already evaluated in the EIS. The language in paragraph (a) was changed to more closely parallel the CEO regulations. It replaces § 771.129(b) of the 1980 regulation which required a supplemental EIS when there had been

"significant changes in the proposed action, the affected environment, the anticipated impacts, or the proposed mitigation measures." The word "change" in the regulation is no longer limited to the four categories set forth in the 1980 regulation. Instead, this paragraph focuses the determination of whether a change or new information is "significant" to the anticipated impacts of the proposed action. The regulation is intended to distinguish, for example, between new information that may be very important or interesting, and thus, significant in one context, such as to the scientific community, and yet should not be considered "significant" so as to trigger preparation of a supplemental EIS because the information does not result in a significant change in the anticipated environmental impacts of the proposed action.

Paragraph (b) identifies two circumstances in which a supplemental EIS is not required. Paragraph (b)(1) provides that no supplemental EIS is required where changes or new information would mitigate or lessen adverse impacts that have already been evaluated in the EIS and do not cause any other environmental impacts that are significant and which were not evaluated in the EIS. This provision is intended to cover primarily the situation where a proposed action is down scaled or additional mitigation measures are incorporated in a project. Changes or new information that only reduce impacts and are of the same character as those discussed in the EIS could include, for example, less right-of-way taken, fewer relocations, or reduced noise levels as a result of additional noise walls. This section only applies where the change or new information does not cause any other impacts that are significant. If the change or new information results in impacts that were not evaluated, a supplemental EIS would be required if the new impacts are significant. Thus, in response to comments on the NPRM, the regulation recognizes that even beneficial changes may be significant and require a supplement if they result in a type of impact that was not evaluated in the original EIS. Further, if previously evaluated impacts become significantly worse, so that the environmental impacts of the action are greater than thought initially, a supplemental EIS would also be required. For example, a supplemental EIS would continue to be required where mitigation measures, presented as commitments in the final EIS, are changed or withdrawn, thereby creating new and significant environmental effects.

Paragraph (b)(2) indicates that a supplemental EIS will not be necessary if a decision is made to fund an alternative fully evaluated in a previous EIS but not identified therein as the preferred alternative. In those situations, a revised ROD must be prepared and provided to all parties that received a copy of the final EIS. A supplemental EIS would be required if the impacts from the alternative now designed as the preferred alternative were not fully evaluated and appropriate mitigation measures included in the original EIS. After a revised ROD is prepared, public and agency notification of the change in the recommended alternative is essential. The specific methods used to notify the public of the change will be determined by the Administration on a case-by-case basis.

Paragraph (c) is new paragraph that expresses in slightly different terms a provision contained both in the 1980 rule and the NPRM. If the Administration is uncertain whether the proposed changes to the project would result in significant environmental impacts, it may require the applicant to prepare an EA or environmental studies to aid in determining the significance of the effects. An EA would be appropriate where a number of different environmental effects need to be assessed and, in the Administration's view, there is uncertainty as to the significance of these effects. Also, an EA is warranted if the Administration feels that an examination of alternative routes, sites, or designs (beyond the normal consideration of design options as the project is being refined) might identify ways to avoid or mitigate probable adverse effects. If these effects are found to be not significant, the Administration will document its decision with a notation to the files for projects where environmental studies were prepared and with a FONSI for projects where an EA was prepared.

Several commenters objected to the paragraph in the NPRM which described circumstances under which supplemental EISs may be needed for UMTA's major investment projects. The concern was that this would add to an already lengthy EIS process. This provision has been modified and retained as paragraph (e). It does not require that supplements be prepared in all cases; it gives UMTA the discretion to prepare such a document in those cases where a substantial body of new information relevant to environmental concerns has been developed.

Although it is similar to tiering in that the environmental focus is sharpened as project details are developed, a

supplement eliminates the need to prepare two separate draft and final EISs as in tiering. The UMTA will continue to require a draft EIS at an early stage of project planning for major investments (i.e., alternative analyses); thus, we want to preserve the option of preparing a supplemental draft EIS when circumstances dictate.

Section 771.129(b) of the 1980 regulation stated that a decision to prepare a supplemental EIS does not require withdrawal of the previous approvals for those aspects of the proposed action not directly affected by the changed condition or new information. While the 1980 regulation was silent on whether activities already in progress under the prior approval should be suspended, it has generally been held that such activities need not be suspended. In addition, it has been held that new approvals of activities outside the scope of the supplemental EIS may be granted while a supplemental EIS is being processed.

Provisions have been added to paragraph (f) specifically to permit these practices. These provisions apply only to supplemental EISs of limited scope. Where the supplemental EIS requires a comprehensive reexamination of the entire project or more than a limited portion of the project, then the Administration would suspend any activities that may have an adverse environmental impact or prejudice the selection of reasonable alternatives.

Section 771.131. Emergency action procedures. This section is unchanged from the NPRM.

Section 771.133. Compliance with other requirements. This section is unchanged from the NPRM.

Section 771.135. Section 4(f) (49 U.S.C. 303). This section sets forth the procedures for applying section 4(f). There have been few substantive changes made from the 1980 regulation. Those that have been made are designed to give the Administration more flexibility in dealing with particular actions or to clarify existing requirements. We do not believe that any of the changes diminish the substantive protection provided section 4(f) sites.

Numerous comments were received on this section. To a large extent, these comments urged the Administration to narrow the situations in which section 4(f) would apply. For example, some commenters expressed frustration with the application for section 4(f) requirements to acquisition of minor amounts of land resulting in little or no impact on the site. The legislative history of section 4(f) makes clear that the "nibbling away" of section 4(f) lands

by repeated minor acquisition was of primary concern to Congress. As a result, the DOT and the courts have always taken the position that even minor takings require the preparation of a section 4(f) document.

Paragraph (c) has been revised to emphasize that the "entire resource" must be found to be not significant before the Administration can determine that section 4(f) requirements are not applicable. Furthermore, determination that an entire area is not significant is subject to review by the Administration prior to a determination that section 4(f) requirements are not applicable. This has been a longstanding Administration practice and the change in the regulation states existing practice.

Paragraph (d) addresses the application of section 4(f) to publicly owned lands managed for multiple use. Typically, multiple use management is applied to the natural resources on large tracts of land where such resources can serve a variety of needs. Section 4(f) will apply only to those parts designated or being used for park, recreation, or wildlife refuge purposes. It should be noted that the multiple-use concept does not apply within areas which have been designated as parks, recreation areas, or wildlife and waterfowl refuges. Section 4(f) applies throughout such areas. Historic sites were included in this paragraph in the NPRM but have been eliminated in the final regulation because it was felt that this was inconsistent with the approach for identifying historic sites in paragraph (e). In addition, paragraph (d) has been revised from the NPRM to state more clearly the procedures for applying section 4(f) to multiple use lands.

Paragraph (f) clarifies existing FHWA and UMTA practices on the application of section 4(f) to existing transportation facilities. Examples include highway bridges, railroad stations, and terminal buildings which are on or eligible for the National Register Historic Places and proposed for improvement with Federal funds. Most of the commenters on this paragraph favored the proposed provision. The NPRM indicated that section 4(f) requirements did not apply to "work" on transportation facilities under certain circumstances. The final regulation clarifies those circumstances and substitutes for "work" the term "restoration, rehabilitation or maintenance" of transportation facilities. The intention of this change is to better define the key concept "use."

The overriding purpose of section 4(f) was to protect certain publicly owned lands and historic sites from road building and other projects, except in extraordinary circumstances. Toward

that end, section 4(f) restricts the approval of projects which require the "use" of certain publicly owned parks and recreation areas and any historic sites. The applicability of section 4(f) in the first instance, therefore, turns on whether a project requires "use" of the land in question. Courts construing the term "use" under section 4(f) have focused on whether the proposed project actually takes or significantly adversely affects the site in question. Accordingly, UMTA and FHWA believe that if a project involves a facility that is already dedicated to transportation purposes (so there is no taking), and does not adversely affect the historic qualities of that facility, then the project does not "use" the facility within the meaning of section 4(f). If there is no use under section 4(f), its requirements do not apply. This construction is consistent with the purpose of section 4(f) and with case law on this issue. Accordingly, the Administration will evaluate any proposed restoration, rehabilitation or maintenance activities of transportation facilities that are on or eligible for the National Register to determine if the criteria of paragraph (f) are met. If those criteria are met, then the work may proceed without a section 4(f) evaluation.

One commenter described paragraph (f) as having alternative criteria. This is incorrect. Both criteria must be met in order for the paragraph to apply.

Some commenters thought paragraph (f) confused the responsibilities of UMTA and FHWA under section 4(f) with our responsibilities under section 106 of the National Historic Preservation Act. The UMTA and FHWA are well aware that section 4(f) and section 106 have distinct requirements. However, in our experience, there is overlap between the analyses necessary to meet the requirements of sections 4(f) and 106. The UMTA and the FHWA's objective is to use a coordinated approach while retaining the distinct requirements of sections 4(f) and 106. If a project will adversely affect the historic qualities of the transportation facility, then the project will require the use of the facility under section 4(f), and the requirements of that provision will apply, i.e. the Administration will evaluate avoidance alternatives and measures to minimize harm to the degree necessary to make the determinations required by paragraph (a). At the same time the Administration will also comply with the separate, consultation requirements of Section 106.

One commenter suggested that paragraph (f) should apply to all section 4(f) properties, not just transportation

facilities. However, the rationale for paragraph (f) only applies to transportation facilities. Therefore, the application of paragraph (f) remains limited to transportation facilities.

Paragraph (g) deals with the application of section 4(f) to archeological resources. Whether or not section 4(f) applies to such resources will depend primarily on whether the value of the resource can best be realized through a data recovery program. The degree to which the value of the resource is tied to a particular site must also be considered. These determinations are always made in consultation with the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP).

If it is decided, after consulting the SHPO and the ACHP, that data recovery is appropriate and there is no need to preserve the resource in place, section 4(f) will not apply. However, section 4(f) will apply in case where data recovery is deemed appropriate, and, in addition, there is an overriding concern to preserve a major portion of the resource in place, e.g., for the purpose of public interpretation.

If data recovery is determined to be inappropriate, the application of section 4(f) will depend on the reason underlying this determination. If preservation in place is the paramount concern or if it is determined that there are not adequate techniques to properly recover the resource, section 4(f) will apply. However, if a data recovery program is deemed inappropriate because the site has minimal value in terms of scientific research, section 4(f) would not apply. This latter situation often arises when a proposed transportation project would affect a number of sites all of which will reveal the same information. Where an adequate data recovery program focuses on a representative site or sites, it may be determined that the remaining sites would yield no further values. Thus section 4(f) would not apply.

In reaching judgments on the value of the archeological resource, the desirability and feasibility of a data recovery plan, and the need for preservation in place, the views of the SHPO and the ACHP will be given substantial deference. The intent of this provision is not to unnecessarily narrow the application of section 4(f) when dealing with archeological sites, but, rather, to apply the protections of section 4(f) to the situations for which they were originally intended. Frequently, the greatest value of the resource can be realized through data recovery. In those cases the primary

mandate of section 4(f)—to investigate every feasible and prudent alternative to avoid the site—would serve no useful purpose.

Paragraph (g) on archeological properties also retains a provision in the 1980 regulation concerning the discovery of archeological resources during project construction. Where section 4(f) applies, the section 4(f) process will be expedited. Noting that late designation of historically significant properties has posed problems in the past by invoking section 4(f) protection late in project development, several commenters proposed cut-off points after which a property newly designated for the National Register of Historic Places would not be afforded section 4(f) protection. Paragraph (h) deals with late designations of parks, recreational areas, and historic sites. With respect to historic and cultural properties, the regulation establishes an affirmative responsibility of the Administration and the applicant to identify historic properties on or eligible for the National Register of Historic Places. This is to be done early in the NEPA compliance process; thus, it is not expected that there will be late identification of historic buildings or structures. However, unidentified archeological resources do pose problems and paragraph (g) sets forth an expedited approach for these cases.

Another commenter found the regulation unclear as to how properties "on or eligible for the National Register" would be identified, and questioned whether only those properties known to the SHPO would be considered. Particularly where large projects are concerned, FHWA and UMTA, in cooperation with the applicant, will undertake a survey to identify properties which are potentially eligible for the National Register. The Administration or the applicant will seek assistance from the SHPO in this identification effort but a State register or list of historic properties provided by State and local officials does not relieve FHWA or UMTA from the need to undertake a comprehensive inventory. If the SHPO indicates that an adequate inventory of the area has already been completed, this will normally satisfy Federal requirements.

A sentence has been added to paragraph (i) in recognition of FHWA's use of programmatic section 4(f) evaluations. In such cases, coordination and documentation are usually accomplished in two phases. The first phase, the development of the programmatic section 4(f) evaluation, entails coordination with interested agencies and organizations, and

culminates in the issuance of a document (the programmatic section 4(f) evaluation) which defines the criteria and procedures for its use and contains requisite legal findings. The second phase, the use of the programmatic evaluation on a specific project, involves coordination with the officials with jurisdiction over the section 4(f) resource in question and documentation sufficient to demonstrate that the procedures set up by the programmatic evaluation has been followed. The UMTA currently has no plans to issue any programmatic section 4(f) evaluations.

Paragraph (n) adopts a provision set forth at § 771.133(m) of the NPRM. It emphasizes that the decision to prepare a supplemental environmental document must be made pursuant to § 771.130 of this regulation, independent of any decision to prepare new or separate section 4(f) documentation. The mere change in legal status of an area to which section 4(f) applies does not require such a supplemental document if the environmental impacts of the action on the area or the site have already been evaluated. Similarly, changes in the action which may generate additional section 4(f) requirements would not also require supplemental environmental documentation if the changes were not environmentally significant.

Paragraph (n) has also been modified to clarify that project activities need not be suspended and that new project approvals may be granted during the preparation of a separate section 4(f) evaluation when it is prepared late in project development. The Administration will hold in abeyance those aspects of the project that may prejudice the consideration of avoidance alternatives or measures to minimize harm, but may proceed with other elements of the project.

Section 771.137. International actions. This portion of the regulation has been taken from DOT Order 5610.1C. The Administration did not receive any comments on this section. However, certain editorial changes were made to clarify the application of this section to FHWA and UMTA programs.

Section 771.111(h) Public Involvement. On January 31, 1985, the FHWA published at 50 FR 4528, Docket No. 85-12, a NPRM: amendment and rescission of public involvement regulations. The purpose of this proposal was to eliminate confusing regulatory duplication as part of FHWA's overall efforts to institute a streamlined environmental process in which public involvement is fully integrated with

other project development and environmental procedures.

The FHWA has had two major regulations which pertain to public involvement. Detailed requirements for public hearings and location and design approval appear in 23 CFR Part 790. Beginning in 1974, the FHWA provided an alternative process for public involvement/public hearings and project location approval. This alternative process has given the States more flexibility in developing public involvement programs which are better integrated into the States' project development processes.

In order to avoid the confusion and inefficiency of two separate, but duplicative public involvement regulations, this final rule rescinds 23 CFR Part 790 and consolidates in 23 CFR 771.111(h) all regulatory requirements for public involvement in the development of Federal-aid highway projects. To allow the fewer than 10 States still conducting public hearings under 23 CFR Part 790 time to adopt new public involvement/public hearing procedures which satisfy the requirements of 23 CFR 771.111(h), the effective date of the rescission of Part 790 has been delayed 1 year after the publication of this notice in the Federal Register.

In addition, individual public involvement requirements appear at 23 CFR 650.109. The FHWA is consolidating all public involvement requirements in 23 CFR 771.111(h). Thus, § 650.109 is rescinded as a technical amendment in this final notice. This will remove the specific requirement by FHWA that significant floodplain encroachments be identified in public hearing notices. Section 771.111(h)(2)(iv) has been modified to require that public hearing notices provide information required to comply with public involvement requirements of other laws, Executive Orders and regulations. This would cover the requirement for a public notice of encroachments as required by Executive Order 11988, "Floodplain Management." In addition, FHWA plans to issue technical guidance to ensure that notice of encroachment is provided as part of the public notice.

The FHWA believes that 23 CFR 771.111(h), as amended in this final rule, will result in better public involvement. It more clearly encourages early identification of issues, early consultation and continuing coordination with concerned members of the public, and early resolution of issues.

No major changes are being made in existing programs, policies, and procedures with respect to public

involvement or design approval. The rescission of 23 CFR Part 790 does not in any manner eliminate the requirements for design approvals under 23 U.S.C. 106, 109, and 112. Design submissions and approvals to meet these requirements are carried out according to procedures developed by the FHWA and the State highway agencies. These procedures have been tailored to fit the specific project-development processes of each State highway agency.

Eight comments, all from State highway agencies, were received on the NPRM. The FHWA has given the following consideration to these comments.

Three commenters supported the rescission of 23 CFR Part 790 and the simplification of FHWA's regulations concerning public involvement.

In the NPRM, the FHWA proposed linking the conditions triggering a required public hearing to the classification of projects according to their environmental documentation. However, two commenters correctly pointed out that one of the proposed public hearing criteria (Class II and III projects with significant environmental effects) in 23 CFR 771.111(h)(2) was inconsistent with the definitions of Class II and Class III projects found in 23 CFR 771.115. The FHWA had decided to return the wording of the criteria triggering a required public hearing to the four criteria previously found in 23 CFR 771.111(h). This will assure that there is no change in the opportunities for a public hearing as a result of the present rulemaking.

Two SHAs observed that the criteria for public hearings on Class III projects are less stringent than their current procedures which require a public hearing for all Class III projects. This final rule states minimum Federal criteria for public involvement on Federal-aid highway projects. If, in its public involvement/public hearing procedures, a State chooses to exceed these Federal requirements, that is the State's prerogative. Thus, in their public involvement/public hearing procedures States may require public hearings for all Class III projects.

One western State highway agency expressed concern that public hearings for Class II and III projects requiring substantial amounts of right-of-way resulted in some hearings of little or no public interest, since the projects involved only one or two landowners. The commenter asked that "substantial" right-of-way acquisition be replaced by "sensitive" right-of-way acquisition. The FHWA believes the regulation provides for this situation through the public hearing opportunity. The State highway

agency may advertise an opportunity for a public hearing. Except to the extent required by 23 U.S.C. 128, if a project does not arouse public interest, a public hearing need not be held.

It was suggested by two commenters that requiring submission to the FHWA of a written, verbatim transcript is unnecessary for some public hearings. The revised regulation simply retains and repeats the statutory requirements of 23 U.S.C. 128 for transcripts.

One commenter expressed concern that the reevaluation of a project's public involvement activities not become a separate procedural reevaluation in addition to the substantive reevaluation of the project's environmental document under 23 CFR 771.129. The NPRM may not have been clear that the reevaluation of public involvement is intended to be based on the project reevaluation. The wording of the regulation has been changed to make this relationship clearer.

In addition, the FHWA has clarified wording at several points and deleted reference to the inclusion of other agencies and governmental jurisdictions in public involvement/public hearing procedures and to other agencies receiving notices of public hearings (23 CFR 771.111(h)(2)(iii) and (iv)). Coordination with other agencies and governmental jurisdictions is addressed in 23 CFR 771.111(a), 771.119, and 771.123 (c) and (g). Written statements from the public to accompany the public hearing transcript have been more clearly defined in 23 CFR 771.111(h)(2)(v). Publication in the Federal Register of notices of availability of new public involvement/public hearing procedures has been eliminated as not being an effective way to reach residents of specific States. The FHWA encourages States to use appropriate ways of communicating the provisions of their public involvement/public hearing procedures to residents. Separate reference to mitigation measures as an element of the public hearing presentation has also been deleted (23 CFR 771.111(a)(2)(v)(D)) because the beneficial impacts of mitigation measures are included in the required discussion of impacts.

As a result of the rescission of 23 CFR Part 790 and amendments to 23 CFR 771.111(h), those few States currently under 23 CFR 790 must submit procedures for approval under Section 771.111(h); however, these States will at the same time have the opportunity to gain flexibility to conduct public hearings in a way which is compatible with the State's own project development process. The remaining

States for which alternate public involvement/public hearing procedures already have been approved pursuant to 23 CFR 771 are not required to adopt new public involvement/public hearing procedures.

The public involvement procedures developed pursuant to this section must be sufficient to meet the public hearing and other public involvement requirements imposed by law or regulation on FHWA. Furthermore, in implementing this section, the FHWA urges the States, including States with procedures already approved by FHWA, to consider the public involvement needs of other State and Federal agencies with approval, permitting or consultation responsibilities for highway actions. The FHWA has engaged in extensive discussion with Federal agencies having such responsibilities in an effort to find ways to expedite the highway approval process. One of the most effective ways of accomplishing this goal is to avoid multiple and other duplicative public hearings or other public meetings. Section 771.111(h)(2)(i) should be read broadly to encourage the States to adopt public involvement procedures which accommodate the needs of as many other involved State and Federal agencies as practicable.

Implementation

Other Federal agencies are often involved in reviewing the environmental effects of UMTA and FHWA actions. It is important that these agencies have an opportunity to provide feedback on how well they perceive that interagency coordination is working under the new regulation. To give them this opportunity, FHWA will sponsor a series of meetings, region by region, to air issues of mutual concern pertaining to this regulation. FHWA plans to hold these meetings about a year to a year and a half after this regulation becomes effective.

Regulatory Impacts

The Administrators of FHWA and UMTA have determined that this document does not contain a major rule as defined by Executive Order 12291. However, it is a significant rulemaking action under Department of Transportation regulatory policies and procedures because important departmental policy is implemented by FHWA and UMTA as involved.

A regulatory evaluation has been prepared and is available for inspection in the FHWA docket room. A copy may be obtained from Mr. Frederick Skaer or Mr. A. Joseph Ossi at the addresses provided under the heading "For Further Information Contact."

The amendments impose no additional requirements. The anticipated impacts include the elimination of duplicative requirements and the increase in decisionmaking authority for the Administration's field offices. By streamlining the project development process, the amendments should reduce project development time and costs. Economic savings will be realized through changes which permit more efficient processing of legally required documentation.

With regard to the public involvement requirements which were the subject of a separate NPRM (50 FR 4528), since there will be no substantial change in the approach FHWA has traditionally employed in dealing with public involvement, it is anticipated that this action will not have a significant economic impact. The economic impacts, if any, would result in administrative savings caused by the elimination of procedural duplication.

The impact of the other amendments will fall primarily on Federal and State and local governments. It is possible that application of this rule could have an adverse economic impact on small governmental jurisdictions that must prepare environmental documents. However, the potential impacts derive primarily from NEPA and not from the procedures contained in this rule. For these reasons and under the criteria of the Regulatory Flexibility Act, FHWA and UMTA hereby certify that this document will not have a significant economic impact on a substantial number of small entities.

In accordance with the Paperwork Reduction Act of 1980 (Pub. L. 96-511), the information collection requirements contained in this document are being submitted for approval to the Office of Management and Budget (OMB).

List of Subjects in 23 CFR 771 and 750 and 49 CFR 622

Environmental impact statements, Grant programs—transportation, Highways and roads, Highway location and design, Public hearings, Reporting and recordkeeping requirements, Mass transportation, Historic Preservation, Parks, Public lands—multiple use, Recreation areas, Wildlife refuges.

(Catalog of Federal Domestic Assistance Program Numbers: 20.205, Highway Research, Planning and Construction; 20.500, Urban Mass Transportation Capital Grants; 20.501, Urban Mass Transportation Capital Improvement Loans; 20.504, Urban Mass Transportation Technology; 20.505, Urban Mass Transportation Technical Studies Grants; 20.506, Urban Mass Transportation Demonstration Grants; 20.507, Urban Mass Transportation Capital and Operating

Assistance Formula Grants; 20.509, Public Transportation for Rural and Small Urban Areas; 20.510, Urban Mass Transportation Planning Methods, Research and Development; 23.003, Appalachian Development Highway Systems; 23.060, Appalachian Local Access Roads. The regulation implementing Executive Order 12372 regarding intergovernmental consultation on Federal programs and activities apply to this program.)

In consideration of the foregoing, Chapter VI of Title 49 and Chapter I of Title 23, Code of Federal Regulations, are amended as set forth below.

Issued on August 27, 1987.

Robert L. Farris,
Deputy Federal Highway Administrator,
Alfred A. Dellibovi,
Deputy Administrator, Urban Mass
Transportation Administration.

1. Subpart A of Part 622 of 49 CFR is revised to read as follows:

TITLE 49—TRANSPORTATION

CHAPTER VI—URBAN MASS TRANSPORTATION ADMINISTRATION, DEPARTMENT OF TRANSPORTATION

PART 622—ENVIRONMENTAL IMPACT AND RELATED PROCEDURES

Subpart A—Environmental Procedures

Sec.

622.101 Cross-reference to procedures.

Authority: 42 U.S.C. 4321 *et seq.*; 49 U.S.C. 1601 *et seq.*; 49 CFR 1.51.

Subpart A—Environmental Procedures

§ 622.101 Cross-reference to procedures.

The procedures for complying with the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 *et seq.*), and related statutes, regulations, and orders are set forth in Part 771 of Title 23 of the Code of Federal Regulations.

2. Part 771 of 23 CFR is revised to read as follows:

TITLE 23—HIGHWAY

CHAPTER I—FEDERAL HIGHWAY ADMINISTRATION, DEPARTMENT OF TRANSPORTATION

SUBCHAPTER H—RIGHT-OF-WAY AND ENVIRONMENT

PART 771—ENVIRONMENTAL IMPACT AND RELATED PROCEDURES

Sec.

771.101 Purpose.
771.103 [Reserved]
771.105 Policy.
771.107 Definitions.
771.109 Applicability and responsibilities.
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771.115	Classes of actions.
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771.121	Findings of no significant impact.
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771.125	Final environmental impact statements.
771.127	Record of decision.
771.129	Reevaluations.
771.130	Supplemental environmental impact statements.
771.131	Emergency action procedures.
771.133	Compliance with other requirements.
771.135	Section 4(f) (49 U.S.C. 303).
771.137	International actions.

Authority: 42 U.S.C. 4321 *et seq.*; 23 U.S.C. 109, 128, 138 and 315; 49 U.S.C. 303(c), 1802(d), 1804(h), 1804(i), and 1810; 40 CFR Part 1500 *et seq.*; 49 CFR 1.48(b) and 1.51.

§ 771.101 Purpose.

This regulation prescribes the policies and procedures of the Federal Highway Administration (FHWA) and the Urban Mass Transportation Administration (UMTA) for implementing the National Environmental Policy Act of 1969 as amended (NEPA), and the regulation of the Council on Environmental Quality (CEQ), 40 CFR Parts 1500-1508. This regulation sets forth all FHWA, UMTA, and Department of Transportation (DOT) requirements under NEPA for the processing of highway and urban mass transportation projects. This regulation also sets forth procedures to comply with 23 U.S.C. 109(h), 128, 138, and 49 U.S.C. 303, 1802(d), 1804(h), 1804(i), 1807a, 1807a-1 and 1810.

§ 771.103 [Reserved]

§ 771.105 Policy.

It is the policy of the Administration that:

(a) To the fullest extent possible, all environmental investigations, reviews, and consultations be coordinated as a single process, and compliance with all applicable environmental requirements be reflected in the environmental document required by this regulation.¹

(b) Alternative courses of action be evaluated and decisions be made in the best overall public interest based upon a balanced consideration of the need for safe and efficient transportation; of the social, economic, and environmental impacts of the proposed transportation

improvement; and of national, State, and local environmental protection goals.

(c) Public involvement and a systematic interdisciplinary approach be essential parts of the development process for proposed actions.

(d) Measures necessary to mitigate adverse impacts be incorporated into the action. Measures necessary to mitigate adverse impacts are eligible for Federal funding when the Administration determines that:

(1) The impacts for which the mitigation is proposed actually result from the Administration action; and

(2) The proposed mitigation represents a reasonable public expenditure after considering the impacts of the action and the benefits of the proposed mitigation measures. In making this determination, the Administration will consider, among other factors, the extent to which the proposed measures would assist in complying with a Federal statute, Executive Order, or Administration regulation or policy.

(e) Costs incurred by the applicant for the preparation of environmental documents requested by the Administration be eligible for Federal assistance.

(f) No person, because of handicap, age, race, color, sex, or national origin, be excluded from participating in, or denied benefits of, or be subject to discrimination under any Administration program or procedural activity required by or developed pursuant to this regulation.

§ 771.107 Definitions.

The definitions contained in the CEQ regulation and in Titles 23 and 49 of the United States Code are applicable. In addition, the following definitions apply.

(a) *Environmental studies*—The investigations of potential environmental impacts to determine the environmental process to be followed and to assist in the preparation of the environmental document.

(b) *Action*—A highway or transit project proposed for FHWA or UMTA funding. It also includes activities such as joint and multiple use permits, changes in access control, etc., which may or may not involve a commitment of Federal funds.

(c) *Administration action*—The approval by FHWA or UMTA of the applicant's request for Federal funds for construction. It also includes approval of activities such as joint and multiple use permits, changes in access control, etc., which may or may not involve a commitment of Federal funds.

(d) *Administration*—FHWA or UMTA, whichever is the designated lead agency for the proposed action.

(e) *Section 4(f)*—Refers to 49 U.S.C. 303 and 23 U.S.C. 138.²

§ 771.109 Applicability and responsibilities.

(a)(1) The provisions of this regulation and the CEQ regulation apply to actions where the Administration exercises sufficient control to condition the permit or project approval. Actions taken by the applicant which do not require Federal approvals, such as preparation of a regional transportation plan are not subject to this regulation.

(2) This regulation does not apply to, or alter approvals by the Administration made prior to the effective date of this regulation.

(3) Environmental documents accepted or prepared by the Administration after the effective date of this regulation shall be developed in accordance with this regulation.

(b) It shall be the responsibility of the applicant, in cooperation with the Administration to implement those mitigation measures stated as commitments in the environmental documents prepared pursuant to this regulation. The FHWA will assure that this is accomplished as a part of its program management responsibilities that include reviews of designs, plans, specifications, and estimates (PS&E), and construction inspections. The UMTA will assure implementation of committed mitigation measures through incorporation by reference in the grant agreement, followed by reviews of designs and construction inspections.

(c) The Administration, in cooperation with the applicant, has the responsibility to manage the preparation of the appropriate environmental document. The role of the applicant will be determined by the Administration accordance with the CEQ regulation:

(1) *Statewide agency*. If the applicant is a public agency that has statewide jurisdiction (for example, a State highway agency or a State department of transportation) or is a local unit of government acting through a statewide agency, and meets the requirements of section 102(2)(D) of NEPA, the applicant may prepare the environmental impact statement (EIS) and other environmental documents with the Administration furnishing guidance, participating in the

¹ FHWA and UMTA have supplementary guidance on the format and content of NEPA documents for their programs. This includes a list of various environmental laws, regulations, and Executive Orders which may be applicable to projects. The FHWA Technical Advisory T8640.6A, October 20, 1987, and the UMTA supplementary guidance are available from the respective FHWA and UMTA headquarters and field offices as prescribed in 49 CFR Part 7, Appendices D and G.

² Section 4(f), which protected certain public lands and all historic sites, technically was repealed in 1983 when it was codified, without substantive change, as 49 U.S.C. 303. This regulation continues to refer to section 4(f) because it would create needless confusion to do otherwise; the policies section 4(f) engendered are widely referred to as "section 4(f)" matters. A provision with the same meaning is found at 23 U.S.C. 138 and applies only to FHWA actions.

preparation, and independently evaluating the document. All FHWA applicants qualify under this paragraph.

(2) *Joint lead agency.* If the applicant is a public agency and is subject to State or local requirements comparable to NEPA, then the Administration and the applicant may prepare the EIS and other environmental documents as joint lead agencies. The applicant shall initially develop substantive portions of the environmental document, although the Administration will be responsible for its scope and content.

(3) *Cooperating Agency.* Local public agencies with special expertise in the proposed action may be cooperating agencies in the preparation of an environmental document. An applicant for capital assistance under the Urban Mass Transportation Act of 1984, as amended (UMT Act), is presumed to be a cooperating agency if the conditions in paragraph (c) (1) or (2) of this section do not apply. During the environmental process, the Administration will determine the scope and content of the environmental document and will direct the applicant, acting as a cooperating agency, to develop information and prepare those portions of the document concerning which it has special expertise.

(4) *Other.* In all other cases, the role of the applicant is limited to providing environmental studies and commenting on environmental documents. All private institutions or firms are limited to this role.

§ 771.111 Early coordination, public involvement, and project development.

(a) Early coordination with appropriate agencies and the public aids in determining the type of environmental document an action requires, the scope of the document, the level of analysis, and related environmental requirements. This involves the exchange of information from the inception of a proposal for action to preparation of the environmental document. Applicants intending to apply for funds should notify the Administration at the time that a project concept is identified. When requested, the Administration will advise the applicant, insofar as possible, of the probable class of action and related environmental laws and requirements and of the need for specific studies and findings which would normally be developed concurrently with the environmental document.

(b) The Administration will identify the probable class of action as soon as sufficient information is available to identify the probable impacts of the action. For UMTA, this is normally no

later than the review of the transportation improvement program (TIP) and for FHWA, the approval of the 105 program (23 U.S.C. 105).

(c) When FHWA and UMTA are involved in the development of joint projects, or when FHWA or UMTA acts as a joint lead agency with another Federal agency, a mutually acceptable process will be established on a case-by-case basis.

(d) During the early coordination process, the Administration, in cooperation with the applicant, may request other agencies having special interest or expertise to become cooperating agencies. Agencies with jurisdiction by law must be requested to become cooperating agencies.

(e) Other States, and Federal land management entities, that may be significantly affected by the action or by any of the alternatives shall be notified early and their views solicited by the applicant in cooperation with the Administration. The Administration will prepare a written evaluation of any significant unresolved issues and furnish it to the applicant for incorporation into the environmental assessment (EA) or draft EIS.

(f) In order to ensure meaningful evaluation of alternatives and to avoid commitments to transportation improvements before they are fully evaluated, the action evaluated in each EIS or finding of no significant impact (FONSI) shall:

(1) Connect logical termini and be of sufficient length to address environmental matters on a broad scope;

(2) Have independent utility or independent significance, i.e., be usable and be a reasonable expenditure even if no additional transportation improvements in the area are made; and

(3) Not restrict consideration of alternatives for other reasonably foreseeable transportation improvements.

(g) For major transportation actions, the tiering of EISs as discussed in the CEQ regulation (40 CFR 1502.20) may be appropriate. The first tier EIS would focus on broad issues such as general location, mode choice, and areawide air quality and land use implications of the major alternatives. The second tier would address site-specific details on project impacts, costs, and mitigation measures.

(h) For the Federal-aid highway program:

(1) Each State must have procedures approved by the FHWA to carry out a public involvement/public hearing program pursuant to 23 U.S.C. 128 and 40 CFR Parts 1500-1508.

(2) State public involvement/public hearing procedures must provide for:

(i) Coordination of public involvement activities and public hearings with the entire NEPA process.

(ii) Early and continuing opportunities during project development for the public to be involved in the identification of social, economic, and environmental impacts, as well as impacts associated with relocation of individuals, groups, or institutions.

(iii) One or more public hearings or the opportunity for hearing(s) to be held by the State highway agency at a convenient time and place for any Federal-aid project which requires significant amounts of right-of-way, substantially changes the layout or functions of connecting roadways or of the facility being improved, has a substantial adverse impact on abutting property, otherwise has a significant social, economic, environmental or other effect, or for which the FHWA determines that a public hearing is in the public interest.

(iv) Reasonable notice to the public of either a public hearing or the opportunity for a public hearing. Such notice will indicate the availability of explanatory information. The notice shall also provide information required to comply with public involvement requirements of other laws, Executive Orders, and regulations.

(v) Explanation at the public hearing of the following information, as appropriate:

(A) The project's purpose, need, and consistency with the goals and objectives of any local urban planning.

(B) The project's alternatives, and major design features.

(C) The social, economic, environmental, and other impacts of the project.

(D) The relocation assistance program and the right-of-way acquisition process.

(E) The State highway agency's procedures for receiving both oral and written statements from the public.

(vi) Submission to the FHWA of a transcript of each public hearing and a certification that a required hearing or hearing opportunity was offered. The transcript will be accompanied by copies of all written statements from the public, both submitted at the public hearing or during an announced period after the public hearing.

(3) Based on the reevaluation of project environmental documents required by § 771.129, the FHWA and the State highway agency will determine whether changes in the project or new information warrant additional public involvement.

(4) Approvals or acceptances of public involvement/public hearing procedures prior to the publication date of this regulation remain valid.

(i) Applicants for capital assistance in the UMTA program achieve public participation on proposed projects by holding public hearings and seeking input from the public through the scoping process for environmental documents. For projects requiring EISs, a public hearing will be held during the circulation period of the draft EIS. For all other projects, an opportunity for public hearings will be afforded with adequate prior notice pursuant to 49 U.S.C. 1602(d), 1604(i), 1607a(f) and 1607a-1(d), and such hearings will be held when anyone with a significant social, economic, or environmental interest in the matter requests it. Any hearing on the action must be coordinated with the NEPA process to the fullest extent possible.

(j) Information on the UMTA environmental process may be obtained from: Director, Office of Planning Assistance, Urban Mass Transportation Administration, Washington, DC 20590. Information on the FHWA environmental process may be obtained from: Director, Office of Environmental Policy, Federal Highway Administration, Washington, DC 20590.

§ 771.113 Timing of Administration activities.

(a) The Administration in cooperation with the applicant will perform the work necessary to complete a FONSI or an EIS and comply with other related environmental laws and regulations to the maximum extent possible during the NEPA process. This work includes environmental studies, related engineering studies, agency coordination and public involvement. However, final design activities, property acquisition (with the exception of hardship and protective buying, as defined in § 771.117(d)), purchase of construction materials or rolling stock, or project construction shall not proceed until the following have been completed:

- (1)(i) The action has been classified as a categorical exclusion (CE), or
 - (ii) A FONSI has been approved, or
 - (iii) A final EIS has been approved and available for the prescribed period of time and a record of decision has been signed;
- (2) For actions proposed for FHWA funding, the FHWA Division Administrator has received and accepted the certifications and any required public hearing transcripts required by 23 U.S.C. 128;
- (3) For activities proposed for FHWA funding, the programming requirements

of 23 CFR Part 450, Subpart B, and 23 CFR Part 630, Subpart A, have been met.

(b) For FHWA, the completion of the requirements set forth in paragraph (a)(1) and (a)(2) of this section is considered acceptance of the general project location and concepts described in the environmental document unless otherwise specified by the approving official. However, such approval does not commit the Administration to approve any future grant request of fund the preferred alternative.

(c) Letters of Intent issued under the authority of section 3(a)(4) of the UMT Act are used by UMTA to indicate an intention to obligate future funds for multi-year capital transit projects. Letters of Intent will not be issued by UMTA until the NEPA process is completed.

§ 771.115 Classes of actions

There are three classes of actions which prescribe the level of documentation required in the NEPA process.

(a) *Class I (EISs)*. Actions that significantly affect the environment require an EIS (40 CFR 1508.27). The following are examples of actions that normally required an EIS:

- (1) A new controlled access freeway.
- (2) A highway project of four or more lanes on a new location.
- (3) New construction or extension of fixed rail transit facilities (e.g., rapid rail, light rail, commuter rail, automated guideway transit).

(4) New construction or extension of a separate roadway for buses or high occupancy vehicles not located within an existing highway facility.

(b) *Class II (CEs)*. Actions that do not individually or cumulative have a significant environmental effect are excluded from the requirement to prepare an EA or EIS. A specific list of CEs normally not requiring NEPA documentation is set forth in § 771.117(c). When appropriately documented, additional projects may also qualify as CEs pursuant to § 771.117(d).

(c) *Class III (EAs)*. Actions in which the significance of the environmental impact is not clearly established. All actions that are not Class I or II are Class III. All actions in this class require the preparation of an EA to determine the appropriate environmental document required.

§ 771.117 Categorical exclusions.

(a) Categorical exclusions (CEs) are actions which meet the definition contained in 40 CFR 1508.4, and, based on past experience with similar actions, do not involve significant environmental

impacts. They are actions which: do not induce significant impacts to planned growth or land use for the area; do not require the relocation of significant numbers of people; do not have a significant impact on any natural, cultural, recreational, historic or other resource; do not involve significant air, noise, or water quality impacts; do not have significant impacts on travel patterns; or do not otherwise, either individually or cumulatively, have any significant environmental impacts.

(b) Any action which normally would be classified as a CE but could involve unusual circumstances will require the Administration, in cooperation with the applicant, to conduct appropriate environmental studies to determine if the CE classification is proper. Such unusual circumstances include:

- (1) Significant environmental impacts;
- (2) Substantial controversy on environmental grounds;
- (3) Significant impact on properties protected by section 4(f) of the DOT Act or section 106 of the National Historic Preservation Act; or
- (4) Inconsistencies with any Federal, State, or local law, requirement or administrative determination relating to the environmental aspects of the action.

(c) The following actions meet the criteria for CEs in the CEQ regulation (section 1508.4) and § 771.117(a) of this regulation and normally do not require any further NEPA approvals by the Administration:

(1) Activities which do not involve or lead directly to construction, such as planning and technical studies; grants for training and research programs; research activities as defined in 23 U.S.C. 307; approval of a unified work program and any findings required in the planning process pursuant to 23 U.S.C. 134; approval of statewide programs under 23 CFR Part 630; approval of project concepts under 23 CFR Part 476; engineering to define the elements of a proposed action or alternatives so that social, economic, and environmental effects can be assessed; and Federal-aid system revisions which establish classes of highways on the Federal-aid highway system.

(2) Approval of utility installations along or across a transportation facility.

(3) Construction of bicycle and pedestrian lanes, paths, and facilities.

(4) Activities included in the State's "highway safety plan" under 23 U.S.C. 402.

(5) Transfer of Federal lands pursuant to 23 U.S.C. 317 when the subsequent action is not an FHWA action.

(6) The installation of noise barriers or alterations to existing publicly owned buildings to provide for noise reduction.

(7) Landscaping.

(8) Installation of fencing, signs, pavement markings, small passenger shelters, traffic signals, and railroad warning devices where no substantial land acquisition or traffic disruption will occur.

(9) Emergency repairs under 23 U.S.C. 125.

(10) Acquisition of scenic easements.

(11) Determination of payback under 23 CFR Part 480 for property previously acquired with Federal-aid participation.

(12) Improvements to existing rest areas and truck weigh stations.

(13) Ridesharing activities.

(14) Bus and rail car rehabilitation.

(15) Alterations to facilities or vehicles in order to make them accessible for elderly and handicapped persons.

(16) Program administration, technical assistance activities, and operating assistance to transit authorities to continue existing service or increase service to meet routine changes in demand.

(17) The purchase of vehicles by the applicant where the use of these vehicles can be accommodated by existing facilities or by new facilities which themselves are within a CE.

(18) Track and railbed maintenance and improvements when carried out within the existing right-of-way.

(19) Purchase and installation of operating or maintenance equipment to be located within the transit facility and with no significant impacts off the site.

(20) Promulgation of rules, regulations, and directives. (d) Additional actions which meet the criteria for a CE in the CEQ regulations (40 CFR 1508.4) and paragraph (a) of this section may be designated as CEs only after Administration approval. The applicant shall submit documentation which demonstrates that the specific conditions or criteria for these CEs are satisfied and that significant environmental effects will not result. Examples of such actions include but are not limited to:

(1) Modernization of a highway by resurfacing, restoration, rehabilitation, reconstruction, adding shoulders, or adding auxiliary lanes (e.g., parking, weaving, turning, climbing).

(2) Highway safety or traffic operations improvement projects including the installation of ramp metering control devices and lighting.

(3) Bridge rehabilitation, reconstruction or replacement or the construction of grade separation to

replace existing at-grade railroad crossings.

(4) Transportation corridor fringe parking facilities.

(5) Construction of new truck weigh stations or rest areas.

(6) Approvals for disposal of excess right-of-way or for joint or limited use of right-of-way, where the proposed use does not have significant adverse impacts.

(7) Approvals for changes in access control.

(8) Construction of new bus storage and maintenance facilities in areas used predominantly for industrial or transportation purposes where such construction is not inconsistent with existing zoning and located on or near a street with adequate capacity to handle anticipated bus and support vehicle traffic.

(9) Rehabilitation or reconstruction of existing rail and bus buildings and ancillary facilities where only minor amounts of additional land are required and there is not a substantial increase in the number of users.

(10) Construction of bus transfer facilities (an open area consisting of passenger shelters, boarding areas, kiosks and related street improvements) when located in a commercial area or other high activity center in which there is adequate street capacity for projected bus traffic.

(11) Construction of rail storage and maintenance facilities in areas used predominantly for industrial or transportation purposes where such construction is not inconsistent with existing zoning and where there is no significant noise impact on the surrounding community.

(12) Acquisition of land for hardship or protective purposes; advance land acquisition loans under section 3(b) of the UMT Act.⁹ Hardship and protective

⁹ Hardship acquisition is early acquisition of property by the applicant at the property owner's request to alleviate particular hardship to the owner, in contrast to there, because of an inability to sell his property. This is justified when the property owner can document on the basis of health, safety or financial reasons that remaining in the property poses an undue hardship compared to others.

Protective acquisition is done to prevent imminent development of a parcel which is needed for a proposed transportation corridor or site. Documentation must clearly demonstrate that development of the land would preclude future transportation use and that such development is imminent. Advance acquisition is not permitted for the sole purpose of reducing the cost of property for a proposed project.

buying will be permitted only for a particular parcel or a limited number of parcels. These types of land acquisition qualify for a CE only where the acquisition will not limit the evaluation of alternatives, including shifts in alignment for planned construction projects, which may be required in the NEPA process. No project development on such land may proceed until the NEPA process has been completed.

(e) Where a pattern emerges of granting CE status for a particular type of action, the Administration will initiate rulemaking proposing to add this type of action to the list of categorical exclusions in paragraph (c) or (d) of this section, as appropriate.

§ 771.119 Environmental assessments.

(a) An EA shall be prepared by the applicant in consultation with the Administration for each action that is not a CE and does not clearly require the preparation of an EIS, or where the Administration believes an EA would assist in determining the need for an EIS.

(b) For actions that require an EA, the applicant, in consultation with the Administration, shall, at the earliest appropriate time, begin consultation with interested agencies and others to advise them of the scope of the project and to achieve the following objectives: determine which aspects of the proposed action have potential for social, economic, or environmental impact; identify alternatives and measures which might mitigate adverse environmental impacts; and identify other environmental review and consultation requirements which should be performed concurrently with the EA. The applicant shall accomplish this through an early coordination process (i.e., procedures under § 771.111) or through a scoping process. Public involvement shall be summarized and the results of agency coordination shall be included in the EA.

(c) The EA is subject to Administration approval before it is made available to the public as an Administration document. The UMTA applicants may circulate the EA prior to Administration approval provided that the document is clearly labeled as the applicant's document.

(d) The EA need not be circulated for comment but the document must be made available for public inspection at the applicant's office and at the appropriate Administration field offices in accordance with paragraphs (e) and (f) of this section. Notice of availability of the EA, briefly describing the action and its impacts, shall be sent by the

applicant to the affected units of Federal, State and local government. Notice shall also be sent to the State intergovernmental review contacts established under Executive Order 12372.

(e) When a public hearing is held as part of the application for Federal funds, the EA shall be available at the public hearing and for a minimum of 15 days in advance of the public hearing. The notice of the public hearing in local newspapers shall announce the availability of the EA and where it may be obtained or reviewed. Comments shall be submitted in writing to the applicant or the Administration within 30 days of the availability of the EA unless the Administration determines, for good cause, that a different period is warranted. Public hearing requirements are as described in § 771.111.

(f) When a public hearing is not held, the applicant shall place a notice in a newspaper(s) similar to a public hearing notice and at a similar stage of development of the action, advising the public of the availability of the EA and where information concerning the action may be obtained. The notice shall invite comments from all interested parties. Comments shall be submitted in writing to the applicant or the Administration within 30 days of the publication of the notice unless the Administration determines, for good cause, that a different period is warranted.

(g) If no significant impacts are identified, the applicant shall furnish the administration a copy of the revised EA, as appropriate; the public hearing transcript, where applicable; copies of any comments received and responses thereto; and recommend a FONSI. The EA should also document compliance, to the extent possible, with all applicable environmental laws and Executive Orders, or provide reasonable assurance that their requirements can be met.

(h) When the Administration expects to issue a FONSI for an action described in § 771.115(a), copies of the EA shall be made available for public review (including the affected units of government) for a minimum of 30 days before the Administration makes its final decision (See 40 CFR 1501.4(e)(2).) This public availability shall be announced by a notice similar to a public hearing notice.

(i) If at any point in the EA process, the Administration determines that the action is likely to have a significant impact on the environment, the preparation of an EIS will be required.

§ 771.121 Findings of no significant impact.

(a) The Administration will review the EA and any public hearing comments and other comments received regarding the EA. If the Administration agrees with the applicant's recommendations pursuant to § 771.119(g), it will make a separate written FONSI incorporating by reference the EA and any other appropriate environmental documents.

(b) After a FONSI has been made by the Administration, a notice of availability of the FONSI shall be sent by the applicant to the affected units of Federal, State and local government and the document shall be available from the applicant and the Administration upon request by the public. Notice shall also be sent to the State intergovernmental review contacts established under Executive Order 12372.

(c) If another Federal agency has issued a FONSI on an action which includes an element proposed for Administration funding, the Administration will evaluate the other agency's FONSI. If the Administration determines that this element of the project and its environmental impacts have been adequately identified and assessed, and concurs in the decision to issue a FONSI, the Administration will issue its own FONSI incorporating the other agency's FONSI. If environmental issues have not been adequately identified and assessed, the Administration will require appropriate environmental studies.

§ 771.123 Draft environmental impact statements.

(a) A draft EIS shall be prepared when the Administration determines that the action is likely to cause significant impacts on the environment. When the decision has been made by the Administration to prepare an EIS, the Administration will issue a Notice of Intent (40 CFR 1508.22) for publication in the Federal Register. Applicants are encouraged to announce the intent to prepare an EIS by appropriate means at the local level.

(b) After publication of the Notice of Intent, the Administration, in cooperation with the applicant, will begin a scoping process. The scoping process will be used to identify the range of alternatives and impacts and the significant issues to be addressed in the EIS and to achieve the other objectives of 40 CFR 1501.7. For FHWA, scoping is normally achieved through public and agency involvement procedures required by § 771.111. For UMTA, scoping is achieved by soliciting agency and public responses to the

action by letter or by holding scoping meetings. If a scoping meeting is to be held, it should be announced in the Administration's Notice of Intent and by appropriate means at the local level.

(c) The draft EIS shall be prepared by the Administration in cooperation with the applicant or, where permitted by law, by the applicant with appropriate guidance and participation by the Administration. The draft EIS shall evaluate all reasonable alternatives to the action and discuss the reasons why other alternatives, which may have been considered, were eliminated from detailed study. The draft EIS shall also summarize the studies, reviews, consultations, and coordination required by environmental laws or Executive Orders to the extent appropriate at this stage in the environmental process.

(d) An applicant which is a "statewide agency" may select a consultant to assist in the preparation of an EIS in accordance with applicable contracting procedures. Where the applicant is a "joint lead" or "cooperating" agency, the applicant may select a consultant, after coordination with the Administration to assure compliance with 40 CFR 1506.5(c). The Administration will select any such consultant for "other" applicants. (See § 771.109(c) for definitions of these terms.)

(e) The Administration, when satisfied that the draft EIS complies with NEPA requirements, will approve the draft EIS for circulation by signing and dating the cover sheet.

(f) A lead, joint lead, or a cooperating agency shall be responsible for printing the EIS. The initial printing of the draft EIS shall be in sufficient quantity to meet requirements for copies which can reasonably be expected from agencies, organizations, and individuals. Normally, copies will be furnished free of charge. However, with Administration concurrence, the party requesting the draft EIS may be charged a fee which is not more than the actual cost of reproducing the copy or may be directed to the nearest location where the statement may be reviewed.

(g) The draft EIS shall be circulated for comment by the applicant on behalf of the Administration. The draft EIS shall be made available to the public and transmitted to agencies for comment no later than the time the document is filed with the Environmental Protection Agency in accordance with 40 CFR 1506.9. The draft EIS shall be transmitted to:

(1) Public officials, interest groups, and members of the public known to have an interest in the proposed action or the draft EIS;

(2) Federal, State and local government agencies expected to have jurisdiction or responsibility over, or interest or expertise in, the action. Copies shall be provided directly to appropriate State and local agencies, and to the State intergovernmental review contacts established under Executive Order 12372; and

(3) States and Federal land management entities which may be significantly affected by the proposed action or any of the alternatives. These copies shall be accompanied by a request that such State or entity advise the Administration in writing of any disagreement with the evaluation of impacts in the statement. The Administration will furnish the comments received to the applicant along with a written assessment of any disagreements for incorporation into the final EIS.

(h) The UMTA requires a public hearing during the circulation period of all draft EISs. FHWA public hearing requirements are as described in § 771.111(h). Whenever a public hearing is held, the draft EIS shall be available at the public hearing and for a minimum of 15 days in advance of the public hearing. The availability of the draft EIS shall be mentioned, and public comments requested, in any public hearing notice and at any public hearing presentation. If a public hearing on an action proposed for FHWA funding is not held, a notice shall be placed in a newspaper similar to a public hearing notice advising where the draft EIS is available for review, how copies may be obtained, and where the comments should be sent.

(i) The Federal Register public availability notice (40 CFR 1506.10) shall establish a period of not less than 45 days for the return of comments on the draft EIS. The notice and the draft EIS transmittal letter shall identify where comments are to be sent.

(j) For UMTA funded major urban mass transportation investments, the applicant shall prepare a report identifying a locally preferred alternative at the conclusion of the Draft EIS circulation period. Approval may be given to begin preliminary engineering on the principal alternative(s) under consideration. During the course of such preliminary engineering, the applicant will refine project costs, effectiveness, and impact information with particular attention to alternative designs, operations, detailed location decisions and appropriate mitigation measures. These studies will be used to prepare the final EIS or, where appropriate, a supplemental draft EIS.

§ 771.125 Final environmental impact statements.

(a)(1) After circulation of a draft EIS and consideration of comments received, a final EIS shall be prepared by the Administration in cooperation with the applicant or, where permitted by law, by the applicant with appropriate guidance and participation by the Administration. The final EIS shall identify the preferred alternative and evaluate all reasonable alternatives considered. It shall also discuss substantive comments received on the draft EIS and responses thereto, summarize public involvement, and describe the mitigation measures that are to be incorporated into the proposed action. Mitigation measures presented as commitments in the final EIS will be incorporated into the project as specified in § 771.109(b). The final EIS should also document compliance, to the extent possible, with all applicable environmental laws and Executive Orders, or provide reasonable assurance that their requirements can be met.

(2) Every reasonable effort shall be made to resolve interagency disagreements on actions before processing the final EIS. If significant issues remain unresolved, the final EIS shall identify those issues and the consultations and other efforts made to resolve them.

(b) The final EIS will be reviewed for legal sufficiency prior to Administration approval.

(c) The Administration will indicate approval of the EIS for an action by signing and dating the cover page. Final EISs prepared for actions in the following categories will be submitted to the Administration's Headquarters for prior concurrence:

(1) Any action for which the Administration determines that the final EIS should be reviewed at the Headquarters office. This would typically occur when the Headquarters office determines that (i) additional coordination with other Federal, State or local governmental agencies is needed; (ii) the social, economic, or environmental impacts of the action may need to be more fully explored; (iii) the impacts of the proposed action are unusually great; (iv) major issues remain unresolved; or (v) the action involves national policy issues.

(2) Any action to which a Federal, State or local government agency has indicated opposition on environmental grounds (which has not been resolved to the written satisfaction of the objecting agency).

(3) Major urban mass transportation investments as defined by UMTA's

policy on major investments (49 FR 21284; May 18, 1984).

(d) The signature of the UMTA approving official on the cover sheet also indicates compliance with section 14 of the UMT Act and fulfillment of the grant application requirements of sections 3(d)(1) and (2), 5(h), and 5(i) of the UMT Act.

(e) Approval of the final EIS is not an Administration Action (as defined in § 771.107(c)) and does not commit the Administration to approve any future grant request to fund the preferred alternative.

(f) The initial printing of the final EIS shall be in sufficient quantity to meet the request for copies which can be reasonably expected from agencies, organizations, and individuals. Normally, copies will be furnished free of charge. However, with Administration concurrence, the party requesting the final EIS may be charged a fee which is not more than the actual cost of reproducing the copy or may be directed to the nearest location where the statement may be reviewed.

(g) The final EIS shall be transmitted to any persons, organizations, or agencies that made substantive comments on the draft EIS or requested a copy, no later than the time the document is filed with EPA. In the case of lengthy documents, the agency may provide alternative circulation processes in accordance with 40 CFR 1502.19. The applicant shall also publish a notice of availability in local newspapers and make the final EIS available through the mechanism established pursuant to DOT Order 4600.13 which implements Executive Order 12372. When filed with EPA, the final EIS shall be available for public review at the applicant's offices and at appropriate Administration offices. A copy should also be made available for public review at institutions such as local government offices, libraries, and schools, as appropriate.

§ 771.127 Record of decision.

(a) The Administration will complete and sign a record of decision (ROD) no sooner than 30 days after publication of the final EIS notice in the Federal Register or 90 days after publication of a notice for the draft EIS, whichever is later. The ROD will present the basis for the decision as specified in 40 CFR 1505.2, summarize any mitigation measures that will be incorporated in the project and document any required section 4(f) approval in accordance with § 771.135(l). Until any required ROD has been signed, no further approvals may be given except for administrative

activities taken to secure further project funding and other activities consistent with 40 CFR 1506.1.

(b) If the Administration subsequently wishes to approve an alternative which was not identified as the preferred alternative but was fully evaluated in the final EIS, or proposes to make substantial changes to the mitigation measures or findings discussed in the ROD, a revised ROD shall be subject to review by those Administration offices which reviewed the final EIS under § 771.125(c). To the extent practicable the approved revised ROD shall be provided to all persons, organizations, and agencies that received a copy of the final EIS pursuant to § 771.125(g).

§ 771.129 Re-evaluations.

(a) A written evaluation of the draft EIS shall be prepared by the applicant in cooperation with the Administration if an acceptable final EIS is not submitted to the Administration within 3 years from the date of the draft EIS circulation. The purpose of this evaluation is to determine whether a supplement to the draft EIS or a new draft EIS is needed.

(b) A written evaluation of the final EIS will be required before further approvals may be granted if major steps to advance the action (e.g., authority to undertake final design, authority to acquire a significant portion of the right-of-way, or approval of the plans, specifications and estimates) have not occurred within three years after the approval of the final EIS, final EIS supplement, or the last major Administration approval or grant.

(c) After approval of the EIS, FONSI, or CZ designation, the applicant shall consult with the Administration prior to requesting any major approvals or grants to establish whether or not the approved environmental document or CZ designation remains valid for the requested Administration action. These consultations will be documented when determined necessary by the Administration.

§ 771.130 Supplemental environmental impact statements.

(a) A draft EIS, final EIS, or supplemental EIS may be supplemented at any time. An EIS shall be supplemented whenever the Administration determines that:

(1) Changes to the proposed action would result in significant environmental impacts that were not evaluated in the EIS; or

(2) New information or circumstances relevant to environmental concerns and bearings on the proposed action or its impacts would result in significant

environmental impacts not evaluated in the EIS.

(b) However, a supplemental EIS will not be necessary where:

(1) The changes to the proposed action, new information, or new circumstances result in a lessening of adverse environmental impacts evaluated in the EIS without causing other environmental impacts that are significant and were not evaluated in the EIS; or

(2) The Administration decides to approve an alternative fully evaluated in an approved final EIS but not identified as the preferred alternative. In such a case, a revised ROD shall be prepared and circulated in accordance with § 771.127(b).

(c) Where the Administration is uncertain of the significance of the new impacts, the applicant will develop appropriate environmental studies or, if the Administration deems appropriate, an EA to assess the impacts of the changes, new information, or new circumstances. If, based upon the studies, the Administration determines that a supplemental EIS is not necessary, the Administration shall so indicate in the project file.

(d) A supplement is to be developed using the same process and format (i.e., draft EIS, final EIS, and ROD) as an original EIS, except that scoping is not required.

(e) A supplemental draft EIS may be necessary for UMTA major urban mass transportation investments if there is a substantial change in the level of detail on project impacts during project planning and development. The supplement will address site-specific impacts and refined cost estimates that have been developed since the original draft EIS.

(f) In some cases, a supplemental EIS may be required to address issues of limited scope, such as the extent of proposed mitigation or the evaluation of location or design variations for a limited portion of the overall project. Where this is the case, the preparation of a supplemental EIS shall not necessarily:

(i) Prevent the granting of new approvals;

(ii) Require the withdrawal of previous approvals; or

(iii) Require the suspension of project activities for any activity not directly affected by the supplement. If the changes in question are of such magnitude to require a reassessment of the entire action, or more than a limited portion of the overall action, the Administration shall suspend any activities which would have an adverse environmental impact or limit the choice

of reasonable alternatives, until the supplemental EIS is completed.

§ 771.131 Emergency action procedures.

Requests for deviations from the procedures in this regulation because of emergency circumstances (40 CFR 1506.11) shall be referred to the Administration's headquarters for evaluation and decision after consultation with CEQ.

§ 771.133 Compliance with other requirements.

The final EIS or FONSI should document compliance with requirements of all applicable environmental laws, Executive Orders, and other related requirements. If full compliance is not possible by the time the final EIS or FONSI is prepared, the final EIS or FONSI should reflect consultation with the appropriate agencies and provide reasonable assurance that the requirements will be met. Approval of the environmental document constitutes adoption of any Administration findings and determinations that are contained therein. The FHWA approval of the appropriate NEPA document will constitute its finding of compliance with the report requirements of 23 U.S.C. 122.

§ 771.135 Section 4(f) (49 U.S.C. 303).

(a)(1) The Administration may not approve the use of land from a significant publicly owned public park, recreation area, or wildlife and waterfowl refuge, or any significant historic site unless a determination is made that:

(i) There is no feasible and prudent alternative to the use of land from the property; and

(ii) The action includes all possible planning to minimize harm to the property resulting from such use.

(2) Supporting information must demonstrate that there are unique problems or unusual factors involved in the use of alternatives that avoid these properties or that the cost, social, economic, and environmental impacts, or community disruption resulting from such alternatives reach extraordinary magnitudes.

(b) The Administration will determine the application of section 4(f). Any use of lands from a section 4(f) property shall be evaluated early in the development of the action when alternatives to the proposed action are under study.

(c) Consideration under section 4(f) is not required when the Federal, State, or local officials having jurisdiction over a park, recreation area or refuge determine that the entire site is not

significant. In the absence of such a determination, the section 4(f) land will be presumed to be significant. The Administration will review the significance determination to assure its reasonableness.

(d) Where Federal lands or other public land holdings (e.g., State forests) are administered under statutes permitting management for multiple uses, and, in fact, are managed for multiple uses, section 4(f) applies only to those portions of such lands which function for, or are designated in the plans of the administering agency as being for, significant park, recreation, or wildlife and waterfowl purposes. The determination as to which lands so function or are so designated, and the significance of those lands, shall be made by the officials having jurisdiction over the lands. The Administration will review this determination to assure its reasonableness. The determination of significance shall apply to the entire area of such park, recreation, or wildlife and waterfowl refuge sites.

(e) In determining the application of section 4(f) to historic sites, the Administration, in cooperation with the applicant, will consult with the State Historic Preservation Officer (SHPO) and appropriate local officials to identify all properties on or eligible for the National Register of Historic Places (National Register). The section 4(f) requirements apply only to sites on or eligible for the National Register unless the Administration determines that the application of section 4(f) is otherwise appropriate.

(f) The Administration may determine that section 4(f) requirements do not apply to restoration, rehabilitation, or maintenance of transportation facilities that are on or eligible for the National Register when:

(1) Such work will not adversely affect the historic qualities of the facility that caused it to be on or eligible for the National Register, and

(2) The SHPO and the Advisory Council on Historic Preservation (ACHP) have been consulted and have not objected to the Administration finding in paragraph (f)(1) of this section.

(g)(1) Section 4(f) applies to all archeological sites on or eligible for inclusion on the National Register, including those discovered during construction except as set forth in paragraph (g)(2) of this section. Where section 4(f) applies to archeological sites discovered during construction, the section 4(f) process will be expedited. In such cases, the evaluation of feasible and prudent alternatives will take account of the level of investment already made. The review process

including the consultation with other agencies, will be shortened as appropriate.

(2) Section 4(f) does not apply to archeological sites where the Administration, after consultation with the SHPO and the ACHP, determines that the archeological resource is important chiefly because of what can be learned by data recovery and has minimal value for preservation in place. This exception applies both to situations where data recovery is undertaken or where the Administration decides, with agreement of the SHPO and, where applicable, the ACHP not to recover the resource.

(h) Designations of park and recreation lands, wildlife and waterfowl refuges, and historic sites are sometimes made and determinations of significance changed late in the development of a proposed action. With the exception of the treatment of archeological resources in paragraph (g) of this section, the Administration may permit a project to proceed without consideration under section 4(f) if the property interest in the section 4(f) lands was acquired for transportation purposes prior to the designation or change in the determination of significance and if an adequate effort was made to identify properties protected by section 4(f) prior to acquisition.

(i) The evaluations of alternatives to avoid the use of section 4(f) land and of possible measures to minimize harm to such lands shall be developed by the applicant in cooperation with the Administration. This information should be presented in the draft EIS, EA, or, for a project classified as a CE in a separate document. The section 4(f) evaluation shall be provided for coordination and comment to the officials having jurisdiction over the section 4(f) property and to the Department of the Interior, and as appropriate to the Department of Agriculture and the Department of Housing and Urban Development. A minimum of 45 days shall be established by the Administration for receipt of comments. Uses of section 4(f) land covered by a programmatic section 4(f) evaluation shall be documented and coordinated as specified in the programmatic section 4(f) evaluation.

(j) When adequate support exists for a section 4(f) determination, the discussion in the final EIS, FONSI, or separate section 4(f) evaluation shall specifically address:

(1) The reasons why the alternatives to avoid a section 4(f) property are not feasible and prudent; and

(2) All measures which will be taken to minimize harm to the section 4(f) property.

(k) The final Section 4(f) evaluation will be reviewed for legal sufficiency.

(l) For actions processed with EISs, the Administration will make the section 4(f) approval either in its approval of the final EIS or in the ROD. Where the section 4(f) approval is documented in the final EIS, the Administration will summarize the basis for its section 4(f) approval in the ROD. Actions requiring the use of section 4(f) property, and proposed to be processed with a FONSI or classified as a CE, shall not proceed until notified by the Administration of section 4(f) approval. For these actions, any required section 4(f) approval will be documented separately.

(m) Circulation of a separate section 4(f) evaluation will be required when:

(1) A proposed modification of the alignment or design would require the use of section 4(f) property after the CE, FONSI, draft EIS, or final EIS has been processed;

(2) The Administration determines, after processing the CE, FONSI, draft EIS, or final EIS that section 4(f) applies to a property;

(3) A proposed modification of the alignment, design, or measures to minimize harm (after the original section 4(f) approval) would result in a substantial increase in the amount of section 4(f) land used, a substantial increase in the adverse impacts to section 4(f) land, or a substantial reduction in mitigation measures; or

(4) Another agency is the lead agency for the NEPA process, unless another DOT element is preparing the section 4(f) evaluation.

(n) If the Administration determines under section 771.135(m) or otherwise, that section 4(f) is applicable after the CE, FONSI, or final EIS has been processed, the decision to prepare and circulate a section 4(f) evaluation will not necessarily require the preparation of a new or supplemental environmental document. Where a separately circulated section 4(f) evaluation is prepared, such evaluation does not necessarily:

(i) Prevent the granting of new approvals;

(ii) Require the withdrawal of previous approvals; or

(iii) Require the suspension of project activities; for any activity not affected by the section 4(f) evaluation.

(o) An analysis required by section 4(f) may involve different levels of detail where the section 4(f) involvement is addressed in a tiered EIS.

(1) When the first-tier, broad-scale EIS is prepared, the detailed information necessary to complete the section 4(f) evaluation may not be available at that stage in the development of the action. In such cases, an evaluation should be made on the potential impacts that a proposed action will have on section 4(f) land and whether those impacts could have a bearing on the decision to be made. A preliminary determination may be made at this time as to whether there are feasible and prudent locations or alternatives for the action to avoid the use of section 4(f) land. This preliminary determination shall consider all possible planning to minimize harm to the extent that the level of detail available at the first-tier EIS stage allows. It is recognized that such planning at this stage will normally be limited to ensuring that opportunities to minimize harm at subsequent stages in the development process have not been precluded by decisions made at the first-tier stage. This preliminary determination is then incorporated into the first-tier EIS.

(2) A section 4(f) approval made when additional design details are available will include a determination that:

(i) The preliminary section 4(f) determination made pursuant to paragraph (c)(1) of this section is still valid; and

(ii) The criteria of paragraph (a) of this section have been met.

§ 771.137 International actions.

(a) The requirements of this part apply to:

(1) Administration actions significantly affecting the environment of a foreign nation not participating in the action or not otherwise involved in the action.

(2) Administration actions outside the U.S., its territories, and possessions which significantly affect natural resources of global importance designated for protection by the President or by international agreement.

(b) If communication with a foreign government concerning environmental studies or documentation is anticipated, the Administration shall coordinate such communication with the Department of State through the Office of the Secretary of Transportation.

Due to the revision of 23 CFR Part 771, the following technical amendments are necessary to correct references and certain phrases found in Parts 640 and 712. These technical amendments are effective on the same date as the rule for Part 771.

PART 640—[AMENDED]

§ 640.107 [Amended]

3. In § 640.107, paragraph (d) is amended by removing the words "a nonmajor action" and "23 CFR 771.9" and inserting in their place "categorical exclusions" and "23 CFR Part 771" respectively.

PART 712—[AMENDED]

§ 712.204 [Amended]

4. In § 712.204, paragraph (c)(1) is amended by removing the words "negative declaration" and inserting in their place "environmental assessment;" paragraph (c)(3)(ii) is amended by removing the reference "§ 771.5" and the words "negative declarations" and inserting in their place "23 CFR Part 771" and "findings of no significant impact," respectively; and paragraph (c)(3)(iii) is amended by removing the reference "§ 771.19" and the word "statements" and inserting in their place

"23 CFR Part 771" and "evaluations," respectively.

PART 790—[REMOVED]

5. Part 790, Public Hearings and Location/Design Approval is removed from Chapter I of 23 CFR, effective one year after publication in the Federal Register.

Due to the rescission of 23 CFR Part 790, the following technical amendments are necessary to correct references found in other parts of Title 23, Code of Federal Regulations, as set forth below. These technical amendments are effective on the same date as the rescission of 23 CFR Part 790.

PART 635—[AMENDED]

§ 635.309 [Amended]

6. In § 635.309, paragraph (d) is amended by removing "has satisfied the requirements of 23 CFR Part 790 where applicable or, under alternate procedures which have been accepted by FHWA" and inserting in its place "in accord with 23 CFR 771.111(h)."

PART 650—[AMENDED]

§ 650.109 [Removed]

7. Part 650, Subpart A, is amended by removing § 650.109, Public Involvement, in its entirety.

PART 712—[AMENDED]

§ 712.204 [Amended]

8. In § 712.204, paragraphs (c)(3) (iii) and (iv) are amended by removing, "and" and inserting a period at the end of paragraph (c)(3)(iii), and removing paragraph (c)(3)(iv) entirely.

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Appendix D

Council on Environmental Quality, Regulations for
Implementing the Procedural Provisions of the National
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PART 1500—PURPOSE, POLICY, AND MANDATE

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AUTHORITY: NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 *et seq.*), sec. 309 of the Clean Air Act, as amended (42 U.S.C. 7609) and E.O. 11514, Mar. 5, 1970, as amended by E.O. 11991, May 24, 1977).

SOURCE: 43 FR 55990, Nov. 28, 1978, unless otherwise noted.

§ 1500.1 Purpose.

(a) The National Environmental Policy Act (NEPA) is our basic national charter for protection of the environment. It establishes policy, sets goals (section 101), and provides means (section 102) for carrying out the policy. Section 102(2) contains "action-forcing" provisions to make sure that federal agencies act according to the letter and spirit of the Act. The regulations that follow implement section 102(2). Their purpose is to tell federal agencies what they must do to comply with the procedures and achieve the goals of the Act. The President, the federal agencies, and the courts share responsibility for enforcing the Act so as to achieve the substantive requirements of section 101.

(b) NEPA procedures must insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. The information must be of high quality. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA. Most important, NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail.

(c) Ultimately, of course, it is not better documents but better decisions that count. NEPA's purpose is not to generate paperwork—even excellent paperwork—but to foster excellent action. The NEPA process is intended to help public officials make decisions

that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment. These regulations provide the direction to achieve this purpose.

§ 1500.2 Policy.

Federal agencies shall to the fullest extent possible:

(a) Interpret and administer the policies, regulations, and public laws of the United States in accordance with the policies set forth in the Act and in these regulations.

(b) Implement procedures to make the NEPA process more useful to decisionmakers and the public; to reduce paperwork and the accumulation of extraneous background data; and to emphasize real environmental issues and alternatives. Environmental impact statements shall be concise, clear, and to the point, and shall be supported by evidence that agencies have made the necessary environmental analyses.

(c) Integrate the requirements of NEPA with other planning and environmental review procedures required by law or by agency practice so that all such procedures run concurrently rather than consecutively.

(d) Encourage and facilitate public involvement in decisions which affect the quality of the human environment.

(e) Use the NEPA process to identify and assess the reasonable alternatives to proposed actions that will avoid or minimize adverse effects of these actions upon the quality of the human environment.

(f) Use all practicable means, consistent with the requirements of the Act and other essential considerations of national policy, to restore and enhance the quality of the human environment and avoid or minimize any possible adverse effects of their actions upon the quality of the human environment.

§ 1500.3 Mandate.

Parts 1500 through 1508 of this title provide regulations applicable to and binding on all Federal agencies for implementing the procedural provisions

of the National Environmental Policy Act of 1969, as amended (Pub. L. 91-190, 42 U.S.C. 4321 et seq.) (NEPA or the Act) except where compliance would be inconsistent with other statutory requirements. These regulations are issued pursuant to NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 et seq.) section 309 of the Clean Air Act, as amended (42 U.S.C. 7609) and Executive Order 11514, Protection and Enhancement of Environmental Quality (March 5, 1970, as amended by Executive Order 11991, May 24, 1977). These regulations, unlike the predecessor guidelines, are not confined to sec. 102(2)(C) (environmental impact statements). The regulations apply to the whole of section 102(2). The provisions of the Act and of these regulations must be read together as a whole in order to comply with the spirit and letter of the law. It is the Council's intention that judicial review of agency compliance with these regulations not occur before an agency has filed the final environmental impact statement, or has made a final finding of no significant impact (when such a finding will result in action affecting the environment), or takes action that will result in irreparable injury. Furthermore, it is the Council's intention that any trivial violation of these regulations not give rise to any independent cause of action.

§ 1500.4 Reducing paperwork.

Agencies shall reduce excessive paperwork by:

(a) Reducing the length of environmental impact statements (§ 1502.2(c)), by means such as setting appropriate page limits (§§ 1501.7(b)(1) and 1502.7).

(b) Preparing analytic rather than encyclopedic environmental impact statements (§ 1502.2(a)).

(c) Discussing only briefly issues other than significant ones (§ 1502.2(b)).

(d) Writing environmental impact statements in plain language (§ 1502.8).

(e) Following a clear format for environmental impact statements (§ 1502.10).

(f) Emphasizing the portions of the environmental impact statement that are useful to decisionmakers and the public (§§ 1502.14 and 1502.15) and reducing emphasis on background material (§ 1502.16).

(g) Using the scoping process, not only to identify significant environmental issues deserving of study, but also to deemphasize insignificant issues, narrowing the scope of the environmental impact statement process accordingly (§ 1501.7).

(h) Summarizing the environmental impact statement (§ 1502.12) and circulating the summary instead of the entire environmental impact statement if the latter is unusually long (§ 1502.19).

(i) Using program, policy, or plan environmental impact statements and tiering from statements of broad scope to those of narrower scope, to eliminate repetitive discussions of the same issues (§§ 1502.4 and 1502.20).

(j) Incorporating by reference (§ 1502.21).

(k) Integrating NEPA requirements with other environmental review and consultation requirements (§ 1502.25).

(l) Requiring comments to be as specific as possible (§ 1503.3).

(m) Attaching and circulating only changes to the draft environmental impact statement, rather than rewriting and circulating the entire statement when changes are minor (§ 1503.4(c)).

(n) Eliminating duplication with State and local procedures, by providing for joint preparation (§ 1506.2), and with other Federal procedures, by providing that an agency may adopt appropriate environmental documents prepared by another agency (§ 1506.3).

(o) Combining environmental documents with other documents (§ 1508.4).

(p) Using categorical exclusions to define categories of actions which do not individually or cumulatively have a significant effect on the human environment and which are therefore exempt from requirements to prepare an environmental impact statement (§ 1508.4).

(q) Using a finding of no significant impact when an action not otherwise excluded will not have a significant

effect on the human environment and is therefore exempt from requirements to prepare an environmental impact statement (§ 1508.13).

[43 FR 55990, Nov. 29, 1978; 44 FR 873, Jan. 3, 1979]

§ 1500.5 Reducing delay.

Agencies shall reduce delay by:

(a) Integrating the NEPA process into early planning (§ 1501.2).

(b) Emphasizing interagency cooperation before the environmental impact statement is prepared, rather than submission of adversary comments on a completed document (§ 1501.6).

(c) Insuring the swift and fair resolution of lead agency disputes (§ 1501.5).

(d) Using the scoping process for an early identification of what are and what are not the real issues (§ 1501.7).

(e) Establishing appropriate time limits for the environmental impact statement process (§§ 1501.7(b)(2) and 1501.8).

(f) Preparing environmental impact statements early in the process (§ 1502.5).

(g) Integrating NEPA requirements with other environmental review and consultation requirements (§ 1502.25).

(h) Eliminating duplication with State and local procedures by providing for joint preparation (§ 1506.2) and with other Federal procedures by providing that an agency may adopt appropriate environmental documents prepared by another agency (§ 1506.3).

(i) Combining environmental documents with other documents (§ 1506.4).

(j) Using accelerated procedures for proposals for legislation (§ 1506.8).

(k) Using categorical exclusions to define categories of actions which do not individually or cumulatively have a significant effect on the human environment (§ 1508.4) and which are therefore exempt from requirements to prepare an environmental impact statement.

(l) Using a finding of no significant impact when an action not otherwise excluded will not have a significant effect on the human environment (§ 1508.13) and is therefore exempt

from requirements to prepare an environmental impact statement.

§ 1500.6 Agency authority.

Each agency shall interpret the provisions of the Act as a supplement to its existing authority and as a mandate to view traditional policies and missions in the light of the Act's national environmental objectives. Agencies shall review their policies, procedures, and regulations accordingly and revise them as necessary to insure full compliance with the purposes and provisions of the Act. The phrase "to the fullest extent possible" in section 102 means that each agency of the Federal Government shall comply with that section unless existing law applicable to the agency's operations expressly prohibits or makes compliance impossible.

PART 1501—NEPA AND AGENCY PLANNING

Sec.

1501.1 Purpose.

1501.2 Apply NEPA early in the process.

1501.3 When to prepare an environmental assessment.

1501.4 Whether to prepare an environmental impact statement.

1501.5 Lead agencies.

1501.6 Cooperating agencies.

1501.7 Scoping.

1501.8 Time limits.

AUTHORITY: NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 et seq.), sec. 309 of the Clean Air Act, as amended (42 U.S.C. 7609, and E.O. 11514 (Mar. 5, 1970, as amended by E.O. 11991, May 24, 1977).

SOURCE: 43 FR 55992, Nov. 29, 1978, unless otherwise noted.

§ 1501.1 Purpose.

The purposes of this part include:

(a) Integrating the NEPA process into early planning to insure appropriate consideration of NEPA's policies and to eliminate delay.

(b) Emphasizing cooperative consultation among agencies before the environmental impact statement is prepared rather than submission of adversary comments on a completed document.

(c) Providing for the most fair resolution of lead agency disputes.

(d) Identifying at an early stage the significant environmental issues deserving of study and deemphasizing insignificant issues, narrowing the scope of the environmental impact statement accordingly.

(e) Providing a mechanism for putting appropriate time limits on the environmental impact statement process.

§ 1501.2 Apply NEPA early in the process.

Agencies shall integrate the NEPA process with other planning at the earliest possible time to insure that planning and decisions reflect environmental values, to avoid delays later in the process, and to head off potential conflicts. Each agency shall:

(a) Comply with the mandate of section 102(2)(A) to "utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on man's environment," as specified by § 1507.2.

(b) Identify environmental effects and values in adequate detail so they can be compared to economic and technical analyses. Environmental documents and appropriate analyses shall be circulated and reviewed at the same time as other planning documents.

(c) Study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources as provided by section 102(2)(E) of the Act.

(d) Provide for cases where actions are planned by private applicants or other non-Federal entities before Federal involvement so that:

(1) Policies or designated staff are available to advise potential applicants of studies or other information foreseeably required for later Federal action.

(2) The Federal agency consults early with appropriate State and local agencies and Indian tribes and with interested private persons and organizations when its own involvement is reasonably foreseeable.

(3) The Federal agency commences its NEPA process at the earliest possible time.

§ 1501.3 When to prepare an environmental assessment.

(a) Agencies shall prepare an environmental assessment (§ 1508.9) when necessary under the procedures adopted by individual agencies to supplement these regulations as described in § 1507.3. An assessment is not necessary if the agency has decided to prepare an environmental impact statement.

(b) Agencies may prepare an environmental assessment on any action at any time in order to assist agency planning and decisionmaking.

§ 1501.4 Whether to prepare an environmental impact statement.

In determining whether to prepare an environmental impact statement the Federal agency shall:

(a) Determine under its procedures supplementing these regulations (described in § 1507.3) whether the proposal is one which:

(1) Normally requires an environmental impact statement, or

(2) Normally does not require either an environmental impact statement or an environmental assessment (categorical exclusion).

(b) If the proposed action is not covered by paragraph (a) of this section, prepare an environmental assessment (§ 1508.9). The agency shall involve environmental agencies, applicants, and the public, to the extent practicable, in preparing assessments required by § 1508.9(a)(1).

(c) Based on the environmental assessment make its determination whether to prepare an environmental impact statement.

(d) Commence the scoping process (§ 1501.7), if the agency will prepare an environmental impact statement.

(e) Prepare a finding of no significant impact (§ 1508.13), if the agency determines on the basis of the environmental assessment not to prepare a statement.

(1) The agency shall make the finding of no significant impact available

to the affected public as specified in § 1506.6.

(2) In certain limited circumstances, which the agency may cover in its procedures under § 1507.3, the agency shall make the finding of no significant impact available for public review (including State and areawide clearings) for 30 days before the agency makes its final determination whether to prepare an environmental impact statement and before the action may begin. The circumstances are:

(i) The proposed action is, or is closely similar to, one which normally requires the preparation of an environmental impact statement under the procedures adopted by the agency pursuant to § 1507.3, or

(ii) The nature of the proposed action is one without precedent.

§ 1501.5 Lead agencies.

(a) A lead agency shall supervise the preparation of an environmental impact statement if more than one Federal agency either:

(1) Proposes or is involved in the same action; or

(2) Is involved in a group of actions directly related to each other because of their functional interdependence or geographical proximity.

(b) Federal, State, or local agencies, including at least one Federal agency, may act as joint lead agencies to prepare an environmental impact statement (§ 1506.2).

(c) If an action falls within the provisions of paragraph (a) of this section the potential lead agencies shall determine by letter or memorandum which agency shall be the lead agency and which shall be cooperating agencies. The agencies shall resolve the lead agency question so as not to cause delay. If there is disagreement among the agencies, the following factors (which are listed in order of descending importance) shall determine lead agency designation:

(1) Magnitude of agency's involvement.

(2) Project approval/disapproval authority.

(3) Expertise concerning the action's environmental effects.

(4) Duration of agency's involvement.

(5) Sequence of agency's involvement.

(d) Any Federal agency, or any State or local agency or private person substantially affected by the absence of lead agency designation, may make a written request to the potential lead agencies that a lead agency be designated.

(e) If Federal agencies are unable to agree on which agency will be the lead agency or if the procedure described in paragraph (c) of this section has not resulted within 45 days in a lead agency designation, any of the agencies or persons concerned may file a request with the Council asking it to determine which Federal agency shall be the lead agency.

A copy of the request shall be transmitted to each potential lead agency. The request shall consist of:

(1) A precise description of the nature and extent of the proposed action.

(2) A detailed statement of why each potential lead agency should or should not be the lead agency under the criteria specified in paragraph (c) of this section.

(f) A response may be filed by any potential lead agency concerned within 20 days after a request is filed with the Council. The Council shall determine as soon as possible but not later than 20 days after receiving the request and all responses to it which Federal agency shall be the lead agency and which other Federal agencies shall be cooperating agencies.

[43 FR 55992, Nov. 29, 1978; 44 FR 873, Jan. 3, 1979]

§ 1501.6 Cooperating agencies.

The purpose of this section is to emphasize agency cooperation early in the NEPA process. Upon request of the lead agency, any other Federal agency which has jurisdiction by law shall be a cooperating agency. In addition any other Federal agency which has special expertise with respect to any environmental issue, which should be addressed in the statement may be a cooperating agency upon request of the lead agency. An agency may re-

quest the lead agency to designate it a cooperating agency.

(a) The lead agency shall:

(1) Request the participation of each cooperating agency in the NEPA process at the earliest possible time.

(2) Use the environmental analysis and proposals of cooperating agencies with jurisdiction by law or special expertise, to the maximum extent possible consistent with its responsibility as lead agency.

(3) Meet with a cooperating agency at the latter's request.

(b) Each cooperating agency shall:

(1) Participate in the NEPA process at the earliest possible time.

(2) Participate in the scoping process (described below in § 1501.7).

(3) Assume on request of the lead agency responsibility for developing information and preparing environmental analyses including portions of the environmental impact statement concerning which the cooperating agency has special expertise.

(4) Make available staff support at the lead agency's request to enhance the latter's interdisciplinary capability.

(5) Normally use its own funds. The lead agency shall, to the extent available funds permit, fund those major activities or analyses it requests from cooperating agencies. Potential lead agencies shall include such funding requirements in their budget requests.

(c) A cooperating agency may in response to a lead agency's request for assistance in preparing the environmental impact statement (described in paragraph (b) (3), (4), or (5) of this section) reply that other program commitments preclude any involvement or the degree of involvement requested in the action that is the subject of the environmental impact statement. A copy of this reply shall be submitted to the Council.

§ 1501.7 Scoping.

There shall be an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action. This process shall be termed scoping. As soon as practicable after its decision to prepare an environmental impact statement and

before the scoping process the lead agency shall publish a notice of intent (§ 1508.22) in the FEDERAL REGISTER except as provided in § 1507.3(e).

(a) As part of the scoping process the lead agency shall:

(1) Invite the participation of affected Federal, State, and local agencies, any affected Indian tribe, the proponent of the action, and other interested persons (including those who might not be in accord with the action on environmental grounds), unless there is a limited exception under § 1507.3(c). An agency may give notice in accordance with § 1506.6.

(2) Determine the scope (§ 1508.25) and the significant issues to be analyzed in depth in the environmental impact statement.

(3) Identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (§ 1506.3), narrowing the discussion of these issues in the statement to a brief presentation of why they will not have a significant effect on the human environment or providing a reference to their coverage elsewhere.

(4) Allocate assignments for preparation of the environmental impact statement among the lead and cooperating agencies, with the lead agency retaining responsibility for the statement.

(5) Indicate any public environmental assessments and other environmental impact statements which are being or will be prepared that are related to but are not part of the scope of the impact statement under consideration.

(6) Identify other environmental review and consultation requirements so the lead and cooperating agencies may prepare other required analyses and studies concurrently with, and integrated with, the environmental impact statement as provided in § 1502.25.

(7) Indicate the relationship between the timing of the preparation of environmental analyses and the agency's tentative planning and decisionmaking schedule.

(b) As part of the scoping process the lead agency may:

(1) Set page limits on environmental documents (§ 1502.7).

(2) Set time limits (§ 1501.8).

(3) Adopt procedures under § 1507.3 to combine its environmental assessment process with its scoping process.

(4) Hold an early scoping meeting or meetings which may be integrated with any other early planning meeting the agency has. Such a scoping meeting will often be appropriate when the impacts of a particular action are confined to specific sites.

(c) An agency shall revise the determinations made under paragraphs (a) and (b) of this section if substantial changes are made later in the proposed action, or if significant new circumstances or information arise which bear on the proposal or its impacts.

§ 1501.8 Time limits.

Although the Council has decided that prescribed universal time limits for the entire NEPA process are too inflexible, Federal agencies are encouraged to set time limits appropriate to individual actions (consistent with the time intervals required by § 1506.10). When multiple agencies are involved the reference to agency below means lead agency.

(a) The agency shall set time limits if an applicant for the proposed action requests them: *Provided*, That the limits are consistent with the purposes of NEPA and other essential considerations of national policy.

(b) The agency may:

(i) Consider the following factors in determining time limits.

(i) Potential for environmental harm.

(ii) Size of the proposed action.

(iii) State of the art of analytic techniques.

(iv) Degree of public need for the proposed action, including the consequences of delay.

(v) Number of persons and agencies affected.

(vi) Degree to which relevant information is known and if not known the time required for obtaining it.

(vii) Degree to which the action is controversial.

(viii) Other time limits imposed on the agency by law, regulations, or executive order.

(2) Set overall time limits or limits for each constituent part of the NEPA process, which may include:

(i) Decision on whether to prepare an environmental impact statement (if not already decided).

(ii) Determination of the scope of the environmental impact statement.

(iii) Preparation of the draft environmental impact statement.

(iv) Review of any comments on the draft environmental impact statement from the public and agencies.

(v) Preparation of the final environmental impact statement.

(vi) Review of any comments on the final environmental impact statement.

(vii) Decision on the action based in part on the environmental impact statement.

(3) Designate a person (such as the project manager or a person in the agency's office with NEPA responsibilities) to expedite the NEPA process.

(c) State or local agencies or members of the public may request a Federal Agency to set time limits.

PART 1502—ENVIRONMENTAL IMPACT STATEMENT

Sec.

1502.1 Purpose.

1502.2 Implementation.

1502.3 Statutory requirements for statements.

1502.4 Major Federal actions requiring the preparation of environmental impact statements.

1502.5 Timing.

1502.6 Interdisciplinary preparation.

1502.7 Page limits.

1502.8 Writing.

1502.9 Draft, final, and supplemental statements.

1502.10 Recommended format.

1502.11 Cover sheet.

1502.12 Summary.

1502.13 Purpose and need.

1502.14 Alternatives including the proposed action.

1502.15 Affected environment.

1502.16 Environmental consequences.

1502.17 List of preparers.

1502.18 Appendix.

1502.19 Circulation of the environmental impact statement.

1502.20 Tiering.

1502.21 Incorporation by reference.

1502.22 Incomplete or unavailable information.

- Sec.
1502.23 Cost-benefit analysis.
1502.24 Methodology and scientific accuracy.
1502.25 Environmental review and consultation requirements.

AUTHORITY: NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 *et seq.*), sec. 309 of the Clean Air Act, as amended (42 U.S.C. 7609), and E.O. 11514 (Mar. 5, 1970, as amended by E.O. 11991, May 24, 1977).

SOURCE: 43 FR 55994, Nov. 29, 1978, unless otherwise noted.

§ 1502.1 Purpose.

The primary purpose of an environmental impact statement is to serve as an action-forcing device to insure that the policies and goals defined in the Act are infused into the ongoing programs and actions of the Federal Government. It shall provide full and fair discussion of significant environmental impacts and shall inform decision-makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment. Agencies shall focus on significant environmental issues and alternatives and shall reduce paperwork and the accumulation of extraneous background data. Statements shall be concise, clear, and to the point, and shall be supported by evidence that the agency has made the necessary environmental analyses. An environmental impact statement is more than a disclosure document. It shall be used by Federal officials in conjunction with other relevant material to plan actions and make decisions.

§ 1502.2 Implementation.

To achieve the purposes set forth in § 1502.1 agencies shall prepare environmental impact statements in the following manner:

(a) Environmental impact statements shall be analytic rather than encyclopedic.

(b) Impacts shall be discussed in proportion to their significance. There shall be only brief discussion of other than significant issues. As in a finding of no significant impact, there should be only enough discussion to show why more study is not warranted.

(c) Environmental impact statements shall be kept concise and shall be no longer than absolutely necessary to comply with NEPA and with these regulations. Length should vary first with potential environmental problems and then with project size.

(d) Environmental impact statements shall state how alternatives considered in it and decisions based on it will or will not achieve the requirements of sections 101 and 102(1) of the Act and other environmental laws and policies.

(e) The range of alternatives discussed in environmental impact statements shall encompass those to be considered by the ultimate agency decisionmaker.

(f) Agencies shall not commit resources prejudicing selection of alternatives before making a final decision (§ 1506.1).

(g) Environmental impact statements shall serve as the means of assessing the environmental impact of proposed agency actions, rather than justifying decisions already made.

§ 1502.3 Statutory requirements for statements.

As required by sec. 102(2)(C) of NEPA environmental impact statements (§ 1508.11) are to be included in every recommendation or report.

On proposals (§ 1508.23).

For legislation and (§ 1508.17).

Other major Federal actions (§ 1508.18).

Significantly (§ 1508.27).

Affecting (§§ 1508.3, 1508.8).

The quality of the human environment (§ 1508.14).

§ 1502.4 Major Federal actions requiring the preparation of environmental impact statements.

(a) Agencies shall make sure the proposal which is the subject of an environmental impact statement is properly defined. Agencies shall use the criteria for scope (§ 1508.25) to determine which proposal(s) shall be the subject of a particular statement. Proposals or parts of proposals which are related to each other closely enough to be, in effect, a single course of action shall

be evaluated in a single impact statement.

(b) Environmental impact statements may be prepared, and are sometimes required, for broad Federal actions such as the adoption of new agency programs or regulations (§ 1508.18). Agencies shall prepare statements on broad actions so that they are relevant to policy and are timed to coincide with meaningful points in agency planning and decisionmaking.

(c) When preparing statements on broad actions (including proposals by more than one agency), agencies may find it useful to evaluate the proposal(s) in one of the following ways:

(1) Geographically, including actions occurring in the same general location, such as body of water, region, or metropolitan area.

(2) Generically, including actions which have relevant similarities, such as common timing, impacts, alternatives, methods of implementation, media, or subject matter.

(3) By stage of technological development including federal or federally assisted research, development or demonstration programs for new technologies which, if applied, could significantly affect the quality of the human environment. Statements shall be prepared on such programs and shall be available before the program has reached a stage of investment or commitment to implementation likely to determine subsequent development or restrict later alternatives.

(d) Agencies shall as appropriate employ scoping (§ 1501.7), tiering (§ 1502.20), and other methods listed in §§ 1500.4 and 1500.5 to relate broad and narrow actions and to avoid duplication and delay.

§ 1502.5 Timing.

An agency shall commence preparation of an environmental impact statement as close as possible to the time the agency is developing or is presented with a proposal (§ 1508.23) so that preparation can be completed in time for the final statement to be included in any recommendation or report on the proposal. The statement shall be prepared early enough so that it can

serve practically as an important contribution to the decisionmaking process and will not be used to rationalize or justify decisions already made (§§ 1500.2(c), 1501.2, and 1502.2). For instance:

(a) For projects directly undertaken by Federal agencies the environmental impact statement shall be prepared at the feasibility analysis (go-no go) stage and may be supplemented at a later stage if necessary.

(b) For applications to the agency appropriate environmental assessments or statements shall be commenced no later than immediately after the application is received. Federal agencies are encouraged to begin preparation of such assessments or statements earlier, preferably jointly with applicable State or local agencies.

(c) For adjudication, the final environmental impact statement shall normally precede the final staff recommendation and that portion of the public hearing related to the impact study. In appropriate circumstances the statement may follow preliminary hearings designed to gather information for use in the statements.

(d) For informal rulemaking the draft environmental impact statement shall normally accompany the proposed rule.

§ 1502.6 Interdisciplinary preparation.

Environmental impact statements shall be prepared using an interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts (section 102(2)(A) of the Act). The disciplines of the preparers shall be appropriate to the scope and issues identified in the scoping process (§ 1501.7).

§ 1502.7 Page limits.

The text of final environmental impact statements (e.g., paragraphs (d) through (g) of § 1502.10) shall normally be less than 150 pages and for proposals of unusual scope or complexity shall normally be less than 300 pages.

§ 1502.8 Writing.

Environmental impact statements shall be written in plain language and may use appropriate graphics so that decisionmakers and the public can readily understand them. Agencies should employ writers of clear prose or editors to write, review, or edit statements, which will be based upon the analysis and supporting data from the natural and social sciences and the environmental design arts.

§ 1502.9 Draft, final, and supplemental statements.

Except for proposals for legislation as provided in § 1506.8 environmental impact statements shall be prepared in two stages and may be supplemented.

(a) Draft environmental impact statements shall be prepared in accordance with the scope decided upon in the scoping process. The lead agency shall work with the cooperating agencies and shall obtain comments as required in Part 1503 of this chapter. The draft statement must fulfill and satisfy to the fullest extent possible the requirements established for final statements in section 102(2)(C) of the Act. If a draft statement is so inadequate as to preclude meaningful analysis, the agency shall prepare and circulate a revised draft of the appropriate portion. The agency shall make every effort to disclose and discuss at appropriate points in the draft statement all major points of view on the environmental impacts of the alternatives including the proposed action.

(b) Final environmental impact statements shall respond to comments as required in Part 1503 of this chapter. The agency shall discuss at appropriate points in the final statement any responsible opposing view which was not adequately discussed in the draft statement and shall indicate the agency's response to the issues raised.

(c) Agencies:

(1) Shall prepare supplements to either draft or final environmental impact statements if:

(i) The agency makes substantial changes in the proposed action that are relevant to environmental concerns; or

(ii) There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts.

(2) May also prepare supplements when the agency determines that the purposes of the Act will be furthered by doing so.

(3) Shall adopt procedures for introducing a supplement into its formal administrative record, if such a record exists.

(4) Shall prepare, circulate, and file a supplement to a statement in the same fashion (exclusive of scoping) as a draft and final statement unless alternative procedures are approved by the Council.

§ 1502.10 Recommended format.

Agencies shall use a format for environmental impact statements which will encourage good analysis and clear presentation of the alternatives including the proposed action. The following standard format for environmental impact statements should be followed unless the agency determines that there is a compelling reason to do otherwise:

- (a) Cover sheet.
- (b) Summary.
- (c) Table of contents.
- (d) Purpose of and need for action.
- (e) Alternatives including proposed action (sections 102(2)(C)(iii) and 102(2)(E) of the Act).
- (f) Affected environment.
- (g) Environmental consequences (especially sections 102(2)(C) (i), (ii), (iv), and (v) of the Act).
- (h) List of preparers.
- (i) List of Agencies, Organizations, and persons to whom copies of the statement are sent.
- (j) Index.
- (k) Appendices (if any).

If a different format is used, it shall include paragraphs (a), (b), (c), (h), (i), and (j), of this section and shall include the substance of paragraphs (d), (e), (f), (g), and (k) of this section, as further described in §§ 1502.11 through 1502.18, in any appropriate format.

§ 1502.11 Cover sheet.

The cover sheet shall not exceed one page. It shall include:

(a) A list of the responsible agencies including the lead agency and any cooperating agencies.

(b) The title of the proposed action that is the subject of the statement (and if appropriate the titles of related cooperating agency actions), together with the State(s) and county(ies) (or other jurisdiction if applicable) where the action is located.

(c) The name, address, and telephone number of the person at the agency who can supply further information.

(d) A designation of the statement as a draft, final, or draft or final supplement.

(e) A one paragraph abstract of the statement.

(f) The date by which comments must be received (computed in cooperation with EPA under § 1506.10).

The information required by this section may be entered on Standard Form 424 (in items 4, 6, 7, 10, and 18).

§ 1502.12 Summary.

Each environmental impact statement shall contain a summary which adequately and accurately summarizes the statement. The summary shall stress the major conclusions, areas of controversy (including issues raised by agencies and the public), and the issues to be resolved (including the choice among alternatives). The summary will normally not exceed 15 pages.

§ 1502.13 Purpose and need.

The statement shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action.

§ 1502.14 Alternatives including the proposed action.

This section is the heart of the environmental impact statement. Based on the information and analysis presented in the sections on the Affected Environment (§ 1502.15) and the Environmental Consequences (§ 1502.16), it should present the environmental im-

pacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public. In this section agencies shall:

(a) Rigorously explore and objectively evaluate all reasonable alternatives and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.

(b) Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.

(c) Include reasonable alternative not within the jurisdiction of the lead agency.

(d) Include the alternative of no action.

(e) Identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such preference.

(f) Include appropriate mitigation measures not already included in the proposed action or alternatives.

§ 1502.15 Affected environment.

The environmental impact statement shall succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration. The descriptions shall be no longer than is necessary to understand the effects of the alternatives. Data and analyses in a statement shall be commensurate with the importance of the impact, with the important material summarized, consolidated, or simply referenced. Agencies shall avoid useless bulk in statements and shall concentrate effort and attention on important issues. Verbose descriptions of the affected environment are themselves no measure of the adequacy of an environmental impact statement.

§ 1502.16 Environmental consequences.

This section forms the scientific and analytic basis for the comparison under § 1502.14. It shall consolidate

the discussions of those elements required by sections 102(2)(C) (i), (ii), (iv), and (v) of NEPA which are within the scope of the statement and as much of section 102(2)(C)(iii) as is necessary to support the comparisons. The discussion will include the environmental impacts of the alternatives including the proposed action, any adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented. This section should not duplicate discussions in § 1502.14. It shall include discussions of:

(a) Direct effects and their significance (§ 1508.8).

(b) Indirect effects and their significance (§ 1508.8).

(c) Possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned. (See § 1506.2(d).)

(d) The environmental effects of alternatives including the proposed action. The comparisons under § 1502.14 will be based on this discussion.

(e) Energy requirements and conservation potential of various alternatives and mitigation measures.

(f) Natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures.

(g) Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures.

(h) Means to mitigate adverse environmental impacts (if not fully covered under § 1502.14(f)).

[43 FR 55994, Nov. 29, 1978; 44 FR 873, Jan. 3, 1979]

§ 1502.17 List of preparers.

The environmental impact statement shall list the names, together

with their qualifications (expertise, experience, professional disciplines), of the persons who were primarily responsible for preparing the environmental impact statement or significant background papers, including basic components of the statement (§§ 1502.6 and 1502.8). Where possible the persons who are responsible for a particular analysis, including analyses in background papers, shall be identified. Normally the list will not exceed two pages.

§ 1502.18 Appendix.

If an agency prepares an appendix to an environmental impact statement the appendix shall:

(a) Consist of material prepared in connection with an environmental impact statement (as distinct from material which is not so prepared and which is incorporated by reference (§ 1502.21)).

(b) Normally consist of material which substantiates any analysis fundamental to the impact statement.

(c) Normally be analytic and relevant to the decision to be made.

(d) Be circulated with the environmental impact statement or be readily available on request.

§ 1502.19 Circulation of the environmental impact statement.

Agencies shall circulate the entire draft and final environmental impact statements except for certain appendices as provided in § 1502.18(d) and unchanged statements as provided in § 1503.4(c). However, if the statement is unusually long, the agency may circulate the summary instead, except that the entire statement shall be furnished to:

(a) Any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved and any appropriate Federal, State or local agency authorized to develop and enforce environmental standards.

(b) The applicant, if any.

(c) Any person, organization, or agency requesting the entire environmental impact statement.

(d) In the case of a final environmental impact statement any person,

organization, or agency which submitted substantive comments on the draft.

If the agency circulates the summary and thereafter receives a timely request for the entire statement and for additional time to comment, the time for that requestor only shall be extended by at least 15 days beyond the minimum period.

§ 1502.20 Tiering.

Agencies are encouraged to tier their environmental impact statements to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review (§ 1508.28). Whenever a broad environmental impact statement has been prepared (such as a program or policy statement) and a subsequent statement or environmental assessment is then prepared on an action included within the entire program or policy (such as a site specific action) the subsequent statement or environmental assessment need only summarize the issues discussed in the broader statement and incorporate discussions from the broader statement by reference and shall concentrate on the issues specific to the subsequent action. The subsequent document shall state where the earlier document is available. Tiering may also be appropriate for different stages of actions. (Section 1508.28).

§ 1502.21 Incorporation by reference.

Agencies shall incorporate material into an environmental impact statement by reference when the effect will be to cut down on bulk without impeding agency and public review of the action. The incorporated material shall be cited in the statement and its content briefly described. No material may be incorporated by reference unless it is reasonably available for inspection by potentially interested persons within the time allowed for comment. Material based on proprietary data which is itself not available for review and comment shall not be incorporated by reference.

§ 1502.22 Incomplete or unavailable information.

When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking.

(a) If the incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement.

(b) If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are not known, the agency shall include within the environmental impact statement: (1) A statement that such information is incomplete or unavailable; (2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and (4) the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the purposes of this section, "reasonably foreseeable" includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.

(c) The amended regulation will be applicable to all environmental impact statements for which a Notice of Intent (40 CFR 1508.22) is published in the FEDERAL REGISTER on or after May 27, 1986. For environmental impact statements in progress, agencies may choose to comply with the re-

requirements of either the original or amended regulation.

(51 FR 15625, Apr. 25, 1986)

§ 1502.23 Cost-benefit analysis.

If a cost-benefit analysis relevant to the choice among environmentally different alternatives is being considered for the proposed action, it shall be incorporated by reference or appended to the statement as an aid in evaluating the environmental consequences. To assess the adequacy of compliance with section 102(2)(B) of the Act the statement shall, when a cost-benefit analysis is prepared, discuss the relationship between that analysis and any analyses of unquantified environmental impacts, values, and amenities. For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision.

§ 1502.24 Methodology and scientific accuracy.

Agencies shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement. An agency may place discussion of methodology in an appendix.

§ 1502.25 Environmental review and consultation requirements.

(a) To the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with environmental impact analyses and related surveys and studies required by the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.), the National Historic Preservation Act of 1966 (16 U.S.C. 470 et seq.), the Endangered

Species Act of 1973 (16 U.S.C. 1531 et seq.), and other environmental review laws and executive orders.

(b) The draft environmental impact statement shall list all Federal permits, licenses, and other entitlements which must be obtained in implementing the proposal. If it is uncertain whether a Federal permit, license, or other entitlement is necessary, the draft environmental impact statement shall so indicate.

PART 1503—COMMENTING

Sec.

1503.1 Inviting comments.

1503.2 Duty to comment.

1503.3 Specificity of comments.

1503.4 Response to comments.

AUTHORITY: NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 et seq.), sec. 309 of the Clean Air Act, as amended (42 U.S.C. 7609), and E.O. 11514 (Mar. 5, 1970, as amended by E.O. 11991, May 24, 1977).

SOURCE: 43 FR 55997, Nov. 29, 1978, unless otherwise noted.

§ 1503.1 Inviting comments.

(a) After preparing a draft environmental impact statement and before preparing a final environmental impact statement the agency shall:

(1) Obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved or which is authorized to develop and enforce environmental standards.

(2) Request the comments of:

(i) Appropriate State and local agencies which are authorized to develop and enforce environmental standards;

(ii) Indian tribes, when the effects may be on a reservation; and

(iii) Any agency which has requested that it receive statements on actions of the kind proposed.

Office of Management and Budget Circular A 95 (Revised), through its system of clearinghouses, provides a means of securing the views of State and local environmental agencies. The clearinghouses may be used, by mutual agreement of the lead agency and the clearinghouse, for securing

State and local reviews of the draft environmental impact statements.

(3) Request comments from the applicant, if any.

(4) Request comments from the public, affirmatively soliciting comments from those persons or organizations who may be interested or affected.

(b) An agency may request comments on a final environmental impact statement before the decision is finally made. In any case other agencies or persons may make comments before the final decision unless a different time is provided under § 1506.10.

§ 1503.2 Duty to comment.

Federal agencies with jurisdiction by law or special expertise with respect to any environmental impact involved and agencies which are authorized to develop and enforce environmental standards shall comment on statements within their jurisdiction, expertise, or authority. Agencies shall comment within the time period specified for comment in § 1506.10. A Federal agency may reply that it has no comment. If a cooperating agency is satisfied that its views are adequately reflected in the environmental impact statement, it should reply that it has no comment.

§ 1503.3 Specificity of comments.

(a) Comments on an environmental impact statement or on a proposed action shall be as specific as possible and may address either the adequacy of the statement or the merits of the alternatives discussed or both.

(b) When a commenting agency criticizes a lead agency's predictive methodology, the commenting agency should describe the alternative methodology which it prefers and why.

(c) A cooperating agency shall specify in its comments whether it needs additional information to fulfill other applicable environmental reviews or consultation requirements and what information it needs. In particular, it shall specify any additional information it needs to comment adequately on the draft statement's analysis of significant site-specific effects associated with the granting or approving by that cooperating agency of neces-

sary Federal permits, licenses, or entitlements.

(d) When a cooperating agency with jurisdiction by law objects to or expresses reservations about the proposal on grounds of environmental impacts, the agency expressing the objection or reservation shall specify the mitigation measures it considers necessary to allow the agency to grant or approve applicable permit, license, or related requirements or concurrences.

§ 1503.4 Response to comments.

(a) An agency preparing a final environmental impact statement shall assess and consider comments both individually and collectively, and shall respond by one or more of the means listed below, stating its response in the final statement. Possible responses are to:

(1) Modify alternatives including the proposed action.

(2) Develop and evaluate alternatives not previously given serious consideration by the agency.

(3) Supplement, improve, or modify its analyses.

(4) Make factual corrections.

(5) Explain why the comments do not warrant further agency response, citing the sources, authorities, or reasons which support the agency's position and, if appropriate, indicate those circumstances which would trigger agency reappraisal or further response.

(b) All substantive comments received on the draft statement (or summaries thereof where the response has been exceptionally voluminous), should be attached to the final statement whether or not the comment is thought to merit individual discussion by the agency in the text of the statement.

(c) If changes in response to comments are minor and are confined to the responses described in paragraphs (a) (4) and (5) of this section, agencies may write them on errata sheets and attach them to the statement instead of rewriting the draft statement. In such cases only the comments, the responses, and the changes and not the final statement need be circulated (§ 1502.19). The entire document with

a new cover sheet shall be filed as the final statement (§ 1506.9).

PART 1504—PREDECISION REFERRALS TO THE COUNCIL OF PROPOSED FEDERAL ACTIONS DETERMINED TO BE ENVIRONMENTALLY UNSATISFACTORY

Sec.
1504.1 Purpose.
1504.2 Criteria for referral.
1504.3 Procedure for referrals and response.

AUTHORITY: NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 *et seq.*), sec. 309 of the Clean Air Act, as amended (42 U.S.C. 7609), and E.O. 11514 (Mar. 5, 1970, as amended by E.O. 11991, May 24, 1977).

SOURCE: 43 FR 55998, Nov. 29, 1978, unless otherwise noted.

§ 1504.1 Purpose.

(a) This part establishes procedures for referring to the Council Federal interagency disagreements concerning proposed major Federal actions that might cause unsatisfactory environmental effects. It provides means for early resolution of such disagreements.

(b) Under section 309 of the Clean Air Act (42 U.S.C. 7609), the Administrator of the Environmental Protection Agency is directed to review and comment publicly on the environmental impacts of Federal activities, including actions for which environmental impact statements are prepared. If after this review the Administrator determines that the matter is "unsatisfactory from the standpoint of public health or welfare or environmental quality," section 309 directs that the matter be referred to the Council (hereafter "environmental referrals").

(c) Under section 102(2)(C) of the Act other Federal agencies may make similar reviews of environmental impact statements, including judgments on the acceptability of anticipated environmental impacts. These reviews must be made available to the President, the Council and the public.

§ 1504.2 Criteria for referral.

Environmental referrals should be made to the Council only after con-

certed, timely (as early as possible in the process), but unsuccessful attempts to resolve differences with the lead agency. In determining what environmental objections to the matter are appropriate to refer to the Council, an agency should weigh potential adverse environmental impacts, considering:

- (a) Possible violation of national environmental standards or policies.
- (b) Severity.
- (c) Geographical scope.
- (d) Duration.
- (e) Importance as precedents.
- (f) Availability of environmentally preferable alternatives.

§ 1504.3 Procedure for referrals and response.

(a) A Federal agency making the referral to the Council shall:

(1) Advise the lead agency at the earliest possible time that it intends to refer a matter to the Council unless a satisfactory agreement is reached.

(2) Include such advice in the referring agency's comments on the draft environmental impact statement, except when the statement does not contain adequate information to permit an assessment of the matter's environmental acceptability.

(3) Identify any essential information that is lacking and request that it be made available at the earliest possible time.

(4) Send copies of such advice to the Council.

(b) The referring agency shall deliver its referral to the Council not later than twenty-five (25) days after the final environmental impact statement has been made available to the Environmental Protection Agency, commenting agencies, and the public. Except when an extension of this period has been granted by the lead agency, the Council will not accept a referral after that date.

(c) The referral shall consist of:

(1) A copy of the letter signed by the head of the referring agency and delivered to the lead agency informing the lead agency of the referral and the reasons for it, and requesting that no action be taken to implement the matter until the Council acts upon the

referral. The letter shall include a copy of the statement referred to in (c)(2) of this section.

(2) A statement supported by factual evidence leading to the conclusion that the matter is unsatisfactory from the standpoint of public health or welfare or environmental quality. The statement shall:

(i) Identify any material facts in controversy and incorporate (by reference if appropriate) agreed upon facts.

(ii) Identify any existing environmental requirements or policies which would be violated by the matter.

(iii) Present the reasons why the referring agency believes the matter is environmentally unsatisfactory.

(iv) Contain a finding by the agency whether the issue raised is of national importance because of the threat to national environmental resources or policies or for some other reason.

(v) Review the steps taken by the referring agency to bring its concerns to the attention of the lead agency at the earliest possible time, and

(vi) Give the referring agency's recommendations as to what mitigation alternative, further study, or other course of action (including abandonment of the matter) are necessary to remedy the situation.

(d) Not later than twenty-five (25) days after the referral to the Council the lead agency may deliver a response to the Council, and the referring agency. If the lead agency requests more time and gives assurance that the matter will not go forward in the interim, the Council may grant an extension. The response shall:

(1) Address fully the issues raised in the referral.

(2) Be supported by evidence.

(3) Give the lead agency's response to the referring agency's recommendations.

(e) Interested persons (including the applicant) may deliver their views in writing to the Council. Views in support of the referral should be delivered not later than the referral. Views in support of the response shall be delivered not later than the response.

(f) Not later than twenty-five (25) days after receipt of both the referral and any response or upon being informed that there will be no response

(unless the lead agency agrees to a longer time), the Council may take one or more of the following actions:

(1) Conclude that the process of referral and response has successfully resolved the problem.

(2) Initiate discussions with the agencies with the objective of mediation with referring and lead agencies.

(3) Hold public meetings or hearings to obtain additional views and information.

(4) Determine that the issue is not one of national importance and request the referring and lead agencies to pursue their decision process.

(5) Determine that the issue should be further negotiated by the referring and lead agencies and is not appropriate for Council consideration until one or more heads of agencies report to the Council that the agencies' disagreements are irreconcilable.

(6) Publish its findings and recommendations (including where appropriate a finding that the submitted evidence does not support the position of an agency).

(7) When appropriate, submit the referral and the response together with the Council's recommendation to the President for action.

(g) The Council shall take no longer than 60 days to complete the actions specified in paragraph (f) (2), (3), or (5) of this section.

(h) When the referral involves an action required by statute to be determined on the record after opportunity for agency hearing, the referral shall be conducted in a manner consistent with 5 U.S.C. 557(d) (Administrative Procedure Act).

[43 FR 55998, Nov. 29, 1978, 44 FR 873 Jan. 3, 1979]

PART 1505—NEPA AND AGENCY DECISIONMAKING

Sec.
1505.1 Agency decisionmaking procedures.
1505.2 Record of decision in cases requiring environmental impact statements.
1505.3 Implementing the decision.

AUTHORITY: NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 *et seq.*), sec. 309 of the Clean Air Act, as amended (42 U.S.C.

7609) and E.O. 11514 (Mar. 5, 1970, as amended by E.O. 11991, May 24, 1977).

SOURCE: 43 FR 55999, Nov. 29, 1978, unless otherwise noted.

§ 1505.1 Agency decisionmaking procedures.

Agencies shall adopt procedures (§ 1507.3) to ensure that decisions are made in accordance with the policies and purposes of the Act. Such procedures shall include but not be limited to:

(a) Implementing procedures under section 102(2) to achieve the requirements of sections 101 and 102(1).

(b) Designating the major decision points for the agency's principal programs likely to have a significant effect on the human environment and assuring that the NEPA process corresponds with them.

(c) Requiring that relevant environmental documents, comments, and responses be part of the record in formal rulemaking or adjudicatory proceedings.

(d) Requiring that relevant environmental documents, comments, and responses accompany the proposal through existing agency review processes so that agency officials use the statement in making decisions.

(e) Requiring that the alternatives considered by the decisionmaker are encompassed by the range of alternatives discussed in the relevant environmental documents and that the decisionmaker consider the alternatives described in the environmental impact statement. If another decision document accompanies the relevant environmental documents to the decisionmaker, agencies are encouraged to make available to the public before the decision is made any part of that document that relates to the comparison of alternatives.

§ 1505.2 Record of decision in cases requiring environmental impact statements.

At the time of its decision (§ 1506.10) or, if appropriate, its recommendation to Congress, each agency shall prepare a concise public record of decision. The record, which may be integrated into any other record prepared by the agency, including that required by

OMB Circular A-95 (Revised), part I, sections 6 (c) and (d), and part II, section 5(b)(4), shall:

(a) State what the decision was.

(b) Identify all alternatives considered by the agency in reaching its decision, specifying the alternative or alternatives which were considered to be environmentally preferable. An agency may discuss preferences among alternatives based on relevant factors including economic and technical considerations and agency statutory missions. An agency shall identify and discuss all such factors including any essential considerations of national policy which were balanced by the agency in making its decision and state how those considerations entered into its decision.

(c) State whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted, and if not, why they were not. A monitoring and enforcement program shall be adopted and summarized where applicable for any mitigation.

§ 1505.3 Implementing the decision.

Agencies may provide for monitoring to assure that their decisions are carried out and should do so in important cases. Mitigation (§ 1505.2(c)) and other conditions established in the environmental impact statement or during its review and committed as part of the decision shall be implemented by the lead agency or other appropriate consenting agency. The lead agency shall:

(a) Include appropriate conditions in grants, permits or other approvals.

(b) Condition funding of actions on mitigation.

(c) Upon request, inform cooperating or commenting agencies on progress in carrying out mitigation measures which they have proposed and which were adopted by the agency making the decision.

(d) Upon request, make available to the public the results of relevant monitoring.

PART 1506—OTHER REQUIREMENTS OF NEPA

Sec.

1506.1 Limitations on actions during NEPA process.

1506.2 Elimination of duplication with State and local procedures.

1506.3 Adoption.

1506.4 Combining documents.

1506.5 Agency responsibility.

1506.6 Public involvement.

1506.7 Further guidance.

1506.8 Proposals for legislation.

1506.9 Filing requirements.

1506.10 Timing of agency action.

1506.11 Emergencies.

1506.12 Effective date.

AUTHORITY: NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 *et seq.*), sec. 309 of the Clean Air Act, as amended (42 U.S.C. 7609), and E.O. 11514 (Mar. 5, 1970, as amended by E.O. 11991, May 24, 1977).

SOURCE: 43 FR 56000, Nov. 29, 1978, unless otherwise noted.

§ 1506.1 Limitations on actions during NEPA process.

(a) Until an agency issues a record of decision as provided in § 1505.2 (except as provided in paragraph (c) of this section), no action concerning the proposal shall be taken which would:

(1) Have an adverse environmental impact; or

(2) Limit the choice of reasonable alternatives.

(b) If any agency is considering an application from a non-Federal entity, and is aware that the applicant is about to take an action within the agency's jurisdiction that would meet either of the criteria in paragraph (a) of this section, then the agency shall promptly notify the applicant that the agency will take appropriate action to insure that the objectives and procedures of NEPA are achieved.

(c) While work on a required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment unless such action:

(1) Is justified independently of the program;

(2) Is itself accompanied by an adequate environmental impact statement; and

(3) Will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision on the program when it tends to determine subsequent development or limit alternatives.

(d) This section does not preclude development by applicants of plans or designs or performance of other work necessary to support an application for Federal, State or local permits or assistance. Nothing in this section shall preclude Rural Electrification Administration approval of minimal expenditures not affecting the environment (*e.g.* long leadline equipment and purchase options) made by non-governmental entities seeking loan guarantees from the Administration.

§ 1506.2 Elimination of duplication with State and local procedures.

(a) Agencies authorized by law to cooperate with State agencies of statewide jurisdiction pursuant to section 102(2)(D) of the Act may do so.

(b) Agencies shall cooperate with State and local agencies to the fullest extent possible to reduce duplication between NEPA and State and local requirements, unless the agencies are specifically barred from doing so by some other law. Except for cases covered by paragraph (a) of this section, such cooperation shall to the fullest extent possible include:

(1) Joint planning processes.

(2) Joint environmental research and studies.

(3) Joint public hearings (except where otherwise provided by statute).

(4) Joint environmental assessments.

(c) Agencies shall cooperate with State and local agencies to the fullest extent possible to reduce duplication between NEPA and comparable State and local requirements, unless the agencies are specifically barred from doing so by some other law. Except for cases covered by paragraph (a) of this section, such cooperation shall to the fullest extent possible include joint environmental impact statements. In

such cases one or more Federal agencies and one or more State or local agencies shall be joint lead agencies. Where State laws or local ordinances have environmental impact statement requirements in addition to but not in conflict with those in NEPA, Federal agencies shall cooperate in fulfilling these requirements as well as those of Federal laws so that one document will comply with all applicable laws.

(d) To better integrate environmental impact statements into State or local planning processes, statements shall discuss any inconsistency of a proposed action with any approved State or local plan and laws (whether or not federally sanctioned). Where an inconsistency exists, the statement should describe the extent to which the agency would reconcile its proposed action with the plan or law.

§ 1506.3 Adoption.

(a) An agency may adopt a Federal draft or final environmental impact statement or portion thereof provided that the statement or portion thereof meets the standards for an adequate statement under these regulations.

(b) If the actions covered by the original environmental impact statement and the proposed action are substantially the same, the agency adopting another agency's statement is not required to recirculate it except as a final statement. Otherwise the adopting agency shall treat the statement as a draft and recirculate it (except as provided in paragraph (c) of this section).

(c) A cooperating agency may adopt without recirculating the environmental impact statement of a lead agency when, after an independent review of the statement, the cooperating agency concludes that its comments and suggestions have been satisfied.

(d) When an agency adopts a statement which is not final within the agency that prepared it, or when the action it assesses is the subject of a referral under Part 1504, or when the statement's adequacy is the subject of a judicial action which is not final, the agency shall so specify.

§ 1506.4 Combining documents.

Any environmental document in compliance with NEPA may be combined with any other agency document to reduce duplication and paperwork.

§ 1506.5 Agency responsibility.

(a) *Information.* If an agency requires an applicant to submit environmental information for possible use by the agency in preparing an environmental impact statement, then the agency should assist the applicant by outlining the types of information required. The agency shall independently evaluate the information submitted and shall be responsible for its accuracy. If the agency chooses to use the information submitted by the applicant in the environmental impact statement, either directly or by reference, then the names of the persons responsible for the independent evaluation shall be included in the list of preparers (§ 1502.17). It is the intent of this paragraph that acceptable work not be redone, but that it be verified by the agency.

(b) *Environmental assessments.* If an agency permits an applicant to prepare an environmental assessment, the agency, besides fulfilling the requirements of paragraph (a) of this section, shall make its own evaluation of the environmental issues and take responsibility for the scope and content of the environmental assessment.

(c) *Environmental impact statements.* Except as provided in §§ 1506.2 and 1506.3 any environmental impact statement prepared pursuant to the requirements of NEPA shall be prepared directly by or by a contractor selected by the lead agency or where appropriate under § 1501.6(b), a cooperating agency. It is the intent of these regulations that the contractor be chosen solely by the lead agency, or by the lead agency in cooperation with cooperating agencies, or where appropriate by a cooperating agency to avoid any conflict of interest. Contractors shall execute a disclosure statement prepared by the lead agency, or where appropriate the cooperating agency, specifying that they have no financial or other interest in the out-

come of the project. If the document is prepared by contract, the responsible Federal official shall furnish guidance and participate in the preparation and shall independently evaluate the statement prior to its approval and take responsibility for its scope and contents. Nothing in this section is intended to prohibit any agency from requesting any person to submit information to it or to prohibit any person from submitting information to any agency.

§ 1506.6 Public involvement.

Agencies shall:

(a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.

(b) Provide public notice of NEPA-related hearings, public meetings, and the availability of environmental documents so as to inform those persons and agencies who may be interested or affected.

(1) In all cases the agency shall mail notice to those who have requested it on an individual action.

(2) In the case of an action with effects of national concern notice shall include publication in the FEDERAL REGISTER and notice by mail to national organizations reasonably expected to be interested in the matter and may include listing in the *102 Monitor*. An agency engaged in rulemaking may provide notice by mail to national organizations who have requested that notice regularly be provided. Agencies shall maintain a list of such organizations.

(3) In the case of an action with effects primarily of local concern the notice may include:

(i) Notice to State and areawide clearinghouses pursuant to OMB Circular A 95 (Revised).

(ii) Notice to Indian tribes when effects may occur on reservations.

(iii) Following the affected State's public notice procedures for comparable actions.

(iv) Publication in local newspapers (in papers of general circulation rather than legal papers).

(v) Notice through other local media.

(vi) Notice to potentially interested community organizations including small business associations.

(vii) Publication in newsletters that may be expected to reach potentially interested persons.

(viii) Direct mailing to owners and occupants of nearby or affected property.

(ix) Posting of notice on and off site in the area where the action is to be located.

(c) Hold or sponsor public hearings or public meetings whenever appropriate or in accordance with statutory requirements applicable to the agency. Criteria shall include whether there is:

(1) Substantial environmental controversy concerning the proposed action or substantial interest in holding the hearing.

(2) A request for a hearing by another agency with jurisdiction over the action supported by reasons why a hearing will be helpful. If a draft environmental impact statement is to be considered at a public hearing, the agency should make the statement available to the public at least 15 days in advance (unless the purpose of the hearing is to provide information for the draft environmental impact statement).

(d) Solicit appropriate information from the public.

(e) Explain in its procedures where interested persons can get information or status reports on environmental impact statements and other elements of the NEPA process.

(f) Make environmental impact statements, the comments received, and any underlying documents available to the public pursuant to the provisions of the Freedom of Information Act (5 U.S.C. 552), without regard to the exclusion for interagency memoranda where such memoranda transmit comments of Federal agencies on the environmental impact of the proposed action. Materials to be made available to the public shall be provided to the public without charge to the extent practicable, or at a fee which is not more than the actual costs of reproducing copies required to be sent to other Federal agencies, including the Council.

§ 1506.7 Further guidance.

The Council may provide further guidance concerning NEPA and its procedures including:

(a) A handbook which the Council may supplement from time to time, which shall in plain language provide guidance and instructions concerning the application of NEPA and these regulations.

(b) Publication of the Council's Memoranda to Heads of Agencies.

(c) In conjunction with the Environmental Protection Agency and the publication of the 102 Monitor, notice of:

- (1) Research activities;
- (2) Meetings and conferences related to NEPA; and
- (3) Successful and innovative procedures used by agencies to implement NEPA.

§ 1506.8 Proposals for legislation.

(a) The NEPA process for proposals for legislation (§ 1508.17) significantly affecting the quality of the human environment shall be integrated with the legislative process of the Congress. A legislative environmental impact statement is the detailed statement required by law to be included in a recommendation or report on a legislative proposal to Congress. A legislative environmental impact statement shall be considered part of the formal transmittal of a legislative proposal to Congress; however, it may be transmitted to Congress up to 30 days later in order to allow time for completion of an accurate statement which can serve as the basis for public and Congressional debate. The statement must be available in time for Congressional hearings and deliberations.

(b) Preparation of a legislative environmental impact statement shall conform to the requirements of these regulations except as follows:

(1) There need not be a scoping process.

(2) The legislative statement shall be prepared in the same manner as a draft statement, but shall be considered the "detailed statement" required by statute; *Provided*, That when any of the following conditions exist both the draft and final environmental impact statement on the legislative

proposal shall be prepared and circulated as provided by §§ 1503.1 and 1506.10.

(i) A Congressional Committee with jurisdiction over the proposal has a rule requiring both draft and final environmental impact statements.

(ii) The proposal results from a study process required by statute (such as those required by the Wild and Scenic Rivers Act (16 U.S.C. 1271 et seq.) and the Wilderness Act (16 U.S.C. 1131 et seq.)).

(iii) Legislative approval is sought for Federal or federally assisted construction or other projects which the agency recommends be located at specific geographic locations. For proposals requiring an environmental impact statement for the acquisition of space by the General Services Administration, a draft statement shall accompany the Prospectus or the 11(b) Report of Building Project Surveys to the Congress, and a final statement shall be completed before site acquisition.

(iv) The agency decides to prepare draft and final statements.

(c) Comments on the legislative statement shall be given to the lead agency which shall forward them along with its own responses to the Congressional committees with jurisdiction.

§ 1506.9 Filing requirements.

Environmental impact statements together with comments and responses shall be filed with the Environmental Protection Agency, attention Office of Federal Activities (A 104), 401 M Street SW., Washington, D.C. 20460. Statements shall be filed with EPA no earlier than they are also transmitted to commenting agencies and made available to the public. EPA shall deliver one copy of each statement to the Council, which shall satisfy the requirement of availability to the President. EPA may issue guidelines to agencies to implement its responsibilities under this section and § 1506.10.

§ 1506.10 Timing of agency action.

(a) The Environmental Protection Agency shall publish a notice in the FEDERAL REGISTER each week of the environmental impact statements filed

during the preceding week. The minimum time periods set forth in this section shall be calculated from the date of publication of this notice.

(b) No decision on the proposed action shall be made or recorded under § 1505.2 by a Federal agency until the later of the following dates:

(1) Ninety (90) days after publication of the notice described above in paragraph (a) of this section for a draft environmental impact statement.

(2) Thirty (30) days after publication of the notice described above in paragraph (a) of this section for a final environmental impact statement.

An exception to the rules on timing may be made in the case of an agency decision which is subject to a formal internal appeal. Some agencies have a formally established appeal process which allows other agencies or the public to take appeals on a decision and make their views known, after publication of the final environmental impact statement. In such cases, where a real opportunity exists to alter the decision, the decision may be made and recorded at the same time the environmental impact statement is published. This means that the period for appeal of the decision and the 30-day period prescribed in paragraph (b)(2) of this section may run concurrently. In such cases the environmental impact statement shall explain the timing and the public's right of appeal. An agency engaged in rule-making under the Administrative Procedure Act or other statute for the purpose of protecting the public health or safety, may waive the time period in paragraph (b)(2) of this section and publish a decision on the final rule simultaneously with publication of the notice of the availability of the final environmental impact statement as described in paragraph (a) of this section.

(c) If the final environmental impact statement is filed within ninety (90) days after a draft environmental impact statement is filed with the Environmental Protection Agency, the minimum thirty (30) day period and the minimum ninety (90) day period may run concurrently. However, subject to paragraph (d) of this section agencies shall allow not less than 45

days for comments on draft statements.

(d) The lead agency may extend prescribed periods. The Environmental Protection Agency may upon a showing by the lead agency of compelling reasons of national policy reduce the prescribed periods and may upon a showing by any other Federal agency of compelling reasons of national policy also extend prescribed periods, but only after consultation with the lead agency. (Also see § 1507.3(d).) Failure to file timely comments shall not be a sufficient reason for extending a period. If the lead agency does not concur with the extension of time EPA may not extend it for more than 30 days. When the Environmental Protection Agency reduces or extends any period of time it shall notify the Council.

[43 FR 56000, Nov. 29, 1978, 44 FR 874, Jan. 3, 1979]

§ 1506.11 Emergencies.

Where emergency circumstances make it necessary to take an action with significant environmental impact without observing the provisions of these regulations, the Federal agency taking the action should consult with the Council about alternative arrangements. Agencies and the Council will limit such arrangements to actions necessary to control the immediate impacts of the emergency. Other actions remain subject to NEPA review.

§ 1506.12 Effective date.

The effective date of these regulations is July 30, 1979, except that for agencies that administer programs that qualify under section 102(2)(D) of the Act or under sec. 104(h) of the Housing and Community Development Act of 1974 an additional four months shall be allowed for the State or local agencies to adopt their implementing procedures.

(a) These regulations shall apply to the fullest extent practicable to ongoing activities and environmental documents begun before the effective date. These regulations do not apply to an environmental impact statement or supplement if the draft statement was filed before the effective date of these

regulations. No completed environmental documents need be redone by reasons of these regulations. Until these regulations are applicable, the Council's guidelines published in the *FEDERAL REGISTER* of August 1, 1973, shall continue to be applicable. In cases where these regulations are applicable the guidelines are superseded. However, nothing shall prevent an agency from proceeding under these regulations at an earlier time.

(b) NEPA shall continue to be applicable to actions begun before January 1, 1970, to the fullest extent possible.

PART 1507—AGENCY COMPLIANCE

Sec.

- 1507.1 Compliance.
- 1507.2 Agency capability to comply.
- 1507.3 Agency procedures.

AUTHORITY: NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 *et seq.*), sec. 309 of the Clean Air Act, as amended (42 U.S.C. 7609), and E.O. 11514 (Mar. 5, 1970, as amended by E.O. 11991, May 24, 1977).

SOURCE: 43 FR 56002, Nov. 29, 1978, unless otherwise noted.

§ 1507.1 Compliance.

All agencies of the Federal Government shall comply with these regulations. It is the intent of these regulations to allow each agency flexibility in adapting its implementing procedures authorized by § 1507.3 to the requirements of other applicable laws.

§ 1507.2 Agency capability to comply.

Each agency shall be capable (in terms of personnel and other resources) of complying with the requirements enumerated below. Such compliance may include use of other's resources, but the using agency shall itself have sufficient capability to evaluate what others do for it. Agencies shall:

(a) Fulfill the requirements of section 102(2)(A) of the Act to utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on the human environment. Agencies shall designate a

person to be responsible for overall review of agency NEPA compliance.

(b) Identify methods and procedures required by section 102(2)(B) to insure that presently unquantified environmental amenities and values may be given appropriate consideration.

(c) Prepare adequate environmental impact statements pursuant to section 102(2)(C) and comment on statements in the areas where the agency has jurisdiction by law or special expertise or is authorized to develop and enforce environmental standards.

(d) Study, develop, and describe alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources. This requirement of section 102(2)(E) extends to all such proposals, not just the more limited scope of section 102(2)(C)(iii) where the discussion of alternatives is confined to impact statements.

(e) Comply with the requirements of section 102(2)(H) that the agency initiate and utilize ecological information in the planning and development of resource-oriented projects.

(f) Fulfill the requirements of sections 102(2)(F), 102(2)(G), and 102(2)(I), of the Act and of Executive Order 11514, Protection and Enhancement of Environmental Quality, Sec. 2.

§ 1507.3 Agency procedures.

(a) Not later than eight months after publication of these regulations as finally adopted in the *FEDERAL REGISTER*, or five months after the establishment of an agency, whichever shall come later, each agency shall as necessary adopt procedures to supplement these regulations. When the agency is a department, major subunits are encouraged (with the consent of the department) to adopt their own procedures. Such procedures shall not paraphrase these regulations. They shall confine themselves to implementing procedures. Each agency shall consult with the Council while developing its procedures and before publishing them in the *FEDERAL REGISTER* for comment. Agencies with similar programs should consult with each other

and the Council to coordinate their procedures, especially for programs requesting similar information from applicants. The procedures shall be adopted only after an opportunity for public review and after review by the Council for conformity with the Act and these regulations. The Council shall complete its review within 30 days. Once in effect they shall be filed with the Council and made readily available to the public. Agencies are encouraged to publish explanatory guidance for these regulations and their own procedures. Agencies shall continue to review their policies and procedures and in consultation with the Council to revise them as necessary to ensure full compliance with the purposes and provisions of the Act.

(b) Agency procedures shall comply with these regulations except where compliance would be inconsistent with statutory requirements and shall include:

(1) Those procedures required by §§ 1501.2(d), 1502.9(c)(3), 1505.1, 1506.6(e), and 1508.4.

(2) Specific criteria for and identification of those typical classes of action:

(i) Which normally do require environmental impact statements.

(ii) Which normally do not require either an environmental impact statement or an environmental assessment (categorical exclusions (§ 1508.4)).

(iii) Which normally require environmental assessments but not necessarily environmental impact statements.

(c) Agency procedures may include specific criteria for providing limited exceptions to the provisions of these regulations for classified proposals. They are proposed actions which are specifically authorized under criteria established by an Executive Order or statute to be kept secret in the interest of national defense or foreign policy and are in fact properly classified pursuant to such Executive Order or statute. Environmental assessments and environmental impact statements which address classified proposals may be safeguarded and restricted from public dissemination in accordance with agencies' own regulations, applica-

ble to classified information. These documents may be organized so that classified portions can be included as annexes, in order that the unclassified portions can be made available to the public.

(d) Agency procedures may provide for periods of time other than those presented in § 1506.10 when necessary to comply with other specific statutory requirements.

(e) Agency procedures may provide that where there is a lengthy period between the agency's decision to prepare an environmental impact statement and the time of actual preparation, the notice of intent required by § 1501.7 may be published at a reasonable time in advance of preparation of the draft statement.

PART 1508—TERMINOLOGY AND INDEX

Sec.

- 1508.1 Terminology.
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- 1508.26 Special expertise.
- 1508.27 Significantly.
- 1508.28 Tiering.

AUTHORITY: NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 *et seq.*), sec. 309 of the Clean Air Act, as amended (42 U.S.C. 7609), and E.O. 11514 (Mar. 5, 1970, as amended by E.O. 11991, May 24, 1977).

SOURCE: 43 FR 56003, Nov. 29, 1978, unless otherwise noted.

§ 1508.1 Terminology.

The terminology of this part shall be uniform throughout the Federal Government.

§ 1508.2 Act.

"Act" means the National Environmental Policy Act, as amended (42 U.S.C. 4321, et seq.) which is also referred to as "NEPA."

§ 1508.3 Affecting.

"Affecting" means will or may have an effect on.

§ 1508.4 Categorical exclusion.

"Categorical exclusion" means a category of actions which do not individually or cumulatively have a significant effect on the human environment and which have been found to have no such effect in procedures adopted by a Federal agency in implementation of these regulations (§ 1507.3) and for which, therefore, neither an environmental assessment nor an environmental impact statement is required. An agency may decide in its procedures or otherwise, to prepare environmental assessments for the reasons stated in § 1508.9 even though it is not required to do so. Any procedures under this section shall provide for extraordinary circumstances in which a normally excluded action may have a significant environmental effect.

§ 1508.5 Cooperating agency.

"Cooperating agency" means any Federal agency other than a lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major Federal action significantly affecting the quality of the human environment. The selection and responsibilities of a cooperating agency are described in § 1501.6. A State or local agency of similar qualifications or, when the effects are on a reservation, an Indian Tribe, may by agreement with the lead agency become a cooperating agency.

§ 1508.6 Council.

"Council" means the Council on Environmental Quality established by Title II of the Act.

§ 1508.7 Cumulative impact.

"Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

§ 1508.8 Effects.

"Effects" include:

(a) Direct effects, which are caused by the action and occur at the same time and place.

(b) Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Effects and impacts as used in these regulations are synonymous. Effects includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial.

§ 1508.9 Environmental assessment.

"Environmental assessment":

(a) Means a concise public document for which a Federal agency is responsible that serves to:

(1) Briefly provide sufficient evidence and analysis for determining

whether to prepare an environmental impact statement or a finding of no significant impact.

(2) Aid an agency's compliance with the Act when no environmental impact statement is necessary.

(3) Facilitate preparation of a statement when one is necessary.

(b) Shall include brief discussions of the need for the proposal, of alternatives as required by section 102(2)(E), of the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted.

§ 1508.10 Environmental document.

"Environmental document" includes the documents specified in § 1508.9 (environmental assessment), § 1508.11 (environmental impact statement), § 1508.13 (finding of no significant impact), and § 1508.22 (notice of intent).

§ 1508.11 Environmental impact statement.

"Environmental impact statement" means a detailed written statement as required by section 102(2)(C) of the Act.

§ 1508.12 Federal agency.

"Federal agency" means all agencies of the Federal Government. It does not mean the Congress, the Judiciary, or the President, including the performance of staff functions for the President in his Executive Office. It also includes for purposes of these regulations States and units of general local government and Indian tribes assuming NEPA responsibilities under section 104(h) of the Housing and Community Development Act of 1974.

§ 1508.13 Finding of no significant impact.

"Finding of no significant impact" means a document by a Federal agency briefly presenting the reasons why an action, not otherwise excluded (§ 1508.4), will not have a significant effect on the human environment and for which an environmental impact statement therefore will not be prepared. It shall include the environmental assessment or a summary of it and shall note any other environmental documents related to it

(§ 1501.7(a)(5)). If the assessment is included, the finding need not repeat any of the discussion in the assessment but may incorporate it by reference.

§ 1508.14 Human environment.

"Human environment" shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment. (See the definition of "effects" (§ 1508.8).) This means that economic or social effects are not intended by themselves to require preparation of an environmental impact statement. When an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment.

§ 1508.15 Jurisdiction by law.

"Jurisdiction by law" means agency authority to approve, veto, or finance all or part of the proposal.

§ 1508.16 Lead agency.

"Lead agency" means the agency or agencies preparing or having taken primary responsibility for preparing the environmental impact statement.

§ 1508.17 Legislation.

"Legislation" includes a bill or legislative proposal to Congress developed by or with the significant cooperation and support of a Federal agency, but does not include requests for appropriations. The test for significant cooperation is whether the proposal is in fact predominantly that of the agency rather than another source. Drafting does not by itself constitute significant cooperation. Proposals for legislation include requests for ratification of treaties. Only the agency which has primary responsibility for the subject matter involved will prepare a legislative environmental impact statement.

§ 1508.18 Major Federal action.

"Major Federal action" includes actions with effects that may be major and which are potentially subject to

Federal control and responsibility. Major reinforces but does not have a meaning independent of significantly (§ 1508.27). Actions include the circumstance where the responsible officials fail to act and that failure to act is reviewable by courts or administrative tribunals under the Administrative Procedure Act or other applicable law as agency action.

(a) Actions include new and continuing activities, including projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by federal agencies; new or revised agency rules, regulations, plans, policies, or procedures; and legislative proposals (§§ 1506.8, 1508.17). Actions do not include funding assistance solely in the form of general revenue sharing funds, distributed under the State and Local Fiscal Assistance Act of 1972, 31 U.S.C. 1221 et seq., with no Federal agency control over the subsequent use of such funds. Actions do not include bringing judicial or administrative civil or criminal enforcement actions.

(b) Federal actions tend to fall within one of the following categories:

1) Adoption of official policy, such as rules, regulations, and interpretations adopted pursuant to the Administrative Procedure Act, 5 U.S.C. 551 et seq.; treaties and international conventions or agreements; formal documents establishing an agency's policies which will result in or substantially alter agency programs.

(2) Adoption of formal plans, such as official documents prepared or approved by federal agencies which guide or prescribe alternative uses of federal resources, upon which future agency actions will be based.

(3) Adoption of programs, such as a group of concerted actions to implement a specific policy or plan; systematic and connected agency decisions allocating agency resources to implement a specific statutory program or executive directive.

(4) Approval of specific projects, such as construction or management activities located in a defined geographic area. Projects include actions approved by permit or other regulatory decision as well as federal and federally assisted activities.

§ 1508.19 Matter.

"Matter" includes for purposes of Part 1504:

(a) With respect to the Environmental Protection Agency, any proposed legislation, project, action or regulation as those terms are used in section 309(a) of the Clean Air Act (42 U.S.C. 7609).

(b) With respect to all other agencies, any proposed major federal action to which section 102(2)(C) of NEPA applies.

§ 1508.20 Mitigation.

"Mitigation" includes:

(a) Avoiding the impact altogether by not taking a certain action or parts of an action.

(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.

(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.

(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.

(e) Compensating for the impact by replacing or providing substitute resources or environments.

§ 1508.21 NEPA process.

"NEPA process" means all measures necessary for compliance with the requirements of section 2 and Title I of NEPA.

§ 1508.22 Notice of intent.

"Notice of Intent" means a notice that an environmental impact statement will be prepared and considered. The notice shall briefly:

(a) Describe the proposed action and possible alternatives.

(b) Describe the agency's proposed scoping process including whether, when, and where any scoping meeting will be held.

(c) State the name and address of a person within the agency who can answer questions about the proposed action and the environmental impact statement.

§ 1508.23 Proposal.

"Proposal" exists at that stage in the development of an action when an agency subject to the Act has a goal and is actively preparing to make a decision on one or more alternative means of accomplishing that goal and the effects can be meaningfully evaluated. Preparation of an environmental impact statement on a proposal should be timed (§ 1502.5) so that the final statement may be completed in time for the statement to be included in any recommendation or report on the proposal. A proposal may exist in fact as well as by agency declaration that one exists.

§ 1508.24 Referring agency.

"Referring agency" means the federal agency which has referred any matter to the Council after a determination that the matter is unsatisfactory from the standpoint of public health or welfare or environmental quality.

§ 1508.25 Scope.

Scope consists of the range of actions, alternatives, and impacts to be considered in an environmental impact statement. The scope of an individual statement may depend on its relationships to other statements (§§ 1502.20 and 1508.28). To determine the scope of environmental impact statements, agencies shall consider 3 types of actions, 3 types of alternatives, and 3 types of impacts. They include:

(a) Actions (other than unconnected single actions) which may be:

(1) Connected actions, which means that they are closely related and therefore should be discussed in the same impact statement. Actions are connected if they:

(i) Automatically trigger other actions which may require environmental impact statements.

(ii) Cannot or will not proceed unless other actions are taken previously or simultaneously.

(iii) Are interdependent parts of a larger action and depend on the larger action for their justification.

(2) Cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts

and should therefore be discussed in the same impact statement.

(3) Similar actions, which when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography. An agency may wish to analyze these actions in the same impact statement. It should do so when the best way to assess adequately the combined impacts of similar actions or reasonable alternatives to such actions is to treat them in a single impact statement.

(b) Alternatives, which include: (1) No action alternative.

(2) Other reasonable courses of actions.

(3) Mitigation measures (not in the proposed action).

(c) Impacts, which may be: (1) Direct; (2) indirect; (3) cumulative.

§ 1508.26 Special expertise.

"Special expertise" means statutory responsibility, agency mission, or related program experience.

§ 1508.27 Significantly.

"Significantly" as used in NEPA requires considerations of both context and intensity:

(a) *Context.* This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

(b) *Intensity.* This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

(1) Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency

believes that on balance the effect will be beneficial.

(2) The degree to which the proposed action affects public health or safety.

(3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

(4) The degree to which the effects on the quality of the human environment are likely to be highly controversial.

(5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

(6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

(7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

(8) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

(9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that

has been determined to be critical under the Endangered Species Act of 1973.

(10) Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

[43 FR 56003, Nov. 29, 1978; 44 FR 874, Jan. 3, 1979]

§ 1508.28 Tiering.

"Tiering" refers to the coverage of general matters in broader environmental impact statements (such as national program or policy statements) with subsequent narrower statements or environmental analyses (such as regional or basinwide program statements or ultimately site-specific statements) incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared. Tiering is appropriate when the sequence of statements or analyses is:

(a) From a program, plan, or policy environmental impact statement to a program, plan, or policy statement or analysis of lesser scope or to a site-specific statement or analysis.

(b) From an environmental impact statement on a specific action at an early stage (such as need and site selection) to a supplement (which is preferred) or a subsequent statement or analysis at a later stage (such as environmental mitigation). Tiering in such cases is appropriate when it helps the lead agency to focus on the issues which are ripe for decision and exclude from consideration issues already decided or not yet ripe.

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THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969, AS AMENDED*

An Act to establish a national policy for the environment, to provide for the establishment of a Council on Environmental Quality, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Environmental Policy Act of 1969."

PURPOSE

SEC. 2. The purposes of this Act are: To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation, and to establish a Council on Environmental Quality.

TITLE I

DECLARATION OF NATIONAL ENVIRONMENTAL POLICY

SEC. 101. (a) The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

(b) In order to carry out the policy set forth in this Act, it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may --

- (1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
- (2) assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;
- (3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
- (4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;
- (5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
- (6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

*Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-50, July 3, 1975, and Pub. L. 94-48, August 9, 1975.

(c) The Congress recognizes that each person should enjoy a healthful environment and that each person has a responsibility to contribute to the preservation and enhancement of the environment.

Sec. 102. The Congress authorizes and directs that, to the fullest extent possible: (1) the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act, and (2) all agencies of the Federal Government shall--

(A) Utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on man's environment;

(B) Identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by title II of this Act, which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations;

(C) Include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on--

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

Prior to making any detailed statement, the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved. Copies of such statement and the comments and views of the appropriate Federal, State, and local agencies, which are authorized to develop and enforce environmental standards, shall be made available to the President, the Council on Environmental Quality and to the public as provided by section 552 of title 5, United States Code, and shall accompany the proposal through the existing agency review processes.

(D) Any detailed statement required under subparagraph (c) after January 1, 1970, for any major Federal action funded under a program of grants to States shall not be deemed to be legally insufficient solely by reason of having been prepared by a State agency or official, if:

- (i) the State agency or official has statewide jurisdiction and has the responsibility for such action,
- (ii) the responsible Federal official furnishes guidance and participates in such preparation,
- (iii) the responsible Federal official independently evaluates such statement prior to its approval and adoption, and
- (iv) after January 1, 1976, the responsible Federal official provides early notification to, and solicits the views of, any other State or any Federal land management entity of any action or any alternative thereto which may have significant impacts upon such State or affected Federal land management entity and, if there is any disagreement on such impacts, prepares a written assessment of such impacts and views for incorporation into such detailed statement.

The procedures in this subparagraph shall not relieve the Federal official of his responsibilities for the scope, objectivity, and content of the entire statement or of any other responsibility under this Act; and further, this subparagraph does not affect the legal sufficiency of statements prepared by State agencies with less than statewide jurisdiction.

(E) Study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources,

(F) Recognize the worldwide and long-range character of environmental problems and, where consistent with the foreign policy of the United States, lend appropriate support to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of mankind's world environment;

(G) Make available to States, counties, municipalities, institutions, and individuals, advice and information useful in restoring, maintaining, and enhancing the quality of the environment;

(H) Initiate and utilize ecological information in the planning and development of resource-oriented projects; and

(I) Assist the Council on Environmental Quality established by title II of this Act.

Sec. 103. All agencies of the Federal Government shall review their present statutory authority, administrative regulations, and current policies and procedures for the purpose of determining whether there are any deficiencies or inconsistencies therein which prohibit full compliance with the purposes and provisions of this Act and shall propose to the President not later than July 1, 1971, such measures as may be necessary to bring their authority and policies into conformity with the intent, purposes, and procedures set forth in this Act.

Sec. 104. Nothing in section 102 or 103 shall in any way affect the specific statutory obligations of any Federal agency (1) to comply with criteria or standards of environmental quality, (2) to coordinate or consult with any other Federal or State agency, or (3) to act, or refrain from acting contingent upon the recommendations or certification of any other Federal or State agency.

Sec. 105. The policies and goals set forth in this Act are supplementary to those set forth in existing authorizations of Federal agencies.

TITLE II

COUNCIL ON ENVIRONMENTAL QUALITY

Sec. 201. The President shall transmit to the Congress annually beginning July 1, 1970, an Environmental Quality Report (hereinafter referred to as the "report") which shall set forth (1) the status and condition of the major natural, manmade, or altered environmental classes of the Nation, including, but not limited to, the air, the aquatic, including marine, estuarine, and fresh water, and the terrestrial environment, including, but not limited to, the forest, dryland, wetland, range, urban, suburban and rural environment, (2) current and foreseeable trends in the quality, management and utilization of such environments and the effects of those trends on the social, economic, and other requirements of the Nation; (3) the adequacy of available natural resources for fulfilling human and economic requirements of the Nation in the light of expected population pressures; (4) a review of the programs and activities (including regulatory activities) of the Federal Government, the State and local governments, and nongovernmental entities or individuals with particular reference to their effect on the environment and on the conservation, development and utilization of natural resources; and (5) a program for remedying the deficiencies of existing programs and activities, together with recommendations for legislation.

Sec. 202. There is created in the Executive Office of the President a Council on Environmental Quality (hereinafter referred to as the "Council"). The Council shall be composed of three members who shall be appointed by the President to serve at his pleasure, by and with the advice and consent of the Senate. The President shall designate one of the members of the Council to serve as Chairman. Each member shall be a person who, as a result of his training, experience, and attainments, is exceptionally well qualified to analyze and interpret environmental trends and information of all kinds; to appraise programs and activities of the Federal Government in the light of the policy set forth in title I of this Act, to be conscious of and responsive to

the scientific, economic, social, esthetic, and cultural needs and interests of the Nation, and to formulate and recommend national policies to promote the improvement of the quality of the environment.

Sec. 203. The Council may employ such officers and employees as may be necessary to carry out its functions under this Act. In addition, the Council may employ and fix the compensation of such experts and consultants as may be necessary for the carrying out of its functions under this Act, in accordance with section 3109 of title 5, United States Code (but without regard to the last sentence thereof).

Sec. 204. It shall be the duty and function of the Council

(1) to assist and advise the President in the preparation of the Environmental Quality Report required by section 201 of this title;

(2) to gather timely and authoritative information concerning the conditions and trends in the quality of the environment both current and prospective, to analyze and interpret such information for the purpose of determining whether such conditions and trends are interfering, or are likely to interfere, with the achievement of the policy set forth in title I of this Act, and to compile and submit to the President studies relating to such conditions and trends;

(3) to review and appraise the various programs and activities of the Federal Government in the light of the policy set forth in title I of this Act for the purpose of determining the extent to which such programs and activities are contributing to the achievement of such policy, and to make recommendations to the President with respect thereto;

(4) to develop and recommend to the President national policies to foster and promote the improvement of environmental quality to meet the conservation, social, economic, health, and other requirements and goals of the Nation;

(5) to conduct investigations, studies, surveys, research, and analyses relating to ecological systems and environmental quality;

(6) to document and define changes in the natural environment, including the plant and animal systems, and to accumulate necessary data and other information for a continuing analysis of these changes or trends and an interpretation of their underlying causes;

(7) to report at least once each year to the President on the state and condition of the environment; and

(8) to make and furnish such studies, reports thereon, and recommendations with respect to matters of policy and legislation as the President may request.

Sec. 205. In exercising its powers, functions, and duties under this Act, the Council shall

(1) Consult with the Citizens' Advisory Committee on Environmental Quality established by Executive Order No. 11472, dated May 29, 1969, and with such representatives of science, industry, agriculture, labor, conservation organizations, State and local governments and other groups, as it deems advisable; and

(2) Utilize, to the fullest extent possible, the services, facilities and information (including statistical information) of public and private agencies and organizations, and individuals, in order that duplication of effort and expense may be avoided, thus assuring that the Council's activities will not unnecessarily overlap or conflict with similar activities authorized by law and performed by established agencies.

Sec. 206. Members of the Council shall serve full time and the Chairman of the Council shall be compensated at the rate provided for Level II of the Executive Schedule Pay Rates (5 U.S.C. 5313). The other members of the Council shall be compensated at the rate provided for Level IV of the Executive Schedule Pay Rates (5 U.S.C. 5315).

Sec. 207. The Council may accept reimbursements from any private non-profit organization or from any department, agency, or instrumentality of the Federal Government, any State, or local government, for the reasonable travel expenses incurred by an officer or employee of the Council in connection with his attendance at any conference, seminar, or similar meeting conducted for the benefit of the Council.

Sec. 208. The Council may make expenditures in support of its international activities, including expenditures for (1) international travel, (2) activities in implementation of international agreements, and (3) the sup-

port of international exchange programs in the United States and in foreign countries.

Sec. 209. There are authorized to be appropriated to carry out the provisions of this chapter not to exceed \$300,000 for fiscal year 1970, \$700,000 for fiscal year 1971, and \$1,000,000 for each fiscal year thereafter.

Appendix E

FHWA Final Rule, Mass Transit and Special Use
Highway Projects



SUBCHAPTER I—PUBLIC TRANSPORTATION

PART 810—MASS TRANSIT AND SPECIAL USE HIGHWAY PROJECTS

Subpart A—General

Sec.

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 810.4 Definitions.
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- 810.100 Purpose.
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- 810.300 Purpose.
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 810.310 Applicability of other provisions.

AUTHORITY: 23 U.S.C. 137, 142, 149 and 315; sec. 4 of Pub. L. 97-134, 95 Stat. 1699; secs. 118, 120, and 163 of Pub. L. 97-424, 96 Stat. 2097; 49 CFR 1.48(b) and 1.51(f).

SOURCE: 50 FR 33917, Aug. 22, 1985, unless otherwise noted.

Subpart A—General

§ 810.2 Purpose.

The purpose of this regulation is to implement sections 137, 142, and 149 of title 23, U.S.C.

§ 810.4 Definitions.

(a) Except as otherwise provided terms defined in 23 U.S.C. 101(a) are used in this subpart as so defined.

(b) The following terms, where used in the regulations in this subpart have the following meanings:

(1) Exclusive or preferential high occupancy vehicle, truck, or emergency vehicle lanes—one or more lanes of a highway facility or an entire highway facility where high occupancy vehicles, trucks or emergency vehicles or any combination thereof, are given, at all times or at any regularly scheduled times, a priority or preference over some or all other vehicles moving in the general stream of mixed highway traffic. Carpool lane(s)—Is any high occupancy vehicle lane which allows use by carpools.

(2) Fringe and transportation corridor parking facilities—those facilities which are intended to be used for the temporary storage of vehicles and which are located and designed so as to facilitate the safe and convenient transfer of persons traveling in such vehicles to and from high occupancy vehicles and/or public mass transportation systems including rail. The term "parking facilities" includes but is not limited to access roads, buildings, structures, equipment, improvements and interests in land.

(3) High occupancy vehicle—a bus or other motorized passenger vehicle such as a carpool or vanpool vehicle used for ridesharing purposes and occupied by a specified minimum number of persons.

(4) Highway traffic control devices—traffic control devices as defined by the currently approved "Manual on Uniform Traffic Control Devices for Streets and Highways."¹

¹The MUTCD is incorporated by reference at 23 CFR 655, Subpart F.

(5) Metropolitan Planning Organization—that organization designated as being responsible, together with the State, for carrying out the provisions of 23 U.S.C. 134, as required by 23 U.S.C. 104(f)(3), and capable of meeting the requirements of sections 3(e)(1), 5(1), 8 (a) and (c) and 9(e)(3)(G) of the Urban Mass Transportation Act of 1964, as amended, 49 U.S.C. 1602(e)(1), 1604(1), 1607 (a) and (c) and 1607a(e)(3)(G). This organization shall be the forum for cooperative transportation decisionmaking.

(6) Nonhighway public mass transit project a project to develop or improve public mass transit facilities or equipment. A project need not be physically located or operated on a route designated as part of the Federal aid urban system, but must be included in and related to a program for the development or improvement of an urban public mass transit system which includes the purchase and rehabilitation of passenger buses and rolling stock for fixed rail facilities, and the purchase, construction, reconstruction or improvement of fixed rail passenger operating facilities. Such projects may also include the construction, reconstruction or rehabilitation of passenger loading and unloading facilities for either bus or rail passengers.

(7) Passenger loading areas and facilities (including shelters)—areas and facilities located at or near passenger loading points for safety, protection, comfort, or convenience of high occupancy vehicle passengers. The term "areas and facilities" includes but is not limited to access roads, buildings, structures, equipment, improvements, and interest in land.

(8) Responsible local officials—(i) In areas under 50,000 population, the principal elected officials of general purpose local governments; or (ii) In urbanized areas, the principal elected officials of general purpose local governments acting through the Metropolitan Planning Organization.

[59 FR 33917, Aug. 22, 1985, as amended at 61 FR 10834, May 7, 1986]

§ 810.6 Prerequisites for projects authorized by 23 U.S.C. 137, 142, or 149.

(a) Projects in an urbanized area must be based on a continuing comprehensive transportation planning process, carried on in accordance with 23 U.S.C. 134 as prescribed in 23 CFR Part 450, Subpart A and included in the transportation improvement program required by 23 CFR Part 450, Subpart B.

(b) Except as otherwise provided by 23 CFR 450.202, projects under this subpart located outside the urbanized area boundaries should be coordinated with the appropriate local officials of the urbanized area as necessary to insure compatibility with the area's urban transportation plan.

(c) All proposed projects must be included in a program of projects approved pursuant to 23 CFR Part 630, Subpart A (Federal-Aid Program Approval and Authorization).

§ 810.8 Coordination.

The Federal Highway Administrator and the Urban Mass Transportation Administrator shall coordinate with each other on any projects involving public mass transit to facilitate project selection, approval and completion.

Subpart B—Highway Public Transportation Projects and Special Use Highway Facilities

§ 810.100 Purpose.

The purpose of the regulations in this subpart is to implement 23 U.S.C. 137, 142(a)(1), 142(b), and 149, which authorize various highway public mass transportation improvements and special use highway facilities as Federal-aid highway projects.

§ 810.102 Eligible projects.

Under this subpart the Federal Highway Administrator may approve on any Federal-aid system projects which facilitate the use of high occupancy vehicles and public mass transportation systems so as to increase the traffic capacity of the Federal-aid system for the movement of persons. Eligible projects include:

(a) Construction of exclusive or preferential high occupancy vehicle, truck, or emergency vehicle lanes, except the construction of exclusive or preferential lanes limited to use by emergency vehicles can be approved only on the Federal-aid Interstate System;

(b) Highway traffic control devices;

(c) Passenger loading areas and facilities (including shelters) that are on or serve a Federal-aid system; and

(d) Construction or designation of fringe and transportation corridor parking facilities. For parking facilities located in the central business district the Federal-aid project must be limited to space reserved exclusively for the parking of high occupancy vehicles used for carpools or vanpools.

§ 810.104 Applicability of other provisions.

(a) Projects authorized under § 810.102 shall be deemed to be highway projects for all purposes of Title 23, U.S.C., and shall be subject to all regulations of Title 23, CFR.

(b) Projects approved under this subpart on the Federal-aid Interstate System for exclusive or preferential high occupancy vehicle, truck, and emergency vehicle lanes are excepted from the minimum four-lane requirement of 23 U.S.C. 109(b).

(c) Exclusive or preferential lanes on the Interstate System, including approaches and directly related facilities, can be constructed with Interstate construction funds only if they were approved in the 1981 Interstate Cost Estimate.

(d) The Federal proportional share of a project approved under this subpart shall be as provided in 23 U.S.C. 120 for the class of funds involved. The Federal share for Interstate substitution projects is 85 percent except for signalization projects which may be 100 percent as provided by 23 U.S.C. 120(d). The provisions of section 120(d) Title 23 U.S.C. may also be applied to regularly funded projects under § 810.102 of this subpart as follows:

(1) Signalization projects.

(2) Passenger loading area and facilities which principally serve carpools and vanpools.

(3) Fringe and transportation corridor parking facilities or portions

thereof which are reserved exclusively for use by carpool and vanpool passengers and vehicles.

(e) As required by section 163 of the Surface Transportation Assistance Act of 1982, approval of Federal-aid highway funding for a physical construction or resurfacing project having a carpool lane(s) within the project limits may not be granted unless the project allows the use of the carpool lane(s) by motorcycles or it is certified by the State that such use will create a safety hazard. This requirement does not apply to high occupancy vehicle lanes which exclude carpools or to carpool lanes constructed by the State without the use of Federal-aid Highway funds. The issue of the extent of utilization of these facilities including those constructed prior to January 6, 1982 with Federal-aid Highway funds is a matter for individual determination by the State Highway Agency.

§ 810.106 Approval of fringe and transportation corridor parking facilities.

(a) In approving fringe and transportation corridor parking facilities, the Federal Highway Administrator:

(1) Shall make a determination that the proposed parking facility will benefit the Federal-aid systems by improving its traffic capacity for the movement of persons;

(2) May approve acquisition of land proximate to the right-of-way of a Federal-aid highway;

(3) May approve construction of publicly-owned parking facilities on land within the right-of-way of any Federal-aid highway, including the use of the airspace above and below the established gradeline of the highway pavement, and on land, acquired with or without Federal-aid funds which is not within the right-of-way of any Federal-aid highway but which was acquired in accordance with the Uniform Relocation Assistance and Land Acquisition Policies Act of 1970 (84 Stat. 1894, 42 U.S.C. 4601 *et seq.*);

(4) May permit the charging of fees for the use of the facility, except that the rate of the fee shall not be in excess of that required for maintenance and operation and the cost of providing shuttle service to and from

the facility (including compensation to any person for operating such facility and for providing such shuttle service);

(5) Shall determine that the State, or the political subdivision thereof, where the project is to be located, or any agency or instrumentality of such State or political subdivision, has the authority and capability of constructing, maintaining, and operating the facility.

(6) Shall receive assurance from the State that the facility will remain in public ownership as long as the facility is needed and that any change in ownership shall have prior FHWA approval;

(7) Shall enter into an agreement with the State, political subdivision, agency, or instrumentality governing the financing, maintenance, and operation of the parking facility; and

(8) Shall approve design standards for constructing the facility as developed in cooperation with the State highway agency.

(b) A State political subdivision, agency, or instrumentality thereof may contract with any person to operate any parking facility constructed under this section.

(c) In authorizing projects involving fringe and transportation corridor parking facilities, the class of Federal-aid funds (primary, secondary, or urban system) used for projects under this subpart may be either funds designated for the Federal-aid system on which the facility is located or the Federal-aid system substantially benefited. For Interstate funds to be used for such eligible projects the Federal-aid Interstate system must be the system which substantially benefits. The benefiting system is that system which would have otherwise carried the high occupancy vehicle or rail passengers to their destination. Interstate construction funds may be used only where the parking facility was approved in the 1981 Interstate Cost Estimate and is constructed in conjunction with a high occupancy vehicle lane approved in the 1981 Interstate Cost Estimate.

§ 810.108 Designation of existing facilities.

(a) In accordance with the provisions of 23 CFR 810.102, the Federal Highway Administrator may approve on any Federal-aid system the work necessary to designate existing parking facilities (such as at shopping centers or other public or private locations) for fringe and transportation corridor parking.

(1) Eligible activities include the acquisition of or the initial and renewal costs for leasing existing parking space, signing of and modifications to existing facilities, trail blazer signs, and passenger loading areas and facilities.

(2) The approval criteria in 23 CFR 810.106 (a)(1), (4), (5), (7) and (8) apply to these parking facilities.

(b) In accordance with the provisions of 23 CFR 810.102, the Federal Highway Administrator may approve on any Federal-aid system the work necessary to designate existing highway lanes as high occupancy vehicle lanes.

(1) Eligible activities include preliminary engineering, signing, pavement marking, traffic control devices, minor physical modifications and initial inspection or monitoring of use.

(2) Such improvements may be approved on any public road if they facilitate more efficient use of any Federal-aid highway.

(c) Interstate construction funds may be used only where the proposed projects were approved in the 1981 Interstate Cost Estimate.

Subpart C—Making Highway Rights-of-Way Available for Mass Transit Projects

§ 810.209 Purpose.

The purpose of this subpart is to implement 23 U.S.C. 142(g), which permits the Federal Highway Administrator to authorize a State to make available to a publicly-owned mass transit authority existing highway rights-of-way for rail or other non-highway public mass transit facilities.

§ 810.202 Applicability.

(a) The provisions of this subpart are applicable to the rights-of-way of

all Federal-aid highways in which Federal-aid highway funds have participated or will participate in any part of the cost of the highway.

(b) The provisions of this subpart do not preclude acquisition of rights-of-way for use involving mass transit facilities under the provisions of Subparts B and D of this part. Rights-of-way made available under this subpart may be used in combination with rights-of-way acquired under Subparts B and D of this part.

§ 810.204 Application by mass transit authority.

A publicly-owned mass transit authority desiring to utilize land existing within the publicly acquired right-of-way of any Federal-aid highway for a rail or other nonhighway public mass transit facility may submit an application therefor to the State highway agency.

§ 810.206 Review by the State Highway Agency.

The State highway agency, after reviewing the application, may request the Federal Highway Administrator to authorize the State to make available to the publicly-owned mass transit authority the land needed for the proposed facility. A request shall be accompanied by evidence that utilization of the land for the proposed purposes will not impair future highway improvements or the safety of highway users.

§ 810.208 Action by the Federal Highway Administrator.

The Federal Highway Administrator may authorize the State to make available to the publicly-owned mass transit authority the land needed for the proposed facility, if it is determined that:

(a) The evidence submitted by the State highway agency under § 810.206 is satisfactory;

(b) The public interest will be served thereby; and

(c) The proposed action in urbanized areas is based on a continuing, comprehensive transportation planning process carried on in accordance with 23 U.S.C. 134 as described under 23 CFR Part 450, Subpart A.

§ 810.210 Authorization for use and occupancy by mass transit.

(a) Upon being authorized by the Federal Highway Administrator, the State shall enter into a written agreement with the publicly-owned mass transit authority relating to the use and occupancy of highway right-of-way subject to the following conditions:

(1) That any significant revision in the design, construction, or use of the facility for which the land was made available shall receive prior review and approval by the State highway agency.

(2) The use of the lands made available to the publicly-owned mass transit authority shall not be transferred to another party without the prior approval of the State highway agency.

(3) That, if the publicly-owned mass transit authority falls within a reasonable or agreed time to use the land for the purpose for which it was made available, or if it abandons the land or the facility developed, such use shall terminate. Any abandoned facility developed or under development by the publicly-owned mass transit authority which was financed all or in part with Federal funds shall be disposed of in a manner prescribed by OMB Circular A-102, Attachment N. The land shall revert to the State for its original intended highway purpose.

(b) A copy of the use and occupancy agreement and any modification under paragraphs (a) (1), (2), and (3) of this section shall be forwarded to the Federal Highway Administrator.

§ 810.212 Use to be without charge.

The use and occupancy of the lands made available by the State to the publicly-owned transit authority shall be without charge. Costs incidental to making the lands available for mass transit shall be borne by the publicly-owned mass transit authority.

Subpart D—Federal-Aid Urban System Nonhighway Public Mass Transit Projects

§ 810.300 Purpose.

The purpose of this subpart is to implement 23 U.S.C. 142(a)(2), which allows the Urban Mass Transportation

Administrator, by delegation of the Secretary, to approve nonhighway public mass transit projects as Federal-aid urban system projects.

§ 810.302 Eligible projects.

(a) Eligible projects are those defined as nonhighway public mass transit projects in § 810.4 of this part subject to the limitations in paragraph (b) of this section.

(b) All projects under this subpart for the construction, reconstruction, or improvement of fixed rail facilities shall be located within the urban boundaries established under 23 U.S.C. 101(a).

§ 810.304 Submission of projects.

(a) An application for an urban system nonhighway public mass transit project shall be developed by a public body as defined under the UMTA Discretionary Capital Assistance Program and shall be prepared in accordance with procedures for the same Discretionary Capital Assistance program.

(b) The application shall be submitted concurrently to the State highway agency and to the UMTA Administrator. The State highway agency, if it concurs, shall submit a request to the FHWA Administrator for a reservation of apportioned Federal-aid urban system funds. The State shall include in its submission advice that such reservation of funds will not impair its ability to comply with the provisions of section 105(d) of Pub. L. 97-424 (if a State certifies it does not need forty percent of its Federal-aid urban system funds for 4R work, and the Secretary accepts such certification, the State may spend that unneeded amount for other eligible FAUS purpose, including nonhighway public mass transit projects).

§ 810.306 Reservation of funds.

(a) The FHWA Administrator shall review the State request, determine whether sufficient Federal-aid urban system funds are available, and notify the State highway agency and the UMTA Administrator of the reservation of funds.

(b) The apportioned funds reserved for the proposed project under paragraph (a) of this section shall remain available for obligation unless the FHWA Administrator is notified that the application has been disapproved by the UMTA Administrator, or unless the responsible local officials in whose jurisdiction the project is to be located and the State highway agency jointly request the withdrawal of the project application.

§ 810.308 Approval of urban system nonhighway public mass transit projects.

(a) An urban system public mass transit project may be approved by the UMTA Administrator when it is determined that:

(1) The application and project are in accordance with the current UMTA procedures relating to discretionary capital assistance grants; and

(2) Notification has been received from the FHWA Administrator that sufficient apportioned Federal-aid urban system funds are available to finance the Federal share of the cost of the proposed project.

(b) Approval of the plans, specifications, and estimates of a nonhighway public mass transit project shall be deemed to occur on the date the UMTA Administrator approves the project application. This approval which is subject to the availability of obligation authority at the time of approval, will obligate the United States to pay its proportional share of the cost of the project.

(c) Upon approval of an urban system nonhighway public mass transit project, the UMTA Administrator will execute a grant contract covering implementation of the project.

§ 810.310 Applicability of other provisions.

The Federal proportional share of the cost of an urban system nonhighway public mass transit project approved under this subpart shall be equal to the Federal share which would have been paid if the project were a highway project as determined under 23 U.S.C. 120(a).

Appendix F

A Detailed Description of UMTA's System for Rating
Proposed Major Transit Investments



Appendix G

UMTA's Financial Capacity Policy



US Department
of Transportation
**Urban Mass
Transportation
Administration**

CIRCULAR

UMTA C 7008.1

March 30, 1987

Subject: **URBAN MASS TRANSPORTATION FINANCIAL CAPACITY POLICY**

1. PURPOSE. This circular clarifies how the Urban Mass Transportation Administration (UMTA), when making grants, will conduct its assessments of the financial capacity of applicants. In addition, it re-emphasizes the need for local officials to strengthen financial capacity assessment throughout the transit project development process.
2. REFERENCES.
 - a. Section 3(a)(2)(A)(i) of the Urban Mass Transportation Act of 1964, as amended (UMT Act) which requires that the Secretary determine that the applicant has "the legal, financial and technical capacity to carry out the proposed project."
 - b. Section 9(e)(3)(A) of the UMT Act which requires an applicant to make a self-certification that it has or will have the legal, financial and technical capacity to carry out the proposed program of projects under Section 9.
 - c. Section 3(a)(2)(A)(ii) of the UMT Act which requires that UMTA find that the applicant will exert "satisfactory continuing control . . . over the use of the facilities and equipment."
 - d. Section 9(e)(3)(B) of the UMT Act which requires grantees to make self-certifications of continuing control.
 - e. Section 8(c) of the UMT Act which requires the Secretary to review and approve a program of projects.
 - f. Section 9(g)(2) which requires Triennial Reviews of recipients compliance with statutory and administrative requirements.
 - g. Section 19 of the UMT Act which requires nondiscrimination in any activity funded under the Act.
 - h. 23 CFR 450.204(b)(4) of the Joint Federal Highway Administration (FHWA)/UMTA regulations governing the planning process which requires that the Transportation Improvement Program (TIP) include "a realistic estimate of the total costs and revenues for the program period."

- i. 23 CFR 450.204(b)(3) which requires a description of the proposed sources of Federal and nonfederal funds.
 - j. The UMTA Major Capital Investments Policy of 5-18-84, which anticipates an assessment of financial capacity at several stages of the project development process for such investments.
 - k. UMTA Circular 9030.1, "Section 9 Formula Grant Application Instructions," dated 6-27-83.
3. POLICY. This document defines the basis upon which UMTA will make the determinations of financial capacity of grantees required under Section 3 of the UMT Act and in reviewing TIP's. For Section 9, it provides similar guidance for grantees making the required self-certifications of financial capacity and for UMTA to determine compliance during Triennial Reviews. The provisions of this circular will be applied without regard to race, color, creed, national origin, sex or age.
4. SCOPE AND DEFINITION. The policy is applicable to all required determinations of financial capacity under Section 3 of the UMT Act and self-certifications of financial capacity under Section 9 of the UMT Act.

There are two aspects to financial capacity: the general financial condition of the public transportation operating enterprise and its nonfederal funding entities; and the financial capability of the agency and its funding entities which includes the sufficiency of their funding sources to meet future operating deficits and capital costs.

- a. Financial condition includes historical trends and current experience in financial factors affecting the ability of a transit agency to operate and maintain the transit system at present levels of service. The information supporting the assessment of financial condition of the agency is usually documented in audited annual financial statements and other financial reports. Financial condition is reflected in working capital levels, current assets versus current liabilities, capital reserves and the presence and status of depreciation accounts, debt levels, trends in transit costs compared to available revenues and trends in relevant economic indicators.
- b. Financial capability refers to the stability and reliability of revenue sources to meet future annual capital and operating costs. Assessments of financial capability should cover the period of the TIP. Financial capability considers the nature of funds pledged to support operating deficits at capital programs and forecasted changes in fare and non-fare

revenues. Capital costs include both replacement and rehabilitation of existing equipment and facilities as well as new investments. Operating and maintenance costs include those for the present system and increases due to capital investments and service expansion.

5. DELEGATIONS OF AUTHORITY. This Circular does not impact UMTA delegations of authority.
6. BACKGROUND. Triennial Review reports indicate that the certifications of financial capacity made by grantees are too often made only with a cursory review of the present financial status of the grantee and not with a sufficient formal review by the grantees of their financial capacity as defined above. Typically, there is no recorded forecast of future operating, maintenance and capital costs associated with continued operation of the existing transit system or incremental costs resulting from new transit capital projects. Nor is there typically a financial plan for covering future costs.

General Accounting Office (GAO) reviews and a number of other studies conducted for UMTA have also found inadequacy in those instances where financial plans were available. For instance, only one of the proposed new rail transit system projects reviewed in a study of eleven systems was judged to have an adequate financial plan.

Serious problems can result when financial planning is not adequately performed. Cases include the many "New Start" cities which have been forced to reduce overall service levels in order to afford putting new lines into service and, as been the case far too often, rail lines originally intended to save operating funds but which increased the cost. In other cities, investments have been made on rail lines neither operated at their originally intended level of service nor having the originally intended feeder bus services. Transit agencies with fleets well in excess of peak requirements are widespread in the transit industry, again reflecting the serious miscalculations of the financial requirements to maintain desired service levels.

These factors indicate that improvements in the decisionmaking process and the quality of financial capacity assessments are needed to ensure that transit service is not interrupted due to a lack of financial capacity. When projects are programmed and grants are made, facilities and equipment should remain in service and be maintained and operated as originally specified in the grant contract. This can be assured when there is a high level of financial scrutiny to ensure efficient and effective use of scarce transit funds before the funds are actually committed.

7. EFFECTIVE DATE. This policy is effective as of March 30, 1987. Reviews of financial capacity after this date made by UMTA will take account of the criteria outlined herein. In addition, self-certifications of financial capacity made after this date should account for the criteria herein described. While these guidelines are effective immediately, grantees will be given the opportunity to reassess financial information, develop new financial plans and implement their provisions before these more stringent criteria are applied to grant approval decisions. UMTA will work with grantees to identify any deficiencies and the steps needed to remedy them.

8. ASSESSMENT OF FINANCIAL CAPACITY

- a. Financial Capacity Reviews. A determination of financial capacity is required at the stage where commitments to finance projects are made by the grantee and UMTA. For Section 3 grants, UMTA will assess financial capacity both at the stage when TIP's are approved and when selecting projects for Section 3 funds. For Section 9 grants, UMTA will assess financial capacity at the TIP approval stage and grantees will be required to make their own self-certifications at the grant application stage. The documentation supporting these self-certifications will then be reviewed during the Triennial Reviews.

The level of detail of the financial capacity assessments and subsequent reviews shall be consistent with the size of the transit system being considered and the scale of any capital investments being proposed. Thus, while all grantees should closely scrutinize the financial implications of their capital commitments, UMTA will give special attention to proposals for major service level expansions, as well as proposals for maintaining present levels of service which require major capital investments such as rail modernization, large scale bus replacement or development of new or replacement bus maintenance facilities. These investments often have a major impact on the financial condition of transit agencies and their funding sources.

This Circular adds no new requirements, nor does it add any new required documentation. Reviews of financial capacity will utilize information contained in the TIP's, short-range transit plans, capital budgets and reports on financial operations such as periodic financial statements and audit reports. Reviews conducted locally and by UMTA will provide an opportunity for local officials to understand the financial condition of the transit system and the need

to develop financial plans to meet future costs reflected in the investments proposed.

If it is determined that the grantee does not meet the financial capacity requirements as outlined in this Circular (e.g., no means exist to meet unfunded operating deficits, or if operating and maintenance costs could not be covered by projected revenue sources, etc.), the grantee will be informed of the deficiencies. The grantee would then provide further information or propose how the deficiencies will be remedied. Technical assistance will be available to aid in developing plans for addressing the problems identified. Grants will not be awarded for capital investments until an accord on a plan for remedial action has been reached.

Since the focus of this Circular is on the longer term financial implications of capital programs, for the purpose of operating assistance, self-certifications of financial capacity and reviews of these certifications may be made on the basis of only the current financial condition of the operator. Nevertheless, grantees should consider the interrelationship between capital costs and operating costs, including amounts of assistance from Federal, State and local governments, in assessing financial capacity with respect to operating assistance.

Full Funding Contracts for major investments will not be entered into until the plans for financing have been made final. Information shall be provided on the steps which have been taken to put the plan into operation.

By giving early consideration to reviews of financial capacity in the planning and programming process, grantees can greatly facilitate the conduct of the financial capacity assessments needed to meet grant approval requirements. In preparing TIP's, local officials are encouraged to scrutinize proposed programs of projects for sufficiency of funds to cover total capital, operating and maintenance costs over the life of the projects. UMTA will review TIP's along these lines. Where TIP's provide evidence of satisfactory financial capacity, the reviews made at the time of grant approval will be limited to assuring the continued validity of assessments made at the TIP review stage.

b. Planning and Project Development

- (1) Unified Planning Work Program. Transportation planning activities such as data base development and the development of analytical revenue and cost forecasting techniques needed to perform financial capacity

assessments should be included in the urbanized area's Unified Planning Work Program, required by the UMTA/FHWA joint planning regulations. However, activities carried out by the transit agency as part of its normal budget development and financial analysis process need not be so documented, unless Section 8 funds are used. In addition, when States and metropolitan planning organizations certify that the planning process is being carried out in accordance with Federal requirements, they should take into account the region's process for balancing the cost of approved plans and programs with financial capacity.

- (2) Major Systems Investment Policy. An assessment of financial feasibility should be a major component of studies conducted under UMTA's Major Investments Policy Statement of May 1984. Such studies should incorporate or update as appropriate the results of the systemwide financial capacity analyses in defining alternative transportation improvements and related financing options during Alternatives Analysis. However, approval to enter Alternatives Analysis will not be given if the financial condition of the transit implementing agency and its funding sources, and their capability to successfully undertake major investments while continuing to operate, maintain and reinvest in the existing transit system, is tenuous based on then-existing information.

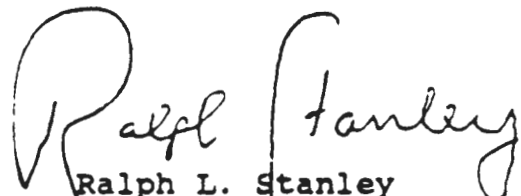
Approval to enter the preliminary engineering step of the process defined by the Major Investments Policy will be predicated, in part, on the quality of the proposed financing plan for the locally preferred alternative emerging from Alternatives Analysis. This will be measured on the basis of the region's capability to implement, operate and maintain the project, as well as the remainder of the region's transit system, over the preferred project's useful life.

- c. Program Management and Compliance. Conventional grant monitoring will place additional emphasis on whether the findings and self-certifications of financial capacity made at the grant approval stage retain their validity. The instruments for this monitoring include periodic progress reports and meetings, activities performed by Project Management Oversight (PMO) contractors retained by UMTA, routine audits and reviews and, for Section 9 projects, the Triennial Reviews required by Section 9(g)(2) of the UMT Act. They provide UMTA the opportunity to review compliance with the requirement that the recipient have financial capacity to

carry out the proposed program of projects. During these reviews, UMTA will assess the basis used by the grantee to certify financial capacity, consistent with the criteria for such self-certifications as described above.

9. TIMING AND IMPLEMENTATION/TECHNICAL ASSISTANCE. Some grantees may require time to structure procedures and reviews to strengthen their assessment capabilities. In such cases, UMTA will take into consideration the grantee's pledge to remedy deficiencies within a reasonable period of time.

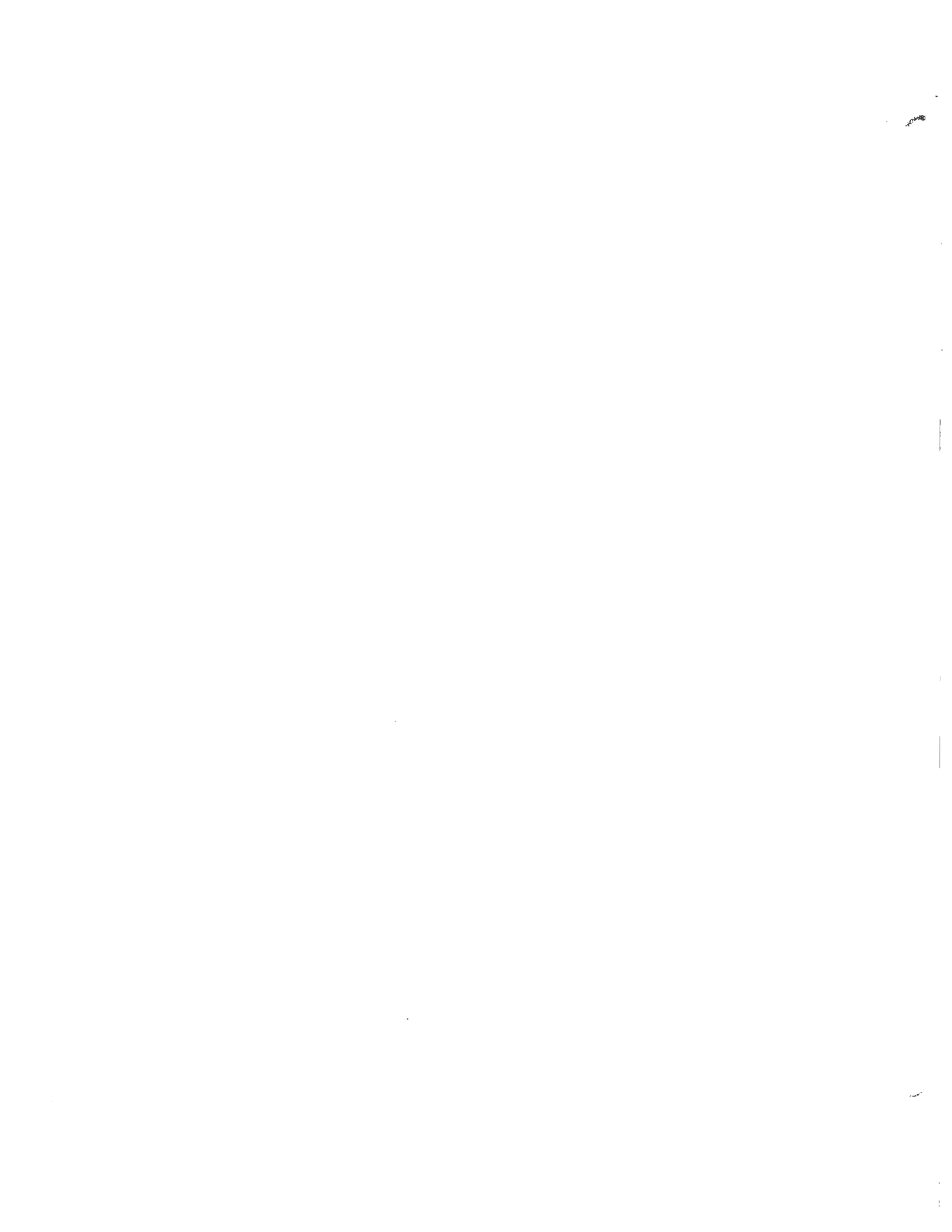
As further support of this policy, UMTA has made analyses of financial capacity a National Emphasis Area in its Section 8 Planning and Technical Studies Program. In addition, supplemental technical guidance describes the elements of financial capacity analysis. It includes detailed guidance on analysis techniques and provides criteria and standards which could be applied in a self-rating of financial capacity. Training and technical assistance will also be available to grantees.


Ralph L. Stanley
Administrator



Appendix H

Sample Notice of Intent for Federal Register Publication



DEPARTMENT OF TRANSPORTATION

Urban Mass Transportation Administration

**Environmental Impact Statement on the Extension of BART to San Francisco
Airport in San Mateo County, California**

AGENCY: Urban Mass Transportation Administration, DOT.

ACTION: Notice of Intent to Prepare an Environmental Impact Statement.

SUMMARY: The Urban Mass Transportation Administration (UMTA), the San Francisco Metropolitan Transportation Commission (MTC), the Bay Area Rapid Transit District (BART), and the San Mateo County Transit District hereby give notice that they intend to prepare an Environmental Impact Statement (EIS) in accordance with the National Environmental Policy Act (NEPA), on the proposed extension of rail rapid transit service from Colma to the vicinity of the San Francisco International Airport. The local joint lead agencies will ensure that the EIS also satisfies the requirements of the California Environmental Quality Act (CEQA) and serves as the Environmental Impact Report (EIR) required by CEQA. In addition to the BART extension, the EIS/EIR will evaluate the No-Action and Transportation System Management (TSM) alternatives and any new alternatives generated through the scoping process. Scoping will be accomplished through correspondence with interested persons, organizations, and federal, state and local agencies, and through two public meetings. See **SUPPLEMENTARY INFORMATION** below for details.

DATES: Written comments on the scope of alternatives and impacts to be considered should be sent to [local lead agency] by [date which is at least 30 days from date notice will appear]. Public scoping meetings will be held on [day of week], [date] at [time] in the San Bruno City Council Chambers, and at [time] in the Capuchino High School Auditorium. See **ADDRESSES** below.

FOR FURTHER INFORMATION CONTACT: [Name and title of UMTA Regional contact person], Office of Grants Assistance, UMTA Region IX, 211 Main St., Suite 1160, San Fransisco, CA 94105. Phone: (415) 774-3115.

ADDRESSES: Written comments on project scope should be sent to [name, title, agency, and address of contact person at local lead agency]. Scoping meetings will be held at San Bruno City Hall, 567 El Camino Real, San Bruno, CA 91254 and at Capuchino High School, 1501 Magnolia Dr., San Bruno, CA 91254.

SUPPLEMENTARY INFORMATION:

Scoping: UMTA and the local joint lead agencies invite interested individuals, organizations, and federal, state and local agencies to participate in defining the alternatives to be evaluated in the EIS/EIR and identifying any significant social, economic, or environmental issues related to the alternatives. An information packet describing the purpose of the project, the proposed alternatives, the impact areas to be evaluated, the citizen involvement program, and the preliminary project schedule is being mailed to affected federal, state and local agencies and to interested parties on record. Others may request the scoping materials by contacting [name of contact person at local lead agency] at the address above or by calling him at [telephone number for contact person at local lead agency]. Scoping comments may be made verbally at either of the

public scoping meetings or in writing. See the **DATES** and **ADDRESSES** sections above for locations and times. During scoping, comments should focus on identifying specific social, economic or environmental impacts to be evaluated and suggesting alternatives which are less costly or less environmentally damaging while achieving similar transit objectives. Scoping is not the appropriate time to indicate a preference for a particular alternative. Comments on preferences should be communicated after the Draft EIS/EIR has been completed. If you wish to be placed on the mailing list to receive further information as the project develops, contact [name of contact person at local lead agency] as previously described.

Description of Study Area and Project Need: The study area is a corridor approximately five miles wide along the Southern Pacific Transportation Company (SPTCO) right-of-way from the planned Colma BART station to the San Francisco International Airport (the Airport) in northern San Mateo County. UMTA and the local joint lead agencies are presently doing Preliminary Engineering and preparing a separate Final EIS for an extension of BART from its present terminus in Daly City to Colma. The proposed Airport extension is intended to improve transit accessibility between the Airport and developed areas to the north, including San Francisco City and County and northern San Mateo County. The project should also improve transit accessibility between the study area and the East Bay and Peninsula if the proposed connection of BART and CalTrain in the vicinity of the Airport is implemented. The project should alleviate regional air quality problems by providing an alternative to the automobile for many trips.

Alternatives: The alternatives proposed for evaluation include: No-Action which involves no change to transportation services or facilities in the corridor beyond already committed projects; the TSM alternative, which consists of low-to-medium cost improvements to the facilities and operations of BART, CalTrain, and SamTrans in addition to the currently planned transit improvements in the corridor; and BART-to-the-Airport, which is a 6-mile extension of BART generally following the SPTCO right-of-way with subway and at-grade sections from the planned Colma station to a terminus west of the Airport and Highway 101. The BART alternative includes three proposed stations: one in south San Francisco located north of Chestnut Avenue between El Camino Real and Grand Avenue, a station in San Bruno adjacent to the Tanforan Shopping Center, and a terminal station in unincorporated San Mateo County west of the Airport and northeast of Millbrae.

Probable Effects: UMTA and the local joint lead agencies plan to evaluate in the EIS/EIR all significant social, economic, and environmental impacts of the alternatives. Among the primary issues are the expected increase in transit ridership, the capital outlays needed to construct the project, the cost of operating and maintaining the facilities created by the project, and the financial impacts on the funding agencies. Environmental and social impacts proposed for analysis include land use and neighborhood impacts, traffic and parking impacts near stations, visual impacts, impacts on cultural resources, and noise and vibration impacts. Impacts on natural areas, rare and endangered species, air and water quality, groundwater, and geologic forms will also be covered. The impacts will be evaluated both for the construction period and for the long-term period of operation. Measures to mitigate significant adverse impacts will be explored.

UMTA Procedures: In accordance with the Urban Mass Transportation Act and UMTA policy, the Draft EIS/EIR will be prepared in conjunction with an Alternatives Analysis, and the Final EIS/EIR in conjunction with Preliminary Engineering. After its publication, the Draft EIS/EIR will be available for public and agency review and comment, and a public hearing will be held. On the basis of the Draft EIS/EIR and the comments received, [name of local lead agency] will select a locally preferred alternative and seek approval from UMTA to continue with Preliminary Engineering and preparation of the Final EIS/EIR.

Issued on: _____

[Name of UMTA Area Director]

Western Area Director



Appendix I

Sample UMTA Statement for Scoping Meeting



Sample UMTA Statement for Scoping Meeting

This appendix presents a set of talking points that should be incorporated into the UMTA statement made early in the scoping meeting. The general flow of the meeting is typically parallel the following:

- o Welcome and Introductions (public involvement coordinator)
- o Outline of the Agenda (responsible official from the lead local agency)
- o UMTA Statement (responsible regional office staff person)
- o Local Perspectives on the Process (lead local agency)
- o Summary of Proposed Scope of Work (local agency and/or consultant)
- o Comments and Responses (responses provided primarily by persons presenting the scope of work)

Talking points for the (5 to 7 minute) UMTA statement include:

Welcome

- o appreciation of effort made to help structure the analysis
- o encourage continued participation throughout the study

Overview of UMTA's process for development of major investment proposals

- o system planning -- choosing a corridor
- o alternatives analysis -- choosing a preferred alternative
- o preliminary engineering -- refining the costs and impacts for the alternative so that the information is sufficiently reliable allow a firm decision on commitments to the project
- o note that the area is beginning the second step and that a decision will be made at the end of the study on a locally preferred alternative

UMTA's interest in the alternatives analysis

- o appropriate use of Federal taxpayer funds
 - UMTA responsible for prudent management of program
 - UMTA budget does not permit assistance to all projects; information provides basis for identifying best proposals
- o compliance with National Environmental Protection Act
 - requires consideration of alternatives
 - requires careful considerations of environmental consequences before a decision is made
- o therefore, studies like this one are being conducted in cities around the country that are interested in UMTA assistance in development of major transit improvements

General Content of Analysis

- o typically the studies examine:
 - small set of mode and alignment options
 - capital and operation costs
 - impacts on transit service and ridership
 - environmental impacts
 - cost-effectiveness: does the benefits justify the costs?
 - ability of state/local governments to fund their shares of both the capital costs and the operating deficit

Scoping

- o clear that conditions and issues vary from place to place
- o need to tailor the general framework to fit the needs of individual situations
- o that is the function of this meeting and the on-going citizen involvement process that will be maintained throughout the study
- o look to this meeting as a key in making sure that the analysis answers all of the questions important to local official and the public

Role of Participants

- o therefore, ask that you review the proposed scope of the study and the alternatives that will be considered
- o identify any of your concerns that feel need more attention than it appears might be devoted to them
- o also, identify any additional options, or variations of the proposed options, that you believe should be considered
- o group effort to round out the scope of work before we leave

- o PLEASE NOTE
 - we are starting an analysis that will develop the information needed to choose an alternative
 - it is clearly premature to debate the merits of one alternative versus another at this point
 - the appropriate forum for that debate occurs at the public hearing held at the end of the study when we will all have significantly better information on which to base judgments
 - so please try to direct your comments to the proposed scope of work and the set of alternatives to be considered

Conclusion

- o again, thanks for your participation
- o hope to see you at public forums throughout the course of the analysis

Appendix J

Summary of Selected Environmental Legislation

SUMMARY OF SELECTED ENVIRONMENTAL LEGISLATION

<u>LEGISLATIVE REFERENCE</u>	<u>REGULATIONS REFERENCE</u>	<u>PURPOSE</u>	<u>APPLICABILITY</u>	<u>GENERAL PROCEDURES</u>	<u>AGENCY FOR COORDINATION AND CONSULTATION</u>
<u>GENERAL ENVIRONMENTAL STATUTES</u>					
1. National Environmental Policy Act 42 U.S.C. 4321-4347 (P.L. 91-190) (P.L. 94-83)	23 CFR 771 CEQ Regulations Executive Order 11514, as amended by Executive Order 11991 on NEPA responsibilities	Consider environmental factors through systematic interdisciplinary approach before committing FHWA to a course of action.	All FHWA actions.	Procedures set forth in CEQ regulations and FHPM 7-7-2.	Appropriate Federal, State, and local agencies
2. Preservation of Parkland (Section 4(f)) 49 U.S.C. 1653(f) 23 U.S.C. 138	23 CFR 771	Preserve publicly owned parklands, waterfowl and wildlife refuges, and all historic areas.	Significant publicly owned parklands, recreation areas, wildlife and waterfowl refuges, and significant historic sites "used" for a highway project.	Specific finding required. 1. Avoids protected areas, if possible 2. Includes steps to minimize harm	DOI and DOA, HUD, and State or local agencies having jurisdiction.

SUMMARY OF SELECTED ENVIRONMENTAL LEGISLATION

LEGISLATIVE REFERENCE	REGULATIONS REFERENCE	PURPOSE	APPLICABILITY	GENERAL PROCEDURES	AGENCY FOR COORDINATION AND CONSULTATION
<u>GENERAL ENVIRONMENTAL STATUTES</u>					
3. 23 U.S.C. 109(h) (P.L. 91-605) (Economic, social and Environmental effects).	23 CFR 771	To assure that possible adverse economic, social, and environmental effects of proposed highway projects are fully considered and that final decisions on highway projects are made in the best overall public interest.	Applicable to the planning and development of proposed projects, on any Federal-aid system for which the FHWA approves the plans, specifications and estimates or has the responsibility for approving a program.	Identification of social, economic, and environmental effects. Consideration of alternative courses of action. Involvement of other agencies and the public. Systematic interdisciplinary approach.	Appropriate Federal, State, and local agencies
4. Public Hearings 23 U.S.C. 128	FHPM 7-7-5 (23 CFR 790) 23 CFR 771	To ensure adequate opportunity for public hearing(s) on the effects of alternative project locations and major design features; and the consistency of the project with local planning goals and objectives.	Any Federal-aid project which requires the acquisition of significant amounts of right-of-way, substantially changes the layout or function of connecting roadways or of the facility being improved, has a significant adverse impact on abutting real property or otherwise has a significant economic, social, environmental or other effect.	Public hearings or an opportunity for public hearings required during the consideration of highway location and design proposals. 23 CFR 790. (Applies to highway agencies which have not developed alternative public involvement/public hearing procedures acceptable to FHWA pursuant to 23 CFR 771.111)	Appropriate Federal, State and local agencies

SUMMARY OF SELECTED ENVIRONMENTAL LEGISLATION

<u>LEGISLATIVE REFERENCE</u>	<u>REGULATIONS REFERENCE</u>	<u>PURPOSE</u>	<u>APPLICABILITY</u>	<u>GENERAL PROCEDURES</u>	<u>AGENCY FOR COORDINATION AND CONSULTATION</u>
<u>HEALTH</u>					
5. Safe Drinking Water Act 42 U.S.C. 300(f), et seq. (See especially 42 U.S.C. 300(j-6)) (P.L. 93-523)	FHPM 6-7-3-3 23 CFR 650, Subpart E	Ensure public health and welfare through safe drinking water	1. All public drinking water systems and reservoirs (including rest area facilities). 2. Actions which may have a significant impact on an aquifer which is the sole or principal drinking water source.	Compliance with national primary drinking water regulations.	EPA Appropriate State agency

SUMMARY OF SELECTED ENVIRONMENTAL LEGISLATION

LEGISLATIVE REFERENCE	REGULATIONS REFERENCE	PURPOSE	APPLICABILITY	GENERAL PROCEDURES	AGENCY FOR COORDINATION AND CONSULTATION
<u>HEALTH</u>					
6. Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq. See especially 42 U.S.C. 6961-6964 (P.L. 89-272) (P.L. 91-512) (P.L. 94-580)	23 CFR 751 40 CFR 240-261	Provide for the recovery and recycling, and environmentally safe disposal of solid wastes.	All projects which necessitate the disposal of solid wastes.	Solid wastes will be disposed of according to the rules for the specific waste involved.	EPA
7. Federal Environmental Pesticide Control Act (formerly FIFRA) 7 U.S.C. 136-136y (P.L. 92-516)	40 CFR 164-171	Control the application of pesticides to provide greater protection to man and the environment.	All projects which necessitate the use of restricted pesticides	Using or supervising restricted use pesticides will require certification	EPA

SUMMARY OF SELECTED ENVIRONMENTAL LEGISLATION

<u>LEGISLATIVE REFERENCE</u>	<u>REGULATIONS REFERENCE</u>	<u>PURPOSE</u>	<u>APPLICABILITY</u>	<u>GENERAL PROCEDURES</u>	<u>AGENCY FOR COORDINATION AND CONSULTATION</u>
<u>HISTORIC AND ARCHEOLOGICAL PRESERVATION</u>					
8. Section 106 of the National Historic Preservation Act, as amended 16 U.S.C. 470(f) (P.L. 89-665) (P.L. 91-243) (P.L. 93-54) (P.L. 94-422) (P.L. 94-458) (P.L. 96-199) (P.L. 96-244) (P.L. 96-515)	FHPM 7-7-2 23 CFR 771 36 CFR 60 36 CFR 63 36 CFR 800 Executive Order 11593	Protect, rehabilitate, restore, and reconstruct districts, sites, buildings, structures, and objects significant in American architecture, archeology and culture.	All properties on or eligible for inclusion in the National Register of Historic Places.	1. Identify and determine effects of project on subject properties. 2. Afford Advisory Council, early opportunity to comment, in accordance with 36 CFR, Part 800. 3. Mitigate damages to greatest extent possible.	State Historic Preservation Officer, Advisory Council on Historic Preservation, DOI (NPS)
9. Preservation of Historical and Archeological Data 16 U.S.C. 469a (P.L. 93-291) (Hess-Bennett Act)		Preserving historical and archeological data from loss or destruction.	Any alteration of terrain resulting from Federal construction project or federally licensed activity or program.		DOI (NPS)

SUMMARY OF SELECTED ENVIRONMENTAL LEGISLATION

<u>LEGISLATIVE REFERENCE</u>	<u>REGULATIONS REFERENCE</u>	<u>PURPOSE</u>	<u>APPLICABILITY</u>	<u>GENERAL PROCEDURES</u>	<u>AGENCY FOR COORDINATION AND CONSULTATION</u>
<p><u>HISTORIC AND ARCHEOLOGICAL PRESERVATION</u></p> <p>10. Act for the Preservation of American Antiquities (P.L. 59-209) 16 U.S.C. 431-433</p> <p>Archeological Resources Protection Act (P.L. 96-95) 16 U.S.C. 470aa</p>	<p>43 CFR 3 36 CFR 251.50-.64</p>	<p>Preserve and protect paleontological resources, historic monuments, memorials, and antiquities from loss or destruction.</p>	<p>Federal construction projects on federally owned property and any presidentially proclaimed historic landmarks, historic and prehistoric structures, and objects of historic or scientific interest.</p>	<ol style="list-style-type: none"> 1. Identify and evaluate resource. 2. Mitigate or avoid resource in consultation with appropriate officials in the State. 3. If necessary, apply for permission to appropriate, excavate, injure, or destroy such objects. 	<p>State Historic Preservation Officer DOI (NPS) Department having jurisdiction over land on which antiquities are situated.</p>

SUMMARY OF SELECTED ENVIRONMENTAL LEGISLATION

LEGISLATIVE REFERENCE	REGULATIONS REFERENCE	PURPOSE	APPLICABILITY	GENERAL PROCEDURES	AGENCY FOR COORDINATION AND CONSULTATION
<u>LAND AND WATER USAGE</u>					
11. Wilderness Act 16 U.S.C. 1131-1134 (P.L. 88-577) (P.L. 90-532) (P.L. 91-504) (P.L. 92-364) (P.L. 93-429) (P.L. 93-550) (P.L. 93-632) (P.L. 94-557) (P.L. 95-450) (P.L. 96-487) (P.L. 96-550) (P.L. 96-560)	36 CFR 293 43 CFR 19 50 CFR 35	Preserve and protect wilderness areas in their natural condition for use and enjoyment by present and future generations.	All lands designated as part of the wilderness system by Congress.	Apply for modification or adjustment of wilderness and boundary by Secretary of sponsoring Department.	Agriculture (USFS) DOI (FWS, NPS, BLM) State agencies.
12. Wild and Scenic Rivers Act 16 U.S.C. 1273-1287 (P.L. 90-542) (P.L. 93-279) (P.L. 93-621) (P.L. 94-273) (P.L. 94-486) (P.L. 95-625) (P.L. 96-88) (P.L. 96-487)	43 CFR 8350	Preserve and protect wild and scenic rivers and immediate environments for benefit of present and future generations.	All projects which affect designated and potential wild, scenic, and recreational rivers, and/or immediate environments.	Submit project plan reports.	DOI (NPS) and/or Agriculture (USFS)

SUMMARY OF SELECTED ENVIRONMENTAL LEGISLATION

<u>LEGISLATIVE REFERENCE</u>	<u>REGULATIONS REFERENCE</u>	<u>PURPOSE</u>	<u>APPLICABILITY</u>	<u>GENERAL PROCEDURES</u>	<u>AGENCY FOR COORDINATION AND CONSULTATION</u>
<u>LAND AND WATER USAGE</u>					
13. Land and Water Conservation Fund Act (Section 6(f)) 16 U.S.C 460L-4 to 460L-11 (P.L. 88-578)		Preserve, develop, and assure the quality and quantity of outdoor recreation resources for present and future generations.	All projects which impact recreational lands purchased or improved with land and water conservation funds.	Secretary of the Interior must approve any conversion of property acquired or developed with assistance under this Act to other than public outdoor recreation use.	DOI
14. Executive Order 11990, Protection of Wetlands	DOT Order 5660.1A	To avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.	Federally undertaken, financed or assisted construction, and improvements in or with significant impacts on wetlands.	Evaluate and mitigate impacts on wetlands. Specific finding required in final environmental document.	DOI (FWS), EPA, USCE State agencies

SUMMARY OF SELECTED ENVIRONMENTAL LEGISLATION

<u>LEGISLATIVE REFERENCE</u>	<u>REGULATIONS REFERENCE</u>	<u>PURPOSE</u>	<u>APPLICABILITY</u>	<u>GENERAL PROCEDURES</u>	<u>AGENCY FOR COORDINATION AND CONSULTATION</u>
<u>LAND AND WATER USAGE</u>					
15. National Trails System Act 16 U.S.C. 1241-1249 (P.L. 90-543) (P.L. 94-527) (P.L. 95-625) (P.L. 95-248)	43 CFR 8350	Provide for outdoor recreation needs and encourage outdoor recreation.	Projects affecting national recreational, scenic, or side trails designated by Congress and lands through which such trails pass.	<ol style="list-style-type: none"> 1. Apply for easement of right-of-way from Secretary of the Interior or Agriculture, as appropriate. 2. Ensure potential trail-properties be made available for use as recreational and scenic trails. 	DOI (NPS) or Agriculture (USFS)
16. Rivers and Harbors Act of 1899 33 U.S.C. 401, et seq., as amended and supplemented	33 CFR 114-115 FHPM 6-7-1	Protection of navigable waters of the U.S.	Any construction affecting navigable waters and any obstruction, excavation, or filling.	Must obtain approval of plans for construction, dumping and dredging permits, and bridge permits.	USCE USCG EPA State agencies

SUMMARY OF SELECTED ENVIRONMENTAL LEGISLATION

LEGISLATIVE
REFERENCE

REGULATIONS
REFERENCE

PURPOSE

APPLICABILITY

GENERAL
PROCEDURES

AGENCY FOR
COORDINATION AND
CONSULTATION

LAND AND
WATER USAGE

17. Federal Water
Pollution
Control Act
(1972), as
amended by the
Clean Water
Act (1977)
(formerly
FWPCA)
33 U.S.C.
1251-1376
(P.L. 92-500)
(P.L. 95-217)

DOT Order 5660.1A
FHWA Notices N5000.3
and N5000.4
FHWM 6-7-3-3
40 CFR 120
40 CFR 122-125
40 CFR 128-131
40 CFR 133
40 CFR 135-136
23 CFR, Part 650,
Subpart B

Restore and
maintain chemical,
physical, and
biological
integrity of the
Nation's waters
through prevention,
reduction, and
elimination of
pollution.

Any discharge
of a pollutant
into waters of
the U.S.

1. Obtain permit
for dredge or
fill material
from USCE or
State agency,
as appropriate
(Section 404).
2. Permit for all
other discharges
from EPA or
appropriate State
agency (Section 402).
(Rest area sewage
disposal and
asphalt batch
plants.)
3. Water quality
certification
is required
from State
(Section 401).
4. Control of ocean
discharges
(Section 403).

USCE
EPA
Designated State
water quality
control agency

SUMMARY OF SELECTED ENVIRONMENTAL LEGISLATION

LEGISLATIVE REFERENCE	REGULATIONS REFERENCE	PURPOSE	APPLICABILITY	GENERAL PROCEDURES	AGENCY FOR COORDINATION AND CONSULTATION
<u>LAND AND WATER USAGE</u>					
18. Executive Order 11988, Floodplain Management	DOT Order 5650.2 23 CFR, Part 650, Subpart A FHPM 6-7-3-2 23 CFR 771	To avoid the long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to restore and preserve the natural and beneficial values served by floodplains.	All construction of Federal or Federally-aided buildings, structures, roads, or facilities which encroach upon or affect the base floodplain.	1. Assessment of flood hazards 2. Specific finding required in final environmental document.	FEMA
19. National Flood Insurance Act (P.L. 90-448) Flood Disaster Protection Act (P.L. 93-234) 42 U.S.C. 4001-4128	44 CFR 59 FHPM 6-7-3-2 23 CFR, Part 650 Subpart A	a) Identify flood-prone areas and provide insurance. b) Requires purchase of insurance for buildings in special flood-hazard area.	Any federally assisted acquisition or construction project in area identified as having special flood hazards.	Avoid construction in, or design to be consistent with, FEMA-identified flood-hazard areas.	FEMA

SUMMARY OF SELECTED ENVIRONMENTAL LEGISLATION

LEGISLATIVE REFERENCE	REGULATIONS REFERENCE	PURPOSE	APPLICABILITY	GENERAL PROCEDURES	AGENCY FOR COORDINATION AND CONSULTATION
<u>LAND AND WATER USAGE</u>					
20. Marine Protection Research and Sanctuaries Act, as amended 33 U.S.C. 1401-1444 (P.L. 92-532) (P.L. 93-254)	40 CFR 220-225	Regulate dumping of materials into U.S. ocean waters.	Any transportation to and dumping into the open sea.	Apply for permit in accordance with existing procedures.	EPA USCE, if dredge material
21. Water Bank Act 16 U.S.C. 1302-1310 (P.L. 91-559) (P.L. 96-182)	7 CFR 752	Preserve, restore, and improve wetlands of the Nation.	Any agreements with landowners and operators in important migratory waterfowl nesting and breeding areas.	Apply procedures established for implementing Executive Order 11990.	Secretary of Agriculture
22. Coastal Zone Management Act 16 U.S.C. 1451-1464 (P.L. 92-583) (P.L. 94-370)	15 CFR 920 15 CFR 923 15 CFR 925 15 CFR 930	Preserve, protect, develop, and (where possible) restore and enhance resources of the coastal zone.	All projects significantly affecting areas under the control of the State coastal zone management agency, for which a plan is approved by the Department of Commerce.	Ensure that projects comply with Federal consistency regulations for coastal zone management programs.	State coastal zone management agency and the Department of Commerce (OCZM).

SUMMARY OF SELECTED ENVIRONMENTAL LEGISLATION

LEGISLATIVE REFERENCE	REGULATIONS REFERENCE	PURPOSE	APPLICABILITY	GENERAL PROCEDURES	AGENCY FOR COORDINATION AND CONSULTATION
<u>WILDLIFE</u>					
23. Endangered Species Act of 1973, as amended 16 U.S.C. 1531-1542 (P.L. 93-205) (P.L. 95-632) (P.L. 96-159)	50 CFR 17 50 CFR 81 50 CFR 424 50 CFR 451-2	Conserve species of fish, wildlife, and plants facing extinction.	Any action that is likely to jeopardize continued existence of such endangered/threatened species or result in destruction or modification of critical habitat.	Consult with the Secretary of the Interior, or Commerce, as appropriate	DOI (FWS) Commerce (NMFS)
24. Fish and Wildlife Coordination Act 16 U.S.C. 661-666C (P.L. 85-624)		Conservation, maintenance, and management of wildlife resources.	Any project which involves impoundment (surface area of 10 acres or more), diversion, channel deepening, or other modification of a stream or other body of water.	Coordinate early in project development with FWS and State Fish and Wildlife agency	DOI (FWS) State fish and wildlife agencies

SUMMARY OF SELECTED ENVIRONMENTAL LEGISLATION

LEGISLATIVE REFERENCE	REGULATIONS REFERENCE	PURPOSE	APPLICABILITY	GENERAL PROCEDURES	AGENCY FOR COORDINATION AND CONSULTATION
<u>NOISE</u>					
25. Standards 23 U.S.C. 109(i) (P.L. 91-605 & P.L. 93-87)	FHPM 7-7-3 23 CFR 772	Promulgate noise standards for highway traffic.	All federally funded highway construction projects.	<ol style="list-style-type: none"> 1. Noise impact analysis. 2. Analysis of mitigation measures. 3. Incorporate reasonable and feasible noise abatement measures to reduce or eliminate noise impact. 	EPA
<u>AIR QUALITY</u>					
26. Clean Air Act, as amended 42 U.S.C. 7401 (P.L. 91-604 & P.L. 95-95) 23 U.S.C. 109(j) (P.L. 91-605)	40 CFR 50, 51 23 CFR 770 49 CFR 623	Protect and enhance quality of Nation's air resources to promote public health and welfare.	Areas where State imple- mentation plans (SIP's) have transportation control measures (TCM's).	<ol style="list-style-type: none"> 1. Transportation plans, programs, and improvements must conform with SIP. 2. FHWA program must give priority to appropriate TCM's. 3. Project approval sanction for insufficient SIP development progress. 	UMTA, EPA, State and local air pollut control agencies.

ABBREVIATIONS

BLM - Bureau of Land Management
CEQ - Council on Environmental Quality
CFR - Code of Federal Regulations
DOA - Department of the Army
DOI - Department of the Interior
DOT - Department of Transportation
EPA - Environmental Protection Agency
FEMA - Federal Emergency Management Agency
FHFM - Federal-Aid Highway Program Manual
FIFRA - Federal Insecticide, Fungicide, & Rodenticide Act
FWPCA - Federal Water Pollution Control Act
FWS - Fish and Wildlife Service

HUD - Housing and Urban Development
NMFS - National Marine Fisheries Service
NPS - National Park Service
OCZM - Office of Coastal Zone Management
P.L. - Public Law
SIP - State Implementation Plan
Stat. - Statute
TVA - Tennessee Valley Authority
UMTA - Urban Mass Transportation Administration
U.S.C. - United States Code
USCE - U.S. Corps of Engineers
USCG - U.S. Coast Guard
USFS - U.S. Forest Service



Appendix K

Federal Agencies to Receive Copies of
Draft Environmental Impact Statements



Appendix L
Draft EIS Outline

Format and Contents of an AA/DEIS

Title and Signature Page
CEQ Cover Sheet

Preface: Purpose of the AA/DEIS

Table of Contents
List of Figures
List of Tables

S. Summary

- S.1 Purpose and Need for the Proposed Action
- S.2 Alternatives Considered
- S.3 Important Impacts and Mitigation
- S.4 Evaluation of Alternatives
- S.5 Issues to be Resolved

1. Purpose and Need

- 1.1 Need for Transportation Improvements
- 1.2 Planning Context

2. Alternatives Considered

- 2.1 Screening and Selection Process
- 2.2 Definition of Alternatives
 - a. No-Action Alternative
 - b. Transportation System Management (TSM) Alternative
 - c. Alternative 3
 - · ·
 - x. Alternative n
- 2.3 Capital Costs
- 2.4 Operating and Maintenance Costs

3. Affected Environment

- 3.1 Land Use and Zoning
- 3.2 Transportation Facilities and Service
- 3.3 Neighborhoods and Community Resources
- 3.4 Visual and Aesthetic Qualities
- 3.5 Air Quality
- 3.6 Noise and Vibration
- 3.7 Ecosystems
- 3.8 Water Resources
- 3.9 Historic and Archaeological Resources
- 3.10 Parklands

- 4. Transportation Impacts
 - 4.1 Transit
 - a. Service
 - b. Patronage
 - c. Farebox Revenues and Operating Deficits
 - 4.2 Highway
 - a. Congestion
 - b. Access to Stations
 - c. Parking
 - 4.3 Freight Movements (if pertinent)
 - a. Railroads
 - b. Trucking and Deliveries
- 5. Environmental Consequences
 - 5.1 Land Use and Development
 - 5.2 Displacements and Relocation of Existing Uses
 - 5.3 Neighborhoods
 - 5.4 Visual and Aesthetic
 - 5.5 Air Quality
 - 5.6 Noise and Vibration
 - 5.7 Ecosystems
 - 5.8 Water Resources
 - 5.9 Energy
 - 5.10 Historic, Archaeological, and Cultural Impacts
 - 5.11 Parklands
- 6. Financial Analysis and Evaluation of Alternatives
 - 6.1 Financial Analysis
 - a. Costs and Available Revenues
 - b. Capital and Operating Shortfalls
 - c. Additional Revenue Sources
 - d. Cash Flow Analysis
 - e. Conclusions
 - f. Risk and Uncertainty
 - g. Implementation
 - 6.2 Comparative Benefits and Costs
 - a. Effectiveness
 - b. Efficiency
 - c. Financial Feasibility
 - d. Equity
 - e. Significant Trade-Offs

References

List of AA/DEIS Preparers
List of AA/DEIS Recipients
Index
Appendices

The title page is formatted as follows:

TRANSIT IMPROVEMENTS IN
[NAME OF CORRIDOR]
CITY, STATE

ALTERNATIVES ANALYSIS AND
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Prepared in Accordance with the
National Environmental Policy Act of 1969, as amended
42 U.S.C. 4332

and the

Urban Mass Transportation Act of 1964, as amended
49 U.S.C. 1601 et seq.

by the

URBAN MASS TRANSPORTATION ADMINISTRATION
U.S. DEPARTMENT OF TRANSPORTATION

and the

[JOINT LEAD AGENCY(IES)]

Date of Approval

For UMTA [Name]
[Area Location] Area Director

Date of Approval

For [Joint Lead Agency] [Name]
[Title]

The CEQ cover sheet is formatted as follows:

ALTERNATIVES ANALYSIS AND
DRAFT ENVIRONMENTAL IMPACT STATEMENT

RESPONSIBLE AGENCIES

Lead Agency: Urban Mass Transportation Administration

[Joint lead agencies, if any]

Cooperating Agency(ies): [Names of cooperating agencies, if any]

TITLE OF PROPOSED ACTION

[Project title used locally or "Transit Improvements in the <Corridor Name> of <City, State>"]

FOR ADDITIONAL INFORMATION CONCERNING THIS DOCUMENT, CONTACT:

[UMTA Regional Contact]
Urban Mass Transportation
Administration, Region [#]
[Address]
[Area Code - Phone Number]

[Local Agency Contact]
[Agency]
[Address]
[Area Code - Phone Number]

ABSTRACT

[The abstract should include:

- o an identification of the corridor;
- o a listing of the alternatives;
- o a listing of important social, economic, and environmental impacts expected; and
- o a statement that the information will be used to select a locally preferred alternative for the corridor.]

COMMENTS

Comments on this document may be submitted in writing or may be made orally at the public hearing. Written comments should be submitted to [local agency contact] at the above address. Information on the public hearing is available from [local agency contact]. Comments are due by ____ [Date] ____.

[The due date can be no earlier than 45 days after the Friday on which the Notice of Availability appears in the Federal Register.]

Annotated Outline of the AA/DEIS

P. Preface

P.1 Purpose of the AA/DEIS

- o proposed federal action(s)
- o project development milestones
- o Federal and State (if any) laws and regulations governing the decisionmaking process
- o decision at hand

P.2 Organization of the DEIS

S. Summary

S.1 Need for Action

- o study area description and map
- o transportation goals and objectives
- o transportation problems (present and future)
- o other considerations

S.2 Alternatives Considered

- o alternatives dismissed without detailed analysis and reasons for dismissal
- o description of the no-action, TSM, and other alternatives considered in detail: maps, physical characteristics, operating characteristics, capital costs, and operating and maintenance costs

S.3 Important Impacts and Mitigation

- [Summary should cover only important impacts which should weigh in the decisions]
- o transportation impacts
 - o social, economic and environmental impacts and proposed mitigation
 - o impact summary table

S.4 Evaluation of Alternatives

- o financial analysis
- o effectiveness in attaining transportation goals and objectives
- o cost-effectiveness
- o equity
- o trade-offs among alternatives

S.5 Issues to be Resolved

- o selection of locally preferred alternative
- o selection and implementation of a financial plan
- o final mitigation commitments
- o other local issues outstanding

1. Purpose and Need

1.1 Need for transportation improvements

- a. Description of the Study Corridor
 - o physical features
 - o location of activities
 - o travel patterns
 - o growth and development trends
 - o behavioral trends
- b. Transportation Facilities and Services in the Corridor
 - o brief description of highway and transit facilities
 - o brief summary of transit service provided
 - o existing plus likely changes by the study year
 - o levels of service
 - general description of the quality of service with emphasis on travel speeds on important highway links and transit lines
 - identification of severely congested highway facilities
 - identification of high volume transit services that provide relatively slow service
- c. Transportation Goals and Objectives
 - o agencies and organizations involved in transportation planning
 - o delineation of local transportation goals and objectives [examples:]
 - highway and transit service quality
 - transit accessibility
 - transit service to transportation disadvantaged
 - financial standards
 - o planned transportation improvements
 - o identification of different perspectives within the region
- d. Specific Transportation Problems in the Corridor
 - o examination of the highway and transit service levels for instances where transportation objectives are not being met
 - o specific description of the transportation problems that the alternatives are intended to alleviate
- e. Other Goals Important in Selection of an Alternative
 - o difference between (1) transportation problems that lead to consideration of major improvements and (2) non-transportation objectives that are important in considering implementation of the alternatives
 - o identification of additional goals and objectives [examples: economic development, avoidance of neighborhood disruption, preservation and improvement of the environment

1.2 Planning Context

- a. Planning and Project Development Process
 - o decision points within the process
 - selection of priority corridor and promising alternatives
 - selection of a preferred alternative
 - commitment to implementation
 - o summary of analytical work used to support each decision
 - system planning: sketch level, enough detail to set priorities for detailed analysis at the corridor level
 - alternatives analysis: rigorous examination of small number of mode and alignment options so that the choice of an alternative is based on reliable cost and impact information
 - preliminary engineering: development of design options for the preferred alternative to permit an exact description of the alternative and a refined estimate of costs and impacts
- b. Role of the DEIS in Project Development
 - o assessment of reasonable options
 - required by the National Environmental Policy Act
 - provides a broad range of options for consideration
 - provides basis for informed selection of best option
 - ensures opportunity for comment by interested citizens and agencies with jurisdiction or expertise
 - o cost-effectiveness analysis
 - compares the investment required by each option with the likely return on that investment
 - ensures that scarce funds for transportation improvements are directed toward the most useful projects
 - o environmental impacts and necessary mitigation
 - identifies the type and severity of environmental consequences
 - develops mitigation measures and their costs and effectiveness
- c. Decision at Hand
 - o choice of an alternative
 - circulation, public hearing, and comments
 - summary of selection process, including responsible agency(ies) or official(s)
 - documentation of choice in Preferred Alternative Report, which will be distributed to persons who received the AA/DEIS or made comments during the circulation period
 - o next steps, depending on which alternative is chosen
 - non-guideway alternatives: implementation or short range study leading to implementation
 - guideway alternatives: grant application for preliminary engineering funding

2. Alternatives Considered

2.1 Screening and Selection Process

- a. Summary of Relevant System Planning Activities
 - o alternatives considered
 - o summary of the screening process
 - o selection of small set of promising alternatives
- b. Modifications to Set of Alternatives in Scoping Process
 - o summary of comments received on the alternatives during the scoping process
 - o disposition of comments
 - changes made in response to comments
 - comments not used in refinement of the alternatives set

2.2 Definition of Alternatives

- a. Alternative 1
[For each alternative:]
 - o physical characteristics
 - alignment; reference to appended plan and profile drawings
 - typical sections
 - station locations and conceptual design
 - vehicles
 - park/ride facilities
 - storage and maintenance facilities
 - o operating characteristics
 - guideways: hours, headways, consists, speeds
 - feeder bus operations, coordination with guideway operations
 - background bus service
 - summary supply statistics
 - fare policy
- b. Alternative 2
 - . . .
 - . . .
- x. Alternative n

2.3 Capital Costs

- a. Cost Estimation Method(s)
 - o general approach
 - unit costs, and the level of aggregation
 - quantities, taken from the plans and profiles in the appendix
 - detailed analyses at difficult locations
 - o levels of uncertainty in the capital cost estimates

- b. Cost Estimation Results
 - o estimates in base year dollars
 - right-of-way acquisition
 - guideways
 - stations
 - vehicles
 - other facilities
 - o implementation schedule
 - o annual capital requirements for construction and vehicles
- c. Comparative Discussion
[purpose is to enhance the reader's understanding of differences across the alternatives]
 - o summary discussion of differences in the physical characteristics of the alternatives that lead to cost differences
 - o costs of various mode, alignment, and design options and the trade-offs to be made in selecting from among the options

2.4 Operating and Maintenance Costs

- a. Cost Estimation Methods
 - o general approach
 - combination build-up and model
 - basis for bus costs (current experience, modifications, etc.)
 - basis for rail costs (data from other cities with rail, etc.)
 - kinds of cost factors to which the approach is specifically sensitive (station staffing, fare collection scheme, etc.)
 - o levels of uncertainty in the O&M cost estimates
- b. Operating and Maintenance Cost Estimation Results
 - o estimates in base year dollars
 - transportation
 - maintenance
 - engineering
 - general and administrative
 - o annual O&M costs over the study period
- c. Comparative Discussion
 - o summary discussion of differences in the operating and staffing characteristics of the alternatives that lead to cost differences
 - o costs of various operational and staffing options and the trade-offs made in selecting from among the options

3. Affected Environment

[The general approach in this chapter is to identify existing conditions in the corridor that could be changed substantially by one or more of the alternatives. The primary function of this chapter is to establish the focus and baseline conditions for later chapters discussing environmental and other impacts. This approach is in contrast to one that would provide an encyclopedic listing of all environmental conditions found in the corridor, regardless of their relevance to the decisions at hand. This approach relies on an aggressive scoping process to ensure that all potentially significant impacts are identified for inclusion in this and later chapters. Thus, it is necessary to mention here only that which is worth mentioning.]

3.1 Land Use and Economic Activity

- a. Regional Summary
 - o existing land use patterns
 - o trends in population, employment, and economic activities
 - o historical absorption rates and trends for office, retail, and residential development
- b. Study Area
 - o existing land use patterns
 - o major activity sites
 - o land use plans, policies, and controls
 - o distribution of socio-economic characteristics
 - o trends in population, employment, and economic activities
 - o historical absorption rates and trends for office, retail, and residential development

3.2 Transportation

- a. Travel Patterns
 - [forecast year projections and comparisons with current patterns]
 - o tripmaking: numbers of trips, purposes, orientation, lengths [examples]
 - work trip attractions from the corridor to downtown
 - work trip attractions to suburban locations
 - residential areas producing significant work travel
 - extent of "reverse commuting"
 - non-home-based travel between activity centers
 - o mode of travel
 - downtown versus suburban trips
 - work versus non-work
 - "captive" versus "choice" riders
- b. Public Transportation
 - o operating characteristics
 - coverage and hours of service
 - route structure
 - headways

- o operating characteristics (continued)
 - load factors
 - o levels of service
 - travel times for selected interchanges
 - accessibility measures
 - transferring
 - o patronage
 - corridor-wide
 - selected lines
 - to selected destinations
 - o revenues and the operating deficit
 - fare structure, "average" fare, and total revenues
 - operating costs and deficit
 - stratifications by service type (bus/rail, local/express) or jurisdictions
- c. Highways
- o physical characteristics
 - alignments
 - numbers of lanes, capacities
 - degree of grade separation
 - o traffic volumes and levels of service
 - volumes on key facilities/links
 - V/C ratios
 - levels of service and duration
 - travel times for selected interchanges
- d. Parking
- o supply and price
 - downtown
 - other key locations
 - o adequacy for existing parking demand
- e. Transportation Plan
- o improvements planned for the corridor (highway and transit)
 - o short range strategies for the corridor
- f. Freight Railroads
- [When one or more of the alternatives would involve use of existing railroad rights-of-way, this section documents characteristics of the facilities and their usage.]
- o description of rail rights-of-way
 - o existing and projected train movements
 - o importance of the rail operation to the railroad and its customers

3.3 Neighborhoods

[neighborhood-specific discussions]

- a. historic development
- b. demographics (age, ethnic composition, income)
- c. sense of community
- d. community resources (schools, centers, community stores, etc.)
- e. location relative to alignments

3.4 Visual and Aesthetic Conditions

- a. description of sensitive scenic resources (skyline, mountain vistas, bodies of water, historic streetscapes)
- b. description of areas where significant and incompatible visual changes would occur in close proximity with existing uses (residential areas, parklands, etc.)

3.5 Air Quality

- a. Relevant Pollutants
 - o summary of important transportation-related pollutants (CO, HC, NOx, PM10)
 - o National Ambient Air Quality Standards (and State standards, if applicable)
- b. Regional Compliance with the Standards
 - o attainment status of the region
 - o summary of relevant Transportation Control Measures from the State Implementation Plan, if any
 - o air quality trends based on monitoring data and growth projections
- c. Identification of Sensitive Sites
 - o criteria for identification
 - o description of sites
 - o results from the monitoring program

3.6 Noise and Vibration

- a. Noise Criteria for the Project
 - o local noise ordinances (if applicable)
 - o DOT/HUD/EPA guidelines
 - o APTA guidelines
- b. Ambient Noise Conditions in Study Area
 - o identification of sensitive sites
 - o criteria for selection of monitoring sites
 - o ambient noise levels at sensitive sites
 - o characterization of noise levels in surrounding areas
- c. Vibration Criteria for the Project
 - o local ordinances (if applicable)
 - o DOT guidelines
 - o APTA/CHABA guidelines
 - o guidelines recommended by acoustical consultant
- d. Ambient Vibration Conditions in Study Area
 - o identification of sensitive sites
 - o criteria for selection of monitoring sites
 - o ambient vibration levels at sensitive sites

3.7 Ecosystems

- a. Existing Wildlife in Potentially Affected Areas
 - o summary of native wildlife
 - o rare and endangered species
 - o critical habitat
 - o wildlife and waterfowl refuges
- b. Existing Vegetation in Potentially Affected Areas
 - o summary of major plant groups
 - o extent of vegetation by type in parcel
 - o rare and endangered species
 - o critical habitat
- c. Significant Ecological Relationships

3.8 Water

- a. Surface Waters
 - o identification of bodies of water, current use, water quality
 - o State standards
- b. Groundwater
 - o location of aquifer recharge areas
 - o significance
- c. Floodplains
 - o location and geographic boundaries of 100-year floodplain
 - o function (support of wildlife, plants, open space, natural beauty, outdoor recreation, agriculture, forestry, natural moderation of floods, water quality maintenance, groundwater recharge, etc.)
 - o importance of each function
 - o existing developments and controls
- d. Wetlands
 - o location and geographic boundaries
 - o function (flood control, erosion control, pollution abatement, wildlife habitat, groundwater recharge, recreation)
 - o importance of these functions

3.9 Historic and Archaeological Resources

- a. Applicable Legal and Regulatory Requirements
 - o description of national historic preservation process
 - o description of efforts to identify resources

- b. Description of Resources in the Area of Potential Effects [site-by-site discussions]
 - o description of the resource
 - attributes which qualify for the National Register of Historic Places
 - present use, ownership, and condition of property
 - o status of the resource with respect to the National Register
 - o location relative to the alignments, station sites, access roads, etc.
 - o cross-reference to other sections of chapter (noise levels, etc.)

3.10 Parklands

- a. Applicable Legal and Regulatory Requirements
 - o summary of Section 4(f) process
 - o Section 6(f) requirements
- b. Description of Potentially Affected Sites [site-by-site discussions]
 - o size, owner, and location of boundaries (maps)
 - o function or use of the parkland
 - o access to the site and level of use
 - o proximity to the alignments, station sites, access roads, etc.
 - o cross-reference to other sections in Chapter 3
 - noise levels
 - other environmental conditions, as appropriate

4. Transportation Impacts

[Each section in this chapter presents data for all of the alternatives. To the extent possible, the text should enhance this comparative presentation by explaining service, patronage, and impact differences among the alternatives and relating these differences to physical and operating characteristics of the alternatives.]

4.1 Transit

- a. Levels of Service
 - o geographic coverage
 - o hours and frequency of service
 - o travel times
 - travel times for selected interchanges
 - accessibility measures
 - production/attraction - based analyses
 - travel time reductions for existing riders
 - o transferring
 - numbers of transfers for selected interchanges
 - degree of protection, convenience, at transfer facilities
 - o reliability
 - extent to which operation is mixed with congested traffic

- o reliability (continued)
 - extent to which a reserved right-of-way is provided
- o comfort
 - ride quality
 - exposure at access/transfer points
 - chance of getting a seat
- b. Patronage
 - o total transit riders
 - study area transit riders and differences across alternatives, by time of day
 - ridership differences by production/attraction areas
 - o ridership by transit mode
 - o ridership on express services and guideway facilities
 - total boardings by time of day
 - link volumes in peak period
 - peak hour/peak direction volumes at max load points
 - o station volumes
 - boardings and alightings, by time of day
 - access mode volumes
- c. Revenues and Operating Deficits
 - o "average" fare and farebox revenues
 - o operating deficit
 - o stratifications by service type

4.2 Highway

- a. Congestion
 - o changes in highway volumes
 - on critical facilities/links
 - impacts on highway service levels/speeds/travel times
 - o impacts of transit vehicle operations
 - volumes of transit vehicles in mixed traffic
 - impacts of reserved street/highway lanes on highway traffic
 - impacts of transit priority at intersections on cross-traffic
- b. Access to Stations

[station-by-station discussions]

 - o increases in highway link volumes: peak period, peak hour
 - o implications for highway levels of service
 - o reference to related impacts: air quality, noise, etc.
 - o mitigation
- c. Parking
 - o general parking
 - reduction in auto travel to attraction areas
 - number of spaces saved
 - o station areas
 - adequacy of park/ride lots
 - impacts of spillover parking

4.3 Freight Movements [where applicable]

- a. Freight Railroads
 - o impacts on rail operations
 - physical relocations
 - sharing of right-of-way or trackage
 - o modifications to transit service to accomodate freight movements
- b. Trucking and Deliveries
 - o impacts
 - removal of curb parking/delivery lanes
 - possibilities for relocation or rescheduling of deliveries
 - possible modifications to transit service to mitigate impacts

5. Environmental Consequences

5.1 Land Use and Economic Development

- a. Land Use Impacts
 - o regional
 - o corridor
 - o station areas
 - o joint development
- b. Impacts of Land Use Change
 - o consistency with planning and zoning
 - o services and tax base
 - o transit system use
 - o traffic and parking
- c. Employment Impacts of Construction and Operation
 - o temporary jobs created by construction activities
 - o multiplier effects
 - o permanent jobs created by operations
 - o multiplier effects

5.2 Displacements and Relocation of Existing Uses

- a. Displacements
 - o residential uses
 - numbers of units affected
 - characteristics of affected households
 - o business uses
 - size and type
 - number of employees
 - effect on the community
 - o public facilities and land
 - o transportation, communications, and utilities
 - o use of vacant land

- b. Relocation
 - o availability of relocation opportunities
 - o description of relocation assistance that would be offered
 - financial assistance
 - equity participation
 - advisory services
 - timing

5.3 Neighborhoods
[neighborhood-specific discussion]

- a. changes in quality of life
[qualitative discussion of cumulative impact of:]
 - o displacements and land use changes
 - consistency of new development with existing neighborhoods
 - o traffic and parking
 - o noise and vibration
 - o visual or physical intrusion of new facility
 - o mitigation
- b. barriers to social interaction
 - o identification
- c. safety and security
 - o transit operations
 - o auto traffic
 - o crime associated with transit stations
 - o mitigation

5.4 Visual and Aesthetic

- a. views interrupted by the guideway
 - o identification of significant visual changes
 - o identification of affected residential, commercial, and other units
 - o mitigation
- b. Views from the guideway

5.5 Air Quality

- a. Regionwide Analysis
 - o changes in emissions of transportation-related pollutants
 - o discussion of potential for changes in concentrations
- b. Microscale Carbon Monoxide Impacts
 - o line sources (busways, transit malls)
 - summary of methods and assumptions
 - changes in emissions (year of initial operation and horizon year)
 - changes in concentrations (both years)
 - impacts on sensitive receptors

- b. Microscale Carbon Monoxide Impacts (continued)
 - o point sources (park/ride lots, critical intersections)
 - summary of methods and assumptions
 - changes in emissions (year of initial operation and horizon)
 - changes in concentrations (both years)
 - impacts on sensitive receptors
- c. Conformity with the State Implementation Plan
 - o effect on implementation of Transportation Control Measures
 - o consultations with air pollution control agency
 - o preliminary determination on conformity

5.6 Noise and Vibration

- a. Summary of Noise Assessment Method
 - o definition of terms
 - o statement of assumptions
 - o method: exceedance of impact criterion
- b. Estimated Noise Levels
 - o contour lines at criterion levels
 - o identification of receptors within impact contour
 - o implications for these sites
 - magnitude of noise impacts (absolute and relative)
 - impacts on existing uses
- c. Mitigation of Noise Impacts
 - o recommended noise mitigation and resultant noise impacts
 - o alternative mitigation techniques
- d. Summary of Noise Assessment Method
 - o definition of terms
 - o statement of assumptions
 - o method: exceedance of impact criterion
- e. Estimated Vibration Levels at Various Distances
 - o contour lines at criterion levels
 - o identification of receptors within impact contour
 - o magnitude of impact
- f. Mitigation of Vibration Impacts
 - o recommended mitigation and expected results
 - o alternative mitigation techniques

5.7 Ecosystems

- a. Fish and Wildlife
 - o summary of analytical methods
 - o potentially significant impacts (injury, loss, change in habitat)

- a. Fish and Wildlife (continued)
 - o description of coordination with Fish and Wildlife Service (if alternatives involve impoundment, diversion, channel deepening, or other modification of a stream or body of water)
 - o rare and endangered species (where applicable)
 - identification of species
 - coordination with Fish and Wildlife Service
 - results of biological assessment
 - o mitigation
- b. Vegetation
 - o summary of analytical methods
 - o potentially significant impacts (injury, loss or modification of habitat)
 - o description of coordination with Fish and Wildlife Service and Soil Conservation Service (if alternatives involve impoundment, diversion, channel deepening, or other modification of a stream or body of water)
 - o rare and endangered species (where applicable)
 - identification of species
 - coordination with Fish and Wildlife Service
 - results of biological assessment
 - o mitigation

5.8 Water

- a. Water Quality

[discussion of impacts from both the alternatives themselves and attendant land-use changes]

 - o summary of analytical methods
 - o impact on turbidity, sedimentation, chemical pollutants, biota
 - o consistency with State standards
 - o mitigation
- b. Groundwater
 - o summary of analytical methods
 - o indication whether alternative occupies aquifer recharge area
 - o likelihood of contamination of the aquifer
 - o mitigation
- c. Floodplain Encroachment
 - o summary of analytical methods
 - o identification of floodplain boundaries and guideway alignments
 - o impact on floodplain functions
 - o changes in risk of flooding
 - o extent to which alternative directly or indirectly stimulates floodplain development
 - o mitigation

- d. Wetlands
 - o description of specific impacts in relation to function of area
 - o design/alignment variations that would avoid wetland impacts
 - o potential problems in making necessary wetlands finding
- d. Dredge and Fill
 - o location and extent of fill placement
 - o schedule for obtaining Section 404 permit
 - o coordination with Corps, EPA, and FWS
 - o mitigation

5.9 Energy

- a. Summary of Potential Impacts on Energy Consumption
 - o energy requirements for construction and operation
 - o conservation potential of the alternatives
- b. Energy Analysis

[presented where energy issues are of significant local interest or where energy impacts are expected to be part of the justification of the preferred alternative]

 - o summary of methods and assumptions
 - o estimates of energy expenditures and savings
 - construction energy
 - transit operating energy
 - changes in auto operating energy
 - "payback" periods

5.10 Historic and Archeological Impacts

- a. Description of Likely Impacts on Historic Sites

[site-by-site discussions]

 - o probable impacts
 - taking of all or part of site
 - introduction of serious indirect impacts
 - o design/alignment variations that would avoid/minimize impacts
 - o actions to mitigate impacts
- b. Coordination with State Historic Preservation Officer and the Advisory Council
 - o description of coordination
 - o copy of letter from State Historic Preservation Officer commenting on completeness of inventory of historic sites and accuracy of preliminary determinations of effects

5.11 Parklands

- a. Description of Likely Impacts

[site-by-site discussions]

 - o probable impacts (location and extent of changes, with maps)
 - direct use (taking) of land
 - constructive use

- a. Description of Likely Impacts (continued)
 - o design/alignment variations that would avoid/minimize impacts
 - o proposed measures to minimize harm
 - replacement of land and facilities
 - functional replacement
- b. Coordination
 - o discussion of communications with agencies having jurisdiction over potentially affected sites
 - o copies of correspondence for these agencies indicating agreement with the findings presented
 - o issues to be resolved in any further project development efforts

5.12 Impacts During Construction

- a. Transportation and Circulation
 - o identify transportation facilities closed or restricted during construction
 - highway facilities
 - transit routes, stops, etc.
 - freight delivery, Loading Docks
 - parking, sidewalks, etc.
 - o impacts
 - automobile levels-of-service in the area of construction and alternate routes (include travel times, speeds, delays, etc.)
 - transit service, schedule adherence, travel times, walk times, etc.
 - other impacts (pedestrians, parking, deliveries, rail service, etc.)
 - secondary impacts (where significant) discussed below in air, noise, displacements, etc.
 - o mitigation
 - actions to deal with construction transportation impacts
 - . parking restrictions, TSM actions on alternate routes
 - . transit priorities, reserve buses, more dispatchers, etc
 - . carpools, flexible work hours
 - develop mitigation plan
- b. Displacements, Relocation and Restricted Access for Existing Uses
 - o temporary displacements from construction staging, etc
 - o temporary access disruption
 - o relocation and mitigation
- c. Neighborhoods
 - o summarize temporary impacts
 - o mitigation measures

5.12 Impacts During Construction (continued)

- d. Air Quality
 - o temporary impacts during construction
 - from construction (dust, construction equipment)
 - from transportation diversions
 - o mitigation measures
- e. Noise and Vibration
 - o temporary impacts during construction
 - from construction (by time of day, neighborhood type, building type, etc.)
 - from temporary transportation impacts
 - o mitigation measures
 - alternative construction techniques, time-of-day restrictions, etc.
- f. Water
 - o runoff during construction
 - o mitigation
- g. Ecosystems (if necessary)

6. Financial Analysis and Evaluation of Alternatives

6.1 Financial Analysis

- a. Costs and Available Revenues
 - o cost projections
 - o available revenue projections
- b. Capital and Operating Shortfalls
- c. Additional Revenue Sources
 - o federal funding
 - o new non-Federal funding sources
- d. Cash Flow Analysis
- e. Conclusions
- f. Risk and Uncertainty
 - o input variables subject to change
 - o effect of sensitivity analysis
- g. Implementation

6.2 Comparative Benefits and Costs

- a. Approach
 - o definition of terms: effectiveness, cost-effectiveness, financial feasibility, equity
 - o identifying trade-offs

- b. Effectiveness
 - [review of the purpose and need statement and presentation of measures indicating the performance of each alternative on each objective]
 - o measures of effectiveness
 - o comparative discussion

- c. Cost-Effectiveness
 - o introduction
 - cost-effectiveness as a measure of investment worthiness
 - costs included in the calculations
 - use of proxy measures for total benefits
 - o cost-effectiveness measures
 - new trip index
 - user benefit index
 - other measures
 - o results of the analysis
 - table showing indices for each alternative
 - comparative discussion on the relative cost-effectiveness of the alternatives within the corridor
 - explanation of differences
 - comparison with UMTA thresholds

- d. Financial Feasibility
 - o definition of measures
 - o measures of financial feasibility
 - o comparative discussion

- e. Equity
 - o population segments benefiting from alternative investments
 - o population segments paying for alternative investments
 - o net benefits by population segment and compared to needs
 - o comparative discussion

- f. Discussion of Trade-offs
 - o summary table and discussion
 - o identification and explanation of significant differences
[example:]
 - some alternatives may be very efficient but not very effective for certain objectives
 - other options may be less efficient but perform better on a wider range of objectives
 - the trade-off, then, is a reduction in efficiency for a higher level of performance in certain important aspects
 - o inputs from the citizen participation process
 - relative importance of various objectives
 - acceptability of various impacts: cost, environment, etc.
 - divergent views among population subgroups

References

[Including: o documents from past planning efforts;
 o methods and results reports;
 o other technical references.]

List of Preparers

Urban Mass Transportation Administration

[names and titles]

[Joint Lead Agency(ies), if any]

[names and titles]

[Cooperating Agency(ies), if any]

[names and titles]

Consulting Firms

[For each firm involved, give name and location of firm, and names of individuals, titles, degrees, professional certificates, and sections of the DEIS to which each contributed]

List of DEIS Recipients

Federal Agencies:

Environmental Protection Agency
Department of Transportation
Department of the Interior
Department of Commerce
Department of Agriculture
Department of Energy
Advisory Council on Historic Preservation
Federal Railroad Administration
Federal Emergency Management Agency

Regional Offices:

Regional Representative of the Secretary of Transportation
Environmental Protection Agency
Department of Housing and Urban Development
Federal Highway Administration
U.S. Army Corps of Engineers
Federal Emergency Management Agency

List of DEIS Recipients (continued)

Congressional Delegation for the State
State Agencies
State Politicians
Local Governments
Local Agencies
Advisory Committee Members
Neighborhood Associations
Public Libraries
Individuals who commented during scoping
Individuals who have requested a copy

Appendices

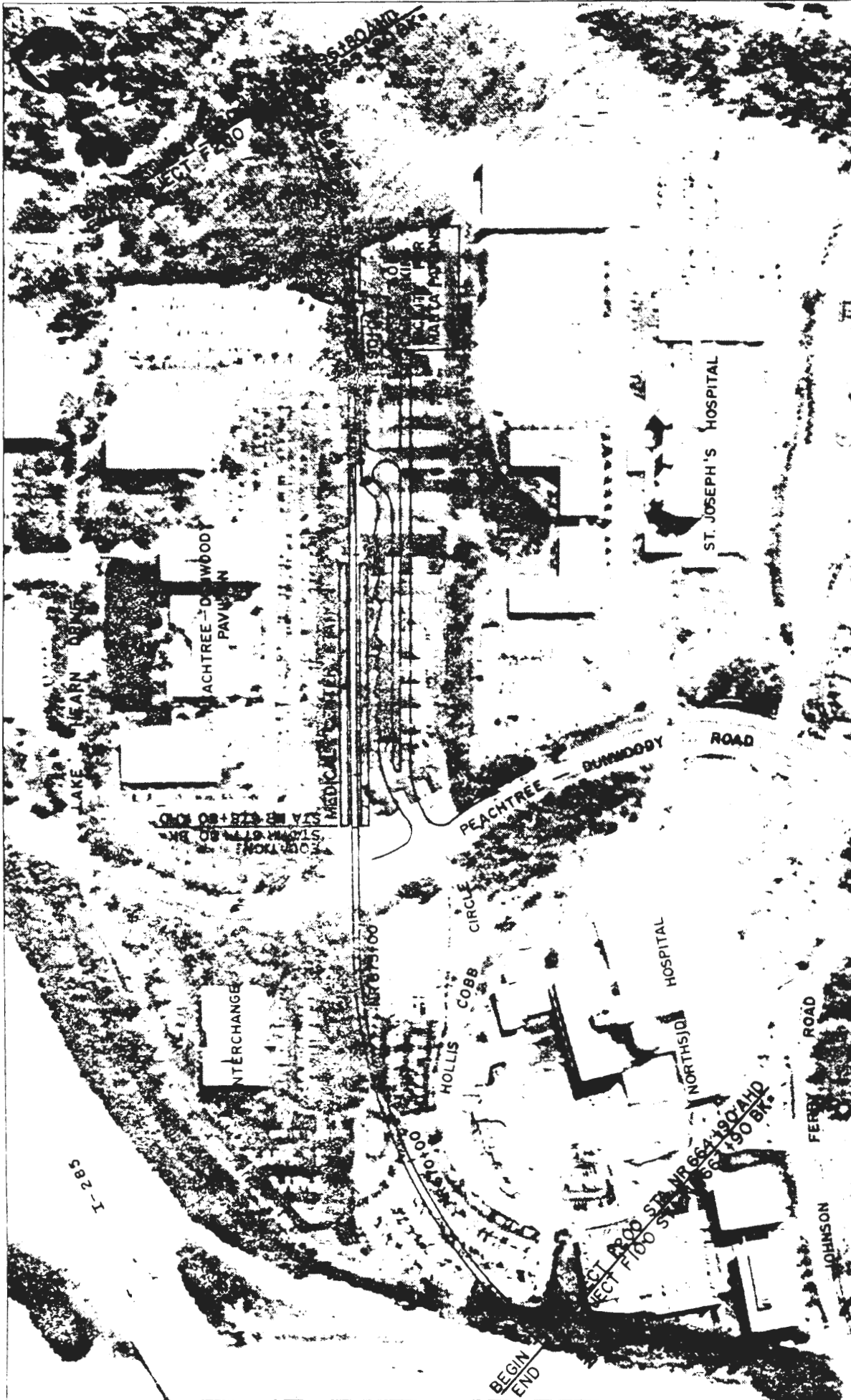
Plan and Profile Drawings or Aerial Photographs

[Other appendices as needed; appendices must be distributed as part of the DEIS]



APPENDIX

Plan and Profile Drawings

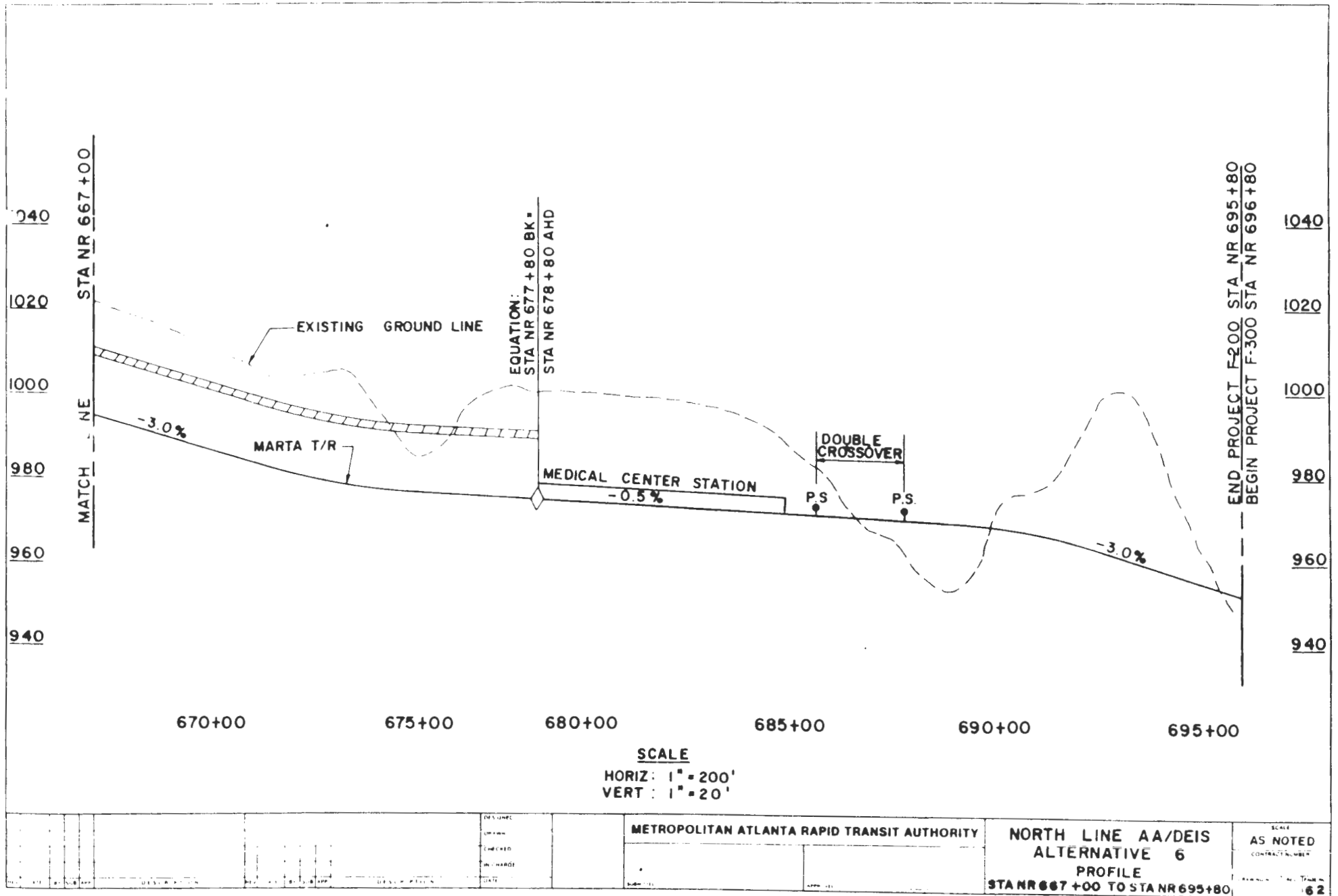


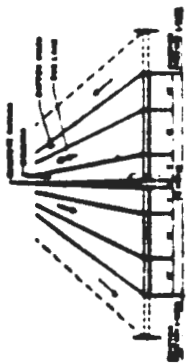
METROPOLITAN ATLANTA RAPID TRANSIT AUTHORITY

NORTH LINE A/DEIS
ALTERNATIVE 6
PLAN

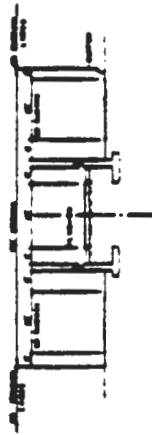
STA NR 664 190 TO STA NR 695 180

1" = 200'





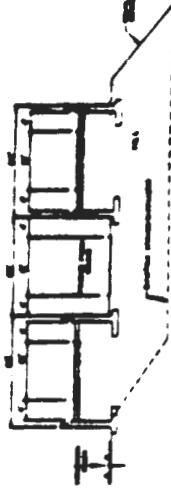
TYPICAL OF NORMAL SECTION



SECTION AT STEVENSON EXTENSION



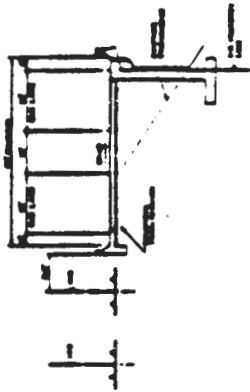
SECTION AT STEVENSON



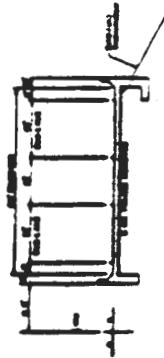
SECTION AT STEVENSON



TYPICAL STATION



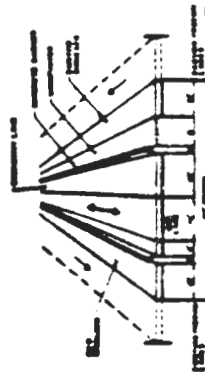
SECTION AT STATION



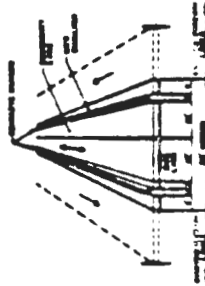
SECTION AT STATION



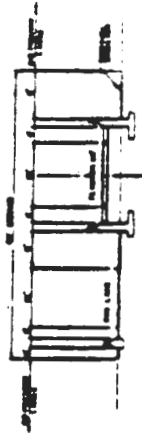
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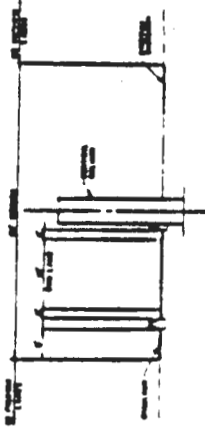
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TYPICAL OF NORMAL SECTION



SECTION AT STATION

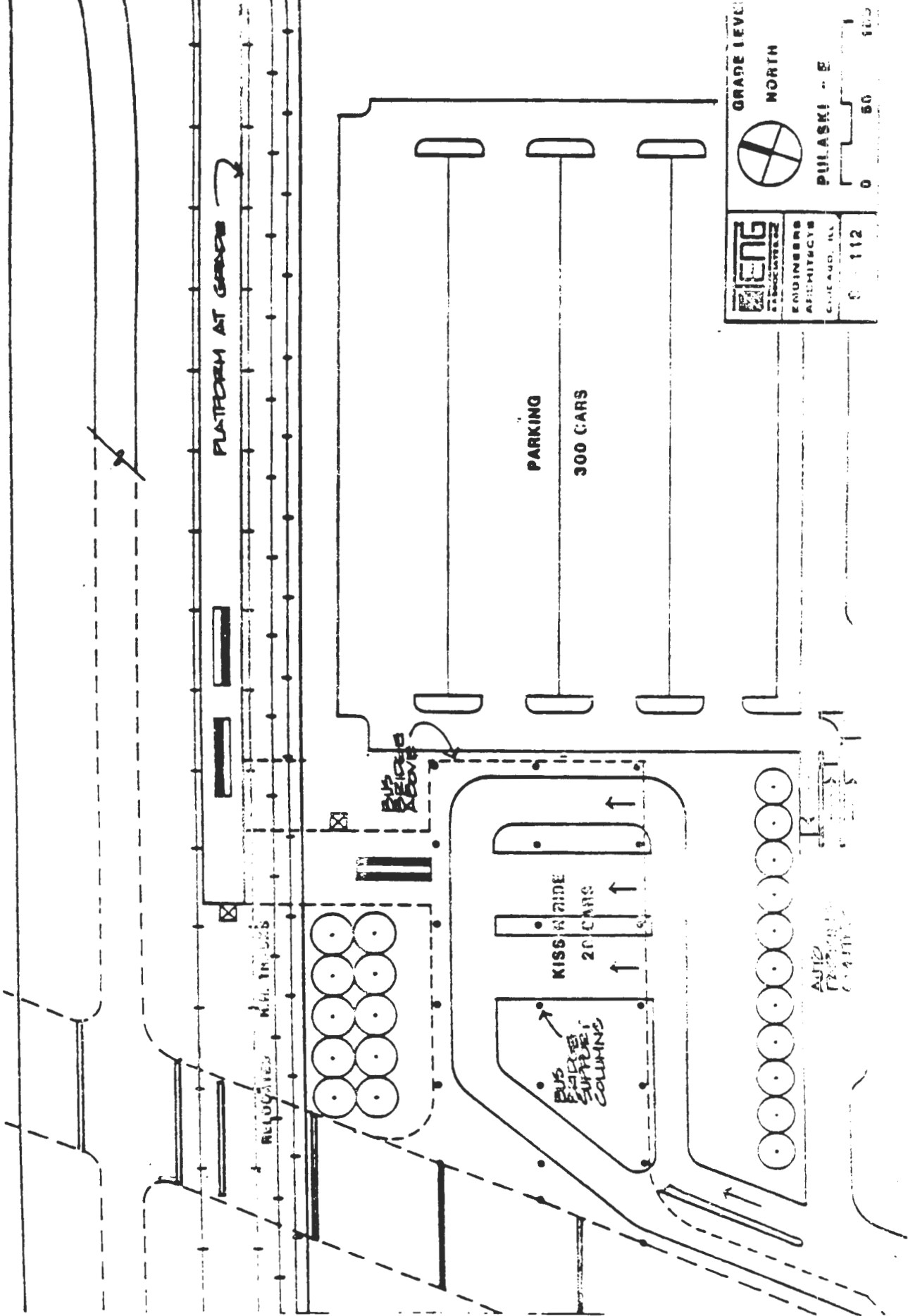



SECTION AT STATION

S.M.R. SUBWAY B1

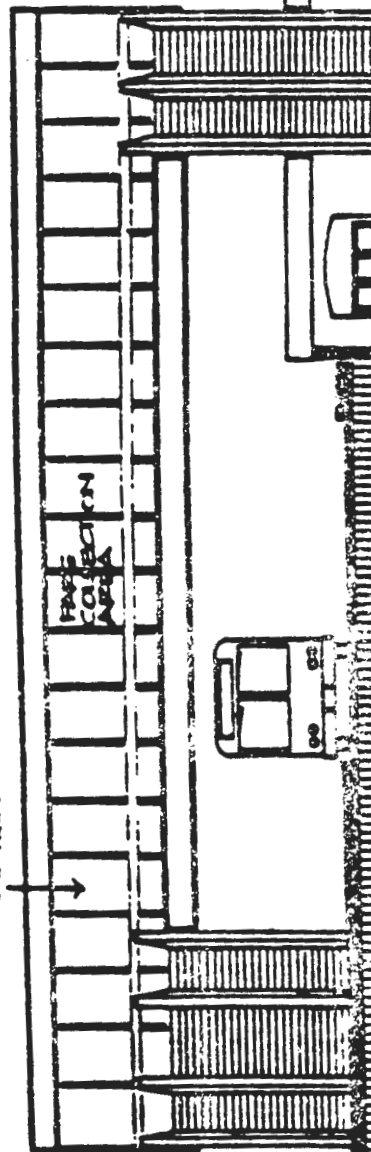
STEVENSON BUSWAY B2

CITY OF SEVENOAKS
 DEPARTMENT OF PUBLIC WORKS
 SOUTHWEST TRANSIT STUDY
 SUBWAY B1 AND B2
 TYPICAL CONSTRUCTION
 DRAWING NO. 2012



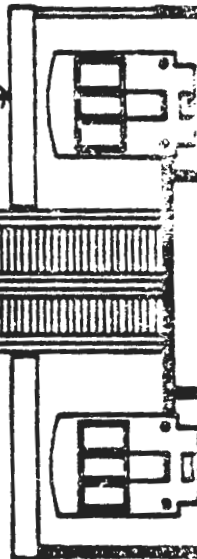
	RENG ENGINEERS ARCHITECTS
	CHICAGO, ILL. 112

GLASS
ENCLOSURE
STATION PLATFORM



PAVED
COVERED
AREA

PLATFORM
CANOPY



EXISTING
RAILROAD
TRACKS



ZENG
ENGINEERS
ARCHITECTS
CHICAGO, ILL.

SECTION

ARCHER - B

8 - 124



