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Major Investment Studies (MIS)

Case Study Examples of Corridor Planning

— **COMSIS CORPORATION and PARSONS BRINKERHOFF QUADE & DOUGLAS, Inc.**

This is one of a series of reports issued periodically by the Federal Highway Administration's Office of Environment and Planning, Metropolitan Planning Division (HEP-20), 400 Seventh Street, SW, Washington, DC 20590. The purpose of the series is to share the latest information on metropolitan planning techniques and analytical procedures. This series will include the results of in-house and contract research, papers written or presented by staff, and summaries of workshops or conferences. Comments on these reports, and recommendations for material to include are welcome.

PREFACE

This is the seventh in a periodic series of reports issued by the Metropolitan Planning Division, Federal Highway Administration. The report in this issue focuses on examples of corridor planning which demonstrate some of the planning principles and concepts underlying the Major Investment Study (MIS) provisions in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991.

This document was produced and is being distributed as part of a continuing effort by FHWA's Office of Environment and Planning to provide timely and pertinent information to those involved in Metropolitan Planning related activities. The purpose of this report is to assist state DOTs, MPOs and local transportation agencies in gaining a better understanding of the ISTEA provisions as they undertake Major Investment Studies.

This document is provided solely to share knowledge that has been gained from the corridor planning experience in three urban areas. It does not imply federal endorsement of the three studies, nor is it intended to prescribe the manner in which future MISs are to be conducted.

CASE STUDY EXAMPLES OF CORRIDOR PLANNING

PREPARED FOR:

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FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF THE ENVIRONMENT AND PLANNING
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

MAJOR INVESTMENT ANALYSIS

CHAPTER 1 INTRODUCTION

Purpose for Case Study Examination

Three transportation capital investment studies are presented here to provide examples of studies that demonstrate various planning principles of the major metropolitan transportation investment provisions of the metropolitan planning regulations (23 CFR 450.104 and 450.318), published October 28, 1993. These three studies were chosen because they highlight many of the concepts underlying the major investment provisions, and because they lend themselves to presentation and explanation of the principles of transportation investment planning.

While these studies were identified as good examples of certain planning, analytical, and evaluation concepts, their selection as case studies does not imply federal endorsement of the projects or alternatives studies. Moreover, they are not intended to prescribe the manner in which future studies are to be conducted. They are presented here to assist transportation planners in gaining a better understanding of the concepts underlying the major investment provisions. In addition to this case study report, FTA and FHWA will be undertaking a number of other activities to provide guidance, training and understanding of the major transportation investment concepts.

Background

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 and the Clean Air Act Amendments of 1990 set the policy framework for the major transportation investment provisions of the statewide and metropolitan planning regulations. ISTEA changed a number of aspects relating to transportation corridor and sub-area planning:

- The flexible funding provisions of ISTEA promotes analyzing transportation problems in a multimodal context.
- ISTEA requires a multimodal and intermodal approach toward transportation planning.
- The Clean Air Act requirements that transportation plans and programs conform with the State Implementation Plans (SIP) and ISTEA's financial constraint requirements, necessitate that long range transportation plans be more specific.

- ISTEA requires that FTA conform their environmental review procedures to those of FHWA.

- ISTEA seeks earlier consideration of environmental factors in the transportation planning process.

- Larger metropolitan areas must now implement congestion management systems as part of their planning process.

In total these changes argue for planners and decision-makers to consider a broader range of mobility options and analyze a more extensive range of impacts than may have been done in past system planning activities.

The metropolitan planning regulations created a process for implementing ISTEA planning principles and addressing alternative transportation investment strategies in corridors and subareas where potentially high cost or high impact alternatives are being considered. Appendix A contains the relevant sections from the planning regulations that pertain to major transportation investments (23 CFR Section 450.104 and 450.318). In general, the planning regulations call for Major Investment Studies (MIS) where federal funds are potentially involved in the development and construction of major transportation projects of substantial cost and impact. The overall process must be collaborative – involving MPOs, State DOTs, FTA/FHWA, transit operators, the public and other stakeholders – and must comprehensively evaluate alternative investment strategies for attaining local, state and national goals.

The MIS requirement is part of the overall metropolitan transportation planning process. MISs are planning studies, even though they may be financed with transferred capital dollars and include preparation of a draft environmental impact statement. As planning studies, MISs are a part of the plan preparation or update process. However, MISs can be accomplished after the adoption of a metropolitan plan. Where a transportation need has been identified that would require completion of an MIS but the study is not done before plan adoption, a place holder may be assumed and included in the plan. This place holder may be either a 'ho build" or 'most promising"alternative for the project; this would allow a conformity determination and financial constraint test to be applied to the plan. Subsequently, the MIS could be structured and completed. If the preferred alternative in the study was other than the one assumed for the plan, the plan would have to be amended before any further work on the project could be completed.

Case Study Selection Process

The selection of case studies was made by screening over 25 transportation/major capital investment planning studies and reviewing whether they had incorporated or followed key principles in the major transportation investment studies. The review focused on three areas of the analytical process:

Development of Alternatives
Estimation of Impacts
Evaluation of Alternatives

These three areas of the process were highlighted because they: 1) clearly illustrate the changes in major investment planning brought about by ISTEA and, 2) are possibly the most critical technical aspects of the major investment analysis process.

From this initial review, a short list of candidate studies was identified for each of the steps listed above. Three candidates studies were then selected for detailed explication of their analysis process.

CHAPTER 2 MAJOR TRANSPORTATION INVESTMENTS: PRINCIPLES AND CONCEPTS

Final selection of the case studies was made by reviewing them relative to the principles and concepts of Major Investment Studies discussed below. These concepts are not new. They follow good planning practice for capital investments, and have been advocated by planning professionals for a number of years. And, as evidenced by the three case studies, they have also found their way into actual planning practice.

The following sections discuss the principles and concepts underlying the major transportation investment provisions which were used to evaluate and select case studies.

Development of Alternatives

The development of alternatives that can meet the purpose and need identified in the planning process is a key component of the entire analytical effort. The emphasis should not be just on finding ways to enhance individual facilities that may be performing below capacity. Rather, it should be on the identification of possible alternatives that can address the underlying causes and/or sources of the transportation demand responsible for producing substandard facility performance or on supporting the development of new facilities. The MIS is a problem-solving analysis not just a mechanism for justifying a particular project.

Basic concepts or principles of alternative development are presented below:

- The corridor/subarea's current and future transportation problems should be carefully defined as the basis for identifying, defining, and evaluating alternatives.

- A Major Investment Study should include all reasonable investment strategies for addressing identified problems and the area's goals and objectives. This would include, as appropriate: alternative modes and technologies, general alignment options, capacity options, multimodal alternatives, low-cost operational improvements (referred to in this document as transportation systems management or TSM) and alternatives that address freight movements. Staging or interim improvements may be included.

- Operational, policy, and financing alternatives may be considered.

- Alternative investment strategies should be defined in all of their dimensions, including physical and operating characteristics for each alternative. Institutional factors, alternative policies, and funding strategies may also be important elements of the definition of alternatives.

- The operating plan for each alternative should be optimized and designed to represent any inherent advantages of its underlying technology. (For example, a metro-type rail system can operate at relatively high speed if the alignment and station spacing allows it)

- The alternatives should be defined in terms of a consistent set of policy assumptions, such as the price of parking and the level of development, although sensitivity analysis may be done to explore the impacts of alternative policies.

- The number of alternatives should be manageable so that decision makers can clearly understand trade-offs and distinctions among alternative investment strategies.

- Alternative development must be based on a broadly collaborative process involving major stakeholders (e.g., state DOTs, MPOs, transit operators, freight operators). In particular, early and effective involvement of the public in alternative development is imperative.

Estimation of Impacts

ISTEA and the metropolitan planning regulations call for a comprehensive analysis of the impacts from transportation investments. This aspect of the planning regulations is particularly significant because Major Investment Studies will provide input into subsequent environmental documents prepared on a preferred investment strategy. Elimination of alternatives from further consideration can be done in a Major Investment Study provided sufficient impact analysis is undertaken and documented as necessary per the requirements of 23 CFR 771.

Some basic concepts or principles for the estimation of impacts are:

- Transportation impacts, e.g., impacts on mobility, level of service, transit ridership, and freight movements would be critical components of impact analysis. A MIS also should analyze a broad range of other impacts including: social, economic, environmental, safety, operating efficiencies, land use, economic development, capital and operating costs, financing, and energy consumption impacts. The level of detail will vary from one corridor analysis to another, but should be comparable when analyzing alternatives against one another.

- Demand forecasting is a critical part of the impact assessment process. The demand forecasting process not only leads to estimates of usage for each alternative, but also provides the basis for estimating transportation benefits and costs. The demand analysis indicates the transportation impact of the alternatives on other facilities, such as congestion on connecting routes and provides input to other analysis, e.g., air quality.

- Analysis of impacts other than those listed above also may be appropriate depending upon the particular situation. The impact areas of importance would be identified early in the study process through consultation and collaboration with interested parties, including other agencies and the public.

- The analysis should include both direct and indirect costs and impacts.

- Given the financial constraint requirements for metropolitan plans and TIPs, financial analysis is an important element of an MIS. This analysis would indicate whether or not sufficient resources are available to meet the capital and operating costs of the alternatives. Where necessary, funding options should be evaluated so that necessary policy decisions on new revenue sources can be addressed during the broader planning process.

- In non-attainment and maintenance areas, the air quality impacts of each alternative will have to be analyzed to determine its impacts on regional air quality. A subsequent conformity determination will have to be made.

- The land use impacts of alternative investment strategies must be considered. In addition, it is desirable to consider the impacts of alternative land use scenarios on the performance of alternative investment strategies.

- Analysis of the equity impacts of alternative investment strategies (i.e., which groups benefit, on which groups are the costs imposed) should be included.

Evaluation of Alternatives

Evaluation of alternative investment strategies may be one of the more difficult elements of an MIS. Because MISs are inherently multimodal in scope, the analysis will address as appropriate mobility and other identified needs in the corridor and will evaluate alternative modes (highway, transit, freight). Further, the evaluation will have to be done in a consistent manner that allows decision makers to understand the trade-offs and impacts among alternatives.

Some basic evaluation principles are:

- The collaborative process should establish the evaluation methodology, criteria, and measures to be used. In general, the evaluation process should look at the alternatives in several different dimensions or perspectives, including operational effectiveness, cost-effectiveness, financial feasibility, and equity.

- The effectiveness portion of the evaluation should consider how well the alternatives attain local, state and national goals and objectives.

Transportation, environmental, economic development, and other objectives may be included. In essence, the effectiveness evaluation assesses how well each of the alternatives addresses the need identified at the outset of the study.

- The cost-effectiveness portion of the evaluation relates the effectiveness measures to the cost, both capital and operating, of achieving identified benefits.

- The financial portion of the evaluation determines whether there are sufficient resources to build and operate the alternatives, given other requirements such as the continued maintenance and rehabilitation of the existing system.

- The equity element of the evaluation would consider how the costs, benefits, and impacts of the alternatives are distributed across different segments of society.

- The evaluation process should be multimodal. It should include measures that permit unbiased comparisons across modes and technologies.

- The evaluation should be presented in a manner that is meaningful to local elected officials and the public.

Structure of Case Study Review

The next chapter presents an overview of each of the three case studies that were reviewed. The three following chapters examine one or more case studies for each of the three analytical areas (alternative development, impact analysis, evaluation). The chapters discuss each study's approach relative to the principles and concepts of the major transportation investment provisions shown above and problem statements, issues and institutional relationships. This review is followed by an analysis and evaluation of the case study relative to these principles and concepts.

Since the case studies were completed prior to the publication of the statewide and metropolitan planning regulations, the following analysis should not be considered a critique or recommendation to modify the study or projects. The information here is presented solely as a means to impart an understanding of these concepts using real-life case studies.

The final chapter of the report discusses general strengths and weaknesses in the studies. Recommendations, couched in terms of the MIS requirement, are offered on approaches to adapting the procedures to more effectively address the principles reviewed in this report and their application to future studies.

CHAPTER 3 OVERVIEW OF CASE STUDIES

Introduction

Three transportation planning studies for major capital investment are presented here to provide actual examples of analyses demonstrating key principles of corridor or sub-area planning. These case studies are included to illustrate "good planning practice" from the perspective of transportation planning professionals, who are part of the decision-making process for major investments. Besides being exemplary of corridor planning, these particular studies were selected because they lend themselves to presentation and explanation of the principles underlying the major capital investment analysis process. Their inclusion as case studies does not imply any particular endorsement of the projects nor are they intended to be prescriptive of the manner in which all future studies are to be conducted.

These case studies were prepared under the procedural and technical guidance for major capital investment planning that existed prior to *The Intermodal Surface Transportation Efficiency Act of 1991* (ISTEA) and the procedural and technical guidance that resulted from that legislation. Nevertheless, these three studies are examples of good planning in that they:

- clearly defined the purpose and need for consideration of a major investment in the corridor (problem statement);
- developed a set of alternatives that emerged through a broad collaborative process representing a broad range of reasonable alternatives;
- analyzed and estimated the full range of transportation benefits, direct and indirect costs, environmental/community, and financial impacts of the alternatives under consideration; and
- evaluated the effectiveness and cost-effectiveness of the alternatives in addressing the problem statement and established goals/objectives.

These bulleted items represent the general planning steps that are highlighted in the case studies. Specific elements of these steps are discussed below in greater detail.

The three case studies presented here are:

- **San Francisco Bay Crossing Study**;
- **I-15/State Street Corridor Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS)**; and
- **I-35 West Corridor Draft Environmental Impact Statement (DEIS)**.

One common characteristic of all three case studies was multimodal planning, involving a variety of highway, transit, and, in the case of the *San Francisco Bay*

Crossing Study, waterborne modes. The *I-15/State Street Corridor AA/DEIS* and the *I-35 West Corridor DEIS* were both detailed corridor planning studies designed to develop and present information leading to the selection of a preferred alternative, and both were presented within a NEPA DEIS (Draft Environmental Impact Statement as regulated by the National Environmental Policy Act) format. The *San Francisco Bay Crossing Study*, in contrast, was a feasibility study intended not to identify a preferred alternative but to establish a set of viable alternatives to include in a subsequent, more detailed corridor study. This study is included here to present an example of a systems-level study which was multimodal and conducted at an appropriate level of detail.

It should be noted that these three case studies all deal only with passenger travel and do not directly provide illustrations of addressing freight and goods movements.

San Francisco Bay Crossing Study, California (March 1991)

This study, performed under the auspices of the Metropolitan Transportation Commission (MTC), designated the Metropolitan Planning Organization (MPO) of the San Francisco Bay metropolitan area, was a comprehensive initial evaluation of the travel characteristics, environmental impacts, costs, and financial feasibility of several alternative transportation improvements. The idea of another major bay crossing alternative had generated over 20 years of area-wide interest. Capitalizing on this interest, the California Legislature implemented a measure that sought to build another transbay crossing. The improvements were designed to increase the capacity and mobility options for transbay travel in the San Francisco Bay area of California. The Bay Bridge connects the east side of the Bay where many of the employees reside with the west side of the Bay where the CBD and many of the employers are located.

This study represents a good example of a multimodal corridor study. The elements of alternatives definition, impact assessment and alternatives evaluation are comprehensive and well-structured. The level of detail of the study is commensurate with the objectives of the study. There was a well-structured process for involving local and state decision makers in the study as well as the public. The technical analysis was well-conceived in terms of stating all key assumptions explicitly and of having been conducted at the appropriate level of detail needed to make decisions for the context of this study. Because the study was not intended to result in a preferred alternative, the level of detail of the analysis and evaluation was not necessarily commensurate with what might be needed for most MISs.

Problem Statement, Issues, and Institutional Relationships

The problem that the study was charged with addressing was the fact that the existing and forecast demand for transbay travel was exceeding the total multimodal transbay transportation capacity. Transbay travel demand was forecast to increase by 25 percent by the year 2010. This is illustrated in Figure 2-1. This increased demand was forecast to occur with or without a new facility crossing San Francisco Bay. The base case alternative (TSM), which included already programmed improvements, would not provide enough capacity to accommodate forecast year 2010 travel demand if current economic trends were to continue. Travel demand models indicated that the region's multimodal transportation capacity was being outstripped

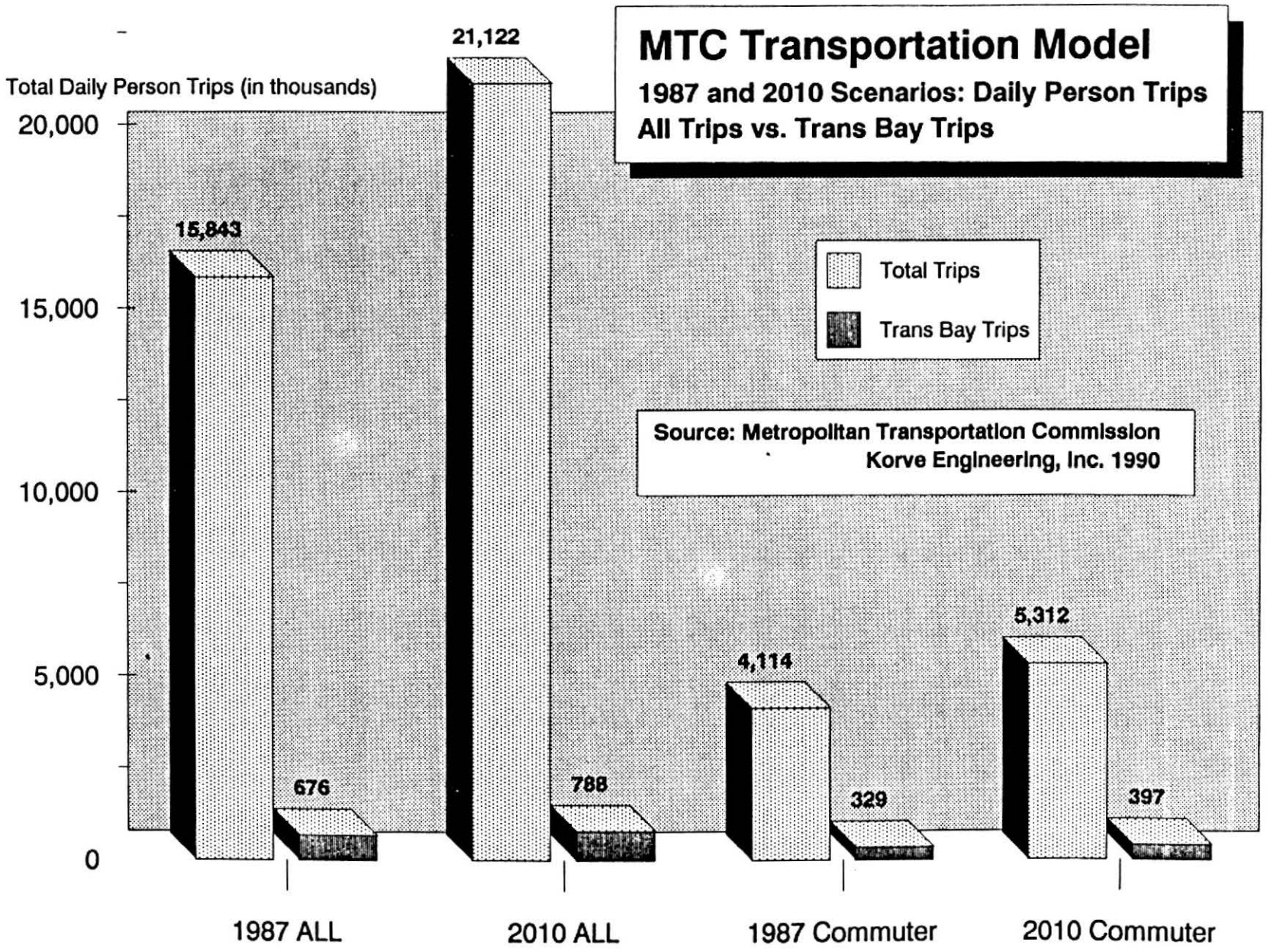

MTC Transportation Model
1987 and 2010 Scenarios: Daily Person Trips
All Trips vs. Trans Bay Trips
Total Daily Person Trips (in thousands)
20,000
15,000
10,000
5,000
0
Total Trips
Trans Bay Trips
Source: Metropolitan Transportation Commission
Korve Engineering, Inc. 1990
15,843
676
21,122
788
4,114
329
5,312
397
1987 ALL
2010 ALL
1987 Commuter
2010 Commuter

Figure 2-1

by demand in almost all modes. The San Francisco-Oakland Bay Bridge was predicted to be at maximum capacity 3.5 hours per day in 2010 versus 1.5 hours in the base year 1990. This level of service (LOS) in 2010 was forecast to have severe negative impacts on regional mobility. In addition, Bay Area Rapid Transit (BART) load factors on transbay lines were already exceeding policy levels in the base year. Capacity increases through reductions in headways would only accommodate 50 percent of the forecast increased demand by the year 2010.

Moreover, local officials and citizens were virtually demanding that another transbay alternative be examined, and the groundswell of local support for a new piece of transportation infrastructure increased. As early indications pointed toward another bridge, support against such a measure mobilized. The idea of a major capital transportation investment like a bridge, without the necessary background studies or planning efforts drew much criticism. This new backlash prompted the legislature to rethink its position, and ultimately brought forth a new piece of legislation.

This new piece of legislation enacted by the California State Senate was Concurrent Resolution Number 20 (SCR-20). This bill required the following topics be addressed:

- Current and predicted patterns of land development and travel demand patterns;
- Current and predicted transportation facilities, including an inventory of potential capital and operating improvements which would facilitate transbay travel over, under, or on San Francisco Bay;
- Identification of the most promising locations for additional transbay crossings, approaches and terminals;
- Preliminary consideration of environmental issues related to new transbay crossings; and
- Comparative analysis of costs and benefits of expanding existing bay crossings and of constructing additional crossings.

The bill set the level of detail for this task at just examining the issues related to transbay mobility. In essence it limited the scope of the study to this particular problem only. This caused the study to be preliminary in nature, not recommending an alternative or alignment, but simply a report of associated findings in each of the categories as prescribed in the scope.

A wide range of multimodal alternatives was developed to address the projected transbay transportation problem. These included new bridge crossings, new BART crossings, expanded ferry services, commuter rail and people-mover technologies, and combinations of these modes. A total of twelve alternatives was initially developed for this study.

The identification and analysis of bay crossing alternatives was conducted using a "two-cycle" process. The initial set of 11 build alternatives was identified and evaluated using preliminary measures for travel demand, engineering and operational feasibility, and cost. The initial screening process resulted in five build alternatives being selected for further study.

Study activities were presented to three committees: the Technical Advisory Committee (TAC), the Advisory Committee, and the Policy Committee, through a series of reports which were then used to prepare this final report. The committees provided direction and guidance to the study team.

- The TAC was composed of agencies involved in Bay Area transportation, including the MTC, BART (the regional rail service provider), the California Department of Transportation (Caltrans), AC Transit (Alameda-Contra Costa bus operator), the Port of Oakland, San Francisco International Airport, San Francisco Regional Park District, East Bay Regional Park District, and San Francisco Public Utilities Commission.

- The Advisory Committee included three members appointed by the MTC from a list of nominees submitted by local environmental organizations. Membership was augmented by the appointment of members from various other groups. Membership in this groups included: one member appointed by the Senate Committee on Rules, one by the Speaker of the California State Assembly, one each by the Mayors of San Francisco and Oakland, one each by the local government bodies of San Francisco, Alameda, Contra Costa and San Mateo Counties, one from the San Francisco Bay Conservation District, and one by the Secretary of Business, Transportation and Housing.

- The Policy Committee was established as a liaison between the MTC and the Advisory Committee.

Issues central to the study came to light through pressure from environmental groups, business lobbying, local citizens groups, industry, transportation professionals, Caltrans, BART, and the general public. Their concerns are evident in the initial assumptions and scope the project took on and the issues that were ultimately addressed in the study. Issues came from a diverse group of individuals and organizations and ranged from environmental concerns, to concerns about growth and sprawl, to noise and aesthetics.

From the beginning it was clear that any new transportation infrastructure below or above the San Francisco Bay would have environmental consequences. Environmentalists, local citizens, and business leaders had several concerns, including:

- environmental degradation resulting from urban sprawl associated with additional highway capacity;

- encroachment and negative impacts of a new bridge or tunnel on wetlands and water quality;
- massive support structures near both shores and in the open bay that would require filling and stabilization measures, thereby disrupting the aquatic ecosystem;
- dredging that would almost certainly have a detrimental effect on water quality;
- the increase in mobility that would result in increased vehicle miles traveled (VMT), and ultimately lead to more congestion and air quality problems;
- right-of-way requirements for the new facility;
- the character of their neighborhoods and downtowns that would be permanently destroyed by the encroachment of transportation infrastructure and its related support facilities;
- the aesthetic blight that would be caused by a bridge or other highway infrastructure; and
- noise and air quality problems.

Given the fact that this study was preliminary in nature, the institutional relationship problems that often develop in various types of transportation studies between competing stakeholders were kept to a minimum. There were never any detrimental institutional problems the study had to contend with in this particular instance. This was due in large part to the fact that SCR-20 mandated the formation of the Advisory Committee, and the Policy Committee, which had widespread representation of local government, business, civic, environmental, and citizen leadership. Also, by being politically generated, the study enjoyed a large base of support that was quite strong. This is especially evident given the fact that a state-level piece of legislation was the catalyst for the study. These factors all contributed to a core coalition of support, and a pre-established institutional framework that was determined to see the study through successfully.

MTC was charged by the legislature with oversight of the entire study. MTC assembled a study team of consultants including engineers, environmental and socioeconomic analysts, traffic modelers, cost estimators, and ferry, transit, and traffic planners. Staff members from the MTC were assigned full time to the project and communicated closely with the consultants and the various committees at all times. Through the use of the three committees, information flow and exchange, as well as necessary feedback and comments, were facilitated among the state legislature, MTC, consultants, environmental groups, Caltrans, BART, local governments, business leaders, and the public at large. Representation on the various committees enabled many groups with differing agendas to come forward and work together on the study to produce a quality report that all involved could live with.

Limited formal at-large public participation was available, but progress on the study was presented to the TAC, Advisory Committee and Policy Committee throughout the study via a series of technical memoranda and reports. These documents subsequently were combined to comprise the Final Report on the *San Francisco Bay Crossing Study*.

I-15/State Street Corridor AA/DEIS, Salt Lake County, Utah (February 1990)

The Wasatch Front Regional Council (WFRC), the MPO for the five-county region that includes Salt Lake County, initiated this study of an eighteen-mile corridor located in Salt Lake County in 1984. The study area is illustrated in Figure S.1. The corridor passes through the cities of Salt Lake City, West Valley City, Murray, West Jordan, Midvale, and Sandy. The corridor is illustrated in Figure S.2.

The main trip attractions are the central business district (CBD) of Salt Lake City and the University of Utah, The study defined and evaluated alternative solutions to transportation problems in the corridor that included I-15 and the connecting arterials. The corridor contained three alignments that served as the basis for the alternatives. Twelve alternatives were developed, including a combination of highway and transit improvements.

The evaluation of alternatives was comprehensive and inclusive of the full range of goals and objectives established by the local decision-makers. The range of impacts estimated by the analytical process was specifically tied to the agreed-upon set of evaluation measures established at the beginning of the study and provided decision-makers with the relevant information needed to determine which alternative best met the objectives of the study. The discussion of the evaluation results was focused and highlighted the key differences between alternatives relative to objective attainment.

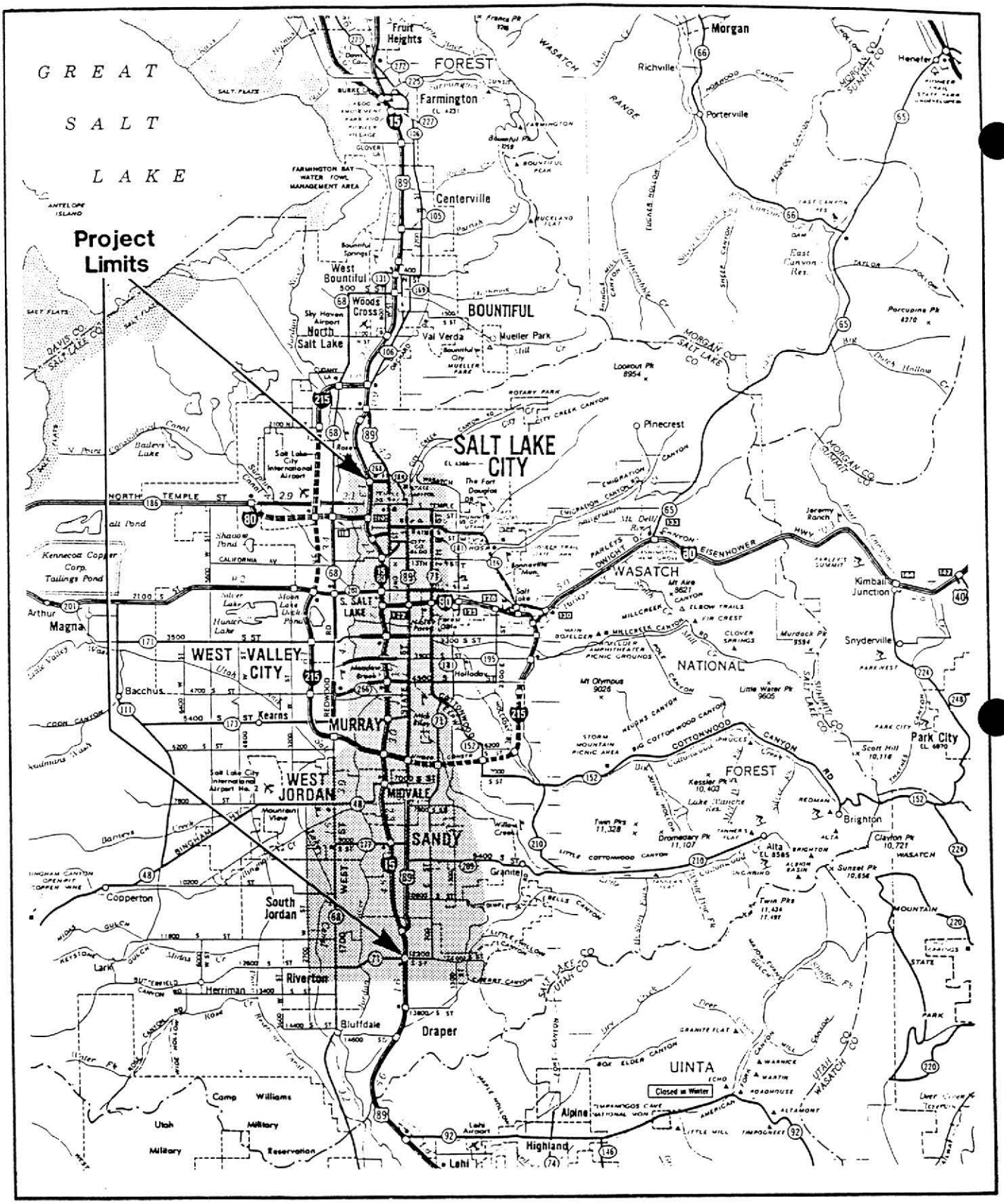
The estimation of impacts was state-of-the-practice at the time the study was conducted. Advances in methodologies since the late 1980's have surpassed the analytic techniques used in this study. However, the impact estimation was tied specifically to the evaluation measures and the requirements of NEPA and FHWA/FTA procedures in effect at the time of the study.

This study was one of the first multimodal alternatives studies performed under NEPA, and associated NEPA guidelines developed separately by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA). It is a good example of performing analysis and evaluation of multimodal investment options in a linear transportation corridor.

Problem Statement, Issues, and Institutional Relationships

The *I-15/State Street Corridor study* clearly defined a set of existing and potential transportation problems that identified the need for a major capital investment project. Population and employment trends and the associated travel patterns, and safety, operational, and physical deficiencies were described in the problem statement.

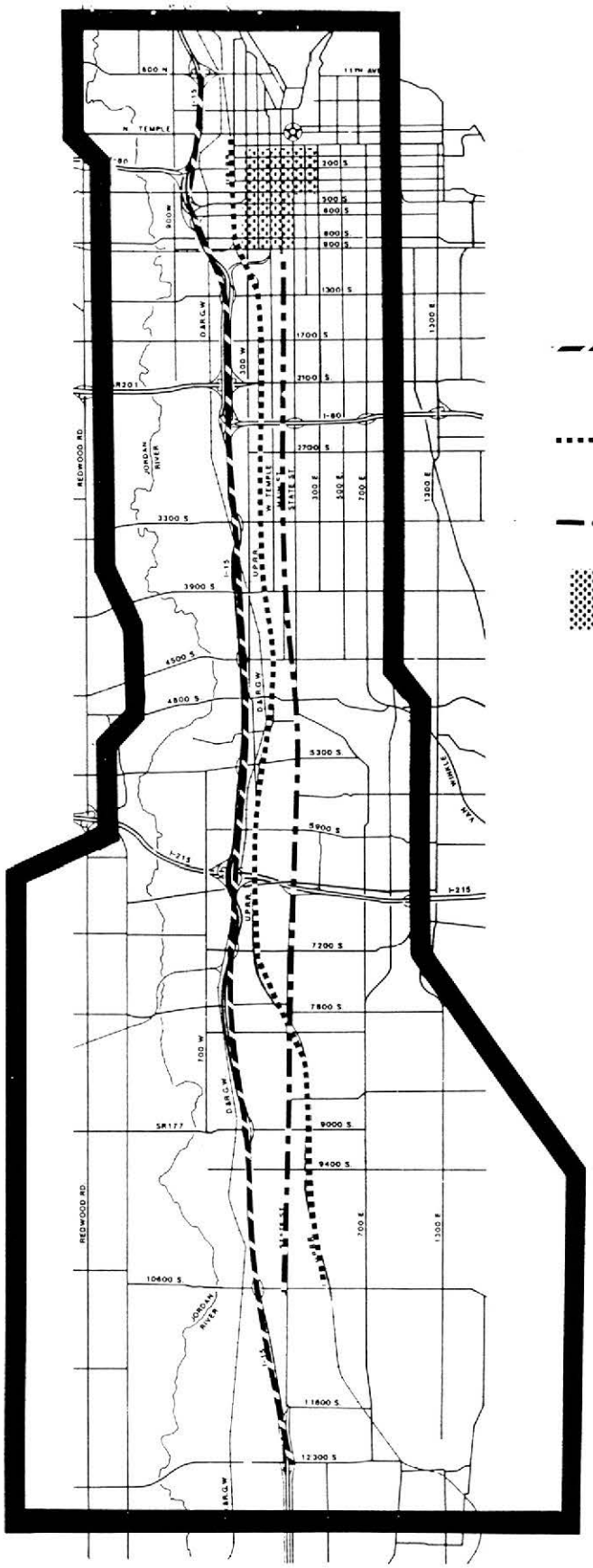
The system planning process and sketch planning review undertaken in WFRC's Long Range Transportation Plan (LRTP) completed in 1987, found that the I-15/State Street Corridor, the central corridor in the region, represented the most pressing transportation problem in the region and provided the best potential for major transit investment. It concluded that a detailed study of alternatives should be undertaken; these alternatives should include major transit investments, major highway improvements, and transportation system management. The *I-15/State Street Corridor*



I-15 / State Street Corridor Alternatives Analysis and Environmental Study

LOCATION MAP

Figure S-1



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I-15/STATE STREET CORRIDOR ALTERNATIVES ANALYSIS AND ENVIRONMENTAL STUDY

STUDY AREA

Fig. No. S-2

study was the outcome of the LRTP. As an aid in evaluating the extent to which a proposed alternative fulfilled the region's transportation needs, a series of goals and objectives were adopted as part of the LRTP. The initial study completed for the corridor recommended that a select few of the multimodal alternatives be carried forward into an alternatives analysis and environmental study; the current study, the *I-15/State Street Corridor AA/DEIS*, resulted. Between the two studies, it was found that the travel demand was higher than originally thought, so the alternatives became larger in scope to accommodate the increased demand.

I-15 is a critical component of the transportation system for both highway users and transit riders. I-15 carried over 130,000 vehicles per day on a six-lane facility in 1983; peak hour volumes exceeded capacities at certain locations. Transit ridership along the I-15 corridor increased to approximately 16,000 passengers per day to offset the growth in vehicular traffic.

Significant growth, driven by a diversification of the local economy in the manufacturing and services sectors, is expected to occur in Salt Lake County by 2005. Population is expected to increase by more than 100 percent while employment is expected to increase by more than 140 percent from 1985. Within the corridor itself, population is projected to increase from 31 percent of the county in 1980 to 38 percent in 2010. Employment is expected to increase from 46 percent of the jobs in the county in 1980 to 56 percent in 2010.

This growth was expected to significantly affect travel patterns in the region. A comparison of screenlines along I-15 showed that by year 2005, traffic volumes are expected to increase anywhere from 62 percent to 102 percent over 1980 volumes. Traffic volumes on I-15 are expected to operate above capacity on all segments except for the two southernmost ones. This translates to congestion for over twelve hours each day in either direction, with one section of I-15 expected to experience congestion for most of the day. This growth in travel would require significant increases to capacity to maintain reasonable levels of service on the highway facility. It is estimated that a doubling of capacity, or an additional six- to eight-lane freeway, would be needed to accommodate the demand.

Additional issues of concern included safety, operational, and physical deficiencies along the corridor. Interchanges along I-15 were reviewed and several were found to have poor and outdated geometrics, short weaving distances at ramp approaches, and inconsistent ramp configurations. Several connector ramps were deemed short, narrow, and lacking sufficient storage capacity. Several bridge structures were substandard and did not provide adequate clearance. Locations for two new interchanges were also identified.

Transit problems had also become an issue. The largest problem with transit service was its operation in mixed traffic and, thus, its vulnerability to congestion on both the arterials and freeways. The operating speed of buses was comparable or slower than that of automobiles since buses operated on the same right-of-way and had to stop to pick up and drop off passengers.

Parking demand and availability, especially in the Salt Lake City CBD and at the University of Utah, were perceived to be transportation problems. A recent study, however, indicated that adequate parking was available in the CBD although it might not be conveniently located. Parking at the University was perceived to be a problem due to a lack of convenient parking and, therefore, a spillover into the adjacent neighborhoods occurred. Both sets of concerns led to the desire to reduce single occupant automobiles as the primary means of access to the two locations.

Twelve alternatives were developed to address these transportation problems; these alternatives were refined from early study findings, public scoping meetings, and consultation with technical staff. Alternatives included a no build alternative, TSM with expanded bus service during the peak periods, freeway widening and interchange improvements, high-occupancy vehicle (HOV) lanes on I-15, extensive expansion of bus services, light rail transit operating either in the existing Union Pacific rail right-of-way (ROW), or semi-exclusively on State and Main Streets, and multimodal combinations of these alternatives. The no build alternative assumed completion of the interstate program and the regional Transportation Improvement Program (TIP). Peak-period transit service would increase somewhat under this alternative. Other alternatives included a variety of highway capacity improvements ranging from an additional lane in each direction to two additional lanes in each direction. The alternatives are summarized in Table 2.1.

The alternatives were structured so that the highway and transit components could be analyzed individually while also allowing for the components to be combined. The combined alternatives were designed to address the total problem regardless of the mode. This allowed the decision makers and public to make tradeoffs between the levels of highway and transit investment. The structure of the alternatives also allowed for their incremental evaluation. Eleven interchange improvements were included, with the level of improvement varying across the alternatives.

The study, performed by a consultant team working under the direction of WFRC, addressed a variety of impacts, including natural, socioeconomic, construction, transportation system performance, and financial impacts. The analysis of air quality impacts was included since Salt Lake County is designated a non-attainment area for particulates, ozone, and carbon monoxide. The transportation impacts analysis revealed that even with a projected increase of 20 percent in transit ridership over then-current levels, transit's share of total regional travel would increase only slightly more than 1 percent to approximately 5.6 percent. The financial analysis identified capital costs, operations and maintenance costs, shortfalls, and potential sources of funding for the improvements proposed in each alternative. It identified whether the then-existing financial resources would be able to meet the projected future requirements of a major capital investment of transportation investments and identified a stable, reliable long-term source of revenue for systemwide needs.

A Steering Committee comprised of technical staff and management from the Utah Department Of Transportation (UDOT), the Utah Transit Authority (UTA), FHWA, and UMTA (FTA) was formed to oversee this study. The twelve-person group included those versed in traffic, environmental, highway design, transit, and federal highway issues. Each of the local and state agencies had a clearly-defined responsibility for

TABLE 2.1

I-15/STATE STREET CORRIDOR
ALTERNATIVES ANALYSIS AND ENVIRONMENTAL STUDY

SUMMARY OF ALTERNATIVES (DESIGN YEAR 2010)

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 3	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 3	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 3	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 3	Same as Alternative 8
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 8

this study. WFRC provided oversight for this project. The implementation of transit was assumed to be the responsibility of UTA, as sole provider of transit services in the area. The highway component was managed by UDOT in its role as state transportation department.

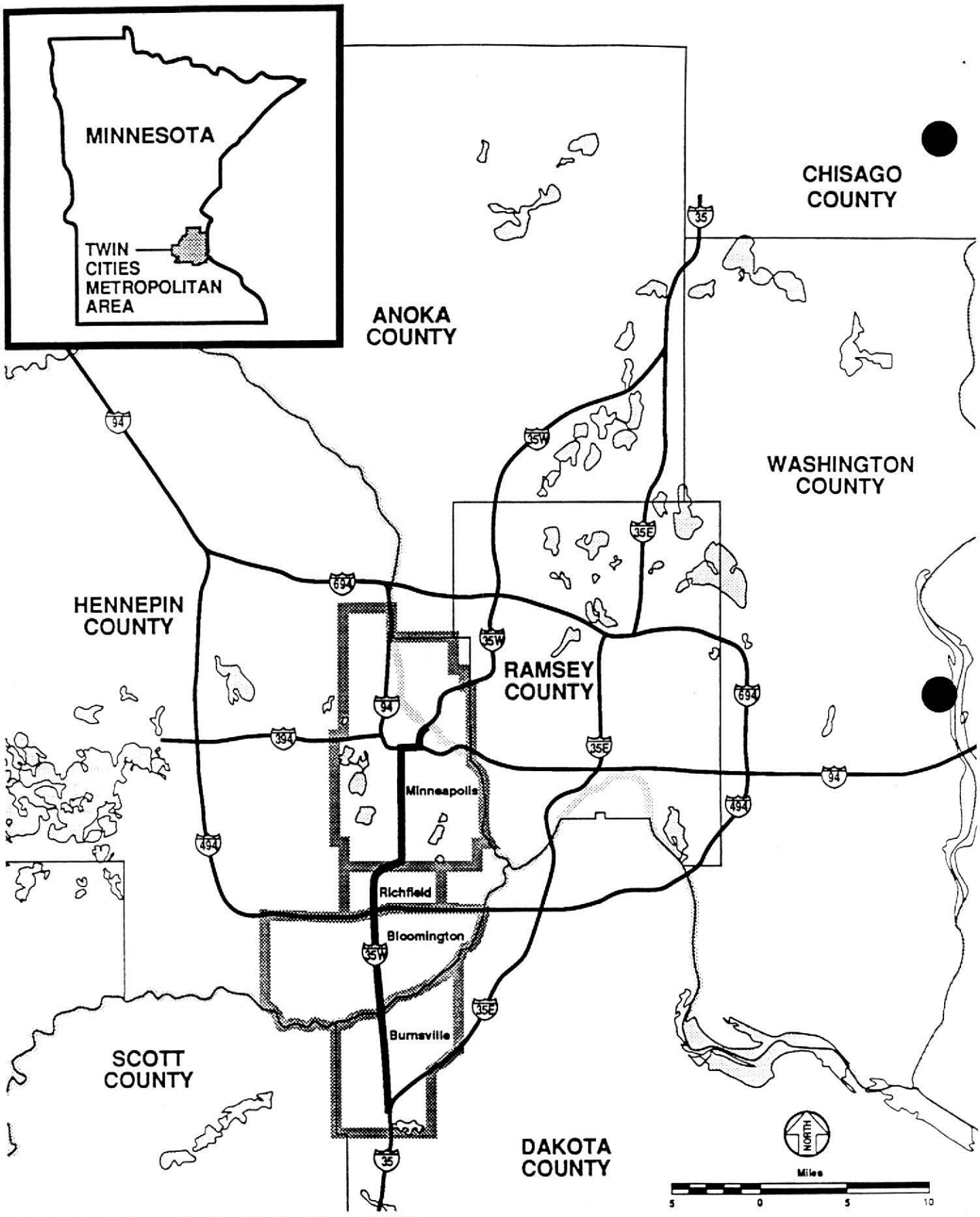
A public involvement program was implemented to encourage open dialogue between the public and policy makers throughout the course of this study. The program was intended to serve as a two-way forum for the study to be presented to the interested public and also for the public to provide input on the study. Interest groups that were involved included individuals and businesses situated within the corridor, local officials, organized citizen groups, and planning and public works officials. Participation at public meetings was limited to small groups of people. Meeting notices, relevant information, and newsletters were mailed periodically. Presentations were made to such organizations as the Salt Lake County Council of Governments and the Salt Lake Area Transportation Technical Advisory Committee. The media were also kept informed throughout the study and were encouraged to publicize the study.

I-35 West Corridor DEIS, Minneapolis, Minnesota (March 1992)

The Minnesota Department of Transportation completed this multi-modal corridor DEIS in 1992. The study considers highway widening, HOV lane conversion or additions, and light rail transit (either in the I-35W right-of-way or along the adjacent Soo Line rail right-of-way). The Federal Highway Administration was the lead federal agency. The study looked at the eighteen-mile corridor approaching the Twin Cities from the south. The corridor is illustrated in Figure 1-2. The entire project lies within Hennepin and Dakota Counties and passes through the cities of Minneapolis, Richfield, Bloomington, and Burnsville. The study area is located within the seven-county Twin Cities metropolitan area, and represents the western leg of Interstate 35 through the metropolitan area. The study area is illustrated in Figure 1-3.

I-35W is a critical part of the metropolitan transportation system for both highway users and transit riders. As of 1992, I-35W carried over 176,000 vehicles per day north of Lake Street. This segment of I-35W is projected to carry approximately 226,000 vehicles per day in 2010. I-35W has interchanges with many major freeways, arterials, and collectors in the study area and provides the principal access to the Minneapolis central business district from the south and southwestern suburbs.

I-35W is a very important transit corridor, with more peak-hour bus riders than any other highway in the metropolitan area. In 1990, buses operating on I-35W carried 12,000 bus passengers per day on an average weekday. An additional 39,000 people used local bus routes in the study area on an average weekday. The expansion of transit service in this corridor is considered important for maintaining the mobility of area residents, many of whom are dependent on transit as their primary mode of transportation. I-35W was identified in the Metropolitan Council's "Long Range Transit Analysis" (1986), the Regional Transit Board's (RTB) "Light Rail Transit Regional Development and Financial Plan" (1990), and the RTB's "Five Year Transit Plan" (1990) as a priority corridor for increases in transit service including high occupancy vehicle lanes or light rail transit.



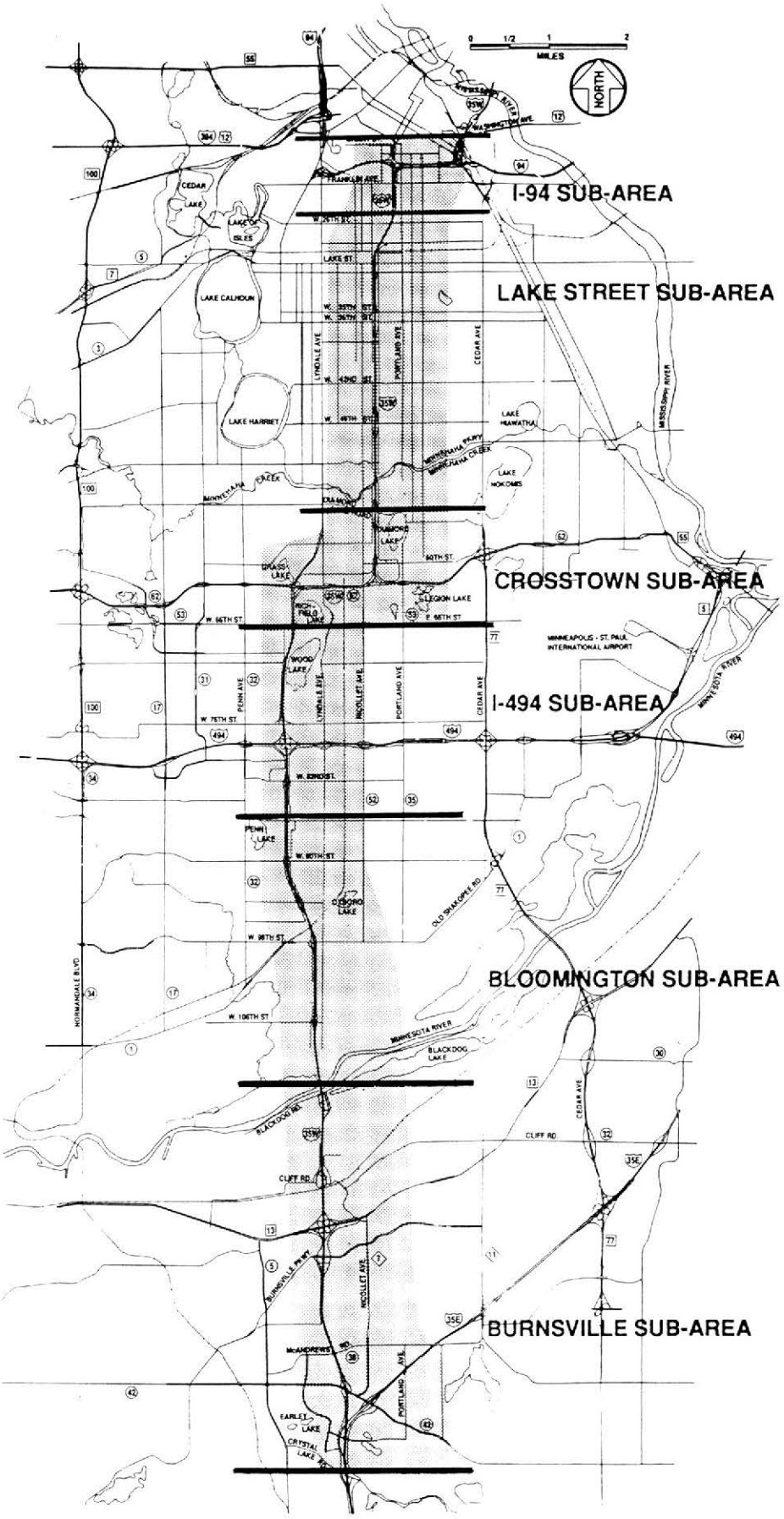
I-35W Preliminary Design Studies Phase 2: EIS

SRF

I-35W PROJECT LOCATION

Figure 1-2

Minnesota Department of Transportation - Metropolitan Council - Federal Highway Administration



I-35W Preliminary Design Studies Phase 2: EIS

SRF

I-35W CORRIDOR STUDY AREAS

Figure 1-3

The I-35W project is a linear urban corridor connecting a CBD with outlying suburbs. The corridor included an under-utilized rail freight line which parallels I-35W. While one of the LRT alternatives utilized this rail line, the study also included other LRT alternatives in the I-35W right-of-way indicating that the inclusion of LRT alternatives was in response to the defined mobility problem and not just the availability of a rail alignment.

The *I-35W Corridor Study* is a good example of a comprehensive approach to understand, analyze, and document various potential solutions to a community's transportation needs in a particular sector of a region. The document included detailed analysis of the region's transportation system and how the corridor relates to it, as well as the roots of the corridor's transportation problems and how those problems and their potential solutions affect the immediate community and the region as a whole.

This DEIS demonstrates how the evaluation process can be tailored to the specific needs and priorities of the community while remaining true to an established, uniform method. The distinctive characteristics of the I-35W corridor (e.g., high traffic volumes, high transit ridership, regional function of existing facility, effective TSM strategies, approaching operational limits, underutilized parallel rail line) are well-covered in the document, but the rational process of problem assessment and potential solution evaluation are typical of a general process used throughout the country (including integrated public review, participation by public agencies at several levels of government, cost equity considerations, multimodal planning, comparison of relative cost and benefits of each alternative). What makes this case stand out is the quality of the multimodal analysis, the development of the various alternatives, and the estimation of their respective impacts according to well-developed criteria that reflect the environmental and mobility interests of the community.

Problem Statement, Issues, and Institutional Relationships

A well formed, succinct statement of the problem condition within a given corridor or sub-area is the foundation of a good planning study. In situations where the problem is not well understood or stated, there is a greater likelihood that the study will be poorly organized or be misdirected. Starting with a clear statement of the problem, a logical investigation of solutions can and should follow. Consider this opening from the *I-35W DEIS*:

> *Interstate 35W (I-35W), as the major north-south freeway in the region, is a key element of the highway infrastructure in the Minneapolis-Saint Paul (Twin Cities) metropolitan area. It carries the heaviest traffic volumes of any segment of the regional highway system. It also has the highest transit ridership of any highway corridor in the Twin Cities. I-35W was built in segments between 1959 and 1968 for traffic volumes forecast for 1975, using design standards which are not as safe or effective as those used today. Because of its age and the high traffic volumes carried, the pavement condition is rated as fair or poor and much of it needs to be replaced, and many of the bridges are in need of extensive repair.*

This introduction sets the stage for the statement of the problem. Note that the introduction establishes some background and perspective on the corridor conditions, but it does not specify the problem. Consider the next paragraph from the study:

> *In response to high traffic volumes in the mid-1970s, the Minnesota Department of Transportation (MnDOT) implemented a number of transportation system management (TSM) strategies to improve levels of service on I-35W. These efforts have been fairly effective in optimizing the people- and vehicle-carrying capacity and operation of the facility. I-35W is recognized nationally as a successful example of transportation system management at work. The ramp metering, television surveillance, preferential bus ramps, traffic information strategies, and express bus service implemented on I-35W resulted in increased traffic speeds, improved vehicular capacity, increased transit ridership, and decreased accidents. However, in spite of continued efforts to maintain acceptable levels of service on the existing facility, the system is approaching its operational limits.*

Here more detailed information is given. The root cause of the problem (increasing demand) is outlined, and efforts to-date to address that demand are given. The final sentence states the fundamental problem of the corridor. It should be noted that stated alone, without the supporting information, the statement may not suitably define the problem. To further support the problem statement, the Purpose and Need section reiterates the goals of the project as a way of outlining the area's transportation needs, with special attention to modal differences:

> *The overall goal of the proposed I-35W reconstruction project is to accommodate I-35W's share of the forecasted regional travel demand between I-94 and downtown Minneapolis on the north and I-35E and the Burnsville Regional Center on the south. The following objectives, which were established by the joint lead agencies (MnDOT, FHWA, and Metropolitan Council) and the Project Advisory Board, are related to the need for the I-35W project:*
>
> 1. *Increase the number of people served on I-35W.*
> 2. *Provide preferential travel time for high occupancy vehicles over single occupancy vehicles.*
> 3. *Provide reasonable access to and from the freeway, giving preference to regional trips over local trips.*
> 4. *Maintain or improve the traffic level of service on I-35W.*
> 5. *Decrease the accident rate along I-35W.*
> 6. *Support development without encouraging excessive growth, particularly outside the Metropolitan Urban Service Area.*

The document addresses how the proposed project would relate to national and regional transportation policies:

> *The reconstruction of I-35W is consistent with National Transportation Policy as presented in the U.S. Department of*

Transportation document Moving America (U.S. Department of Transportation, 1990). All the I-35W Build alternatives address the need to improve safety, which is stated as the top priority of the department. Other goals supported by the national transportation policy include reducing congestion, making better use of an existing facility, providing new capacity without overbuilding, and increasing mobility and access, especially for the transportation disadvantaged. FHWA goals support the use of high occupancy vehicle (HOV) lanes and travel demand management (TDM) strategies to increase transit ridership and improve the people-carrying capacity of freeways. Generally, the proposed alternatives address these goals through improved traffic management, increased transit service, and improved vehicular capacity.

The Metropolitan Council promotes transit options as an integral part of the transportation system. The 2010 Metropolitan Transit System includes light rail transit in the I-35W corridor as one of the two first priority corridors. I-35W is also identified by the Metropolitan Council as a high priority corridor for high occupancy vehicle (HOV) lanes for carpools, vanpools, and buses. All I-35W Build alternatives include improved transit services; three alternatives specifically include light rail transit.

The document also addresses how the proposed project would affect different transportation modes and their interaction:

Implementation of the proposed action would enhance automobile, truck, and transit operations in the region. All Build alternatives would add new mass transit elements to the existing system, thereby complementing the traditional use of buses as the primary mode of mass transit in the corridor. Express transit service from the southern suburbs to the Minneapolis central business district (CBD) and other employment areas along the corridor, as well as east-west transit service, would be improved.

Implementation of the proposed action would not affect freight rail operations. The Soo Line Railroad has proposed abandonment of the rail line parallel to I-35W. River port activities on both the Mississippi and Minnesota Rivers would not be affected by the proposed project.

Improved freeway operations along I-35W and through the T.H. 62 common section and I-494/I-35W interchange would provide improved regional access to the Minneapolis/Saint Paul International Airport located east of [but outside of] the I-35W study area.

Overall, the general approach taken in preparing and developing the *I-35W DEIS* was one of comprehensive consideration. The project team endeavored to look at the problems specific to the study corridor, the immediate communities, and the corridor's

transportation issues as part of the regional system. Team leaders admit that it is difficult to look at one component of a regional system, and that it is hard to justify not looking at I-35W as a whole (from Laredo, Texas to Duluth, Minnesota), or the regional highway network as a whole, because transportation issues are not limited to arbitrary boundaries and tend to blur across borders and modes throughout a metropolitan area.

Two different types of alternatives were developed to facilitate planning and evaluation: transit/highway alternatives involving fundamental changes to the facilities in the roadway/corridor and interchange alternatives involving changes to six specific highway interchanges. Transit/highway alternatives were identified for the entire length of the corridor and addressed the mainline improvements for transit and the addition of general purpose traffic lanes. It is important to note again that all transit/highway alternatives, including no build, assumed full use of traffic management strategies including metering and transit bypass lanes at all on-ramps in addition to strategies currently employed, such as electronic surveillance, changeable message signs, traffic radio, and improved accident response. All transit/highway alternatives, including no build, were also based on the assumption that a full range of Travel Demand Management (TDM) strategies would be in place, including transit marketing activities, Transportation Management Organizations (Toms) in downtown Minneapolis and in the I-494 area, transit incentives, and carpooling incentives. Interchange designs involving various design access and alignment concepts that could be applied to each interchange site along the corridor. The transit/highway alternatives and interchange alternatives are summarized in Table S-2.

The interchange design alternatives and the transit/mainline alternatives could be combined in a variety of ways. Project staff admit that while this method served to distinguish between overall concepts and site-specific geometrics, they fear the format tended to confuse the public. In spite of this objection, they have not been able to develop viable alternate methods. The cumbersome alternatives structure served to separate corridor options from interchange designs, but many people were able to visualize only elements and found it difficult to picture entire mainline concepts. The project leaders also found that most people associated planning trade-offs with interchange designs. This problem of organizing alternatives in a clear and useful manner is not specific to this case and may challenge many MIS project managers.

Participation in the *I-35W DEIS* was guided by an all-inclusive approach. The Project Advisory Board (PAB) assured participation for all interested parties. Through this process the PAB brought together all the shareholders, including the general public, community groups, non-governmental organizations, four cities, two counties, and metropolitan, regional, state, and federal agencies. Clearly, all interested parties were welcome to participate, and influence the alternatives evaluation process. The PAB met monthly since 1986, and has accommodated many views. Of particular note are these organizations which have worked with the PAB to confirm and to challenge its work:

SUB-AREA	TRANSIT/MAINLINE ALTERNATIVES					
	NO BUILD	LANE CONVERSION	DIAMOND LANES	LRT IN I-35W MEDIAN	LRT ON SOO LINE RAILROAD	LANE CONVERSION PLUS LRT
I-94 Sub-Area	No Build	Stacked Mainlines	Stacked Mainlines	Stacked Mainlines	Stacked Mainlines	Stacked Mainlines
Lake Street Sub-Area	No Build	Bridged Ramps	Bridged Ramps	Bridged Ramps	Bridged Ramps	Bridged Ramps
Crosstown Sub-Area	No Build	Minimum Safe, Minimum Access	Side by Side, Revised Partial Access (Base) Stacked Mainlines, Existing Full Access (Sub)	Side by Side, Revised Partial Access (Base) Stacked Mainlines, Existing Full Access (Sub)	Side by Side, Revised Partial Access (Base) Stacked Mainlines, Existing Full Access (Sub)	I-35W in the Middle, Partial Access
I-494 Sub-Area	No Build	Minimum Safe, Minimum Access	One-Way Frontage Roads (Base) Overlapping Diamonds (Sub)	One-Way Frontage Roads (Base) Overlapping Diamonds (Sub)	One-Way Frontage Roads (Base) Overlapping Diamonds (Sub)	One-Way Frontage Roads
Bloomington Sub-Area	No Build	Minimum Safe, Minimum Access	Modified Full Access	Modified Full Access	Modified Full Access	Modified Full Access
Burnsville Sub-Area	No Build	Minimum Safe, Minimum Access	Revised Partial Directional	Revised Partial Directional	Revised Partial Directional	Revised Partial Directional

1. The I-35W Alliance (a business and community coalition);
2. The Minneapolis I-35W Task Force (a city-based community group);
3. The Hennepin County Regional Rail Authority;
4. The Downtown Management Council;
5. The Minneapolis Transportation Management Organization; and
6. The Neighborhood Transportation Network (a South Minneapolis community advocacy group).

Throughout the alternatives evaluation process, the PAB and project leaders were willing to adjust/adapt/redesign alternatives, even to add or eliminate alternatives. This flexibility assured maximum participation in the process, but it also made for a difficult effort to perform detailed environmental analysis and travel forecasting. It is arduous to estimate impacts with 'moving targets." Also, due to the long-term nature of the project (eight years and running) the project's 'audience" tends to change, and this makes the effort to keep all parties current on an evolving project very challenging. Project leaders fear that the media and some interest groups failed to recognize the detail of work and the laborious path of public involvement that took place in the evolution of alternatives as the preferred alternative was selected.

The controversial nature of some issues, such as right-of-way acquisition, tended to complicate public discussion of alternatives, as might be expected. As a consequence, many questions, issues, and suggestions of impacts were introduced into the discussion, some of which were of questionable direct relevance to the project. The project's open and responsive process left the I-35W project team open to much criticism, often presenting team members with hard-to-answer questions that evade easy quantification or public debate.

From the project's inception, it was recognized by all parties that transit would be an integral part of the alternatives package. Light rail transit was a popular issue in Minnesota at the time, and as project objectives were developed it was agreed that there would be both highway and transit components. The Hennepin County Regional Rail Authority was involved from the early scoping stages and the Federal Highway Administration (FHWA) and the Federal Transit Authority (FTA, then known as the Urban Mass Transit Administration, or UMTA) participated together in early project meetings, and the two federal agencies agreed that the project would be carried forward as a joint project. The Metropolitan Council, a lead co-agency, agreed to coordinate rail planning as part of this corridor study, rather than conducting a separate rail study, and Hennepin County committed funding to this study as a sign of its support of the consideration of rail options. This process reveals a relatively progressive intermodal approach, years before the 1991 ISTEA legislation.

Another noteworthy aspect of the project's approach was the position that the initial alternatives development and evaluation processes would not be constrained by cost or policy limitations. The rationale behind this was the expectation that any such constraint would thwart the consideration of all possible solutions to the corridor's transportation problems. This was done, in part, to demonstrate project commitment to finding the best possible solution to the corridor's transportation problems.

Conclusion

These summaries should serve to introduce the reader to the three case studies. The next three chapters investigate the cases in greater detail, each focusing on one of the areas of the analytical process described above in Chapter 2 best illustrated by that case.

CHAPTER 4 DEVELOPMENT OF ALTERNATIVES

Approach of Each Case Study

Methodology for Selecting Modes/Alternatives

A basic planning principle is that carefully defined existing and future transportation problems serve as the basis for identifying, defining, and evaluating alternatives. The alternatives should be developed through a broad collaborative process and represent a full range of reasonable alternatives.

The *San Francisco Bay Crossing Study* identified an initial set of alternatives. These alternatives focused on one corridor, crossing the San Francisco Bay, and followed the operating assumptions outlined in the Senate Resolution. The Resolution defined the problem and identified requirements for the analysis. The alternatives covered a variety of strategies, including alternative modes and technologies, alignment options, multimodal alternatives, and low-cost operational improvements. They were developed from a preliminary analysis of travel demand, feasibility, and cost information.

The *I-35W DEIS* initially defined a set of alternatives that accommodated a variety of modes and technologies, general alignment options, low-cost operational improvements, and staging options. The proposed alternatives were to include a transit component, focus on the existing location of I-35W to minimize right-of-way acquisition, and be compatible with long-range regional plans regarding transit facilities and highways. The alternatives were developed in response to the problem statement identified in the DEIS.

A problem statement was identified in the *I-15/State Street Corridor AA/DEIS*. From that problem statement, a set of alternatives was developed, including a variety of modes and technologies, alignment options, multimodal alternatives, and low-cost operational improvements. The alternatives were the result of a consensus reached among the interested parties such as relevant governmental entities and the public-at-large. They were initially evaluated with data such as typical cross-sections, service performance, order-of-magnitude capital cost estimates, identification of the operating characteristics for rail transit, siting of the rail station locations, and circulation concepts for the CBD area.

All of the case studies are strong at developing alternatives based upon current and future transportation problems as identified in each case study's problem statements. The existing problems are well-documented and describe how the corridor or subarea experienced capacity problems. The future transportation problems are forecast by the regional travel demand forecasting models that have been applied to each of the case studies. The models forecast how traffic conditions are expected to significantly deteriorate beyond the levels of congestion that are currently experienced.

Each of the case studies is also effective at identifying reasonable investment strategies for addressing the identified problems as well as the area's goals and

objectives. Alternative modes and technologies, general alignment options, multimodal alternatives, and low-cost operational improvements are considered. The *San Francisco Bay Crossing Study* identified such alternatives as expanded ferry services, additional bridge crossings, and new tunnel crossings, including one that provided access to the San Francisco airport. In the *I-35W Corridor study*, the highway facility, already a successful example of TSM strategies, also considered such options as HOV lane conversion, additional general purpose lanes, and additional TSM strategies such as changeable message signs, traffic radio, and electronic surveillance. The *I-15/State Street Corridor DEIS* evaluated commuter rail and light rail. Light rail was further evaluated between two alignments: along an existing railroad right-of-way and along the median of I-15.

The one area that is not addressed in any detail in all three case studies is freight movement. Although the *I-35W DEIS* recognized the interstate highway's importance to truck traffic and its function as carriers of goods to and from the Minneapolis CBD in the Purpose and Needs section, none of the alternatives specifically addressed freight movement.

An area in which the *I-15/State Street Corridor DEIS* was particularly strong is at explicitly identifying alternatives in terms of their physical and operating characteristics. For physical characteristics, the alternatives described the technology, degree of right-of-way separation, vertical and horizontal alignment, general location of stations, number of lanes, and tracks. Operating characteristics detailed in each of the alternatives included types of service and transfer stations. The other two studies focused on design alternatives and did not develop detailed operating plans to optimize the inherent advantages of underlying technologies.

The studies were consistent in defining a set of policy assumptions, such as the price of parking and land use assumptions, across all alternatives. In the *I-15/State Street Corridor DEIS*, policy assumptions included load factors, fares, headways, and vehicle types.

It should be noted that although the final set of alternatives that was analyzed in the *I-15/State Street Corridor DEIS* was multimodal, WFRC had initially envisioned that a transit study would be prepared. As the study progressed, alternatives such as a busway and an HOV lane along the freeway were identified by the public, advisory committees, and consultant team; these alternatives, although improvements to the transit system, also represented changes to the highway system. It became apparent that the solution to projected transportation problems required a larger set of multimodal alternatives be analyzed.

Agency and/or Public Involvement Process

One of the principles of the metropolitan planning regulation is that the process, including major investment studies, be conducted as a collaborative and cooperative process with a major emphasis on public involvement. The agency participants in the process should be drawn from all levels of government and bring the perspective of highway, transit, and other modes as appropriate. While these three case studies were completed prior to ISTEA and the metropolitan planning regulation, they are

exemplary in that they were inclusive of both highway and transit agency representation, and in the case of the *I-15/State Street* and *I-35W* studies, involved the participation of FHWA and FTA.

The *San Francisco Bay Crossing Study*, as directed by the California Legislature, was managed by the Metropolitan Transportation Commission. Other participating agencies included BART, Caltrans, AC Transit, the Port of Oakland, San Francisco Regional Park District, San Francisco Public Utilities Commission, San Francisco International Airport, and East Bay Regional Park District. These agencies participated during the development of alternatives as well as throughout the remainder of the study through the TAC. Three advisory boards were outlined in the Resolution; progress reports and technical memoranda were presented regularly to them. Environmental, business, and civic organizations were also involved in the study through the Policy Committee.

The *I-35W DEIS* was a broad, collaborative process involving major stakeholders including citizen and community groups. The lead agencies included the Minnesota Department of Transportation, FHWA, the Metropolitan Council, and the Project Advisory Board (comprised of the general public, community groups, non-governmental organizations, four cities, two counties, and metropolitan, regional, state, and federal agencies). Other participating agencies included the Regional Transit Board and the Hennepin County Regional Railroad Authority.

The *I-15/State Street Corridor AA/DEIS* also entailed a broad, collaborative process with participation from many of the relevant stakeholders. The study was initiated by the WFRC under an agreement with the UDOT and UTA, with funding from UDOT, UTA, FHWA, and FTA. A Steering Committee comprised of technical staff and management from UDOT, UTA, FHWA, and FTA oversaw the study. Public participation was substantive and occurred throughout the study.

Although public participation in the *I-15/State Street Corridor DEIS* appeared to be successful in reaching a large number of people, the WFRC, in retrospect, has said the study could have focused more attention on the general public and on the media in its public involvement process. A ballot measure that would provide funds generated from a tax increase to build the transit identified in the locally preferred alternative was defeated in the fall of 1994. Apparently, the public was confused about the proposed set of improvements. Election results show that the measure was supported only by those who stood to benefit from the LRT; the additional general purpose and HOV lanes did not factor into the public's decision-making. In addition, policy makers, although supportive of the alternative, have not been vocal in expressing their support. WFRC also wishes it had been more successful in encouraging policy makers to support the measure.

The alternative development process in all of the case studies is the result of a collaborative process among the major stakeholders. In the case of the *San Francisco Bay Crossing Study*, the Senate Resolution mandated which agencies should participate in the study. Those agencies were joined by environmental, business, and civic organizations. As a systems level study, this study was not required to have the mandated public scoping and public hearing process required in a NEPA DEIS;

therefore, the public participation program did not include these formal elements. This study was mandated by the California Senate, public support, not necessarily an a priori assumption, was widespread from the onset of the study.

The *I-35W DEIS* and the *I-15/State Street Corridor AA/DEIS* entailed broadly collaborative processes with participation from local, state, and federal agencies as well as the public and interested civic organizations. Again, because none of the studies specifically deal with freight movement, freight operators and customers did not have a defined role in the participation process.

The Project Management Team for the *I-35W DEIS*, in particular, was very flexible and willing to redesign alternatives if constituents could demonstrate good cause and gain mutual consent among stakeholders. A novel feature of the *I-15/State Street Corridor DEIS* was holding public forums at a storefront in a local mall to encourage participation from those who would not normally do so.

Refinement of Alternatives

In the initial stages of a study, a large number of alternatives may be developed in response to the problem/need definition. It may be appropriate to have this set of alternatives go through a screening and refinement step to eliminate alternatives that have characteristics or features that strongly indicate that the alternative will not be a viable option for selection as the preferred option for implementation. In this way, the number of alternatives carried into detailed development, analysis and evaluation can be reduced to a manageable number and conserve study budget and schedule. As part of the screening, the remaining alternatives can be refined to eliminate undesirable features and better address the identified problem/needs.

In the *San Francisco Bay Crossing Study*, an initial set of twelve alternatives was identified, eleven 'build" alternatives and a TSM alternative which served as the baseline scenario. The alternatives included new bridge crossings, new tunnel crossings, new extensions of BART, including a connection to the airport, and railroad crossings. Ultimately, six alternatives were evaluated in the Study, including five "build" alternatives and the TSM alternative.

The *I-35W DEIS* initially identified a total of fifteen alternatives, including seven transit/highway alternatives, seven interchange design alternatives, and a no build alternative. A number of factors had to be addressed in the alternatives development process:

- each of the study area's six subareas had very different travel demand characteristics;
- a multitude of access, alignment, and interchange configurations were possible; and,
- a number of transit and mixed traffic combinations, including light rail, were possible.

During the development stage, alternatives were grouped into two separate but related categories:

- transit/highway alternatives involving numerous transit and mixed traffic lane combinations; and
- interchange designs involving various design access and alignment concepts that could be applied to each of the interchanges along the corridor.

The alternatives were refined and the number reduced during the scoping and analysis stages, so that by the completion of the *I-35W DEIS*, there were five transit/highway alternatives, three interchange alternatives, and the no build alternative,

The *I-15/State Street Corridor DEIS* initially identified a set of thirty-three alternatives. These alternatives included a no build scenario, a TSM scenario, and multimodal alternatives. The multimodal alternatives include light rail, commuter rail, additional general purpose lanes along I-15, HOV lanes along I-15, and an increase in the number of buses serving the area. These alternatives were refined during the scoping stage; the DEIS ultimately evaluated twelve alternatives. The commuter rail alternative was dropped from further consideration. The remaining alternatives included a no build alternative which maintains present conditions and serves as a baseline condition against which the other alternatives can be evaluated, a TSM alternative which represents the "best" improvements that can be made to the existing infrastructure, four highway-oriented alternatives, two light rail transit alternatives, and four alternatives which are combinations of the above improvements.

Each of the case studies resulted in defining a reasonable number of alternatives so that decision makers had a study that presented the trade-offs and distinctions among the alternatives and strategies. Each of the studies had a screening and refinement process that resulted in the number of alternatives being reduced.

In the *I-15/State Street Corridor DEIS*, the alternatives were structured so that trade-offs between alternatives within each mode and across modes could be analyzed. The highway improvement alternatives included evaluating the benefits of adding two lanes in each direction on I-15 against the benefits of adding one lane plus a HOV lane within the same cross-section width. In the transit alternatives, the trade-offs could be made between an all-bus alternative and a LRT alignment, or between two LRT alignments. The alternatives could also be compared across modes such as additional highway lanes versus a LRT system on the highway.

Screening Process of Long-List of Alternatives

A screening process is used to refine and reduce in number the initial set of alternatives proposed for analysis. Typically, some combination of public meetings and study staff meetings are used to further define the alternatives to determine which can be excluded from further analysis.

The *San Francisco Bay Crossing Study* used the following criteria to screen the alternatives: travel system performance; environmental and socioeconomic factors; cost factors; financial issues; and cost effectiveness. Six alternatives were eliminated from further analysis based upon these criteria as well as other factors such as

unfeasibility from an engineering, operational, or other perspective. The consultant team, MTC staff, and Policy and Technical Committees were involved in the preliminary refinement of the alternatives.

The scoping phase of the *I-35W DEIS* included a preliminary analysis of a full range of alternatives that occurred prior to a full round of public meetings. Input from the public meetings was used to refine alternatives further and to identify expected major benefits and environmental impacts. The public identified two "fatal flaw" conditions which would make an alternative completely unacceptable to local communities and corridor residents:

- very high new right-of-way requirements; and
- excessive diversion of traffic onto local streets.

Initial analysis in the *I-35W DEIS* focused on these two concerns. After the initial set of preliminary design concepts for the remaining alternatives was completed, a detailed operations and safety analysis for the remaining alternatives was undertaken. A traffic flow model was used to determine the operational capacity of each mainline segment and each ramp. A methodology was developed to predict the number of accidents based on the proposed designs for each alternative. The interchange design sub-alternatives were modified as needed to ensure that minimum operational and safety objectives would be met before environmental impact analyses were completed.

A screening process was used to evaluate and, ultimately, reduce the number of alternatives studied in the *I-15/State Street Corridor DEIS*. The comparative analysis looked at such factors as traffic and usage performance, capital costs, and financial consideration. Several conclusions were reached from the comparative analyses:

- While six additional general purpose lanes were needed to satisfy corridor travel demand, only four could be added without highly prohibitive capital costs and major adverse environmental impacts.

- Transit improvements alone could not meet the projected future travel demand in the corridor. The ultimate conclusion was that a combination of highway and transit improvements was needed.

- If rail transit improvements were implemented, HOV lanes on I-15 would not be warranted. Therefore, alternative combinations of LRT and HOV lanes were dropped from evaluation.

- LRT in the freeway median was eliminated due to problems with pedestrian and vehicular access to the line.

- A comparison of transit usage and costs between the commuter rail alternative and the mixed bus alternatives indicated that the bus alternatives provide greater transit benefits at less cost. The commuter rail alternative was dropped from further consideration.

Three initial scoping meetings were held for the public. Attendance at these meetings was composed of interested members of governmental agencies, civic groups, and citizens at large. Input from these meetings, although minimal, was used to develop the final set of alternatives along with the comparative analysis that was undertaken.

All three case studies developed a set of criteria that were used to screen the alternatives in order to limit the alternatives to a manageable number. Typical criteria included: operational and safety factors; travel system performance; environmental and socioeconomic factors; engineering feasibility cost factors; financial issues; and cost effectiveness.

Focus on I-15/State Street Case Study

Alternative Development Process

Analysis of Case Relative to MIS Principles

Overall, this case illustrates how MIS principles are not new to planning practice and instead reinforce good planning practice that has been advocated for years. The *I-15/State Street Corridor DEIS* preceded the MIS regulations by three years yet is still exemplary today. The study is effective in the development of alternatives, estimation of impacts, and evaluation of alternatives sections.

The case study clearly identified the existing and future transportation problems along the corridor. It used these to develop alternatives that are multimodal, consider a wide range of strategies to address these problems, are manageable in number, and that have been developed as part of a collaborative process amongst interested parties. In its day, this study was a landmark study as it was one of the first to be jointly funded by FHWA and UMTA (now FTA) at a time when multimodal planning was not typical.

CHAPTER 5 ESTIMATION OF IMPACTS

This discussion focuses on the estimation of impacts sections for each of the three case study examples. It examines how each case approached the estimation of impacts to support the evaluation of the alternatives. This section concludes with a more detailed discussion of the problem statement, issues and relationships that helped shape the estimation of impacts process and final results of the Bay Crossing example.

Approach of Each Case

Relationship to Evaluation Measures

The estimation of impacts provides much of the input to the evaluation of all the alternatives regardless of mode. Both the *I-15/State Street Corridor Study* and the *I-35W Study* were very comprehensive and fair in their approach to the impacts analysis sections as they were guided by the expectation for the scope and level of detail for NEPA DEISs at their time of publication. The *San Francisco Bay Crossing Study* example was less comprehensive, being a feasibility study.

In the *I-15/State Street Corridor Study*, the estimation of impacts covered a full range of issues for the twelve alternatives:

- transportation;
- natural environment:
- socioeconomic environment;
- construction; and,
- financial.

Information was developed to measure the relative performance of each alternative. The results of the impacts analysis is summarized in Table S-4.

The alternatives evaluation was conducted within the context of the achievement of local goals and objectives. These goals and objectives included the minimization of adverse environmental impacts, the reduction of congestion, improvements of freeway interchanges and local street operations, increased transit usage, providing better transportation services in general, and promoting equity and social welfare.

The analysis of impacts in the *I-35W DEIS* was comparable to the *I-15/State Street Corridor Study*. The *I-35W DEIS* case examined:

TABLE S-4

COMPARISON OF ENVIRONMENTAL IMPACTS FOR

I-15/STATE STREET CORRIDOR

Alternative	Alternative 1 (No Build)	Alternative 2 TSM/ Best Bus	Alternative 3 1 Lane - I-15/ Best Bus	Alternative 4 2 Lanes I-15/ Best Bus	Alternative 5 1 Lane - Rev. 1 HOV I-15/ Best Bus	Alternative 6 Lane + 1 Lane HOV I-15/ Best Bus
SIGNIFICANT IMPACTS: Displacement Residences/ Businesses	Will displace: 8 acres 0 residences 0 mobile homes 0 businesses	Will displace: 22 acres 0 residences 0 mobile homes 0 businesses	Will displace: 48 acres 2 residences 0 mobile homes 0 businesses	Same as Alternative 3	Same as Alternative 3	Same as Alternative 3
Noise	Traffic growth on I-15 potentially impacts noise sensitive sites	I-15 alignment potentially impacts 34 noise sensitive sites	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
Wetlands	No Impact	Will potentially displace or disrupt approximately 5 acres of wetlands	Will potentially displace or disrupt approximately 8 acres of wetlands	Will potentially displace or disrupt 10 acres of wetlands		
Cultural Resource/ Historic Sites	No Impact		Displaces one residence potentially eligible for National Register			
Visual	No Impact		New interchanges at 11400 South and North Temple would represent intrusion into the visual environment			
Construction (Temporary)	No Impact	All build alternatives would have similar temporary construction impacts. Disruption and reduced patronage to businesses adjacent to alignments. Short-term economic gains due to influx of workers and purchase of supplies. Increase of truck traffic in the local area. Other impacts would include increase dust, noise and traffic conflicts. Restricted access due to detours and construction activities. Increased energy consumption.				
LESS THAN SIGNIFICANT IMPACTS: Geologic Hazards	Seismic activity in the study area will affect all alternatives similarly. Groundshaking would potentially cause the most damage to transportation facilities existing and proposed during a maximum credible earthquake.					
Natural Resources Water Quality Vegetation/ Wildlife	No Impact	No Impact	All alternatives would involve possible removal of mature trees and landscaping. Disrupted wildlife would return to corridor on their own accord after construction phase. Water quality and floodplains are not significantly affected.			
Soils and Agriculture	No Impact		Removes 8 acres of prime agricultural soil	Same as Alternative 3		
Land Use and Planning	Does not conform with regional and local transportation plans	Complies only slightly with regional and local plans for improving transportation system	No significant impact to local planning			
Floodplain Impacts	No Impact		Minor encroachment on floodplains			
Parklands	No Impact					
BENEFICIAL IMPACTS: Energy	No reduction in energy consumption or saving in travel costs	Daily Savings 245 barrels of oil $44,000 travel cost	Daily Savings 262 barrels of oil $44,000 travel cost	Daily Savings 247 barrels of oil $44,500 travel cost	Daily Savings 315 barrels of oil $57,000 travel cost	Daily Savings Same as Alternative 5
Air Quality	No reduction in regional pollutant burden		All build alternatives will reduce regional pollutant burden by minor amount from the No Build alternatives			
Economies and Development	No change from existing development along I-15. Trends would continue.		Minor enhancement of development along I-15 specifically near interchanges			

TABLE S-4(CONTINUED)

COMPARISON OF ENVIRONMENTAL IMPACTS FOR

1-15/STATE STREET CORRIDOR

Alternative 7 Rehab. I-15/ UPRR LRT	Alternative 8 Rehab. I-15/ State-Main LRT	Alternative 9 1 Lane I-15/ UPRR LRT	Alternative 10 1 Lane - I-15/ State-Main LRT	Alternative 11 2 Lanes - I-15/ UPRR LRT	Alternative 12 2 Lanes I-15/ State-Main LRT
Will displace: 63 acres 6 residences 1 mobile home 4 businesses	Will displace: 54 acres 5 residences 36 mobile homes 5 businesses	Will displace: 87 acres 8 residences 1 mobile home 4 businesses	Will displace: 80 acres 7 residences 36 mobile homes 5 businesses	Same as Alternative 9	Same as Alternative 10
Same as Alternative 2 +UPRR alignment potentially impacts 8 noise sensitive sites	Same as Alternative 2 +State/Main alignment potentially impacts 17 noise sensitive sites	UPRR and I-15 alignment potentially impacts 42 noise sensitive sites	State/Main and I-15 alignment potentially impacts 51 noise sensitive sites	Same as Alternative 9	Same as Alternative 10
Same as Alternative 2		Same as Alternative 3		Same as Alternative 4	
Displaces 2 residences and 2 businesses, and 1 barn potentially eligible for the National Register	Displaces 3 residences and 2 businesses, potentially eligible for the National Register	Displaces 3 residences and 2 businesses, plus 1 barn potentially eligible for the National Register	Displaces 4 residences and 2 businesses, potentially eligible for the National Register	Same as Alternative 9	Same as Alternative 10
Overhead power lines represents an intrusion into the visual environment; obstructing views		New interchanges and over wires represents an intrusion into visual environment; obstructing views			
Removes 7 acres of prime agricultural soil	Same as Alternative 2	Remove 15 acres of prime agricultural soil	Same as Alternative 3	Same as Alternative 9	Same as Alternative 3
	State/Main Street alignment is of concern to planning effort for Salt Lake City & South Salt Lake.	Same as Alternative 3	Same as Alternative 8	Same as Alternative 3	Same as Alternative 8
	no Impacts	Minor encroachment on floodplains			
Daily Savings 273 barrels of oil $60,000 travel cost	Daily Savings 247 barrels of oil $57,000 travel cost	Daily Savings 270 barrels of oil $60,000 travel cost	Daily Savings 232 barrels of oil $53,000 travel cost	Daily Savings 259 barrels of oil $59,000 travel cost	Daily Savings 229 barrels of oil $53,000 travel cost
Minor enhancement of development along UPRR alignment	Minor enhancement of development along State and Main Streets especially near stations	Same as Alternatives 3 and 7	Same as Alternatives 3 and 8	Same as Alternatives 3 and 7	Same as Alternatives 3 and 8

- transportation impacts;
- socioeconomic impacts;
- land-use impacts;
- acquisition and relocation impacts;
- environmental impacts (physical and natural); and,
- financial impacts.

The scoping process for the *I-35W DEIS* identified two issues of concern that received particular attention in the impact analysis and evaluation: right-of-way acquisition and diversion of highway traffic to local streets.

The impact analysis in the *San Francisco Bay Crossing Study* was less detailed than the two previous studies but was still comprehensive in the number and type of issues and subject areas it analyzed. Although its level of detail was less, major issues evaluated by this study were similar to the other two examples, and also included additional issues pertinent to the Bay Area context. The impact categories included:

- travel system performance;
- environmental and socioeconomic issues;
- cost;
- financial issues; and,
- cost effectiveness.

The study established an evaluation methodology and criteria for developing measurements for evaluation of various modes. Additionally, each alternative was evaluated and compared relative to its performance against other alternatives and against the Regional Transportation Plan (RTP) 'blend" which was a mixture of additional BART and bus services and ferry improvements.

Given the sensitive nature of the San Francisco Bay marine habitat areas, several specific environmental quality issues were examined. Included were the analysis of the impacts on water quality, marine wildlife habitats, wetlands and issues associated with soil disposal.

Estimation of Transportation Impacts

The analysis of transportation impacts should allow for a comparison across the alternatives of various performance measures such as: level of service and levels of usage on the various highway and transit services and facilities, as well as consideration of goods movement where appropriate. The analysis should focus on the corridor as well as regional level impacts.

The *I-15/State Street Corridor DEIS* presented a thorough analysis of the transportation impacts associated with the twelve study alternatives. The analysis of the highway, transit, and HOV elements of the alternatives focused on regional impacts, impacts on facilities within the corridor, and specific impacts at critical locations throughout the corridor. The region's travel forecasting model was employed to estimate travel

patterns and characteristics for the year 2010. Procedures were developed to estimate peak hour demand, usage on high-occupancy vehicle lanes, and transit ridership for each alternative. Table 5.8 summarizes the projected transit ridership for each alternative.

The discussion of regional impacts described changes in travel market projections for the year 2010. These changes included growth in total daily person trips, dispersed population and employment growth, changes in mode of travel, and regional travel time savings. The discussions of corridor impacts described changes in transit patronage, traffic patterns, congestion, and travel times. A transit accessibility index was used to measure accessibility to the Salt Lake City CBD during the peak hour as perceived by the transit user for each alternative.

To measure the effectiveness of the alternatives in alleviating congestion, the following measures were used:

- number of miles of roadways with congestion;
- time of day of congestion; and,
- severity (level of service).

The discussion of localized traffic impacts addressed the performance of interchanges along I-15 as well as intersections of arterial streets. Since safety at certain interchange locations was identified as one of the critical transportation problems in the region, the weave areas at all interchanges in the corridor were examined. Other transportation issues reviewed included impacts of LRT service on railroad lines serving the corridor area and parking availability in the CBD. There was no specific discussion of goods movement in the corridor.

The *I-35W Study* followed an approach to analyzing transportation impacts similar to that of the *I-15/State Street Corridor Study*. Like the *I-15/State Street* example, The *I-35 case* used the region's travel demand forecasting model to estimate travel patterns, levels of usage, and benefits. However, unlike the *I-15/State Street Corridor Study*, the *I-35W Study* analysis tended to focus primarily on multimodal alternatives within a highway corridor and therefore examined issues like safety, capacity and geometric design in a highway context. Therefore, the build alternatives were more specifically evaluated in areas that reflected the nature of the above three concerns. The transportation impacts focused on during the analysis were in the following areas:

- people carried;
- accidents;
- access;
- bikeway/pedestrian impacts;
- impacts on local streets; and,
- impacts on energy.

TABLE 5.8

TOTAL DAILY TRANSIT RIDERSHIP
1986 AND 2010

	Alternative	Work Trips	Non-Work Trips	Total Trips
	1986 Ridership	18,500	18,700	37,200
	Alternatives (2010)			
1	No Build	43,300	36,800	80,100
2	Best Bus	51,660	42,240	93,900
3	Best Bus + 1 Lane	51,660	42,240	93,900
4	Best Bus + 2 Lanes	51,760	42,240	93,900
5	Reversible HOV	52,200	41,700	94,900
6	2-Way HOV	52,200	41,700	94,900
7	LRT - UP - Loop	54,000	44,100	98,100
8	LRT - State/Main	52,000	42,700	94,700
9	LRT - UP + 1 Lane	54,000	44,100	98,100
9a	LRT - UP - Depot + 1 Lane	52,400	43,100	95,500
9b	LRT - UP - Main + 1 Lane	53,900	44,100	98,000
10	LRT - State/Main + 1 Lane	52,000	42,700	94,700
11	LRT - UP - Loop + 2 Lanes	54,000	44,100	98,100
12	LRT - State/Main + 2 Lanes	52,000	42,700	94,700

Also included in the analysis was detailed consideration of the demand for transit facilities as well as the impact of the facilities and their potential for construction. Tables S-3(a) and (b) summarize the impacts analyzed in the *I-35W Study*.

The transportation impacts section of the *San Francisco Bay Crossing Study* was also very comprehensive. Like the other two studies, the *Bay Crossing Study* employed the region's travel demand forecasting model to predict travel demand on a regionwide basis, but applied the output only on a corridor level. This study, however, modeled multiple land use scenarios that changed density and settlement patterns to test the effects of the TSM and no-build scenarios in combination with different land-use scenarios. This process of using multiple land use scenarios, including an 'Infill development scenario" supported by environmental advocates, satisfied the suggestion in the MIS guidelines that alternative land use scenarios be analyzed; this is absent in the other two studies.

The transportation impacts section primarily focused on the effects each of the build alternatives would have on overall travel system performance. While completed prior to the issuance of the metropolitan planning regulations, the study employed many features promoted in the regulation. This study was highly political in nature and enjoyed much input from regional transportation professionals. They felt it was necessary to go beyond the current federal requirements, and included issues that were not at the forefront of past regulations, but that are cornerstones of an MIS today. This comprehensiveness is evident in most of the following areas of transportation impacts analysis and concern:

- goods movement potential;
- potential to enhance airport access;
- enhances systemwide performance;
- serves economic growth; and,
- transportation control measures performance.

These areas evaluated each alternative's potential to the region in all its mobility needs, to serve as the 'missing link" in a regional transportation network, and as a cursory measure of how well and to what degree each alternative would attain the objectives articulated in adopted TCMs which sought to reduce VMT, trips, and congestion while improving transit ridership. Since the study was preliminary in nature, the level of detail of the transportation and travel analysis was not sufficient to provide a comprehensive TCM evaluation, nor was it comparable to the level of detail of the other two studies. However, through the use of the regional travel forecasting model, the analysis was able to quantify corridor-level travel criteria like increased transit ridership, reduced VMT and travel times, which are indicators of TCM performance. Estimates of transit ridership are summarized in Table 4-4. For the context of this study the analysis went well beyond the needed requirements, but fell short of the level of detail required by NEPA for a major federal investment, an MIS, or the other two studies.

ENVIRONMENTAL IMPACTS		NO BUILD		LANE CONVERSION		LANE CONVERSION PLUS LRT		DIAMOND LANES							
								BASE INTERCHANGE DESIGN		STACKED MAINLINES AT CROSSTOWN		BASE AT CROSSTOWN; OVERLAPPING DIAMONDS AT I-494		STACKED AT CROSSTOWN; OVERLAPPING DIAMONDS AT I-494	
TRANSPORTATION		MN RIVER	LAKE ST.[a]	MN RIVER	LAKE ST.	MN RIVER	LAKE ST.	MN RIVER	LAKE ST.	MN RIVER	LAKE ST.	MN RIVER	LAKE ST.	MN RIVER	LAKE ST.
	Total People Carried (2010 Peak Hour Peak Direction)	6,300	13,500	9,000	14,700	8,800	15,000	11,300	16,800	11,300	16,800	11,300	16,800	11,300	16,800
	Transit Riders (Bus + LRT) (2010 Peak Hour Peak Direction)	600	3,400	1,300	3,800	1,100	4,200	1,200	3,700	1,200	3,700	1,200	3,700	1,200	3,700
	People in Car Pools (2010 Peak Hour Peak Direction):														
	In Mixed Lanes	2,500	3,200	2,000	2,300	2,000	2,300	2,700	2,800	2,700	2,800	2,700	2,800	2,700	2,800
	In Diamond Lanes	0	0	2,200	2,900	2,200	2,800	2,200	2,700	2,200	2,700	2,200	2,700	2,200	2,700
	Auto Occupancy (Persons per auto)[b]	1.30	1.20	1.38	1.30	1.38	1.30	1.33	1.27	1.33	1.27	1.33	1.27	1.33	1.27
	Vehicles diverted to local streets	4,300	3,400	2,200	2,400	2,300	2,100	300	700	300	700	300	700	300	700
	Accidents (2010 total annual)[c]	3,770		2,830		2,830		2,100		2,100		2,100		2,100	
	Highway Access Points	173		125		167		152		170		136		154	
	Impacts on Frontage Roads	No Change		Minor Impact		Minor Impact		Minor Impact		Minor Impact		Moderate Impact		Moderate Impact	
	Number of park-and-ride spaces provided	0		505		1,990		505		505		505		505	
SOCIO-ECONOMIC	Community Services/Facilities (Number acquired)	0		5		5		5		5		7		5	
	Employment (Number of employees displaced)	0		405		910		975		975		940		940	
	Property Taxes Lost	$0		$1.2 million		$2.2 million		$2.2 million		$2.4 million		$2.4 million		$2.4 million	
	Visual Setting (Impacts on neighbors)[d]	No change		Moderate change from existing		Moderate change from existing		Moderate change from existing		Substantial change from existing		Substantial change from existing		Substantial change from existing	
LAND USE, ACQUISITION, RELOCATION	Existing Land Uses	Not consistent with local plans		Consistent with local plans		Consistent with local plans		Consistent with local plans		Consistent with local plans		Consistent with local plans		Consistent with local plans	
	Parkland Acquired (Acres)	0.0		0.0		0.0		0.0		0.6		0.3		0.9	
	Historic Resources (Number of properties acquired)	0		1		1		1, partial of 1		1		1		1	
	Dwelling Units (Number acquired)	0		755		1,045		1,325		1,265		1,335		1,275	
	Commercial Properties (Number acquired, includes businesses and vacant commercial properties)[e]	0		30		70		70		65		65		65	
PHYSICAL ENVIRONMENT	Air Quality	Within state standards		Within state standards		Within state standards		Within state standards		Within state standards		Within state standards		Within state standards	
	Noise:														
	Number of dwelling units above 70 dB(A)[f]	680		780		805		715		810		660		755	
	Number of dwelling units for which noise walls cannot be built	680		495		490		420		480		365		425	
	Water Quality	No change		Improved over existing		Improved over existing		Improved over existing		Improved over existing		Improved over existing		Improved over existing	
	Potentially Contaminated Sites (Number of acquired properties)	None		20		32		37		35		35		33	
NATURAL ENVIRONMENT	Wetlands (Number of acres of encroachment)	0.0		8.4		11.7		13.6		15.1		13.6		15.1	
	Floodplains	No change		No encroachment		No encroachment		No encroachment		Minor encroachment		No encroachment		Minor encroachment	
	Lakes and Rivers	No change		No impact		Potential at MN River		No impact		No impact		No impact		No impact	
COST	Construction Cost	$235 million		$653 million		$971 million		$830 million		$891 million		$866 million		$927 million	
	Right-of-Way Cost	$0		$32 million		$63 million		$77 million		$76 million		$76 million		$74 million	
	Transit Operating and Maintenance Cost (Annual)	$36 million		$41 million		$46 million		$41 million		$41 million		$41 million		$41 million	
	Cost to mitigate impacts on local streets[g]	$97 million		$45 million		$50 million		$21 million		$21 million		$21 million		$21 million	

(a) P.M. peak load points are at the Minnesota River and Lake Street.
(b) Includes mixed traffic and high occupancy vehicle lanes.
(c) Includes mainline accidents and accidents involving vehicles diverted from I-35W.
(d) Will be mitigated through noise walls and landscaping.
(e) Includes properties required for transit stations and park-and-ride lots.
(f) Assumes existing abatement. Future abatement for Build Alternatives would mitigate most noise impacts.
(g) Costs provided by cities; costs do not include a new river crossing at the Minnesota River or river crossing approach work.

ENVIRONMENTAL IMPACTS		NO BUILD		LRT IN I-35W MEDIAN								LRT ON SOO LINE RR			
				BASE INTERCHANGE DESIGN		STACKED MAINLINES AT CROSSTOWN; BASE INTERCHANGE DESIGN AT I-494		BASE AT CROSSTOWN; OVERLAPPING DIAMONDS AT I-494		STACKED AT CROSSTOWN; OVERLAPPING DIAMONDS AT I-494		BASE INTERCHANGE DESIGN		STACKED MAINLINES AT CROSSTOWN	
		MN RIVER	LAKE ST.[a]	MN RIVER	LAKE ST.	MN RIVER	LAKE ST.	MN RIVER	LAKE ST.	MN RIVER	LAKE ST.	MN RIVER	LAKE ST.	MN RIVER	LAKE ST.
TRANSPORTATION	Total People Carried (2010 Peak Hour Peak Direction)	6,300	13,500	9,300	15,100	9,300	15,100	9,300	15,100	9,300	15,100	9,300	15,100	9,300	15,100
	Transit Riders (Bus + LRT) (2010 Peak Hour Peak Direction)	600	3,400	1,100	4,200	1,100	4,200	1,100	4,200	1,100	4,200	1,100	4,200	1,100	4,200
	People in Car Pools (2010 Peak Hour Peak Direction):														
	In Mixed Lanes	2,500	3,200	3,300	3,400	3,300	3,400	3,300	3,400	3,300	3,400	3,300	3,400	3,300	3,400
	In Diamond Lanes	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Auto Occupancy (Persons per auto)[b]	1.30	1.20	1.28	1.24	1.28	1.24	1.28	1.24	1.28	1.24	1.28	1.24	1.28	1.24
	Vehicles Diverted to Local Streets	4,300	3,400	1,900	2,300	1,900	2,300	1,900	2,300	1,900	2,300	1,900	2,300	1,900	2,300
	Accidents (2010 total annual)[c]	3,770		2,520		2,520		2,520		2,520		2,520		2,520	
	Highway Access Points	173		155		173		139		157		155		173	
	Impacts onFrontage Roads	No change		Minor impact		Minor impact		Moderate impact		Moderate impact		Minor impact		Minor impact	
	Number of park-and-ride spaces provided	0		2,035		1,840		2,035		1,840		1,920		1,920	
SOCIO-ECONOMIC	Community Services/Facilities (Number acquired)	0		6		5		7		5		5		4	
	Businesses/Employment (Number of employees displaced)	0		1,105		965		1,055		915		1,125		1,125	
	Property Taxes	$0		$2.8 million		$2.6 million		$2.7 million		$2.5 million		$3.0 million		$3.0 million	
	Visual Setting (Impacts on neighbors)[d]	No change		Moderate change from existing		Substantial change from existing		Substantial change from existing		Substantial change from existing		Moderate change from existing		Substantial change from existing	
LAND USE, ACQUISITION, RELOCATION	Existing Land Uses	Not consistent with local plans		Consistent with local plans		Consistent with local plans		Consistent with local plans		Consistent with local plans		Consistent with local plans		Consistent with local plans	
	Parkland Acquired (Acres)	0.0		0.5		0.4		0.3		0.7		0.0		0.0	
	Historic Resources (Number of properties acquired)	0		1		1		1		1		1		1	
	Dwelling Units (Number acquired)	0		1,300		1,230		1,305		1,230		1,305		1,335	
	Commercial Properties (Number acquired, includes businesses and vacant commercial properties)[e]	0		75		70		70		65		75		75	
PHYSICAL ENVIRONMENT	Air Quality	Within state standards		Within state standards		Within state standards		Within state standards		Within state standards		Within state standards		Within state standards	
	Noise:														
	Number of dwelling units above 70 dB(A)[f]	680		660		740		605		685		640		730	
	Number of dwelling units for which noise walls cannot be built	680		345		410		300		365		355		405	
	Water Quality	No change		Improved over existing		Improved over existing		Improved over existing		Improved over existing		Improved over existing		Improved over existing	
	Potentially contaminated sites (Number of acquired properties)	None		36		33		32		29		42		42	
NATURAL ENVIRONMENT	Wetlands (Number of acres of encroachment)	0.0		13.0		14.4		13.0		14.4		13.0		14.4	
	Floodplains	No change		No encroachment		Minor encroachment		No encroachment		Minor encroachment		No encroachment		Minor encroachment	
	Lakes and Rivers	No change		Potential impact at MN River		Potential impact at MN River		Potential impact at MN River		Potential impact at MN River		Potential impact at MN River		Potential impact at MN River	
COST	Construction Cost	$235 million		$990 million		$1,059 million		$1,011 million		$1,080 million		$968 million		$1,011 million	
	Right-of-Way Cost	$0		$83 million		$78 million		$82 million		$77 million		$86 million		$88 million	
	Transit Operating and Maintenance Cost (Annual)	$36 million		$46 million		$46 million		$46 million		$46 million		$46 million		$46 million	
	Cost to mitigate impacts on local streets[g]	$97 million		$39 million		$39 million		$39 million		$39 million		$39 million		$39 million	

(a) P.M. peak load points are at the Minnesota River and Lake Street.
(b) Includes mixed traffic and high occupancy vehicle lanes.
(c) Includes mainline accidents and accidents involving vehicles diverted from I-35W.
(d) Will be mitigated through noise walls and landscaping.
(e) Includes properties required for transit stations and park-and-ride lots.
(f) Assumes existing abatement. Future abatement for Build Alternatives would mitigate most noise impacts.
(g) Costs provided by cities; costs do not include a new river crossing at the Minnesota River or river crossing approach work.

I-35W Preliminary Design Studies Phase 2: EIS

SRF

SUMMARY OF STUDY AREA IMPACTS

Figure S-3 (b)

Minnesota Department of Transportation - Metropolitan Council - Federal Highway Administration

TABLE 4-4
TRANSBAY TRANSIT PATRONAGE
Total Daily Trips

	Existing	RTP Blend	Alt 1 RTP Blend + Ferry	Alt 4 RTP Blend + New Bridge w/BART	Alt 6 RTP Blend + Airport/ Airport BART	Alt 8 RTP Blend + Dual Transbay Tube	Alt 11 RTP Blend + Rail Tunnel
Existing BART Tube	102,000	163,126	159,911	152,954	158,175	163,126	159,561
New BART Crossing/Rail Tunnel				12,785	16,132	2,738	6,265
ST: BART/RAIL SERVICE	102,000	163,126	159,911	165,739	174,307	165,864	165,826
Bay Bridge Bus	18,600	14,955	13,961	14,618	14,946	15,073	13,834
Hayward-San Mateo Bus	200	1,843	1,735	1,324	722	1,743	1,700
ST: BUS SERVICE	18,800	16,798	15,696	15,942	15,668	16,816	15,534
San Leandro-SF Ferry			marginal				
Alameda/Oakland-SF Ferry	700	775	919	866	912	893	860
Bay Farm Island-SF Ferry			911				
Berkeley-SF Ferry		108	482	126	128	128	126
Richmond-SF Ferry		707	1,074	798	839	839	727
Rodeo-SF Ferry			2,076				
Vallejo-SF Ferry	500	1,855	2,061	1,637	1,720	1,721	1,720
Martinez-SF Ferry			180				
Benicia-SF Ferry			434				
Oakland-Marin Ferry		185	20	20	20	20	20
Oakland Airport - SF Airport Ferry			43				
San Leandro-Oyster Point Ferry			24				
San Leandro-Coyote Point Ferry			132				
San Leandro-Redwood City Ferry			145				
ST: FERRY SERVICE	1,200	3,630	8,501	3,447	3,619	3,601	3,453
TOTAL TRANSIT PATRONAGE	122,000	183,554	184,108	185,128	193,594	186,281	184,813
INCREASE OVER RTP BLEND	n/a	n/a	554	1,574	10,040	2,727	1,259

Estimation of Socioeconomic and Environmental Impacts

As ISTEA and the metropolitan planning regulations call for a comprehensive analysis of the impacts from transportation infrastructure investments, a wide range of impacts including all pertinent social, economic, and environmental issues should be considered as part of the analysis and evaluation of investment strategies. Many of these concerns, such as community impacts, are major concerns raised as part of the public involvement process.

The *I-15/State Street Corridor DEIS* is consistent with the MIS principles as it considered the impacts to the natural as well as manmade environments. Impacts of the project that were examined included:

- geologic hazards;
- air quality impacts;
- noise and vibration impacts;
- agricultural soil impacts;
- surface water quality impacts;
- floodplain impacts;
- wetland impacts;
- vegetation/wildlife impacts;
- hazardous waste site review;
- energy conservation;
- park and recreational area impacts;
- community impacts; and,
- historical, architectural and archaeological resources.

Emphasis was placed on the air quality analysis since Salt Lake County has been designated a non-attainment area for particulates, ozone, and carbon monoxide by the US Environmental Protection Agency (EPA). Additionally, the study included a Section 4(F) resource evaluation as part of the DEIS, locating seven properties listed as historic and eligible for inclusion on the National Register of Historic Places (NRHP) that could be affected by the alternatives.

Additional analysis was performed on the socioeconomic and overall urban environments, both during construction and operational phases of each of the alternatives.

Socioeconomic impacts analyzed included:

- population, land use, and general economic impacts;
- economic impacts to specific neighborhoods;
- community service impacts; and,
- visual impacts.

The analysis of construction-related impacts focused on noise and vibration impacts as well as other impacts and measures like disruptions and street closures, that would only have significance during construction.

Like the *I-15/State Street Corridor* example, the *I-35W case* also included an evaluation of the manmade and natural environmental impacts although it did not discuss the extent of conditions and issues found in the *I-15/State Street Corridor study.* Environmental issues included:

- air quality impacts;
- noise impacts;
- water quality impacts; and,
- potential impacts upon contaminated sites on the Superfund list;
- wetland impacts;
- floodplain impacts;
- threatened and endangered species impacts;
- community impacts; and,
- wild and scenic river impacts.

As was the case in the Salt Lake City example, the Twin Cities was also designated a non-attainment area, therefore the air quality impacts of each alternative had to be analyzed for their impact on regional air quality in terms of carbon dioxide, ozone, lead, and particulates. The analysis in this case also included a subsequent conformity determination for each alternative as well.

The social and economic impacts section for the *I-35W Study* case focused on social equity issues of each alternative, focusing on which groups benefited and which groups bore the burdens of each alternative. The analysis considered neighborhood impacts, including property acquisition consequences and socioeconomic characteristics of the affected property owners and community facilities which may be affected or relocated. It also considered the effect the alternatives would have on property taxes, land use, and local land-use plans.

The *Bay Crossing* example was also very comprehensive in its approach to environmental impacts. While not a NEPA document, it employed a different approach than the other two studies. Examining the natural and physical environmental effects, the *Bay Crossing Study* broke the analysis down into three sections: environmental, socioeconomic and growth inducing impact categories. While covering generally the same issues as the other two studies, the *San Francisco Bay Crossing Study* used a customized format that examined many issues pertinent to its specific geographic area, although in a somewhat less detailed manner.

In the environmental section, the focus was on the natural as well as the manmade environment, with impacts being analyzed in the following categories:

- ecology impacts;
- wetland impacts;

- geology impacts;
- dredging and water quality impacts;
- noise and vibration impacts; and,
- air quality impacts.

The socioeconomic section focused on physical impacts and primarily concentrated on evaluating each alternative relative to its compatibility with regional and local plans, including those aimed at historic preservation and protection, as well as zoning and land-use plans. Figure 5-1 illustrates the projected impacts associated with the Bay Crossing project. It also included measuring land use impacts on the visual environment, and construction impacts as well. Figure 5-2 illustrates the projected impacts to land use associated with the Bay Crossing project. The final section discussed the growth-inducing impacts associated with each of the five alternatives. It also modeled the differing land use and density scenarios, paying close attention to the increased mobility and capacity consequences each alternative would have on the corridor as well as development patterns that may induce urban sprawl.

The *San Francisco Bay Crossing Study* seems less comprehensive in its approach to the environmental impacts as typically included in NEPA documents and MISs. It is less detailed than the other two studies, but has detailed analysis in the unique and specific areas it does examine. As a whole, the environmental section was tailored specifically to address concerns raised by local environmental groups which would not be found in other studies across the country. Preserving and protecting the natural and physical assets of the San Francisco Bay Area was of great concern. Articulated in that concern and manifested in the study, was a strong desire to preserve and protect the integrity of San Francisco Bay as one of the nation's major estuaries and to fully evaluate the potential negative consequences, especially ones associated with tunneling alternatives, that would affect the local preservation and protection efforts for both the bay and neighborhoods near shore. Impacts on neighborhoods was not fully detailed however, although it was mentioned in the document as a concern of local citizens and leaders. Given the preliminary nature of the study, the level of detail seems appropriate, although it would clearly not meet NEPA expectations.

In the *San Francisco Bay Crossing Study* case, much of the estimation of social and economic impacts is integral to the analysis. Since the entire study was tailored specifically to meet a very special yet complex need of improving transbay mobility, the study was carried out with specific estimation measures in mind. Much of the analysis done in this particular case would not be included in more traditional transportation infrastructure studies, including broad socioeconomic, growth inducing and land use impacts not typically found in other studies. In this respect, it exemplifies the manner in which these type of issues can be included in an MIS.

Financial Analysis

The MIS principles outlined in Chapter 2 suggest that each study incorporate financial analysis as appropriate. This is especially important given the financial constraint requirements that are in place for long-range regional transportation plans and for regional and state Transportation Improvement Programs (TIPs). The financial analysis

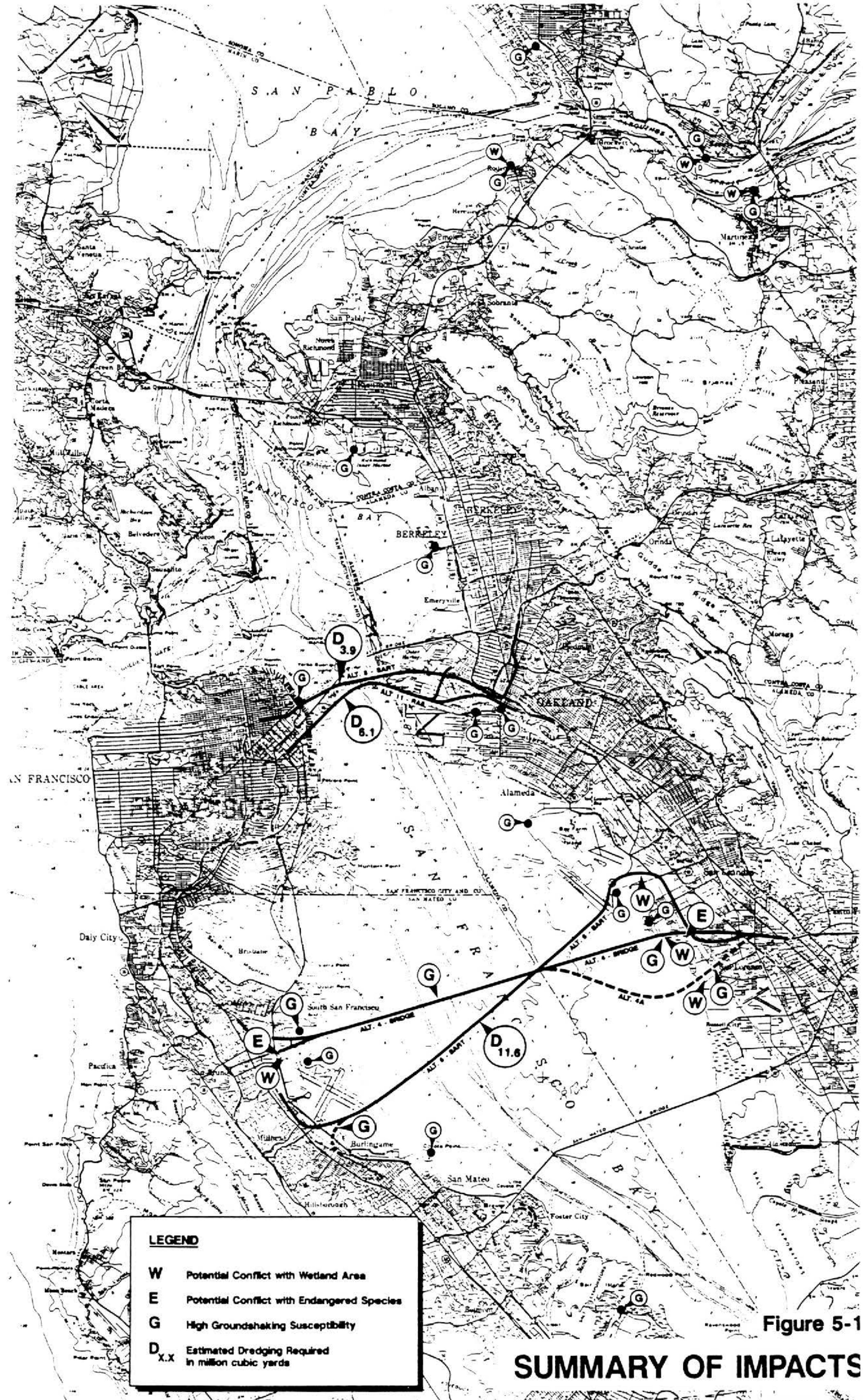


Figure 5-1

SUMMARY OF IMPACTS

Figure 5-2

SUMMARY OF LAND USE IMPACTS

should indicate whether or not sufficient resources are available to meet both capital and operating costs of each of the alternatives. Where necessary, funding options should also be evaluated so that necessary policy decisions regarding new revenue sources can be addressed earlier.

The *I-15/State Street Corridor DEIS* example was very detailed in its assessment of the financial feasibility of the study alternatives. It is the most comprehensive of the three case studies in terms of financial analysis as it was considering the use of discretionary federal funding sources.

The financial analysis for the *I-15/State Street Corridor Study* had three clearly defined objectives:

- establish the degree to which future public financial resources can meet future requirements of a major capital investment for transportation improvements, and the on-going operation, maintenance, and replacement costs of the transportation system as a whole;

- develop and analyze transportation investment options that are comparable among the alternatives; and,

- provide decision makers with a clear understanding of the financial ramifications associated with each of the alternatives under study.

For each of the alternatives, the following information was compiled:

- capital costs (including bus replacement costs);
- operations and maintenance costs;
- highway revenue sources;
- transit revenue sources;
- highway capital shortfall;
- transit capital shortfall; and,
- transit operations and maintenance costs shortfall.

The *I-15/State Street Corridor AA/DEIS* also identified potential additional sources of revenue and financing options for each alternative that could be fully developed to meet the capital and operating requirements. These potential revenue sources are summarized in Table 6.11. Table 6.10 summarizes the actions required to establish the potential revenue sources.

The *I-35W DEIS*, however, does not include an extensive financial analysis on a scale comparable to analysis found in the *I-15/State Street Corridor Study* example previously mentioned. Minnesota Department of Transportation officials point out that, at the time the study was performed, the project was not in the TIP and was not readily fundable. While there were some possible sources of funding, there was no established funding. Recognizing that there were many transportation needs throughout the region and state, it was unlikely that the state would have committed

TABLE 6.11

POTENTIAL REVENUE SOURCES: DISTRIBUTION AND EQUITY ISSUES

Source	Distribution	Equity Issues
• Statewide Gas Tax Increase	• Applied statewide. • Revenues would be available for highway improvements statewide, including I-5 Corridor. • Five percent of revenues reserved for I-15. Analysis assumes 12% of revenues reserved for statewide administrative expenses; with 75% of balance for state highways +25% for cities and counties (B+C fund). Of the 75%, 40% allocated for state highways in Salt Lake County. Twenty percent of County's funds for state highways applied to I-15.	• Applied on uniform basis statewide. • User-based approach with those who travel paying for improvements in proportion to use of of the system. • Assuming propensity to travel increases with income, gas tax increase would be progressive tax.
• Local Option Gas Tax Increase	• Applied in Salt Lake County. • Revenues would be available for highway improvements countywide, including I-15 Corridor. • One-third of revenues assumed reserved for I-15.	• Application within County only could potentially result in some migration of sales to bordering counties. • User-based approach with those who travel paying in proportion to use of the system. • Assuming propensity to travel increases with income, would be progressive tax.
• Extend Sales Tax to Motor fuels	• Applied statewide. • Revenues would be available for highway and transit improvements statewide, including City and County projects. • Forty percent of statewide total assumed for use in project study area (Salt Lake County/South Davis County), of which 66% used for I-15 Corridor (50% for I-15 and 50% for transit). Remaining 33% available for other projects.	• Applied on uniform basis statewide. • Could result in some migration of sales to bordering states. • Net effect is to increase price of motor fuels, similar to tax increase. • Could be perceived as a tax upon a tax, since sales tax would be applied on an existing gallonage tax. • User-based approach. • Progressive tax, with payment increasing with income.
• Increase Property Tax in Salt Lake	• Applied in Salt Lake County. • Revenues would be available for transit improvements within I-15 Corridor.	• Would result in increased property taxes (equivalent to .04% increase) in Salt Lake County. • Assumes benefits of transit improvements with I-15 Corridor project study area would apply uniformly across Salt Lake County. • Other counties receiving benefit from I-15 Corridor transit improvements would not share in cost. • Property taxation generally considered regressive, with lower income property owners paying a higher percentage of income in taxes.

TABLE 6.11 (Continued)

POTENTIAL REVENUE SOURCES: DISTRIBUTION AND EQUITY ISSUES

Source	Distribution	Equity Issues
• Local Option Sales	• Applied in Salt Lake County and Davis County (southern portion). • Revenues would be available for transit improvements within I-15 Corridor.	• Application within two counties could result in some migration of sales to bordering counties. • Potential regressivity reduced by fact that current sales tax exempts federal food stamp purchases and prescription medicines. • Out-of-county benefits accruing would be partially recouped through sales taxes on purchases made by employees and visitors, regardless of place of residence.
• Payroll Tax	• Applied in Salt Lake County. • Revenues would be available for highway and transit improvement countywide, including I-15 Corridor. • Assumes 66% of revenues for I-15 Corridor, of which 50% for highway and 50% for transit.	• Application of .6% payroll tax within County only could potentially result in some migration of employment to bordering counties. • Assumes countywide employment/commuters benefit from improvements regardless of place of residence.
• Local/Private Participation in Interchanges and Stations	• Fifty percent of cost of stations and new interchanges, and 25% of cost of improvements to existing interchanges would be paid by local governments, private sector, or combination thereof.	• Assumes portion of benefits of improvements accrue to local governments and/or to properties within proximity (.4-mile range assumed). • If collected through benefit assessment, would likely require analysis of relationship of the assessment to the relative benefit received.

TABLE 6.10

I-15/STATE STREET CORRIDOR
ALTERNATIVES ANALYSIS AND ENVIRONMENTAL STUDY

ACTIONS REQUIRED TO ESTABLISH POTENTIAL
REVENUE SOURCES

Source	Legislation	Action Required Constitutional Amendment	Voter Approval	Comments
• Statewide Gas Tax Increase	Yes			Current legislation modified in 1986 sets tax at 19¢ per gallon.
• Local Option Gas Tax Increase	Yes	Yes if for highway and transit	Yes	Enabling legislation required. Implementation at local level would likely require majority approval by political bodies and/or voter approval. If proposed to fund highway and transit, would require amending Article XIII of State Constitution.
• Extend Sales Tax to Motor Fuel	Yes	Yes		If proposed to fund highway and transit, could potentially require amending Article XIII of State Constitution.
• Increase Property Tax			Yes	Under the Utah Public Transit District Act (Chapter 20 of the Utah Code), counties in the district may levy a property tax not to exceed two mills by obtaining majority voter approval.
• Local Option Sales Tax	Yes		Yes	To increase local option tax for transit in Salt Lake County would require legislation modifying the current cap of 1/4% in the Utah Public Transit District Act. To implement locally, tax then subject to voter approval. New legislation and voter approval would also be required to fund a defined multimodal program.
• Payroll Tax	Yes		Yes	Enabling legislation and voter approval required.
• Local/Private Participation: Interchanges				Modification required to existing state policy regarding Local Agency participation in funding of interchanges. Utah Municipal Improvement District Act (assessments) and Utah Neighborhood Development Act (tax increment financing) allow for creation of special financing districts, subject to certain conditions.
• Local/Private Participation: Stations	Yes - if UTA to be empowered			Current law enables "communities" and "municipalities" to create special financing districts for individual (station area) projects, subject to certain conditions. Creation of districts requires absence of protest by a majority of the land owners or resident population, but not voter approval. To centralize and/or transfer responsibility to UTA would require additional legislation.

such a large proportion of available resources to one very large project, but the department did ask the legislature to consider a strategy for funding such large projects.

While financial constraints were not a major part of the *I-35W DEIS*, the project team did consider financial feasibility in evaluating some potential alternatives early into the analysis process. This is evident by the fact that the alternative that produced the highest vehicle capacity-improving alternative was eliminated because of the excessive right-of-way cost requirements that would be necessary to operate that alternative.

The *San Francisco Bay Crossing Study* provides a financial analysis for each of the five build alternatives, although only on a preliminary basis. The development of capital and operating cost estimates and the financial analysis were performed in a comprehensive manner. The cost estimates consist of a preliminary evaluation and assessment of capital and operating cost factors. These factors were derived from information taken from various reports and bids for comparable transportation projects in the area and on the West Coast in general. These cost factors were used as unit costs or ranges of unit costs for all modes across the categories of: civil/structural, trackwork, rail station facilities and ferry facilities for capital costs, and costs per revenue hour per vehicle, boat and per train for operating costs. These unit cost factors were used to develop preliminary cost estimates for each alternative based on operating assumptions and demand for travel within that mode. Table 6-1 summarizes the capital costs associated with each alternative. The financial analysis also included a section that examined financial feasibility focusing on toll financing mechanisms, break-even analysis, and the potential for privatization. Differing toll scenarios, including toll and fare elasticities, were tested in an iterative model. Cost-effectiveness was also analyzed to determine if needed infrastructure could be justified and supported through already financially constrained plans or added sources of funding. This analysis was geared to meet the needs of the MTC and the requirement of SCR-20.

Focus on San Francisco Bay Crossing Case

Estimation of Impacts Process

Analysis of Case Relative to MIS Principles

The value and importance of a comprehensive estimation of impacts has already been discussed. This section will discuss the performance of the *San Francisco Bay Crossing Study* example with each of the MIS principles for the estimation of impacts found in Chapter 2.

ISTEA reemphasized the need for a broad examination of mobility impacts, freight movements, social and environmental impacts, safety and operating efficiencies, land use, economic development, and capital and operating costs, as well as financing and energy consumption impacts. It has been mentioned before, but it is worth repeating again, that SCR-20 laid the guiding principles and issues that this study was to follow

TABLE 6-1
SUMMARY OF CAPITAL COSTS

Alternative	Description	Total Capital Cost Range
1	High-Speed Ferry	$570 - 915 million
1, Revised	**High-Speed Ferry (six routes)**	**$177 - 314 million**
4	Interstate 380 to 238 Bridge BART Costs Highway & Bridge Costs Right-of-Way Costs	**$2,770 - 3,391 million** **($822 - 1,106 million)** **($1,521 - 1,858 million)** ($427 million)
4, Revised	**Phase I: Bridge (four-lanes)[1]** **Phase II: Bridge & BART**	**$1,281 - 1,485 million** **$1,878 - 2,304 million**
6	BART Airport Connection	$3,432 - 3,943 million
8	BART Transbay Tube Connection	$2,169 - 2,594 million
11	Inter-City Railroad Connection	$1,518 - 1,601 million

[1] The costs for Alternative 4, Revised (Interstate 380 to 238 Bridge) do not include $130 - $160 million for a pedestrian/bicycle facility on the bridge. The inclusion of these costs would result in a total Phase I cost of $1,411 - $1,645 million and a total Phase II cost of $2,008 - $2,464 million.

and undertake. It is no accident that the legislature charged the MTC to enumerate environmental issues, albeit on a preliminary basis. On the surface this may seem cursory, but the level of detail addressed the needs of the study. In some instances, the environmental analysis was undertaken as a 'fatal flaw" analysis with regard to certain environmental considerations.

It is also worthwhile to note again the various land use and transportation scenarios that were modeled to determine the effects of a new bridge crossing. Concern had been expressed in the early stages of the study that increased or improved mobility might lead to increased sprawl because of growth inducing impacts. For this reason, one of the scenarios examined was one that assumed a new crossing, but predicated new growth on the notion that sprawl would be almost eliminated by channeling the new growth toward infill areas. Since the study of another Bay Crossing facility is/was a politically, socially, economically, and environmentally sensitive issue, the California Legislature structured SCR-20 to ensure that some issues and concerns of stakeholders, interest groups, and the public at large, were adequately addressed in the study. Once again, the legislature charged that the study pay appropriate attention to certain issues. These issues and aspects were mandated by law and more than satisfied the scope of the first MIS principle.

This study utilized a state-of-the-art regional travel forecasting tool and applied it to the different alternatives with various operating assumptions, including toll and fare sensitivities built into the model. The analysis evaluated the effects of each alternative at the corridor level. It took into account various density, settlement and land use scenarios, even going so far as to include an 'Infill development scenario". The model also examined the effect of each alternative on central components of the entire network, be they of different or similar modes to the alternative under study. This aspect of the *San Francisco Bay Crossing Study* case also adequately satisfied the requirement of the MIS principles for demand forecasting, although it did not examine results or consequences on a regionwide basis.

The MIS principles also indicate a need to undertake analysis of other impacts that may be appropriate depending upon the situation or context in which the study occurs. The impact areas of importance should be identified early on, as is the case with the San Francisco example, and be developed through consultation and collaboration with interested parties. By having a piece of state legislation as the impetus for the study, this example all but guaranteed meeting these criteria. Certainly SCR-20 pointed to specific issues that could only be addressed by a study of this nature in a context as unique as the San Francisco Bay Area. By employing many different and often competing interest groups on various technical and advisory committees, the study assured the consultative and collaborative aspects of the study.

Financially, the principles point toward the importance of this aspect of analysis given the constraints put on transportation infrastructure projects and plans. This principle address the fact that funding sources should be analyzed and explored for each of the alternatives. This study adequately addresses that principle. Funding options through increased tolls and even privatization were explored, though cost estimates and analysis were not developed at a level of detail expected in an MIS.

In terms of air quality impacts, the MIS principles recognize the significance of regional air quality and the determination of conformity for each alternative. Although addressing air quality, the study failed to point out the regional benefit or specific significance of each alternative. Specific air quality issues like conformity were not addressed in the study because of the level of detail, or lack thereof, and the corridor-specific nature of the impacts.

ISTEA emphasizes the role of land use in transportation planning. The *San Francisco Bay Crossing Study* example modeled different land use and density scenarios, including an "infill" scenario via the travel demand forecasting model.

CHAPTER 6 EVALUATION OF ALTERNATIVES

Approach of Each Case

Development of Evaluation Measures

As noted in Chapter 2, the development of evaluation measures and the consistent application of those measures can be a very challenging element of an MIS. Factors, such as the multimodal scope of most studies, the various perspectives and interests of different study participants, and the local details of geography and recent experience with transportation, environmental and related issues typically figure into the process of criteria development. Consider the situations and approaches offered by the three cases, as follows:

The main concerns in the development of evaluation measures for the *I-15/State Street Corridor DEIS* included: a) meeting established planning goals and objectives on the local, regional, and federal levels; and b) incorporating the key findings of earlier analyses. A series of scoping meetings was held with representatives of interested citizen groups, the public at-large, governmental agencies, municipalities, and county representatives, to assist in developing the most appropriate and effective set of evaluation measures.

The evaluation measures are intended to provide the following information:

- assessments of the costs of the various alternatives;
- financial feasibility of the "build" alternatives;
- an evaluation of the alternatives based on how well they achieve local goals and objectives;
- an evaluation of the alternatives in terms of cost-effectiveness; and
- a trade-off analysis of the significant factors needed for decision making.

On the other hand, much of what constitutes the evaluative measures of the alternatives for the *San Francisco Bay Crossing Study* was mandated by the California Senate Concurrent Resolution No. 20 (SCR-20) legislation. SCR-20 identified certain topics that were to be addressed in the scope of the study. The broad coalition of participants integral to the project's design provided some degree of a collaborative process. The two topics that the legislation specifically pointed toward were environmental issues and cost-benefit analysis.

The set of evaluation measures was expanded to cover other areas of concern so that the evaluation could more adequately assess the cost-effectiveness and performance of each alternative. The study established an evaluation methodology and criteria that fairly evaluated all alternatives, regardless of mode. How well each alternative achieved goals and objectives and how well each compared to other alternatives was also scrutinized. It should be noted that the analysis was only performed on the final five 'build" alternatives selected for further study. The analysis focused on the

performance of these 'build" alternatives relative to the base case 'blend" (TSM) scenario.

Five key subjects areas were examined in the evaluative process. The subject areas represented a complete evaluation of each alternative's relative effect on system performance, its cost-effectiveness, financial feasibility, environmental and socioeconomic impacts, including equity issues, and cost factors. The evaluation in these five areas is further defined into subgroups to allow for more specialized analysis. This more detailed analysis was performed in order to help determine a qualitative ranking of each of the alternatives. Each of the five major subject areas above has an associated summary matrix, which helps explain the qualitative rankings within the subgroups.

The initial alternatives were more fully defined and analyzed to determine their appropriate ranking relative to the other alternatives. This step involved developing assumptions about alignments and operational issues that were used to estimate capital and operations and maintenance costs. Capital and operations and maintenance cost analyses were done on a level of detail that provided a range of costs using appropriate units of measures (lane-mile, passenger-hour, etc.). This allowed for relative, not absolute, comparisons among the alternatives.

The cost analysis section was primarily focused on capital financial issues and screened for 'fatal flaws" surrounding the cost-effectiveness and financial feasibility of the alternatives. Cost-recovery and pseudo cost effectiveness 'guestimates" were used to compare the alternatives. Toll financing and fare elasticities were some of the other subject areas considered in the financial analysis as well.

Next consider the approach taken in Minnesota. At the beginning of the scoping phase for the *I-35W DEIS*, a number of guidelines were adopted by the Project Advisory Board for the identification, evaluation, and screening of alternative improvements for I-35W. These guidelines were developed in order to shape the evaluation measures themselves, which, in turn, would shape the success or applicability of specific alternatives. The guidelines stipulated that the evaluation measures should help to promote alternatives that:

- focus on the existing I-35W location;
- are compatible with the metropolitan council's long-range transit plan;
- are compatible with the metropolitan council's long-range highway plan;
- account for TSM and TDM measures;
- support the corridor's function as a primary route for goods movement;
- encourage design compatibility with other regional highways in the area;
- can be constructed under existing traffic conditions;
- minimize adverse impacts on adjacent neighborhoods;
- promote the movement of people, not vehicles; and
- encourage public involvement and support throughout the evaluation process.

Established by the Project Advisory Board, these guidelines (goals) reflect the interests and concerns of the constituent agencies and parties that composed the board.

Presentation of Evaluation Information

The presentation of the alternatives evaluation should both inform the reader and provide information and choices for decision making. Another challenging aspect of alternatives evaluation is the manner in which results are presented. Much has been said of the importance of clarity and logic in the development of the problem statement, alternatives, and impact analyses; these same principles are equally applicable to the presentation and delivery of the evaluation. In Chapter 2, it was pointed out that the evaluation process for a major investment should be presented 'In a manner that is meaningful to local elected officials and the public." In order for information to be meaningful, it must be made relevant to the issues and decisions at hand. Since some members of the general public may not be familiar with some of the technical analysis involved in the evaluation process, making the decision process and the choices relevant and meaningful is key to effective presentation of the alternatives evaluation. Consider lessons offered in the three cases:

The *I-15/State Street Corridor DEIS* presented a comparative evaluation of the study alternatives and discusses trade-offs among them, featuring the following:

- assessments of the costs of the various alternatives, including capital costs and operations and maintenance costs;
- the financial feasibility of the "build" alternatives;
- an evaluation of the alternatives based on how well they achieve local goals and objectives;
- an evaluation of the alternatives in terms of costs-effectiveness; and
- a trade-off analysis of the significant factors needed for decision making.

Each of these measures was presented in a matrix, allowing easy comparison across alternatives. Table 7.1 summarizes the cost evaluation that was completed and Table 7.2 summarizes the effectiveness evaluation measures.

The trade-off analysis, in particular, was of interest because it attempted to balance benefits and costs/impacts associated with each of the highway and transit alternatives. The cost-effectiveness of the alternatives was measured with FTA's cost-effectiveness index in use at the time. FTA established the index to use in considering projects for discretionary funding of major transit capital investment projects. It is one of the measures that FTA uses to compare projects throughout the nation and identify those worthy of federal funding; it is also used by FTA to measure projects against thresholds established as a minimum criteria for advancing projects into planning, preliminary engineering, design, and construction phases. The index represents each alternative's cost per new passenger attracted; it is compared to the baseline, or TSM, alternative since that represents the most effective solution to transportation problems, short of construction of major new facilities. The cost-effectiveness index prepared for the *I-15/State Street* study is shown in Table 7.3.

TABLE 7.1

COMPARATIVE SUMMARY OF COST EVALUATION
(1987 $ Millions)

Alternative	Descriptions	Capital Cost			Equivalent Annual Capital Cost			Annual O&M Cost			Total Annualized Cost		
		I-15	Transit	Total	I-15	Transit	Total	I-15	Transit	Total	I-15	Transit	Total
1	No Build	$ 10.1	$ 26.9	$ 37.0	$ 1.2	$ 3.9	$ 5.1	$ 1.5	$ 27.9	$ 29.4	$ 2.7	$ 31.8	$ 34.5
2	TSM I-15 and TSM/ Best Bus	193.0	107.4	300.4	22.6	14.9	37.5	1.6	48.6	50.2	24.2	63.5	87.7
3	1 Lane and TSM/ Best Bus	359.1	107.4	466.5	42.0	14.9	56.9	1.9	48.6	50.5	43.9	63.5	107.4
4	2 Lanes and TSM/ Best Bus	448.1	107.4	555.5	52.4	14.9	67.3	2.1	48.6	50.7	54.5	63.5	118.0
5	1 Lane & Rev. HOV TSM/Best Bus	387.9	214.4	602.3	45.4	27.5	72.9	1.9	48.8	50.7	47.3	76.3	123.6
6	1 Lane & 2-Way HOV and TSM/Best Bus	389.3	241.0	630.3	45.5	30.7	76.2	1.9	48.8	50.7	47.4	79.5	126.9
7	TSM I-15 and UPRR LRT Loop	193.0	231.0	424.0	22.6	27.3	49.9	1.6	47.4	49.0	24.2	74.7	98.9
8	TSM I-15 and State/ Main LRT Loop	193.0	239.7	432.7	22.6	28.4	51.0	1.6	48.6	50.2	24.2	77.0	101.2
9	1 Lane & UPRR LRT Loop	359.1	231.0	590.1	42.0	27.3	69.3	1.9	47.4	49.3	43.9	74.7	118.6
10	1 Lane and State/ Main LRT Loop	359.1	239.7	598.8	42.0	28.4	70.4	1.9	48.6	50.5	43.9	77.0	120.9
11	2 Lanes and UPRR LRT Loop	448.1	231.0	679.1	52.4	27.3	79.7	2.1	47.4	49.5	54.5	74.7	129.2
12	2 Lanes and State/ Main LRT Loop	448.1	239.7	687.8	52.4	28.4	80.8	2.1	48.6	50.7	54.5	77.0	131.5

TABLE 7.2

SUMMARY OF EFFECTIVENESS EVALUATION MEASURES

YEAR 2010

Measure	1 No Build	2 2-Best Bus	3 Best Bus + 1 Lane	4 Best Bus + 2 Lanes	5 Rev. HOV
Reduce Highway Congestion					
Expected Traffic Conditions					
- 9000 South to 7200 South					
V/C Ratio	1.08	1.08	0.95	0.84	0.94
LOS	F	F	E	D	E
Speed (mph)	30	30	43	51	41
- 4500 South to 3300 South					
V/C Ratio	1.07	1.07	1.03	0.96	1.01
LOS	F	F	F	E	F
Speed (mph)	30	30	30	40	30
- 2100 South to 1300 South					
V/C Ratio	0.68	0.68	0.65	0.70	0.63
LOS	C	C	C	C	C
Speed (mph)	56	56	56	55	57
Miles of Congested Roadways					
- Total Miles	25.15	25.15	22.18	21.27	26.67
- I-15 Miles	10.88	10.88	9.35	9.06	13.47
Increase Transit Usage					
Total Daily Transit Trips	80,100	93,900	93,900	93,900	94,900
AM Peak Transit Guideway Riders	0	0	0	0	1,300
Daily Work Trips Diverted from Individual Automobile Use	0	8,360	8,360	8,460	8,900
Mode Split					
- Drive Alone	73.0%	72.5%	72.5%	72.5%	72.3%
- 2 Person Carpool	15.6%	15.5%	15.5%	15.5%	15.4%
- 3+ Carpool	6.4%	6.4%	6.4%	6.4%	6.7%
- Transit	4.7%	5.6%	5.6%	5.6%	5.6%
Provide Better Service					
Auto Travel Times (Minutes)[2]					
- Sandy to CBD	43	43	42	41	42(GP)/39(HOV)
- Sandy to South Salt Lake	31	31	31	30	31
- West Jordan to Fashion Place	15	15	13	13	13
Transit Travel Times (Minutes)[2]					
- Sandy to CBD	72	69	69	69	50
- Sandy to South Salt Lake	70	68	68	68	67
- West Jordan to Fashion Place	37	37	37	37	37
Daily Travel Time Savings (Hours					
- Highway	N/A	0	30,263	40,244	31,163 (GP) 365 (HOV)
- Transit	N/A	0	0	0	890
Average Minutes Saved/Trip					
- Highway	N/A	0	5.19	6.90	5.34
- Transit	N/A	0	0	0	0.56

[1] For comparison purposes, when differences occur, Alternative 9 Depot, Main and Loop termini are presented in Appendix C.

[2] Travel times are total unweighted times including access, egress, and wait time.

V/C Ratio = Traffic volume compared to roadway capacity.
LOS = See text.
Mode Split = The percentage of traffic using alternative modes.

TABLE 7.2(CONTINUED)

SUMMARY OF EFFECTIVENESS EVALUATION MEASURES

YEAR 2010

6 2-Way HOV	7 UPRR LRT Loop	8 State/Main LRT	9[1] UPRR LRT + 1 Lane (loop)	10 STATE/MAIN LRT + 1 Lane	11 UPRR LRT + 2 Lanes (loop)	12 STATE/MAIN LRT + 2 Lanes
0.94 E 41	1.08 F 30	1.08 F 30	0.95 E 43	0.95 F 43	0.84 D 51	0.84 D 51
1.10 F 30	1.07 F 30	1.07 F 30	1.03 F 30	1.03 F 30	0.96 E 40	0.96 E 40
0.63 C 57	0.68 C 56	0.68 C 56	0.65 C 56	0.65 C 56	0.70 C 55	0.70 C 55
26.67 13.47	23.87 10.88	29.22 10.88	22.18 9.35	26.59 9.35	21.57 9.06	25.13 9.06
94,900	98,100	94,700	98,100	94,700	98,100	94,700
2,030	4,000	3,300	4,000	3,300	4,000	3,300
8,900	10,700	8,700	10,700	8,700	10,700	8,700
72.3% 15.4% 6.7% 5.6%	72.2% 15.6% 6.4% 5.8%	72.4% 15.6% 6.4% 5.6%	72.2% 15.6% 6.4% 5.8%	72.4% 15.6% 6.4% 5.6%	72.2% 15.6% 6.4% 5.8%	72.4% 15.6% 6.4% 5.6%
42/39 31 13	43 31 15	43 31 15	42 31 13	42 31 13	41 30 13	41 30 13
50 67 37	53 40 42	60 34 37	53 40 42	60 34 37	53 40 42	60 34 37
31,604 (GP) 198 (HOV) 890	1,766 3,410	530 2,345	32,028 3,410	30,792 2,345	42,009 3,410	40,773 2,345
5.42 0.56	0.30 2.09	0.09 1.49	5.49 2.09	5.28 1.49	7.20 2.09	6.99 1.49

BLE 7.2(CONTINUED)

ECTIVENESS EVALUATION MEASURES

YEAR 2010

9 + 1 Lane	10 STATE/MAIN LRT + 1 Lane	11 UPRR LRT + 2 Lanes (loop)	12 STATE/MAIN LRT + 2 Lanes
0.95 E 43	0.95 F 43	0.84 D 51	0.84 D 51
1.03 F 30	1.03 F 30	0.96 E 40	0.96 E 40
0.65 C 56	0.65 C 56	0.70 C 55	0.70 C 55
22.18 9.35	26.59 9.35	21.57 9.06	25.13 9.06
98,100 4,000 10,700	94,700 3,300 8,100	98,100 4,000 10,700	94,700 3,300 8,700
72.2% 15.6% 6.4% 5.8%	72.4% 15.6% 6.4% 5.6%	72.2% 15.6% 6.4% 5.8%	72.4% 15.6% 6.4% 5.6%
42 31 13	42 31 13	41 30 13	41 30 13
53 40 42	60 34 37	53 40 42	60 34 37
32,028	30,792	42,009	40,773
3,410	2,345	3,410	2,345
5.49 2.09	5.28 1.49	7.20 2.09	6.99 1.49

+ 1 Lane	26.27							
9 LRT UP-Loop + 1 Lane	27.28	47.05	2.53	24.02	55.38			
10 LRT State/Main + 1 Lane	28.40	47.37	2.72	24.65	16.88			
11 LRT UP-Loop + 2 Lanes	27.28	48.59	1.88	24.67	7.03			
12 LRT State/Main + 2 Lanes	28.40	47.37	2.72	23.82	7.97			
		48.59	1.88	24.67	55.38			
				23.82	7.97			
					55.38			

In the *San Francisco Bay Crossing Study*, information obtained during the evaluation of the alternatives was presented in a series of tables. These tables listed the performance of the alternatives in each of the five key subject areas identified above.

Results of the evaluation of impacts were presented in a matrix format, with each matrix divided into a quantitative and qualitative section of evaluative criteria. Each alternative was rated as either 'high," 'moderate," or 'low," with the appropriate descriptive term (benefit, impact, or cost) following the rating in each category. This is illustrated in Figure 8-7.

No weightings were used in the evaluation so the performance of an alternative in one particular category is given equal value in all five categories. This allows for each decision-maker to apply their own implicit weighting to each evaluation criterion in assessing their individual determination of which alternative is "best."

Although the matrix format may be overly simplified by not presenting all the subtleties and nuances of the findings, the style of presentation made the information more meaningful and more easily understood by decision makers and others who were not necessarily versed in all the technical issues. Maps showing preliminary potential alignment as well as typical profiles were also provided for informational purposes.

As in the other cases, the presentation of alternatives evaluation in the *I-35W DEIS* was designed to make the decision process as transparent as possible, and to enable the reader (whether an elected official, a technician, or a concerned citizen) to discern *what* was decided and *how*. Recognizing the complexity of the case, the I-35W Project Management Team devised a process for evaluating transit and access alternatives in a logical method with adequate presentation graphics and features.

The team endeavored to break the process into discernible pieces and to illustrate the actions within each piece as well as possible. The preliminary evaluation and documentation of transit/highway alternatives was separated from that of access alternatives, and any hybrid alternatives (transit/highway and access) were to be done separately as well. A matrix illustrates the range of possible alternatives and the factors of evaluation that were to be applied to each. Concept graphics, maps, and illustrations were to be developed at specific points in the process.

An evaluation matrix was prepared for each alternative to include quantitative data or qualitative statements, with graphic notation of the relative importance of each factor, as determined by project staff. The alternatives and their evaluation were presented to the Project Advisory Board, then at public information meetings for additional input. Finally, the lead agencies involved in the project screened the alternatives based on the evaluation criteria, the advisory board's comments, and public input to recommend one specific alternative. This process served to break the evaluation exercise down

EVALUATION CRITERIA	ALT. 1 (Ferry)	ALT. 1 Revised (Ferry)	ALT. 4/4A (Bridge + BART)	ALT. 4/4A Revised (Phase I, Bridge)	ALT. 4/4A Revised (Phase II, Bridge + BART)	ALT. 6 (Airport BART Tube)	ALT. 8 (Dual BART Tube)	ALT. 11 (Rail Tunnel)
TRAVEL PERFORMANCE	☐		■			◒	☐	◒
ENVIRONMENTAL/ SOCIO-ECONOMIC IMPACT	☐		■			■	◒	◒
COST	◒	☐	■	☐	◒	■	■	◒
FINANCIAL FEASIBILITY	■	■	☐	■	◒	☐	◒	■
COST TO TRAVEL PERFORMANCE	◒	◒	◒	■	■	☐	☐	◒

LEGEND

- ☐ **Relatively Low**
- ◒ **Relatively Moderate**
- ■ **Relatively High**

Figure 8-7
SUMMARY EVALUATION

into easily handled pieces, and to illustrate the many steps that combine to make a complex decision.

Process of Alternatives Evaluation

The two previous sections (Development of Evaluation Measures, and Presentation of Evaluation Information) describe important factors in the overall alternatives evaluation process, but that process also involves other factors, such as methods of criteria application, methods for quantification or qualification, justification for the dismissal of external issues, and strategies for the sequence of the evaluation. Throughout the evaluation process, equity and fairness are the goals guiding the design and implementation of a process often used to compare and contrast similar, and sometimes dissimilar, issues. Consider the examples:

The decision makers in the Utah Transportation Commission and the Utah Transit Authority Board of Directors selected the locally preferred alternative. This alternative combines both highway and transit improvements and was discussed in the *Locally Preferred Alternative Report for the I-15/State Street Corridor Alternatives Analysis & Environmental Study*. The transit component includes expanded bus service, an east/west feeder bus system, and a light rail system along the Union Pacific Railroad (UPRR) right-of-way. The highway component includes a major capacity increase to I-15 – adding four general purpose travel lanes, two in each direction. Subsequent to the publication of the report, it was decided to provide two general purpose travel lanes and two HOV travel lanes instead. Initially, it was thought that HOV lanes and LRT service were mutually exclusive and that the trade-offs between the two were high. Analysis revealed that providing additional highway capacity did not seem to have a significant impact on projected transit ridership and the addition of LRT service did not reduce highway congestion significantly.

The decision makers used the evaluation measures described earlier to select the locally preferred alternative. Both boards agreed upon the specific transportation problems that precipitated the study as well as the need for a multi-modal solution. Their concerns were with the growth in travel, the resulting traffic congestion, and the problems of trying to meet the demand entirely by accommodating single occupant automobiles.

The locally preferred alternative was selected primarily because of its effectiveness in meeting the mobility needs of the corridor. It provides the best overall highway levels of service and the shortest duration that the facility would be operating under congested conditions. The light rail transit line utilizing the UPRR right-of-way combines with a major increase in background bus service to achieve the highest transit ridership levels.

Although the locally preferred alternative has one of the highest capital costs, both boards agreed that the higher costs were justified by the ability of the transportation improvement to more fully address the needs identified in the process. The higher capital costs were to be offset by lower transit operating costs, and the use of an existing rail right-of-way minimizes environmental impacts.

In San Francisco, the entire evaluation process was done in a multimodal format. Measures that were designed for unbiased comparisons across modes were used, as it was the desire of the MTC and the California Senate to examine all possible solutions to mobility improvement, regardless of mode. Since this study was preliminary in nature, the level of detail may be somewhat less than that would be expected or found in a typical FTA alternatives analysis but may be appropriate for MISs addressing similar conditions and issues. The analysis that was performed is comprehensive and quite thorough for the purposes set forth.

The process of alternatives evaluation was outlined in a series of methodology reports produced by the consultant team and presented to the three oversight groups. The methodology reports included a summary of each of the technical studies and their evaluative processes, including detailed discussions of the criteria upon which the alternatives were to be evaluated. Methods for assessing the alternatives against those criteria and relative to one another were also detailed. Additionally, the reports present details and findings of other studies concurrently underway in the region which could supply needed information or augment the MTC's study. Care was taken not to duplicate work already in progress, but to look for and fill critical information gaps via this study in order to aid local decision makers in their future efforts.

The methodology reports were designed and written as a means of communicating the procedures of evaluation to all concerned individuals and parties. Acceptance and approval of these reports was key to the successful technical analysis and reporting that subsequently took place by establishing ahead of time the information needs of the evaluation.

In Minnesota, the I-35W Project Management Team recognized that the evaluation of alternatives in the *I-35W DEIS* had become very complex because of three principal factors:

1. Each of the six segments of the corridor has very different travel characteristics;
2. Numerous transit alternatives were being discussed; and
3. Several access design alternatives were being considered for each of several interchange areas.

Several possible combinations of various transit and access alternatives were identified for evaluation in the scoping phase for each segment of the I-35W corridor. The Project Advisory Board (PAB) recognized that the purpose of the scoping phase was to narrow this large list of alternatives as much as possible before detailed analysis of impacts was to be undertaken.

To make the evaluation process easier to follow, and to provide a clearer understanding of both transit and access alternatives, a three-step evaluation process was used to evaluate the transit/mainline, access, and hybrid transit/mainline and access alternatives. The steps included:

- development of **concept graphic/ schematic drawings** to identify termini and station locations, lane purposes, critical locations for comparing

alternative rights-of-way, transit station/park-and-ride interfaces, access changes, typical cross-sections, and projected traffic volumes at selected locations

- development of an **evaluation matrix** using quantitative data and qualitative statements as well as graphic notation of relative importance of each factor
- presentation of each alternative to the **PAB for review** and comment
- presentation of each alternative and its evaluation at **public information meetings**
- **screening** of alternatives by lead agencies based on evaluation criteria, PAB comments, and public input.

This process reflects an effort to evaluate alternatives in a logical, systematic method, with appropriate input from various parties, and to integrate the results of parallel efforts into a coherent whole. It does not necessarily simplify the process, but breaks the process into understandable pieces which together affect the complexity of the issues, but individually may be more easily dealt with.

Focus on I-35W DEIS Case:

Evaluation of Alternatives Process

As outlined above, the I-35W Project Management Team recognized that the evaluation of alternatives would be a very complex process because of three principal factors:

1. Each of the six segments of the corridor has very different travel characteristics
2. Numerous transit alternatives were being discussed
3. Several access design alternatives were being considered for each of several interchange areas

Several possible combinations of various transit and access alternatives were identified for evaluation in the scoping phase for each segment of the I-35W corridor. One of the stated purposes of the scoping phase was to narrow this large list of alternatives as much as possible before attempting any detailed analysis of impacts.

To make the evaluation process easier to follow, and to provide a clearer understanding of both transit and access alternatives, a three-step evaluation process was used, with the following component actions:

1. **Preliminary evaluation and documentation of transit/mainline alternatives** - In this step, several actions were taken to illustrate and explain the preliminary evaluation and decision process. A corridor transit system concept graphic was created to identify potential termini and station locations. A detailed segment graphic for each corridor segment was made to illustrate lane purposes, critical locations for comparing alternative

rights-of-way, and locations for transit station/park-and-ride interfacing. An evaluation matrix for each transit alternative was developed, using quantitative data and qualitative statements, as well as graphic notation to convey the importance of each factor. Each transit/mainline alternative and its evaluation were presented to the Project Advisory Board (PAB) for review and comment. Similarly, each alternative and its evaluation were presented to the general public. Finally, the lead agencies screened the transit/mainline alternatives according to the evaluation criteria, and the comments from the PAB and the public.

2. **Preliminary evaluation and documentation of access alternatives** - This step, including several actions concerning the access alternatives, paralleled the previous step taken with the transit/mainline alternatives. A detailed segment graphic for each corridor segment was made to illustrate access changes, typical cross-sections, and projected traffic volumes at selected locations. An evaluation matrix for each access alternative was designed, using quantitative data and qualitative statements, as well as graphic notation to convey the importance of each factor. Each access alternative and its evaluation were presented to the Project Advisory Board (PAB) for review and comment. Similarly, each alternative and its evaluation were presented to the general public. Again, the lead agencies screened the access alternatives according to the evaluation criteria, and the comments from the PAB and the public.

3. **Development, evaluation, and screening of hybrid transit/mainline and access alternatives** - This step served to consolidate the evaluation measures taken separately into a whole. Hybrid design concept drawings were developed, incorporating both transit and access for those alternatives remaining after preliminary evaluation. Another set of evaluation matrices was developed for each hybrid alternative using criteria comparable to those used in the preliminary evaluation. These hybrid design concepts were presented to the PAB and then the general public for review and comment. The final scoping decision, based on PAB comments and input from the general public, was made by the lead agencies.

This process reflects an effort to evaluate alternatives in a logical, systematic method, with appropriate input from various parties, and to integrate the results of parallel efforts into a coherent whole. It does not simplify the process, it breaks the process into understandable pieces which together remain complex, but individually may be more easily monitored.

Analysis of Case Relative to MIS Principles

One must remember that the *I-35W DEIS* was developed under the regulations in effect prior to ISTEA and the issuance of the metropolitan planning regulations. It is used here as a comparable example. While this case shares many of the characteristics of an MIS, it should not be judged as such.

The evaluation of alternative investment strategies in support of decision making may be one of the more important and challenging elements of an MIS. The *I-35W DEIS* is a multimodal study, and the analysis does include the evaluation of alternative modes (primarily highway and transit). The role of the corridor as a primary means of goods movement into the Minneapolis CBD is recognized in the DEIS. The format of the evaluation process, particularly the three distinct stages (mainline/transit, access, hybrid) serves to demonstrate the authors' effort to present a consistent evaluation framework that allows decision makers (the lead agencies) to understand the trade-offs and impacts among the many alternatives.

Specifically, the *I-35W DEIS* exhibits many of the prescribed basic evaluation principles:

- The composition of the Project Advisory Board and the participation of its constituent interests assured a collaborative process in establishing the evaluation methodology, criteria, and measures to be used. The evaluation process looked at the alternatives in several different dimensions or perspectives, including safety, access, effectiveness (persons carried), cost-effectiveness, compatibility with existing plans, and equity.

- The involvement of federal, state, and metropolitan agencies assured incorporation of national, state, and local goals and objectives into the evaluation process. Transportation, environmental, and economic development objectives were included, and reflected most of the needs identified at the outset of the study.

- The equity element of the evaluation considered how the costs, benefits, and impacts of the alternatives are distributed across different segments of society, specifically how the different alternatives would affect the surrounding neighborhoods of varying socioeconomic characteristics.

- By design, the evaluation process was multimodal. It included measures (e.g., number of people carried) that promoted unbiased comparisons across modes and technologies.

- With its use of graphics and evaluation matrices, and its sequential presentation and review process, the evaluation results were presented in a manner designed to be meaningful to the general public and local elected officials.

CHAPTER 7 GENERAL STRENGTHS AND WEAKNESSES OF EACH CASE

In this concluding chapter, the three case studies are reviewed in terms of how well they fulfill the overall principles espoused in the metropolitan planning/major investment study process.

The metropolitan planning/major investment study process promotes traditional principles of good planning:

- developing sound statements of purpose and need
- consideration of alternatives
- early consideration of social, economic, and environmental factors in planning
- mitigating or developing environmental enhancement
- making prudent investments of scarce resources
- public involvement.

ISTEA removed many of the institutional and funding constraints that inhibited the application of these principles. For instance, it was typically felt that only highway alternatives could be considered when FHWA capital funds were being used or only transit alternatives could be considered when FTA planning funds were being used. FTA and FHWA each had separate project development procedures for capital investments and fulfilling NEPA investments. ISTEA eliminates these distinctions.

Under ISTEA, good planning principles are adapted to include:

- multimodalism
- flexible funding
- joint FTA/FHWA processing
- early consideration of social economic environmental factors in planning
- Clean Air Act Amendments and conformity
- fiscal constraint
- more public involvement at early stages
- focus on problem solving
- new capacity is not an automatic first option.

The planning process promoted by ISTEA shifts transportation investment decision making to the local level not only on the nature of the investment, but also on the specific conduct of the major investment study itself. The new process is flexible and adaptable to meet the local needs, conditions, and decision making process. It offers a more rational and streamlined process; one that is to be collaborative among a wide range of participants, with the role of FTA, FHWA, FRA, ETC., being one of a partner.

In looking at the three case studies as to how well they fulfill the principles espoused under ISTEA, it should be remembered that all three studies were essentially

completed before the passage of ISTEA and the issuance of the metropolitan planning regulations. In addition, these three case studies were selected from dozens of studies that were nominated as being exemplary of the good planning called for under ISTEA. By being selected as one of the three case studies, these studies were considered among the best and can be seen as precursors of the type of planning called for by ISTEA.

Problem Definition/Alternatives/Evaluation

All three case studies had reasonably well-defined problem statements. All three studies considered multimodal alternatives – not only combinations of highway and transit options, but in the Minneapolis I-35 West Corridor and San Francisco Bay Crossing studies, operational and policy strategies were considered. The alternatives and the evaluation process were geared to the decision at hand. All three studies established a clear relationship among the problem statement, alternatives, and the evaluation process which is an essential linkage in any planning study.

Definition Of Corridor

The I-35 West Corridor and the I-15/State Street Corridor studies tended to be defined, at least initially, more in terms of existing transportation facilities and their problems and less in terms of their travel markets and the underlying causes of the problems and needs. However, both studies did consider a broad range of alternative highway and transit strategies, and especially in the case of the I-35 West Corridor DEIS, a set of operational and policy strategies.

Joint FTA/FHWA Participation

Both the Salt Lake City I-15/State Street AA/DEIS and the I-35 West Corridor DEIS had FTA and FHWA involved together on the study. They had to resolve many of the procedural conflicts and issues in conducting a study with joint sponsorship, especially with regard to their different approaches to the preparation of the NEPA draft environmental impact statements. Under the metropolitan planning/major investment study regulation, FTA and FHWA have joint procedures.

Collaboration/Public Involvement

While all three studies employed advisory committees of some sort to involve a number of federal and local transportation agencies and interested parties, the San Francisco Bay Crossing Study is particularly noteworthy. The Bay Crossing Study was led by the Metropolitan Transportation Commission, the MPO for the San Francisco area. Through a set of advisory committees, a large number of transportation providers, transportation user groups, local governments, environmental interests, and resource groups participated in the conduct and review of the study in the collaborative manner called for in the metropolitan planning/MIS regulations and principles.

Level Of Detail

The San Francisco Bay Crossing Study is distinguished from the other case studies in the level of detail at which it was conducted. The level of detail of the technical analysis was appropriate and sufficient for the issues and decisions at hand. While at considerably lesser detail than the I-15/State Street AA/DEIS and the I-35 West Corridor DEIS, it represents another MIS principle by going to the level of detail necessary to support the decision making process. The level of detail of the other two case studies was also geared to their needs although the established FTA and FHWA guidance and expectations in place at the time the studies were conducted certainly influenced the level of detail of the analyses.

Use Of These Case Studies

The three case studies represent good transportation planning practice and are examples of the type of planning promoted by ISTEA and the metropolitan planning regulations. As current and future corridor transportation planning is conducted within the framework of the major investment studies, additional examples will become available. Nevertheless, these examples are just that – examples – and should be used for gaining an understanding and seeing the application of metropolitan planning/major investment study principles. The conditions and needs of each corridor are unique and what was appropriate for one corridor is not necessarily appropriate for the next. By understanding the principles presented here, however, the study design and work plan, including the types of the alternatives to be considered, the nature and level of detail of the impact analyses, and the evaluation process and structure, can be developed to respond to the conditions, issues, problems, and needs of the individual corridor.