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16. Abstract

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(1) Highway pavement on the Federal-aid system.
(2) Bridges on and off Federal-aid highways.
(3) Highway safety.
(4) Traffic congestion.
(5) Public transportation facilities and equipment.
(6) Intermodal transportation facilities and systems.

This mandate was one of the key provisions in ISTEA and effective compliance in linking management system plans within each state was viewed as a way to reinforce the intermodal focus of ISTEA. The objective of the management system format is that, through system integration, it allows consideration of an entire network for the allocation of scarce resources for design, operations, planning, maintenance, and policy making. Beyond implementation, each management system was to include an evaluation process of the effectiveness of implemented strategies for use as feedback for future decision making. This report evaluates the effectiveness measures that were included in the management system work plans through an assessment of the federal rulemaking process and content analysis of a sample of state DOT work plans. Findings suggest that little attention was paid to measures of effectiveness in both the rulemaking process and in the state work plans. Evaluation theory suggests that this may be the result of ambiguous program objectives as well as an unfamiliarity with program evaluation, in general.

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ASSESSING EFFECTIVENESS MEASURES IN THE ISTEA MANAGEMENT SYSTEMS

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ABSTRACT

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EXECUTIVE SUMMARY

One of the most innovative components found in the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) was the short-lived mandate requiring all 50 states to develop ISTEA Management System plans for six management systems. ISTEA legislation states: "Not later than 1 year after the date of the enactment of this section, the Secretary shall issue regulations for State development, establishment, and implementation of a system for managing each of the following:

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In metropolitan areas, such systems shall be developed and implemented in cooperation with metropolitan planning organizations. Such regulations may include a compliance schedule for development, establishment, and implementation of each system and minimum standards for each system" (Public Law 102-240). In order to ensure compliance, the law provided that up to ten percent of states highway and transit funding could have been withheld if implementation was not initiated by September 30, 1995.

This mandate was one of the key provisions in ISTEA and effective compliance in linking management system plans within each state was viewed as a way to reinforce the intermodal focus of ISTEA. The objective of the management system format is that, through system integration, it allows consideration of an entire network for the allocation of scarce resources for design, operations, planning, maintenance, and policy making. This is in contrast to the project

by project approach traditionally used by state departments of transportation (DOTs). Beyond implementation, each management system was to include an evaluation process of the effectiveness of implemented strategies for use as feedback for future decision making.

This report evaluates the effectiveness measures that were included in the management system work plans. The development of linkages between the six systems is considered, as this was an important objective of the mandate. Although the management system mandate was removed, through the 1995 National Highway System legislation, an assessment of the effectiveness measures, as they existed during the system design process in the state DOTs, from 1991 through late 1995, is valuable for two reasons. First, an assessment addresses the practical problems of designing and incorporating effectiveness measures within broad systems planning tools. Second, this assessment considers the organizational impact of the mandate through content analysis of the management system work plans. These plans provide valuable insight into how large organizations responded to mandates for change, which many state DOTs considered intrusive and unnecessary.

Familiarity and experience with management systems varied considerably from state to state, and within the state DOT. Prior to ISTEA, pavement management systems had been in effect in most states for many years, as had bridge management systems. These two typically overlap in state transportation agencies, but are rarely coordinated administratively. Safety management and congestion management systems are relatively new, and have received increased attention in recent years. The comprehensive approach to safety management seeks to consider safety as a key component in all transportation decisions. Congestion management systems have been recently developed that provide information on system performance, and identify alternative actions in attempts to alleviate congested roadway conditions. State-wide management systems for public transit and intermodal facilities are unique, and were barely in existence prior to ISTEA. Rarely were any of these systems linked together, however, as intended by ISTEA.

RESEARCH DESIGN

The primary method of analysis for this study is content analysis of two sources of documentation: that which was published during the rulemaking process, as illustrated in Chapter Two and Three; and the work plans developed by the State's as they responded to the management systems mandate, which are evaluated in Chapter 4. The work plans were provided by the regional FHWA office in Fort Worth, Texas, or through requests to various state highway or transportation departments.

Content analysis has been shown as an effective means of analyzing how policies or programs are developed or implemented over time (Cozzens and Melkers 1997). In a case such as the one presented in this report, where the policy had a relatively brief life before being challenged and subsequently abandoned as a mandate, content analysis of rules and plans provides, perhaps, the only consistent documentation of the process and intent of the implementing agencies. Consistency is critical for comparisons of intent and approaches to implementing the management system mandate.

Evaluation of the federal rulemaking process has been ignored, for the most part, in the study of federal policy and program development. Written comments on proposed rules, as provided by public participants in the rulemaking process, is a valuable resource, yet one which until recently, has gone untapped in policy analysis (Golden 1998). The influence that respondents to federal notices of proposed rulemaking have on regulatory policy presents an interesting question to consider as the evolution of the management system mandate is traced over time. In this study, the rules and subsequent comments are evaluated for two purposes. First, we are interested in changes made to the effectiveness measure requirement over time, as stated in the Federal Register text, as the management system rule moved from proposal to law. The second purpose is to gain a sense of interest or concern on the part of the respondents to the effectiveness measure requirement.

EFFECTIVENESS MEASURES IN THE RULEMAKING PROCESS

Goals and objectives of the mandate can be found in several places in the text of the advanced notice of proposed rulemaking (ANPRM), the notice of proposed rulemaking (NPRM), and the interim final rule (IFR). This section outlines these instances and notes any changes during the rulemaking process to the definition or emphasis on this requirement.

Advanced Notice of Proposed Rulemaking

The general introduction to the ANPRM states:

> Each of the management systems will require data to define and monitor the magnitude of the problems, identify needs, analyze alternative solutions, and measure the effectiveness of the implemented actions (U.S. Department of Transportation 1992, 23461).

Little mention is made of this requirement in the sections on specific management systems. Under the "CMS Principles," for example, the text includes the following:

> Feedback Loop—Implemented strategies need to be monitored and evaluated to determine if they are accomplishing their intended objectives (U.S. Department of Transportation 1992, 23464).

Notice of Proposed Rulemaking

The NPRM includes summaries of solicited comments, and responses, on the ANPRM, as well as the proposed rule, itself. 900 pages of comments were received in response to the ANPRM, from 162 respondents. Almost half of the comments were from state agencies, such as highway and transportation departments (U.S. Department of Transportation 1993a). The proposed rule (Subpart A—General, Section 500.107) expands the definition and intent of the effectiveness measure requirement:

> Each management system must include appropriate means to evaluate the effectiveness of implemented actions developed through use of that system. The effectiveness of the

> management systems in enhancing and improving overall efficiency of the State's transportation systems and facilities shall be evaluated periodically as part of the metropolitan and statewide planning processes (U.S. Department of Transportation 1993a, 12116-7).

Interim Final Rule

The IFR, which was the final set of guidelines published for the management systems mandate, includes additional comments and responses on the NPRM. 130 sets of comments were submitted in response to the NPRM. The responses contain clarifications and changes that are subsequently found in the text of the IFR. Few of the comments, however, referred to the effectiveness measures issue in the mandate. An exception is found in the SMS section, in a concern expressed over the amount of data involved for effectiveness evaluation (U.S. Department of Transportation 1993b, 63461).

The text of the IFR (U.S. Department of Transportation 1993b, 63475-85) reveals the final changes in wording for the effectiveness measure issue. Section 500.105 (j) states:

> Each management system must include appropriate means to evaluate the effectiveness of implemented actions through use of that system. The effectiveness of the management systems in enhancing transportation investment decisions and improving overall efficiency of the State's transportation systems and facilities shall be evaluated periodically, preferably as part of the metropolitan and statewide planning processes (U.S. Department of Transportation 1993b, 63476).

Few changes in the effectiveness measures requirement can be traced from the ANPRM to the IFR, in spite of a significant amount of comments over this 18 month period. At the end of that time, with the publication of the IFR, State's were left with little direction for developing the means of evaluating the effectiveness of these six systems. Most of the concern expressed in the

comments, in fact, were addressed to the issues of data collection and compliance with the deadlines, not with the eventuality that the effectiveness of the systems would have to be evaluated to see if the intent of the management system mandate was being met.

WORK PLAN ASSESSMENT

The management system work plans were obtained and reviewed for the following states: Texas, Arizona, Arkansas, Louisiana, New Mexico, and Oklahoma. The plans that are evaluated are work plans developed in order to comply with the January 1, 1995 deadline.

As defined in the IFR, a work plan, "means a written description of major activities necessary to develop, establish, and implement a management or monitoring system, including identification of responsibilities, resources, and target dates for completion of the major activities" U.S. Department of Transportation 1993b, 63476). The assumption is that these documents would have served as guidance for the implementation of the state management systems, and as such, they represent a good indicator of the level of consideration and importance that went into developing effectiveness measures at the outset of the management system process. Content analysis of the sample state work plans reveals several important issues that are summarized in this section:

1. The requirement for effectiveness measures held a prominent, and obvious, position in each of the six management systems, yet this requirement received limited attention as the lack of comments to the ANPRM and NPRM show.
2. As responses to comments trace the evolution of specific issues of concern, and the management systems in general, little change is shown in regard to the effectiveness measure requirement as it finally appears in the IFR.
3. The main focus found in both the comments during the rulemaking process and in the actual management system work plans was on data and data requirements, not on

whether or not the specific system would actually have the intended, or desired, impact.

4. Individual performance measures dominate the state work plans. These measures were frequently confused with effectiveness measures.
5. Content analysis of the state work plans show that, first, little attention was paid, overall, to the effectiveness requirement, and that when mention was made of the requirement, it rarely went beyond reiterating the text of the IFR.
6. Subsequent management system development and implementation guidance provided by the USDOT added little to the understanding and development of effectiveness measures.

IMPLICATIONS FOR TRANSPORTATION POLICY MAKING

The federal mandate to develop and implement transportation management systems was only one small part of a much larger piece of groundbreaking legislation. In spite of this, this assessment of the effectiveness measures provides a glimpse into the institutionalized tendencies of transportation policy making in this country. The immediate questions that are raised are, what are the implications from the indifference to system-wide effectiveness measures, and are we, as a profession, paying enough attention to this component of the policy implementation process? There are also different implications for federal level policy making, compared with state-level transportation policy making.

Federal Implications

Federal-level transportation policymaking is changing. The traditional distributive policy relationship of providing state DOTs with federal highway construction dollars for the interstate system has been replaced with the innovative legislation of ISTEA, financial constraints on transportation planning, the influence of environmental policy on transportation, a greater involvement of previously excluded interests, and a need for integration of state transportation

system components. All these suggest that the development of federal rules and guidelines will become more difficult, rather than less. Distributive policymaking and implementation is different from regulatory policymaking and implementation; each provoke diverse politics and reactions from target agencies. Integration of environmental issues, and the increasing number of participants in transportation policy, particularly from the general public and regional governments, implies that different perspectives and demands will have to incorporated into federal rules and regulations. If the "age of assessment" has reached the USDOT, we can expect more emphasis in the future on assessing whether or not programs are doing what they were intended to do. This will create greater expectations from lawmakers that federal agencies can effectively accommodate these assessments.

State Implications

One problem with the management systems mandate, from the perspective of the state DOTs, was that it was too inflexible to allow each state latitude in designing the systems according to their individual needs (U.S. General Accounting Office 1997). This suggests that as federal policy is designed, consideration needs to be given for a non-homogenous target. The question, and implication, is, how can states influence the design of federal policy that is flexible enough to address individual state needs and capacity, yet accomplish the legislative objectives of the policy? Allowing the states the option of continuing the management systems according to their own design allows states interested in innovation, and willing to initiate changes, an opportunity to do so in concert with other like-minded states. The management system mandate constituted a major change in how state DOTs conducted their planning and programming efforts. As such, the state response raises the question of how states respond to opportunity for change. Marginal changes, such as maintaining pre-existing management systems or implementing only one or two new systems may support planning and programming methods that are out of date, expensive, and non-responsive to public need. Lack of a mandate may actually discourage innovation and

integration of management systems into the mainstream of transportation planning and programming.

Transportation planning and programming is traditional designed around the different modes. ISTEA, however, encouraged, and mandated, an intermodal perspective. This perspective is contrary to how state DOTs traditionally function. If state DOTs have problems working across modes in their own agencies, how can we expect them to be successful in interacting with the public and in their requirements for greater public participation?

RECOMMENDATIONS

The General Accounting Office (1997) outlines the current state of the management systems in their post-mandate context. In general, many of the state are continuing development and implementation of the management systems, without significant guidance from federal agencies. This suggests that the importance of the management system has been recognized, and that to a certain extent, states are thinking in terms of systems planning and programming. Addressing the issue of effectiveness measurement needs to be included in these efforts, however.

This report identifies an inability, or unwillingness, of state DOTs to spend much time or resources on the effectiveness measurement of the management system mandate. To the extent that this may be an unfortunate attribute of the profession, this needs to be addressed in future transportation policy. One of the solutions suggested by the Horst model is a recommendation for preassessment of programs during the development stages. What characteristics of the program under development will encourage or discourage program evaluation when then the time comes? This preassessment will ensure that measures are included that will be relevant in an evaluative context, not just in the short term.

The final recommendation focuses on avenues for future research. First, the systematic analysis of policy is rare in the engineering-dominant realm of transportation research. However, as this report shows, the rulemaking process can be a very conflictual and influential part of transportation policy making, with significant impact on policy implementation at the state level as final policy guidelines are constructed. State agencies are powerful proponents of the status quo when it comes to mandated change, yet little research has been conducted on the dynamics of transportation policy making from the intergovernmental perspective.

Second, and in a related context, what are the roles of interest groups in influencing transportation policy through the rulemaking process? This study shows that an overwhelming majority of respondents to the ANPRM and the NPRM were state highway and transportation agencies. This implies that their collective voices were the dominant voices heard by the rulemaking agency, in this case the USDOT. What are the implications from this as far as the taxpaying public is concerned?

Third, this report suggests that many transportation policies or programs may be implemented without the means for evaluating their effectiveness. How widespread is this assumption, and can we systematically evaluate it in both the federal and state contexts? Content analysis can give us an introduction into the objectives of a particular program, but more systematic, and comparative, methods need to be applied to this question.

This report has raised many questions regarding transportation policy making, policy evaluation, the role of the state DOT in policy implementation, and the specifics of one particular effort at mandating system-wide assessments of program effectiveness. This represents only a small step in transportation policy evaluation, however. There is considerable more work that can and should be done.

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CHAPTER ONE: ISTEA MANAGEMENT SYSTEMS

INTRODUCTION

One of the most innovative components found in the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) was the short-lived mandate requiring all 50 states to develop ISTEA Management System plans for six management systems. ISTEA legislation states: "Not later than 1 year after the date of the enactment of this section, the Secretary shall issue regulations for State development, establishment, and implementation of a system for managing each of the following:

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by project approach traditionally used by state departments of transportation (DOTs). Within each management system various tools are used to identify and rank network needs and requirements. These tools may include data collection methods, construction and maintenance procedures, planning, programming, and coordinating policies. Beyond implementation, each management system was to include an evaluation process of the effectiveness of implemented strategies for use as feedback for future decision making.

The purpose of this report is to evaluate the effectiveness measures that were included in the management system work plans. What measures and criteria were selected, and how they were linked to the system design and implementation is of primary concern. In addition, the development of linkages between the six systems is considered, as this was an important objective of the mandate. Although the management system mandate was removed, through the 1995 National Highway System legislation, an assessment of the effectiveness measures, as they existed during the system design process in the state DOTs, from 1991 through late 1995, is valuable for two reasons. First, an assessment addresses the practical problems of designing and incorporating effectiveness measures within broad systems planning tools. This provides useful information for those agencies still pursing any or all of the management systems on their own, and information on effectiveness measures, in general. Second, this assessment considers the organizational impact of the mandate through content analysis of the management system work plans. These plans provide valuable insight into how large organizations responded to mandates for change, which many state DOTs considered intrusive and unnecessary.

The remainder of this chapter presents a brief chronology of the ISTEA management system mandate, supplemented by two perspectives on management systems from interviews with Federal Highway Administration officials. The final section of Chapter One outlines the research design for this study. The remainder of the report is as follows: Chapter 2 focuses on each management system individually, their objectives and goals, and the issue of integration;

Chapter 3 presents the framework for assessing the effectiveness measures in the management systems; Chapter 4 provides the general assessment of the management system effectiveness measures, with specific examples from individual state action plans; Chapter 5 presents a discussion of findings, the broader implications from this study of management systems, and conclusions and recommendations for further study.

CHRONOLOGY OF THE ISTEA MANAGEMENT SYSTEM MANDATE

When ISTEA was signed into law by President Bush, on December 18, 1991, it was hailed as a dramatic departure from previous transportation legislation. Included in the legislation were many elements that effectively changed the intergovernmental relationships involved in transportation policy making and implementation. The state DOTs were now required by law to share in the decision-making with the metropolitan planing organizations (MPOs), rather than maintain their traditional relationship with federal agencies. One element in particular, the management systems mandate, placed significant responsibility on state DOTs for data collection, system integration, and cooperation between internal divisions. Following the enactment of ISTEA, the policy process moved slowly, however, creating problems of system design and implementation. This section outlines the brief history of the management system rules, guidelines, and deadlines imposed on the states until the mandate was lifted in late 1995:

- According to ISTEA legislation, the U. S. Department of Transportation (USDOT) was to issue regulations on management systems by December 18, 1992.
- Advance notice of proposed rulemaking, for input into development of the management systems regulations, was published by the FHWA and FTA in the June 3, 1992, Federal Register (57 FR 23459).
- The proposed rule for the management systems mandate was published in the March 2, 1993, Federal Register.
- The Interim Final Rule (IFR) was published in the December 1, 1993, Federal Register.

- State DOT management system work plans were to be formalized by October 1, 1994.
- A USDOT memo of July 20, 1995, notified regional FHWA and FTA administrators that revision of the interim final rule had begun, and that the Senate's version of the National Highway Systems bill (NHS) (S. 440) provided for the removal of the management system mandate (U.S. Department of Transportation 1995).
- NHS legislation was passed on November 28, 1995, which rescinded the management system mandate, making the systems optional, with the exception of congestion management systems in certain areas (transportation management areas).
- The final rule affecting the management system mandate in the legislation was issued on December 19, 1995.

Initial state DOT response to the mandate was mixed and problems existed when the management systems were mandated in the ISTEA legislation. As some management systems within individual states had been previously established, accepted, and were functioning, the creation of new management systems could have posed problems to the status quo. One remedy that was suggested was to develop an "Office of Management Systems" within the state DOT with the responsibility for the coordination of the individual systems within the agency. The short time available for implementation was also problematic. In efforts to comply with ISTEA deadlines, agencies felt rushed to meet requirements without complete guidance or full awareness of the ramifications of their initial decisions (U.S. General Accounting Office 1997).

Familiarity and experience with management systems varied considerably from state to state, and within the state DOT. Prior to ISTEA, pavement management systems had been in effect in most states for many years, as had bridge management systems. These two typically overlap in state transportation agencies, but are rarely coordinated administratively. Safety management and congestion management systems are relatively new, and have received increased attention in recent years. The comprehensive approach to safety management seeks to consider safety as a

key component in all transportation decisions. Congestion management systems have been recently developed that provide information on system performance, and identify alternative actions in attempts to alleviate congested roadway conditions. State-wide management systems for public transit and intermodal facilities are unique, and were barely in existence prior to ISTEA. Rarely were any of these systems linked together, however, as intended by ISTEA.

TWO PERSPECTIVES ON THE MANAGEMENT SYSTEM MANDATE

Legislative intent and the subsequent response are frequently different, as the interests of the involved parties vary according to their perspectives on the issue. To illustrate the differences that the management systems mandate evoked, two brief summaries of interviews are included here. First, the perspective from the FHWA administration is provided, followed by the regional response from the perspective of one of the regional FHWA offices.

Dr. Thomas D. Larson was the Administrator of the FHWA under President Bush during the Congressional ISTEA hearings in 1991. As Administrator of the FHWA, he presented testimony before Congress on the reauthorization of the surface transportation programs. In joint testimony, with the Administrators of the Urban Mass Transportation Administration and the National Highway Traffic Safety Administration, the management system component of the House version of ISTEA, "provides for a unique new concept to address problem areas in the highway program. States would be required to have in place a bridge management system, a pavement management system, a safety management system, and a congestion management system" (U.S. Congress, House 1991, 328). Dr. Larson was interviewed for this report in the spring of 1996.

As Administrator for the FHWA from 1989 to 1983, Dr. Larson was a key player during the reauthorization process that resulted in ISTEA (Whitnah 1998). As such, he provided an overview of the Administration's original objective and intent for the management system

mandate. Much of the impetus for recommending the management system concept within the national legislation was a result of his experience with the systems in Pennsylvania, in which he served as Secretary of Transportation from 1979 through 1987. As is so often the case, the states acted as a laboratory for federal policy making. Having found success with management systems in Pennsylvania, Larson sought to include them within ISTEA. According to Dr. Larson, the original purpose was simple: the management systems as recommended to Congress (which included only four of the eventual six systems) would provide a means for "keeping track of things." Further, Larson advocated the management systems as a tool with which to maintain the national interstate system to a minimum standard by the use of sanctions for compliance (Larson 1996).

Another perspective is offered by Martin Kelly, Director of the FHWA Region 6 office in Fort Worth, Texas. FHWA Region 6 includes the states of Texas, Louisiana, Oklahoma, Arkansas, and New Mexico. Mr. Kelly was interviewed regarding the role of the regional offices in the management system mandate, system design and implementation process.

According to Mr. Kelly, the regional office assumed three major roles during the implementation process: policy interpretation, encouragement, and technical advice. The office was also responsible for reviewing all work plans for compliance, and for making suggestions if corrections were needed. As essentially a policy "middle man" in the implementation of the mandate, between the federal administration and the state DOTs, Mr. Kelly identified several problems associated with the mandate. First, the perceived burden of implementing the mandate varied across states and within state DOTs, according to the status of any existing management system. If an existing system was weak, the perception of the burden of compliance was high. If the system was strong, or relatively advanced, the perception of the burden was low.

A second problem recognized at the regional level was associated with how to interpret the mandate. According to Mr. Kelly, the ambiguity of the mandate made it difficult to interpret. This situation was compounded by the absence of any specific guidelines from the FHWA for the states to follow in developing their workplans. This led to each state applying its own interpretation of the mandate. Finally, Mr. Kelly identified a paradox of flexibility of the management system mandate. Rather than the flexibility built into the mandate allowing for greater creativity and adaptation of technology to meet unique situations, it actually created confusion and indecision regarding work plan design for the states (Kelly 1996).

These two perspectives of the management system mandate, one regional and the other from the federal administrative level, indicate a certain disparity between intent and ability to implement. The implications from this situation will be explored further in the final chapter of this report.

RESEARCH DESIGN

The primary method of analysis for this study is content analysis of two sources of documentation: that which was published during the rulemaking process, as illustrated in Chapter Two and Three; and the work plans developed by the State's as they responded to the management systems mandate, which are evaluated in Chapter 4. The work plans were provided by the regional FHWA office in Fort Worth, Texas, or through requests to various state highway or transportation departments. This information was supplemented by interviews, when possible.

Content analysis has been shown as an effective means of analyzing how policies or programs are developed or implemented over time (Cozzens and Melkers 1997). In a case such as the one presented in this report, where the policy had a relatively brief life before being challenged and subsequently abandoned as a mandate, content analysis of rules and plans provides, perhaps, the only consistent documentation of the process and intent of the implementing agencies.

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Content analysis of the state management system work plans, as submitted to the U.S. DOT for approval, will also serve several purposes in this study. First, it will allow us to measure, and compare, the extent to which states complied with the overall mandate. Second it will allow us to measure, and compare, how states responded to the effectiveness measure requirement. What emphasis is placed on meeting this requirement, and how did the different states expect to develop and implement these measures of effectiveness? Finally, by using content analysis, we can gain a better understanding of the complex process of transportation policymaking.

CHAPTER TWO: MAKING RULES FOR MANAGEMENT SYSTEMS

INTRODUCTION

This chapter provides, first, definitions and objectives of management systems, as found in the ISTEA legislation, and in the subsequent rulemaking processes. This is followed by an outline of common requirements of the management systems, a description of each management system, as defined by federal regulations and the objectives of each system. The final two sections discuss two issues relevant to effectiveness measures in the management systems mandate: the perceived data requirements of the management systems; and the issue of management system integration.

MANAGEMENT SYSTEMS AND THE FEDERAL RULEMAKING PROCESS

As quoted in the previous chapter, the ISTEA legislation regarding the management systems states that the Secretary shall "issue regulations for State development, establishment, and implementation." Although Congress mandated this concept, interpretation of what constituted "development, establishment, and implementation" was left to the USDOT and its agencies, particularly the FHWA and the Federal Transit Administration.

The rulemaking process for federal legislation follows specific guidelines in order to allow comments on agency interpretation and intentions by interested and affected parties. The first step is to publish an advance notice of proposed rulemaking (ANPRM) in the Federal Register. The ANPRM for the management system mandate was published in the June 3, 1992 Federal Register (57 FR 23459), and solicited comments and questions. The text of the ANPRM states that:

> "The primary purpose of these management systems is to improve the efficiency of, and protect the investment in, the Nation's existing and future transportation system. The management systems, or their elements, are not the end products; they will provide

additional information needed to make informed decisions for optimum utilization of limited resources. Each State will need to tailor the systems to meet its particular goals, policies, and resources" (U.S. Department of Transportation 1992).

Following the release of the ANPRM, interested parties were given 60 days to respond to the issues raised in the notice. During that period, the USDOT and its agencies were also working on the next step in the rulemaking process, developing the notice of proposed rulemaking (NPRM). The proposed rule for the ISTEA management system mandate was published in the Federal Register on March 2, 1993 (58 FR 12096), incorporating the comments from the ANPRM. One hundred and sixty two comments were received by the FHWA and FTA regarding the management system mandate. The general policy objective of the management systems NPRM was changed slightly from the ANPRM:

> "The primary purpose of the management systems is to provide additional information needed to make effective decisions on the use of limited resources to improve the efficiency of, and protect the investment in, the nations' existing and future transportation infrastructure at all levels of jurisdictional control" (U.S. Department of Transportation 1993a).

Following publication of an NPRM, the next step in the federal rulemaking process is usually the release of a final rule. However, because of data collection concerns for management system implementation, an interim final rule (IFR) was published on December 1, 1993 (58 FR 63443). One hundred and thirty sets of comments were received regarding the NPRM and addressed in the IFR. At the time it was published, the IFR stated that it would be made final following additional review of information and comments, although this never actually occurred.

The interim final rule defines a "management system" as:

> "a systematic process, designed to assist decision makers in selecting cost-effective strategies/actions to improve the efficiency and safety of, and protect the investment in, the nation's transportation infrastructure. A management system includes: Identification of performance measures; data collection and analysis; determination of needs; evaluation and selection of appropriate strategies/actions to address the needs; and evaluation of the effectiveness of the implemented strategies/actions" (U.S. Department of Transportation 1993b).

REQUIREMENTS OF THE SIX MANAGEMENT SYSTEMS

As the final regulatory guidance issued by the USDOT, the interim final rule serves as the source of what was generally expected of the State's in developing and implementing the management systems, as well as what was to be included in the management systems. Although the six systems focused on distinct elements of transportation management, the IFR identified several general requirements that were to be consistent across all systems within each State. The following includes the more important common elements identified by the IFR for the development, establishment, and implementation of the systems:

- The systems could be tailored to meet State, regional, or local goals, policies, and resources, but had to comply with the specific management system requirements in the IFR.
- Each State was mandated to cooperate with MPOs, local officials in non-MPO areas, and other agencies.
- Each State was mandated to have procedures within the State DOT for coordinating the development, establishment, implementation, and operation of the management systems.
- The results of the management systems were to be "considered in the development of metropolitan and statewide transportation plans and improvement programs."

- Each management system was also to "include appropriate means to evaluate the effectiveness of implemented actions developed through use of that system. The effectiveness of the management systems in enhancing transportation investment decisions and improving the overall efficiency of the State's transportation systems and facilities shall be evaluated periodically, preferably as part of the metropolitan and statewide planning process" (U.S. Department of Transportation 1993b).

Having defined the management system concept, and their general requirements, as stated in the IFR, the following sections briefly describe each of the six management systems, their characteristics, and status as of ISTEA.

BRIDGE MANAGEMENT SYSTEMS

The bridge management system (BMS) concept existed prior to its inclusion in the ISTEA mandate, and considerable study has been devoted to monitoring and managing bridge condition.

According to a earlier BMS report, a BMS is a, "rational and systematic approach to organizing and carrying out the activities related to planning, designing, constructing, maintaining, rehabilitating, and replacing bridges vital to the transportation infrastructure" (Hudson, et al. 1987).

The interim final rule specified the following components be included in each State's BMS:

- A data base and an ongoing program for the collection and maintenance of the inventory, inspection, cost, and supplemental data needed to support the BMS;
- A rational and systematic procedure for applying network level analysis and optimization to the bridge inventory. The procedure shall have the ability to:
  - predict the deterioration of bridge elements with and without intervening actions;
  - identify feasible actions to improve bridge condition, safety, and serviceability;

- estimate the cost of actions;
- estimate expected user cost savings for safety and serviceability improvements;
- determine least cost maintenance, repair, and rehabilitation strategies for bridge elements using life-cycle cost analysis or a comparable procedure;
- perform multi period optimization;
- use feedback from actions taken to update predictions and cost models; and
- generate summaries and reports as needed for the planning and programming processes (U.S. Department of Transportation 1993b).

The ISTEA mandated BMS relied, in part, on existing bridge data, as required by previous legislation, but expanded the concept to include data on condition, cost, traffic and accident, and historical attributes (Turner and Richardson 1994). A graphical representation of a BMS framework is presented in Figure 1.

CONGESTION MANAGEMENT SYSTEMS

According to the IFR, congestion is defined as, "the level at which transportation system performance is no longer acceptable due to traffic interference. The level of acceptable system performance may vary by type of transportation facility, geographic location (metropolitan area or subarea, rural area) and/or time of day." A congestion management system (CMS) is defined as, "a systematic process that provides information on transportation system performance and alternative strategies to alleviate congestion and enhance the mobility of persons and goods. A CMS includes methods to monitor and evaluate performance, identify alternative actions, assess and implement cost-effective actions, and evaluate the effectiveness of implemented actions" (U.S. Department of Transportation 1993b).

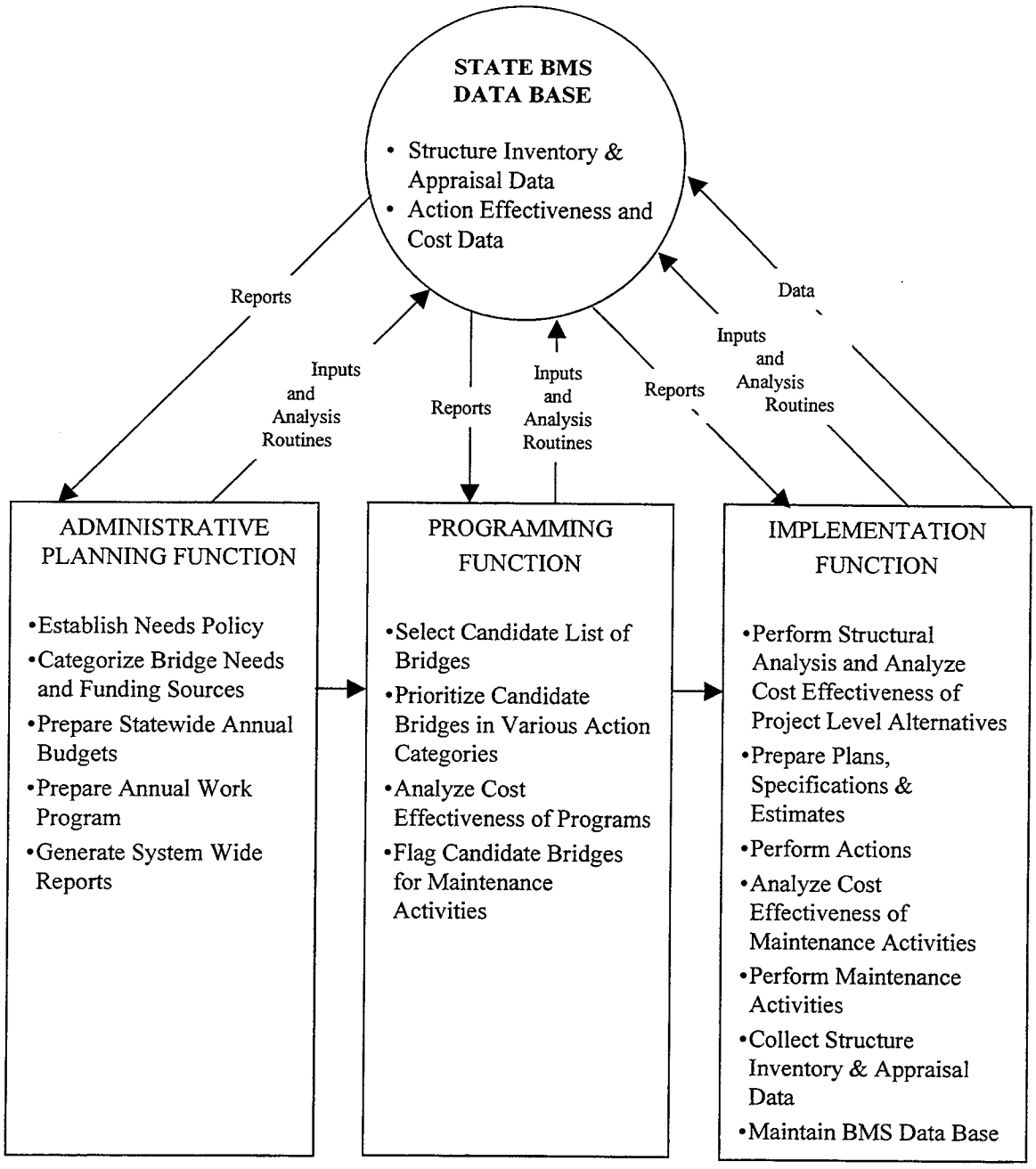

Figure 1. Bridge Management System Framework

Under ISTEA, the congestion management systems were aimed at monitoring and analyzing the performances of entire metropolitan area transportation systems. According to one FHWA/FTA guide, "the CMS should include an ongoing method to provide information on the performance of the transportation system and on alternative strategies to alleviate congestion and enhance mobility (U.S. Department of Transportation. FHWA/FTA 1996).

Objectives of the ISTEA CMS were inclusive: to monitor not just one mode, but performances of all. Included in each CMS were to be the following components:

- Performance measures;
- A program for continuous data collection and system monitoring;
- Identification and evaluation, as part of the planning process, of possible congestion management strategies, including but not limited to:
  - Travel demand management measures
  - Traffic operations improvements
- Measures to encourage use of high occupancy vehicle lanes
- Public transit capital and operational improvements
- Measures to encourage use of non-motorized modes
- Congestion pricing
- Growth management
- Access management techniques
- Incident management techniques
- Intelligent transportation systems applications
- Addition of general purpose lanes;
- Incorporation of strategies into plans and TIPs; and,
- Evaluation of the effectiveness of implemented strategies (Stanley 1994; U.S. Department of Transportation. FHWA/FTA 1996).

The CMS also was assigned the responsibility for providing input for the analysis of alternatives for the reliance on single-occupant vehicles in Transportation Management Areas (TMAs), those areas with a population greater than 200,000, and with non-attainment status for ozone or carbon monoxide. As such, a CMS would link the legislative intent of ISTEA with that of the 1990 Clean Air Act Amendments, which required coordination of transportation control measures in the State Implementation Plan (Ismart 1991; Stanley 1994).

One perspective of a CMS is illustrated in Figure 2.

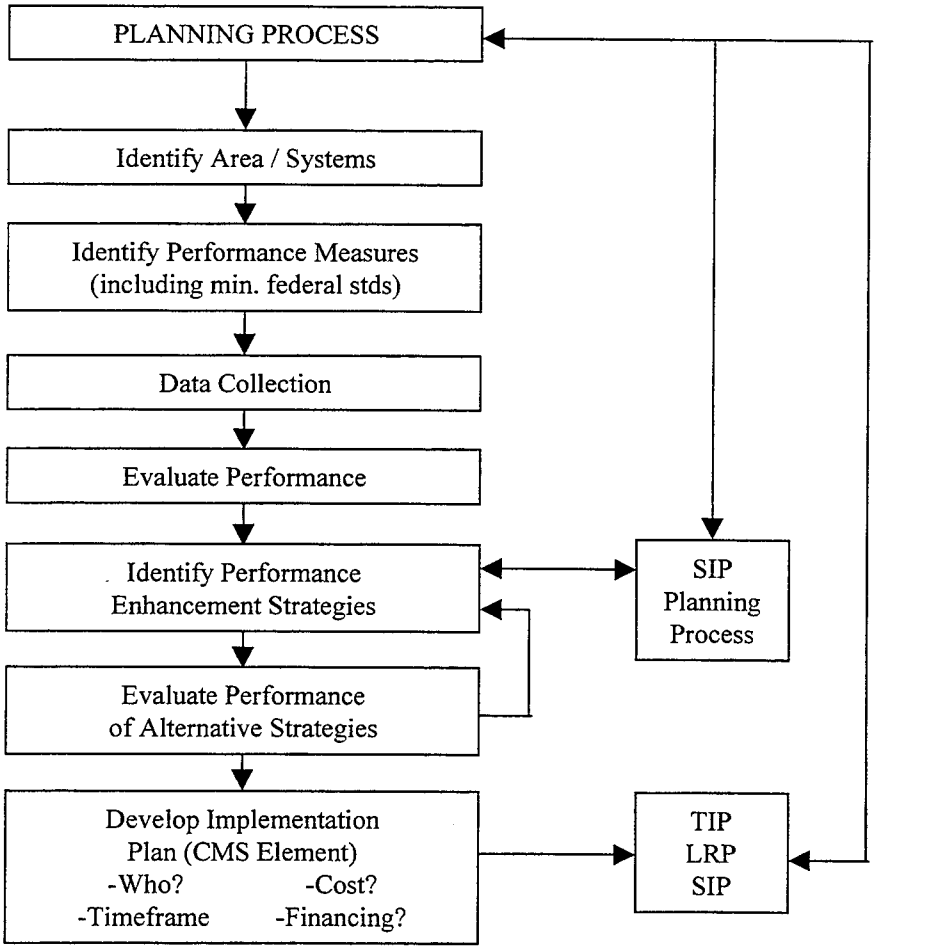

Figure 2. Possible Structure of a Congestion Management System

Source: Adapted from U.S. Department of Transportation, 1991.

PAVEMENT MANAGEMENT SYSTEMS

Pavement management, as a concept, has been around for decades, if not centuries. In the United States, formal, coordinated, attention to pavement management systems was initiated in 1980 with the first of many national workshops devoted to setting short and long-term goals for national PMS strategies (Finn 1998). By 1991, and the ISTEA mandate, PMSs had been established and accepted in the transportation decision-making arena.

A pavement management system (PMS), "means a systematic process that provides, analyzes and summarizes pavement information for use in selecting and implementing cost-effective pavement construction, rehabilitation, and maintenance programs." In general, the ISTEA mandate specified that:

- Each state is responsible for assuring that all Federal-aid highways in the State, except those that are federally owned, are covered by a PMS. Coverage of federally owned public roads shall be determined cooperatively by the State, the FHWA, and the agencies that own the roads;
- PMSs should be based on AASHTO guidelines for pavement management systems; and
- Pavements shall be designed to accommodate current and predicted traffic needs in a safe, durable, and cost-effective manner (U.S. Department of Transportation 1993b).

Prior to ISTEA, each state had been required, by the FHWA, to have a PMS, and AASHTO provided guidelines for their development. Conceptually, a PMS consisted of three major components:

- A data base of pavement inventory; condition data; construction, maintenance, rehabilitation and reconstruction history; traffic data; and other data, such as accident data;

- A data analysis package capable of using the database to allocate funds; and
- A feedback process (Irrang and Maze 1993).

The interim final rule, however, expanded upon these general guidelines, by specifying the following minimum components of a PMS:

- Data collection and management, including the following:
  - inventory of physical pavement features
  - history of project dates and types of construction, reconstruction, rehabilitation, and preventive maintenance
  - condition surveys
  - traffic information, including volumes, classification, and load data
  - a data base that links all data to the PMS
- Analyses, at a frequency established by the State consistent with PMS objectives, including:
  - a pavement condition analysis
  - a pavement performance analysis
  - an investment analysis that includes a network level analysis, a project level analysis, and appropriate horizons for these analyses
- Annual updates (U.S. Department of Transportation 1993b).

Figure 3 shows a conceptual model of a PMS.

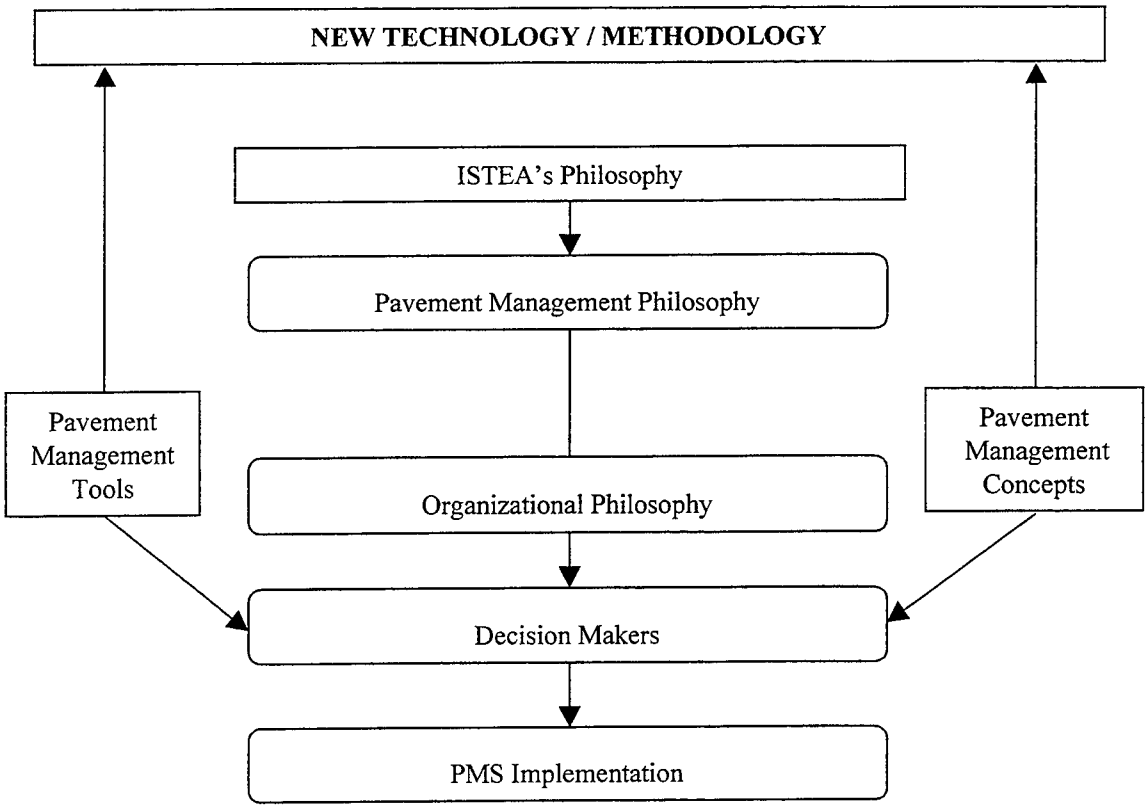

Figure 3. Organizational Model of PMS

Source: Adapted from Amekudzi and Attoh-Okine, 1996.

SAFETY MANAGEMENT SYSTEMS

Safety management practices had, perhaps, the longest history prior to the 1991 ISTEA mandate. The concept dates back to the 1966 Highway Safety Act, which supported state-level highway safety programs. Subsequent federal legislation in 1982 and 1986 expanded the focus on highway safety at the state level (Zogby 1994; U.S. Department of Transportation 1993a).

The proposed rule for safety management systems states that the primary purpose of all the management systems is to:

> Improve the efficiency of, and protect the investment in, the nation's exiting and future transportation infrastructure. The Highway Safety Management System may be further

defined as management processes to ensure that all opportunities to improve safety are identified , considered, implemented where appropriate, and evaluated" (U.S. Department of Transportation 1993a).

The impetus for including safety management systems in the ISTEA mandate was the recognition that, although much progress had been made in highways safety at the state level over the previous 30 years, many of the systems were independent from each other and lacked coordination, and that limited resources needed to be better managed with better planning and programming (Zogby 1994). Guidelines for SMS development published by the FHWA added the continuing loss of life on the nation's highways, and an increased emphasis on health and safety at the federal level as two other reasons for focusing on safety management (U.S. Department of Transportation. Federal Highways Administration 1994b). The SMS was not intended to be a product in itself, however, but rather an on-going process designed to integrate safety-related data into the broader decision-making process. As such, all the agencies involved in transportation planning and programming would be able to include safety issues and concerns into day-to-day operations and program development (Hall 1993; Wortham 1994). Figure 4 illustrates the intended interaction among transportation safety stakeholders.

Program requirements for the SMS focused on five main design areas:

- Coordinating and integrating broad base safety programs such as motor carrier, corridor, and community based traffic safety activities into a comprehensive management approach for highway safety;
- Identifying and investigating hazardous or potentially hazardous highway safety problems, roadway locations and features, including railroad-highway grade crossings, and establishing countermeasures and setting priorities to correct the identified hazards or potential hazards;

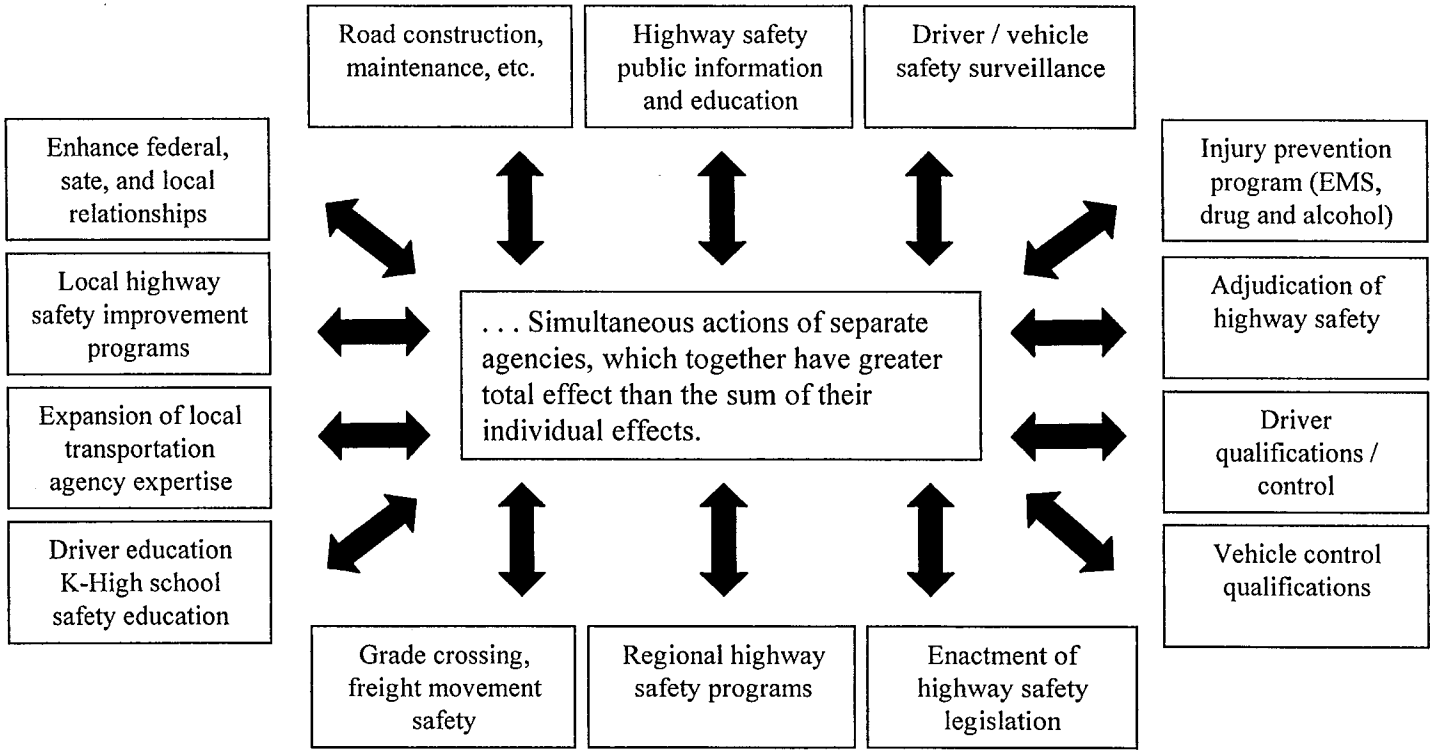

Figure 4. Safety Management System Synergism

Source: Adapted from Zogby, 1994.

- Ensuring early consideration of safety in all highway transportation programs and projects;
- Identifying safety needs of special user groups, such as older drivers, pedestrians, bicyclists, motorcyclists, commercial motor carriers, and hazardous material carriers, in the planning, design, construction, and operation of the highway systems; and
- Routinely maintaining and upgrading safety hardware (including highway-rail crossing warning devices), highway elements, and operational features (U.S. Department of Transportation. Federal Highways Administration 1994b).

To address these five issue areas, the Interim Final Rule specified eight major components that were to be included in each state SMS work plan:

- Establishment of short- and long-term highway safety goals;
- Establishment of accountability by identifying and defining the safety responsibility of units and positions;
- Recognition of institutional and organizational initiatives through identification of disciplines involved in highway safety at the State and local level, assessment of multi-agency responsibilities and accountability, and establishment of coordination, cooperation, and communication mechanisms;
- Collection, maintenance, and dissemination of data necessary for identifying problems and determining improvement needs;
- Analysis of available data, multi-disciplinary and operational investigations, and comparisons of existing conditions and current standards to assess highway safety needs, select countermeasures, and set priorities;
- Evaluation of the effectiveness of activities that relate to highway safety performance to guide future decisions;

- Development and implementation of public information and education activities to educate and inform the public on safety needs, and countermeasures that affect safety on the nation's highways; and
- Identification of the skills, resources, and current and future training needs to implement the State's activities and programs affecting highway safety, development of a program to carry out necessary training, and development of methods for monitoring and disseminating new technology and incorporating effective results (U.S. Department of Transportation 1993b).

PUBLIC TRANSPORTATION MANAGEMENT SYSTEMS

During the process leading up to ISTEA, transit service providers were faced with several issues and major problems, such as uncertainty of federal funding, increased competition for available funding, an aging capital base, and the obligations to meet the requirements of the Americans with Disabilities Act of 1990 (Libberton and Weeks 1994). The public transportation management system (PIMS) concept was developed to alleviate some of these problems by providing information to decision makers in order to make more cost effective decisions in regard to transit assets. The four general requirements for the public transportation management system (PIMS), according to the interim final rule, were as follows:

- Each state shall develop, establish , and implement on a continuing basis a PIMS that covers urban and rural area public transportation systems operated by the State, local jurisdictions, public transportation agencies and authorities, and private (for profit and non-profit) transit operators receiving funds under Federal Transit Act sections 3, 9, 16, or 18, and public transportation systems operated by contracted service providers with capital equipment funded under Federal Transit Act sections 3, 9, 16, or 18;
- The PIMS shall be developed , established, and implemented in cooperation with recipients and sub-recipients of funds under Federal Transit Act sections 3, 9, 16, or 18;

- Transit assets shall be designed to accommodate current and predicted use or ridership in a safe and cost effective manner; and
- Because of their interrelationship, the development, establishment and implementation of the PIMS shall be coordinated with the development, establishment and implementation of the congestion management system and the intermodal management system (U.S. Department of Transportation 1993b).

A certain amount of discretion was provided to each state in the development of the PIMS, however, each system was expected to be able to provide decision makers with the ability to, 1) assess current and future transit asset conditions and needs, 2) identify the major system deficiencies, and, 3) determine when and where to allocate funds for statewide public transportation needs (Libberton and Weeks 1994).

Training material developed by the FHWA states that a PIMS is not a product, but rather a process that should result in:

- A comprehensive inventory of a State's rural and urban transit facilities and equipment;
- The means to assess current and future conditions and needs; and
- The means to generate strategies for consideration in statewide and metropolitan transportation planning processes, through the integration with the CMS and IMS (U.S. Department of Transportation. Federal Highway Administration 1994a).

Development guidelines further stressed that a PIMS was intended as a planning tool, not an asset management tool, and that it is also a decision support tool, developed to provide decision makers with comprehensive and relevant information. Figure 5 illustrates the information flow expected from a PIMS.

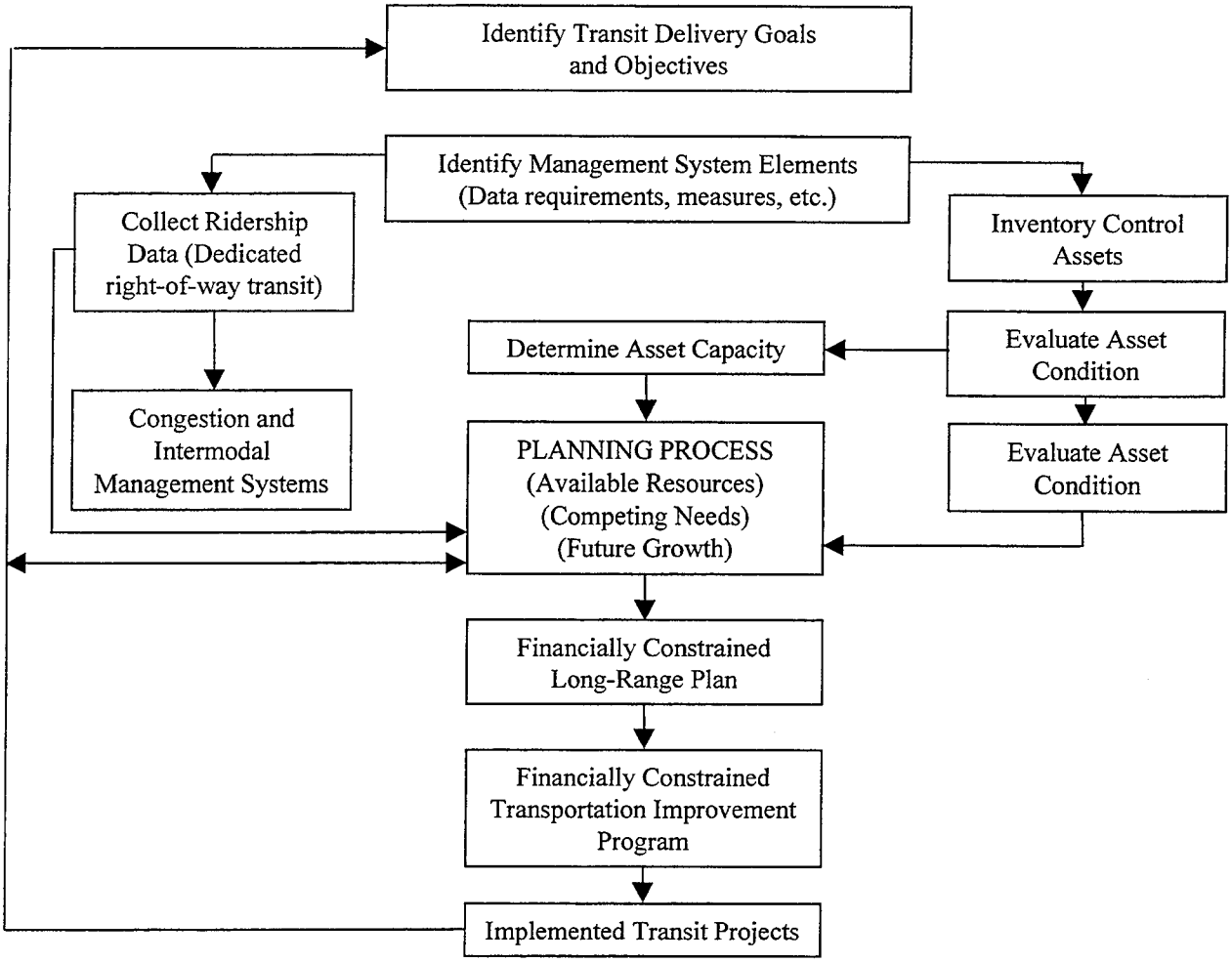

Figure 5. Public Transportation Management System and Relationship to the Planning Process

Source: Adapted from Libberton and Weeks, 1994.

INTERMODAL MANAGEMENT SYSTEMS

The intermodal management system (IMS) was, perhaps, the most ambiguous of the mandated management systems, leading to considerable debate over how to define an IMS and what to include in it (Transportation Research Board 1993). A "mode," as defined by the Intermodal Division of the FHWA, is, "a way of transporting freight and/or passengers." In general, freight modes include highway- truck, rail, pipeline, air, and water; passenger modes include highway- bus, rail, air, and water. "Intermodal," then, is defined as, "pertaining to the transfer and flow of people and/or goods from one mode to another or among several modes" (U.S. Department of

Transportation. Intermodal Division. 1994). The Intermodal Division of the FHWA offers this further definition:

> An IMS in practice is a structured process for information and data collection, analysis and synthesis and evaluation of alternative strategies to provide transportation professionals with the foundation for making strategic and policy decisions" (U.S. Department of Transportation. Intermodal Division 1994).

The basic purpose of an IMS is to, first, integrate intermodal transportation facilities and systems, and, second, to improve coordination in planning and implementing these systems (Dye and Rose 1995). According to the proposed rules issued by the U.S. Department of Transportation, an IMS should also consider the following intermodal needs:

- Connections among modes that are convenient, safe, and efficient;
- Choices for system users to select among transportation alternatives; and
- Coordination and cooperation between planners, system users and providers (U.S. Department of Transportation 1993a).

A Transportation Research Board-sponsored workshop developed the following perspectives on what constituted an IMS:

- An IMS is a continuous process and tool for supporting policy and investment decisions which includes all modes of transportation, facilitates the cooperation of public and private sector stakeholders, and addresses both freight and passenger transport;
- An IMS includes necessary actions for each state to optimize connections, and promote cooperation among the different modes; and
- An IMS is one contributor to the decision-making process and the development of a state intermodal transportation plan (Transportation Research Board 1993).

The TRB workshop recognized the long term character of the IMS concept, and suggested the following elements be included, over time:

- An inventory of modal and intermodal elements (institutions, markets, operations, and infrastructure);
- Identification of an intermodal system, to become the focus of the IMS;
- Performance measures that will provide feedback on system performance and problem identification;
- Identification of strategies for improving intermodal system efficiency and effectiveness;
- Analysis and evaluation of these strategies;
- Establishment of priorities among these strategies within the context of the overall intermodal planning effort; and
- Establishment of the means to include users and providers in the planning process (Transportation Research Board 1993).

Recognizing the extensive data demands of the IMS, and the limitations of state transportation planning agencies, it was suggested to keep the data requirements and evaluation techniques simple and to take an issue approach to IMS planning. Two factors influenced this approach: 1) the lack of available data on intermodal transport, and 2) the lack of procedures for evaluating movement between transport modes (Ismart 1993). It was suggested to use existing data from all relevant sources, and to include legal, regulatory, and financial limitations to intermodal transportation in each state. Possible issues that could be included in an IMS were identified:

- Physical limitations to intermodal movement;
- Accessibility to facilities;
- Transferability and coordination between modes;
- Legal and regulatory constraints;
- Delivery and collection systems for intermodal facilities;

- Safety of facilities; and
- Economic and environmental tradeoffs between modes.

The IMS could be developed through the identification of relevant issues, from the previous list, and the development of simple performance measures for each issue. The IMS would then be integrated into the larger network of management systems to develop policies and decisions (Ismart 1993).

Finally, In its assessment of management system implementation, the General Accounting Office stated that the IMS might be one of the more difficult of the management systems to implement. Prior to ISTEA, the concept was not well developed and few, if any, planning tools and data sources had been developed for this system approach. One of the primary constraints on developing an IMS was the difficulty in obtaining freight movement data from the private sector (U.S. General Accounting Office 1997).

DATA NEEDS FOR MANAGEMENT SYSTEMS

One of the primary concerns of state DOTs with the management system mandate was the considerable emphasis placed on data for developing and implementing these systems (U.S. General Accounting Office 1997). As the previous section suggests, several of the management system concepts had no prior data sources or planning techniques available in order to implement the systems. Even the management systems with considerable prior usage had new data burdens thrust upon them. As the availability of management system data was a critical component of the effectiveness measures, it is necessary to briefly discuss some of the data requirements and concerns. This section briefly outlines general date requirements for the management systems and identifies some of the major data shortfalls exposed by the management system mandate. This is followed by a review of several specific management system data requirements.

Data was a significant factor in the ISTEA management systems mandate, which required each system to use data for problem identification and definition, needs identification, analysis of alternative solutions, and for the measurement of system effectiveness (Karash and Schweiger 1994; McNeil 1995). As suggested by the U.S. Department of Transportation, the primary sources of management systems data could include:

- Traffic counting programs
- Travel time surveys
- Home interview surveys
- Employer surveys
- Vehicle occupancy counts
- Screen line counts
- Travel behavior studies
- Surveys at activity centers
- Parking inventories
- Site impact studies
- Computerized signal systems
- Cordon surveys
- On-board transit surveys (Karash and Schweiger 1994).

Specific data requirements for the six management systems were identified (Karash and Schweiger 1994) as the following:

- **PMS**
  - inventory
  - history
  - condition survey
  - traffic volumes
  - database

- **BMS**
  - bridge inventory data
  - bridge inspection data
  - cost data
  - supplemental data to support the analysis requirements of the BMS
- **SMS**
  - crashes
  - traffic
  - pedestrians
  - enforcement
  - vehicles
  - bicyclists
  - drivers
  - highways
  - medical services
- **CMS**
  - data requirements for the CMS were not specific, but had to be continuous in order to monitor system conditions
- **PIMS**
  - base year comprehensive inventory of transit assets
  - number of vehicles and ridership data for dedicated transit rights-of-way
- **IMS**
  - base year inventory of physical and operating characteristics of intermodal facilities
  - survey of operational and physical characteristics of such facilities based upon performance measures established at the state and local level

McNeil (1995) suggests that, in general, the data collection requirement for the management systems provides support across the system, including:

- Derivation of performance measures;
- Decision making;
- Safety and tort liability;
- Analysis of actions, programs, and policies; and
- Modeling of deterioration, costs, and impacts.

In spite of assertions that much of the necessary data was available, McNeil (1995) identified several significant gaps between what was available and what was required. In particular, the BMS would require more detailed data that was currently being provided by management systems. Additional data for CMS development that could be required included excess delay, congestion indices, and mobility and accessibility data for performance measures. Performance measure data was also missing for the IMSs, such as interconnectedness and goods movement data.

Performance measure data for CMSs that have suggested include:

- Travel time;
- Delay;
- Traffic volume, vehicle classification and vehicle speed;
- Transit;
- Goods movement; and
- Person movement (Schwartz, Suhrbier, and Gardner 1995).

Data sources for the previous list include:

- Traffic monitoring data;
- Highway Performance Monitoring System data;

- Section 15 Transit data; and
- Geographic information systems data (Schwartz, Suhrbier, and Gardner 1995).

Table 1 lists categories of data and related data subsets that were recommended for CMS development.

Table 1. Recommended Data for a Congestion Management System for Recurring Congestion

CATEGORY	DATA	DATA SUBSETS
System Characteristics	Lane Miles by Segment	Total Lane Miles by Segment General Purpose and HOV Lane Miles by Segment Functional Classification
	Capacity	Average Daily Traffic General Purpose and HOV ADT
System Usage/Demand	Average Daily Traffic	Type: General Purpose, HOV, and Trucks Time: Peak and Off Peak Volumes
	Average Vehicle Occupancy (AVO)	Type: General Purpose and HOV Time: Peak and Off Peak
Time/Cost	Speeds/Time	Posted Average Peak Average Off-Peak Duration of Peak Period
	Pricing	Parking Costs Congestion Pricing
Transit/Rail		Service - Routes including ridership and frequency Reliability - Percent on schedule and percent breakdown Transfers - Numbers of
Development Data		Development Type: Residential or Employment Development Density Trip Generation - including Household Surveys Pedestrian Amenities/Design Integration Centers Locations
Other Data Sources	Non-motorized	On/Off Road Bicycle and Pedestrian Routes and Counts

Source: Byrne and Mulhall, 1995.

MANAGEMENT SYSTEMS INTEGRATION

The basic concept presented by the management systems implied that integration for decision making would be an objective. The IFR mentions integration in that common data should be shared across management systems in order to coordinate outputs, which would provide better

information for decision makers (U.S. General Accounting Office 1997). This section focuses on the issue of management systems integration, and the implications this had for effectiveness measures.

In 1993, Vanderbilt University, and others, sponsored a national conference on integrating management systems into transportation and planning operations. Among the topics discussed were implementation of management systems, and specific requirements and concerns of the systems (Vanderbilt Engineering Center for Transportation Operations 1993). Later, in order to address the integration issue, the FHWA funded the Management Systems Integration Committee (MSIC), which was charged with sharing expertise and providing guidance on integration. As defined by the MSIC, a management system, "is a decision support tool which examines the primary components of the transportation system in an effort to monitor, manage, and optimize the system's current and projected performance" (Management Systems Integration Committee 1998).

The MSIC met several times during 1995 and 1996, and, as a result, defined the integration of the management systems as:

- The coordination of inputs, processes, and outputs of the systems.
- Linkage between systems such that:
  - the dynamics of one system will affect other systems as appropriate;
  - data is consistent and easily accessed, displayed, and transferred between the systems.
- The system's information is used effectively and consistently in decision making processes, particularly planning.

As a result of the committee's study, examples of management system integration were identified, including:

- Compatible outputs that allow cross-program comparison;
- Compatible analysis methods;
- Consistency of data used my multiple systems;
- Impact of system changes on other systems;
- Linked data interfaces;
- Common time lines and consistency of reports;
- Effective output use in planning and decision making; and
- Performance measures allowing agencies to compare system performance across functional classes, modes, and jurisdictions (Management Systems Integration Committee 1998).

Figure 6 shows a conceptual schematic of management systems integration.

The significance of management systems integration to an assessment of effectiveness measures is that not only are effectiveness measures an important aspect of each individual management system, but in their aggregate, they would provide decision makers with an overall picture of system performance. In spite of the attention focused on integration, however, little attention was paid to the issue of linking integrated outputs to effectiveness measures. Even in specific case studies of state-level systems integration efforts, effectiveness measures are rarely considered (Cottrell, et al. 1995; Shufon, et al. 1994)

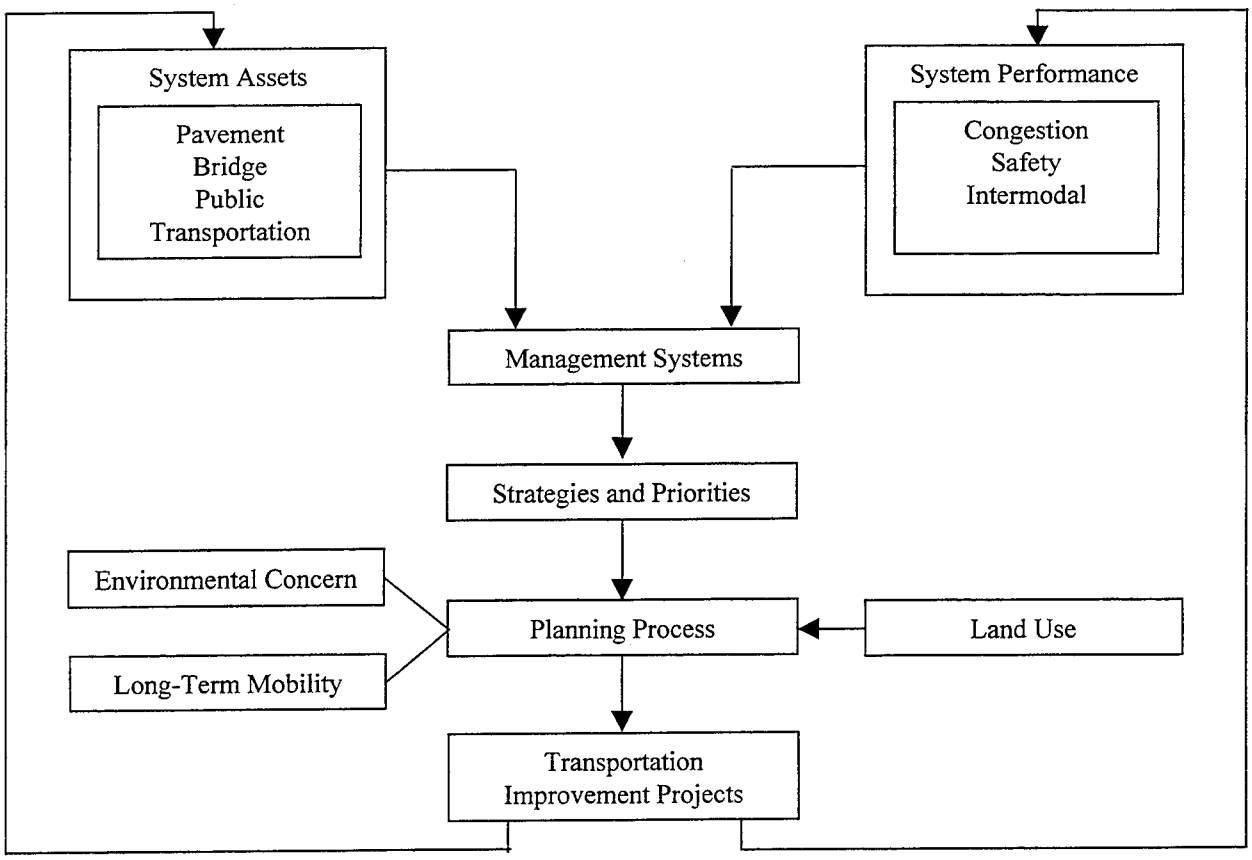

Figure 6. Integration of ISTEA Management Systems

Source: Adapted from Cottrell, et al., 1995.

SUMMARY

This chapter provides an overview of the process by which the ISTEA management systems mandate was formalized through the rulemaking process. In addition, general requirements for all management systems are identified. Each management system was discussed and specific components and approaches identified. This was followed by a brief discussion of two relevant issues, data requirements and integration. This information forms the basic informational framework for the remainder of the report. The next chapter will briefly outline the research approach to assessing the effectiveness measures in the ISTEA management systems.

CHAPTER THREE: A FRAMEWORK FOR ASSESSMENT

INTRODUCTION

In this chapter, we develop the general framework for assessing effectiveness measures in the ISTEA management systems mandate. First, we provide a general definition of effectiveness measures, based on policy analysis literature, as well as a brief overview of previous literature on effectiveness measures. This is followed by a discussion of "effectiveness measures" as used by the U.S. Department of Transportation during the rulemaking process. This is accomplished through a review of the three main directives associated with the management systems, the Advanced Notice of Proposed Rulemaking, the Notice of Proposed Rulemaking and the Interim Final Rule. The final sections of this chapter look at research methods applied in this project, and general expectations from an assessment of the management systems effectiveness measures.

EFFECTIVENESS MEASURES DEFINED

What are "effectiveness" measures, and how are they applied in policy analysis? Deniston defines "effectiveness" as, "the extent to which pre-established objectives are attained as a result of activity" (Deniston, et al. 1968). According to the International City/County Management Association (ICMA), effectiveness measures are *results* measures, that should indicate how well the mission, or objective, of a specific program is being achieved (ICMA 1997). ICMA identifies two levels of effectiveness measures: short-term, and long-term. Short-term effectiveness measures are those that generate feedback for program improvement, which can lead to program adjustment during the implementation process. Long-term measures of effectiveness are those which can be used to evaluate program strategy, or the ultimate outcome of the program:

> Long-term effectiveness indicators inform strategies chosen by policy makers. They also serve as markers for general progress made in areas of concern. Regardless of the outcomes directly achieved by programs, managers must step back and look at the longer-

term indicators and see whether the problems addressed are worsening or improving (ICMA 1997).

One problem associated with effectiveness measures, however, is the potential disconnect between short-term outcomes and long-term outcomes, or objectives. Attention to short-term objectives and outcomes may overshadow the longer-term objectives. This issue must be considered in the development of measures of program effectiveness to be sure that measures of short-term effectiveness can also inform the need for long-term effectiveness measurement.

POLICY ANALYSIS AND EFFECTIVENESS MEASURES

The vast literature on policy analysis and evaluation research can inform this study on effectiveness measures. This section will briefly outline some of the major issues from this literature that can underscore the framework of analysis applied here. As suggested by Langbein, program evaluation is, "partly scientific and partly political" (Langbein 1980). This assumption is particularly relevant to this study, as the management system mandate resulted from the larger political process involved with writing and passing the ISTEA legislation. As Weiss succinctly states: "Policies and programs with which evaluation deals are creatures of political decisions" (1975).

Policy analysis, in general, refers to the "application of systematic methodology to the resolution of public problems" (Langbein 1980). Program evaluation, in turn, is "concerned with the study of the impacts of policy outputs" (Nachmias 1980). Policy evaluation is often divided into two types: process evaluation, which focuses on whether or not a program or policy was implemented according to its actual intent; and, impact evaluation, which focuses on policy effect and whether or not the policy, or program achieved its stated objectives (Nachmias 1980). In regard to the ISTEA management systems mandate, then, the effectiveness measure mandate can be described

as a requirement for impact evaluation, where the program—management systems—would be assessed as to whether or not the stated objectives were achieved.

One of the common themes in evaluation research links the specificity of program goals and objectives with the ability to assess the extent to which they have been achieved. The more ambiguous the goals, the more difficult it is to evaluate whether they have been reached, or not, and why. A related concern is the difference between what Nachmias terms, "immediate and distant goals" (Nachmias 1980). As in the ICMA definition from the preceding section, considerable differences exist between short-term/immediate goals and long-term/distant goals. Reconciliation of these diverse goals presents a challenge to system and program developers.

Deniston, et al. (1968) provide a comprehensive model of program effectiveness evaluation, based on measuring the accomplishment of program subobjectives. Their model evaluates three components of a program: resources, activities, and objectives. Resources are those funds, personnel, or materials devoted to achieving a particular objective. Activity is work performed by personnel within a program. Objectives are situations or conditions that are desired, and can be divided into three types:

- Ultimate objectives, which are conditions desired in and of itself. In regard to the ISTEA management systems, the ultimate objective would be to provide better information for decision making in protecting and improving the nation's transportation infrastructure.
- Program objectives, are statements of particular situations or conditions that are intended to result from the program activities. The management system objectives would be the stated objectives for each of the six management systems.
- Sub-objectives, are subordinate objectives that must be attained prior to achieving program objectives. Management system sub-objectives would include those

activities, or tasks, in each management system that would be developed and implemented, including measures of system effectiveness.

The model derived from these three components includes three basic actions: program description, measurement, and determining effectiveness. According to the authors, a program may be less than effective as a result of several conditions:

- Resources were not used as planned;
- Assumptions linking resources to activities were not valid;
- Activities were not performed as been planned;
- Assumptions linking activities to sub-objectives or objectives were not valid; and,
- Assumptions linking sub-objectives to the program objectives were not valid (Deniston, et al. 1968).

Problems associated with evaluating federal programs, and an alternative model, are identified by Horst, et al. (1974). The focus of their study is on why evaluations of programs are rarely used by managers, and the underlying causes of this problem. They first identify three major problems with federal programs that contribute to this situation:

- Lack of Definition: the problem, intervention (solution), and the expected outcome or impact are not defined well enough to ensure measurement.
- Lack of Clear Logic: the logic linking assumptions of actions, such as the application of resources, to the impact of the actions is not clearly understood.
- Lack of Management: this problem refers to the situation that exists when those responsible for programs lack the interest or ability to act on program evaluations (Horst, et al. 1974).

In response to these major problems, the authors identify six symptoms that can result:

1. Evaluations are not planned to support decision making.
2. Timing, format, and precision of the evaluations are not adequate for user needs.
3. Findings are not communicated to decision makers.
4. Different evaluations of the same program are not comparable.
5. An accumulating body of evaluation research is not provided.
6. Evaluations often focus on unanswerable questions and produce inconclusive results (Horst, et al. 1974).

The solution is one which includes a pre-evaluation stage in the of program development and implementation. This stage assesses the evaluability of a program prior to implementation. In essence this stage addresses the three major problem areas by asking questions during program development, which provide a "rapid feedback evaluation" of current progress.

A recent evaluation study of state science and technology programs further identifies several problems associated with policy and program evaluation. In the study, the authors suggest, first, that federal programs are becoming more scrutinized than ever before, and that, increasingly, program evaluation is required, leading to an "age of assessment (Cozzens and Melkers 1997). Findings from their study show that, first, many mandated evaluation efforts are purely symbolic, and are conducted only to be shelved at a later time and never used as intended. Second, they find differences between mandated evaluation requirements and voluntary evaluation efforts. Third, information that is desired by program managers is usually different from that desired by higher level decision makers. This finding may suggest the conflict between short- and long-term effectiveness measures. Finally, they found that although performance measurement was expected from the beginning of program design and implementation, it was frequently not implemented until project had already been developed, and only then when an individual, in the

case of the science and technology programs this was usually the program director, assumed the responsibility for program evaluation (Cozzens and Melkers 1997).

EFFECTIVENESS MEASURES IN THE RULEMAKING PROCESS

How does the requirement to measure the effectiveness of the implemented ISTEA management systems relate to the previous summary of policy evaluation research? Goals and objectives of the mandate can be found in several places in the text of the advanced notice of proposed rulemaking (ANPRM), the notice of proposed rulemaking (NPRM), and the interim final rule (IFR). This section outlines these instances and notes any changes during the rulemaking process to the definition or emphasis on this requirement.

Advanced Notice of Proposed Rulemaking

The general introduction to the ANPRM states:

> Each of the management systems will require data to define and monitor the magnitude of the problems, identify needs, analyze alternative solutions, and measure the effectiveness of the implemented actions (U.S. Department of Transportation 1992, 23461).

Little mention is made of this requirement in the sections on specific management systems. Under the "CMS Principles," for example, the text includes the following:

> Feedback Loop—Implemented strategies need to be monitored and evaluated to determine if they are accomplishing their intended objectives (U.S. Department of Transportation 1992, 23464).

The IMS section states, under the section, "IMS Elements,"

> System and Facility Performance Evaluation—The data collection and system monitoring program will be used by the States and local agencies to evaluate the performance of intermodal facilities and systems. The major purpose of the performance evaluation

program would be to determine the specific cause(s) for the efficient, or inefficient, movement of goods and people as part of an intermodal transportation system

Notice of Proposed Rulemaking

The NPRM includes summaries of solicited comments, and responses, on the ANPRM, as well as the proposed rule, itself. 900 pages of comments were received in response to the ANPRM, from 162 respondents. Almost half of the comments were from state agencies, such as highway and transportation departments (U.S. Department of Transportation 1993a).

Following a comment regarding the institutional structure for the management systems, the response merely repeats the general requirement for effectiveness measures found in the ANPRM (U.S. Department of Transportation 1993a, 12097-8).

The proposed rule (Subpart A—General, Section 500.107) expands the definition and intent of the effectiveness measure requirement:

> Each management system must include appropriate means to evaluate the effectiveness of implemented actions developed through use of that system. The effectiveness of the management systems in enhancing and improving overall efficiency of the State's transportation systems and facilities shall be evaluated periodically as part of the metropolitan and statewide planning processes (U.S. Department of Transportation 1993a, 12116-7).

The proposed rule text for each specific management system includes a section on "standards" or "structure" intended to address Section 500.107. The following outlines how each system addresses the effectiveness measure requirement:

- *Subpart B—PMS. Section 500.207. Coordination.* No mention of effectiveness measures.

- *Subpart C—BMS. Section 500.307. Minimum standards.* " A system for monitoring the status of actions recommended by the BMS and for updating the BMS database when actions are taken."
- *Subpart D—SMS. Section 500.407. Program structure.* "Evaluation of the effectiveness of all activities that relate to highway safety performance. This information shall be used to guide future decisions."
- *Subpart E—CMS. Section 500.507. Management system structure.* "Evaluation of the effectiveness of implemented strategies. A process for periodic assessment of the effectiveness of implemented strategies, in terms of the area's established performance measures, shall be developed. The results of this evaluation shall be provided to State and local decision makers to determine future actions and provide direction on the most effective strategies for further implementation."
- *Subpart F—PIMS. Section 500.607. General requirements.* No mention of effectiveness measures.
- *Subpart G—IMS. Section 500.707. Management system structure.* No mention of effectiveness measures.

Interim Final Rule

The IFR, which was the final set of guidelines published for the management systems mandate, includes additional comments and responses on the NPRM. 130 sets of comments were submitted in response to the NPRM. The responses contain clarifications and changes that are subsequently found in the text of the IFR. Few of the comments, however, referred to the effectiveness measures issue in the mandate. An exception is found in the SMS section, in a concern expressed over the amount of data involved for effectiveness evaluation (U.S. Department of Transportation 1993b, 63461).

The text of the IFR (U.S. Department of Transportation 1993b, 63475-85) reveals the final changes in wording for the effectiveness measure issue. Section 500.105 (j) states:

> Each management system must include appropriate means to evaluate the effectiveness of implemented actions through use of that system. The effectiveness of the management systems in enhancing transportation investment decisions and improving overall efficiency of the State's transportation systems and facilities shall be evaluated periodically, preferably as part of the metropolitan and statewide planning processes (U.S. Department of Transportation 1993b, 63476).

As in the NPRM text, the IFR subparts associated with each individual management systems can be reviewed for specific mention of effectiveness measures. The subpart sections (207, 307, etc.) containing the effectiveness measures requirement for all management systems were renamed for consistency:

- *Subpart B—PMS. Section 500.207. PMS components.* No mention of effectiveness measures.
- *Subpart C—BMS. Section 500.307. BMS components.* No mention of effectiveness measures.
- *Subpart D—SMS. Section 500.407. SMS components.* "Evaluation of the effectiveness of activities that relate to highway safety performance to guide future decisions."
- *Subpart E—CMS. Section 500.507.CMS components.* "Evaluation of the effectiveness of implemented strategies. A process for periodic assessment of the effectiveness of implemented strategies, in terms of the area's established performance measures, shall be developed. The results of this evaluation shall be provided to decision makers to provide guidance on selection of effective strategies for future implementation."
- *Subpart F—PIMS. Section 500.607. PIMS components.* No mention of effectiveness measures.

- *Subpart G—IMS. Section 500.707. IMS components.* No mention of effectiveness measures.

Few changes in the effectiveness measures requirement can be traced from the ANPRM to the IFR, in spite of a significant amount of comments over this 18 month period. At the end of that time, with the publication of the IFR, State's were left with little direction for developing the means of evaluating the effectiveness of these six systems. Most of the concern expressed in the comments, in fact, were addressed to the issues of data collection and compliance with the deadlines, not with the eventuality that the effectiveness of the systems would have to be evaluated to see if the intent of the management system mandate was being met.

CHAPTER FOUR: WORK PLANS AND EFFECTIVENESS MEASURES

This chapter presents the content analysis of the actual state management system work plans submitted and approved for implementation. The first section develops a conceptual model of the effectiveness measure requirement as it relates to the rest of the management system requirements. This allows us to compare the sequence of development and implementation tasks, or components, that each state prepared for plan compliance. The second section presents the assessment of the effectiveness measures as found in the work plans. A matrix of effectiveness measure characteristics and attributes summarizes the findings from this assessment.

A MANAGEMENT SYSTEM MODEL

The management system mandate in the IFR includes the effectiveness measure requirement, in general, as a final step in the development and implementation of each system. Conceptually, this requirement can be considered a sub-objective of the larger mandate objective. In program evaluation a sub-objective is an outcome that must be achieved prior to a further outcome being achieved (Deniston, et al. 1968; Mohr 1995). If the main objective of the mandate was to develop information and strategies for transportation facility performance improvement, and to provide input for system level planning, then one sub-objective, though the effectiveness measure requirement, was to determine if the management systems were meeting this objective. It is assumed that certain other subobjectives had to be implemented prior to implementing the effectiveness measures. Obviously part, or all, of a management system had to be implemented in order to assess its effectiveness. The effectiveness measure requirement was also intended, as a periodical review mechanism, to inform the overall process as a feedback device. This relationship is illustrated in Figure 7

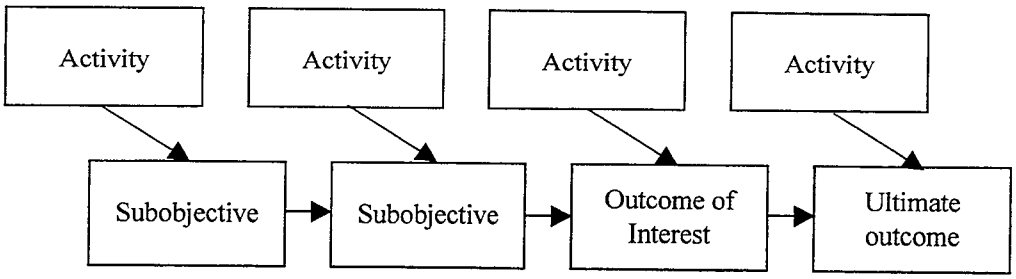

Figure 7. Conceptual Subobjective Model

Source: Adapted from Mohr, 1995.

Having developed this conceptual model, we can determine how it relates to each state work plan.

WORK PLAN ASSESSMENT

The management system work plans were obtained and reviewed for the following states: Texas, Arizona, Arkansas, Louisiana, New Mexico, and Oklahoma. This section describes these individual plans and assesses the approach and specific characteristics of the effectiveness measures. The plans that are evaluated are work plans developed in order to comply with the January 1, 1995 deadline.

As defined in the IFR, a work plan, "means a written description of major activities necessary to develop, establish, and implement a management or monitoring system, including identification of responsibilities, resources, and target dates for completion of the major activities" U.S. Department of Transportation 1993b, 63476). The assumption is that these documents would have served as guidance for the implementation of the state management systems, and as such, they represent a good indicator of the level of consideration and importance that went into developing effectiveness measures at the outset of the management system process. Specific characteristics of the effectiveness measure requirement that are of interest include: level of detail, mention of specific measures of effectiveness (rather than vague "develop methods to

measure effectiveness,") data recommended or used, responsible person or office, and links to other elements in the work plan.

The following sections introduce each State's management system work plan, in general, and then describe and evaluate the effectiveness measure requirement response for each.

Texas

The "Work Plans for Texas Management and Monitoring Systems" (Texas Department of Transportation 1995) was prepared by the Highway Design Division, the Transportation Planning and Programming Division, the Public Transportation Division, and the Traffic Operations Division, with assistance provided by the Texas Transportation Institute. The management and monitoring systems goals are as follows:

> TxDOT's management and monitoring systems goals will be consistent with TxDOT's mission, "to work cooperatively to provide safe, effective, and efficient, movement of people and goods." The management systems should be user-friendly, functional tools that incorporate reliable, cost-effective data collection and analysis techniques. Each management system has individual objectives and performance measures, yet the systems share common data elements and sources (Texas Department of Transportation 1995).

The introduction to the plan lists the "evaluation of the effectiveness of the implemented strategies/actions," as one of the requirements of the federal regulations. The Executive Summary includes brief summaries of each of the management systems, and Sections 5-10 contain the detailed work plans for each management system. All quotes and references are from the work plan (Texas Department of Transportation 1995).

PMS

Neither the description of the existing highway PMS, nor the list of remaining tasks in the work plan mention effectiveness measures. Performance measures are listed as they will be used from the HPMS, yet no intent to integrate these individual measures into an effectiveness measure is mentioned.

BMS

Objective 10 (of 10) of the BMS section is to, "develop an evaluation program to periodically update and refine the system after complete implementation." Two strategies are listed: 1) define and provide for the process of evaluation, and 2) define guidelines for performing evaluation and consequences of evaluation. No mention of effectiveness measures is included in the BMS work plan.

SMS

The executive summary of the Texas SMS states that the work plan will address the eight key elements required by federal regulation, including "evaluation of effectiveness." In the "Definition" section of the BMS, recommended strategy I-2 states, "that the Texas Safety Management System will be periodically assessed to determine that the system is operating efficiently and effectively, is meeting the needs of the State and is in compliance with all requirements." Nothing specific is mentioned in how to conduct this assessment.

PIMS

Phase 1 of the Texas PIMS focuses on development of the system; Phase 2 focuses on implementation. Under Phase 2, Task 3: Develop PIMS Monitoring Program, subtask B states:

> Establish PIMS evaluation. A method for evaluating the future effectiveness and usefulness of PIMS in assisting decision makers in the development of plans and programs, selection of projects and in maintaining transit facilities, equipment and rolling

stock in a serviceable condition will be developed. It is anticipated that this evaluation would be conducted at the end of the first full year of PIMS operation and every two years thereafter.

CMS

The CMS work plan introduces the effectiveness measure requirement under Part 2 - Introduction and Background, section B. Description of CMS, as one of 6 elements that will be included in the CMS: "Evaluation of effectiveness of implemented strategies. A process for assessment of effectiveness of strategies will be developed and the results of this evaluation will be provided to State and local decision makers to determine future actions." The final major activity listed in the work plan is number 8: Evaluation of Effectiveness of Improvement Strategies, which states:

> Once a congestion reduction strategy has been implemented, continuing monitoring efforts are necessary to assess whether the implemented strategy was effective. The objective will be to assess its effectiveness on both the specific congestion problem and the system as a whole.

The task of establishing the effectiveness evaluation methodology is included as part of the final development component for implementation completion

IMS

No specific mention of effectiveness measures is found in the Texas IMS work plan. System and facility efficiency evaluation is considered, however, in the description of the IMS.

New Mexico

No general introductory material was available for the New Mexico management systems work plans. All quotations and references are from the New Mexico work plans (New Mexico State Highway and Transportation Department 1993).

PMS

No mention of effectiveness measures are included in the PMS work plan, although one of the objectives (number 9) is to. "Provide a feedback mechanism to verify and improve the reliability of the system.

BMS

No mention is made in the New Mexico BMS as to the effectiveness measure requirement.

SMS

No mention is made in the New Mexico SMS as to the effectiveness measure requirement.

PIMS

Strategy effectiveness mentioned as a part of report PTMS003: Public Transportation Project/Strategy effectiveness, which would provide data on the effectiveness of implemented projects.

CMS

The New Mexico CMS lists an "implemented strategy evaluation procedure" under the system processes section of the work plan. The procedure, which had not been developed, was to identify the tasks associated with generating information from the CMS t reflect current performance against previous performance using established performance measures. In the CMS Implementation Plan draft, the final deadline listed (March 1, 1996) includes the following task:

Evaluate effectiveness of traffic congestion mitigation strategies. This will be done by comparing historical and current traffic congestion data.

IMS

As in the CMS, the IMS lists "Intermodal Strategy Evaluation" as a system procedure. No details are provided for this evaluation.

Arkansas

No general introductory material was available for the Arkansas management systems work plans. All quotations and references are from the Arkansas work plans (Arkansas State Highway and Transportation Department 1994).

PMS

The Arkansas PMS work plan was not available.

BMS

The Arkansas BMS work plan lists objective 6 as: Evaluation, updating, and refinement of the BMS. No effectiveness measures are mentioned.

SMS

The assessment of the existing Arkansas SMS emphasized the five major areas of safety and eight key elements listed in the IFR, including evaluation of the effectiveness of safety activities. One of the weaknesses identified in the assessment was that few evaluations had been made to determine highway safety improvement effectiveness. There was no mention of alleviating this weakness in the SMS objectives, however.

PIMS

The Arkansas PIMS work plan makes no mention of effectiveness measures.

CMS

The Executive Summary to the Arkansas CMS lists "methods for evaluating the effectiveness of implemented actions and monitoring system performance" as one of the discussion components of the work plan. Six key components are listed in development of the baseline CMS, including, "ongoing system performance and effectiveness evaluation." The component detail states that, "once the CMS is in place and operating, a program will be required to periodically assess levels of congestion and the effectiveness of implemented strategies of the area's established performance objectives." The final task in the CMS "Activities and Schedule" section (Component 6: Ongoing System Performance and Effectiveness Evaluation) states: "Design a systematic process for collecting sufficient data to evaluate their effectiveness of and provide feedback on implemented actions." No specific guidelines or suggestions for this task are included, however.

IMS

Effectiveness measures are not mentioned in the Arkansas IMS work plan.

Louisiana

No general introductory material was available for the Louisiana management systems work plans. All quotations and references are from the Louisiana work plans (Louisiana State Highway and Transportation Department 1994).

PMS

Task 8, "Evaluate effectiveness of strategies," of the PMS states:

> We will monitor the condition of pavements by updating our dROAD distress data base with subsequent consultant data collections. We will know when each strategy was implemented using the MATT file and will update our dROAD inventory data base accordingly. With time, effectiveness will document itself in the shape of rest performance curves associated with the various strategies.

BMS

The Louisiana BMS includes a five-step process for implementation, including an evaluation of the effectiveness of implemented strategies (Step 5). This step is describes as follows:

> A process of periodic assessment of the effectiveness of the implemented strategies will be developed. The assessment will be based upon updated and continuous surveys using the established performance measures. The results will provide guidance on selection of effective strategies for future implementation.

Evaluation of performance measures is included as Action Step 5.5, which includes the task of periodic feedback for an assessment of the effectiveness of the implemented actions or strategies.

SMS

The Louisiana SMS lists "Investment Evaluation" as the primary source of feedback for safety-related performance evaluation and SMS development. Investment evaluation will include four components: resources, projected benefits, actual benefits, and rates of change associated with safety investments.

PIMS

Effectiveness measures are not mentioned in the Louisiana PIMS work plan.

CMS

Goal 4 of the Louisiana CMS states, "the CMS will evaluate the effectiveness of implemented actions." No additional methods or direction is provided.

IMS

Effectiveness measures are not mentioned in the Louisiana IMS work plan.

Oklahoma

No general introductory material was available for the Oklahoma management systems work plans. All quotations and references are from the Oklahoma work plans (Oklahoma Department of Transportation 1994).

PMS

The Oklahoma PMS does not include a reference to effectiveness measures.

BMS

The Oklahoma BMS does not include specific references to effectiveness measures.

SMS

The Oklahoma SMS work plan includes the standard list of five major areas and eight components specified in the IFR. Component number 6 states: "Evaluation of the effectiveness of activities that relate to highway safety performance to guide future directions." Effectiveness measures, however, are not included in the plan implementation steps of the work plan.

PIMS

The Oklahoma PIMS does not include specific references to effectiveness measures.

CMS

Work Task F-2, of the Oklahoma CMS, is titled: "Monitor Implementation Progress and Effectiveness of Congestion Relief Strategies." The task states:

> The implemented congestion relief strategies will be compared to the Performance Expectations developed under Task E-4 [Outline Performance Expectations] in order to assess their effectiveness in solving specific congestion problems.

IMS

Work Task 9, of the Oklahoma IMS, "Evaluate, Update and Certify the IMS Data Base," states that the Oklahoma DOT, and other agencies, will evaluate the performance of the IMS and update the database when necessary. No specific measures are mentioned.

Arizona

Each of the Arizona management system work plans included an identical overview section on the management systems. General goals, summaries of all six management systems, and the relationship of the management systems to statewide transportation planning are included. No reference is made to effectiveness measures in this introductory material. All quotations and references are from the Arizona work plans (Arizona Department of Transportation 1995).

PMS

Task 9 under the PMS work task list is to "implement statewide PMS requirements," including PMS evaluation and updating. Task 11, "evaluate, update, and certify the PMS, also mentions the evaluation of the PMS. No specific effectiveness measures are mentions.

BMS

No specific mention of effectiveness measures are made in the Arizona BMS work plan.

SMS

Task 9 of the SMS work plan, "evaluate, update, and certify the SMS,"states that the SMS Committee will monitor and evaluate the performance and goals of the SMS and update the system as necessary. No specific mention of effectiveness measures are listed.

PIMS

Task 6 of the PIMS work plan, "evaluate, update, and certify," state that the Arizona DOT in cooperation with other agencies, is responsible for evaluating the performance of the PIMS and updating, when necessary. No specific mention of effectiveness measures are listed.

CMS

As in the previous Arizona management systems, Arizona DOT assumes the responsibility to "evaluate, update, and certify," the CMS. No specific mention of effectiveness measures are listed.

IMS

Task 6 of the IMS work plan, "evaluate, update, and certify," state that the Arizona DOT in cooperation with other agencies, is responsible for evaluating the performance of the IMS and updating, when necessary. No specific mention of effectiveness measures are listed.

Effectiveness Measures in Referenced and Subsequent Material

Several of the management system rules, as published in the IFR, reference previously published sources that were to be used as additional guidelines for developing and implementing the ISTEA management systems. Management system developers were also provided with additional guidelines, prepared by the USDOT, following the publication of the IFR. This section evaluates these sources for the inclusion of measures of system effectiveness.

The IFR section for the PMS states, "PMSs should be based on the concepts described in the 'AASHTO Guidelines for Pavement Management Systems.'" The goal of this publication is to:

> Describe the characteristics of a pavement management system, the various parts or components of a PMS which are required for its development and implementation and how the products of the PMS can be used as a strategic planning tool for middle and upper management as well as for applications to pavement engineering (AASHTO 1990).

The guidelines suggest that a PMS should include the following:

- an inventory of network pavements;
- a database of information on current and past pavement condition;
- budget requirements;
- methods of prioritizing expenditures; and
- a basis for communications of agency plans, both internally and externally (AASHTO 1990).

No specific mention is made of measuring PMS effectiveness as a system, however, the "feedback process" can produce useful information as a measure of effectiveness of methods used for design of new or rehabilitated pavements.

The FHWA published a "good practices" handbook for development and implementation of SMSs (U.S. Department of Transportation. Federal Highway Administration. 1994b). The purpose of the manual was to provide guidance for formulation of SMSs at the state level. Among the items listed for possible inclusion in an SMS is the following suggestion:

> Identify the process(es) that will be established for evaluating the effectiveness of the activities that relate to highway safety performance and short and long term goals. The results of these evaluations should guide future decisions (U.S. Department of Transportation. Federal Highway Administration 1994b).

The handbook also reiterates the eight elements of the SMS and the five major issues areas, as stated in the IFR. No specific measures of effectiveness are discussed, however.

The Federal Transit Administration also provided guidelines for PIMS developers, in the form of a Transit Cooperative Research Program report (Transportation Research Board 1995). The guidelines provide a comprehensive overview of the management systems mandate and the role of the PIMS. Chapter 2, "Description of the PIMS Process," lists the multiple components of a PIMS, including the final component: Feedback and Updating a PIMS. This section states:

> To fine tune the PIMS process, participants and stakeholders should be questioned periodically about the PIMS—its effectiveness in providing the information used for state and regional planning processes and as a vehicle for articulating the public transit capital needs of a state or region (Transportation Research Board 1995, 20).

The need to solicit feedback from stakeholders is mentioned again in Chapter 3, "Implementing a PIMS," as one of the final steps in the PIMS planning cycle. Based on these observations, the method of determining effectiveness of the PIMS process would be based on stakeholder input and perspectives.

Guidelines for planning and implementing IMSs were published in 1994 by the FHWA (U.S. Department of Transportation. Intermodal Division. 1994). The handbook includes extensive guidelines for developing and implementing an IMS, and questions and answers regarding data requirements and sources. Effectiveness measures for the IMS are not discussed in the handbook.

CHAPTER FIVE: DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS

This final chapter includes a discussion of findings presented in the previous chapter. This is followed by a discussion of the implications that can be derived from the findings, specifically in regard to management systems, and to transportation policy and programs in general. The final section includes recommendations for effectiveness measure evaluation in transportation programs and for future research direction.

DISCUSSION

Based on this description of the management system rulemaking process, the ambiguous nature of the effectiveness measure found in the IFR, and the apparent lack of interest shown in comments to the U.S. DOT rulemaking notices, what can we expect to find in the assessment of the state management system work plans? Content analysis of the sample state work plans reveals several important issues that are summarized in this section:

1. The requirement for effectiveness measures held a prominent, and obvious, position in each of the six management systems, yet this requirement received limited attention as the lack of comments to the ANPRM and NPRM show.
2. As responses to comments trace the evolution of specific issues of concern, and the management systems in general, little change is shown in regard to the effectiveness measure requirement as it finally appears in the IFR.
3. The main focus found in both the comments during the rulemaking process and in the actual management system work plans was on data and data requirements, not on whether or not the specific system would actually have the intended, or desired, impact.
4. Individual performance measures dominate the state work plans. These measures were frequently confused with effectiveness measures.

5. Content analysis of the state work plans show that, first, little attention was paid, overall, to the effectiveness requirement, and that when mention was made of the requirement, it rarely went beyond reiterating the text of the IFR.
6. Subsequent management system development and implementation guidance provided by the USDOT added little to the understanding and development of effectiveness measures.

Work Plan Effectiveness Measures and Policy Evaluation Theory

How do we explain these findings, and how do they stack up against the theory explored in the evaluation framework discussed in Chapter 3? This section links the previous findings with the issues raised in the theories of policy analysis and evaluation.

Several of the theoretical studies stress the significance of the program objectives to any subsequent program evaluation (Nachmias 1980; Deniston, et al. 1968; Horst et al. 1974). Ambiguous goals and objectives translate into problems when programs are evaluated, as this creates difficulty in linking concrete measures of program effectiveness with objectives. The focus on performance measures in the work plans, too, create difficulties as the aggregate of all performance measures may not equate to a true measure of effectiveness. Many externalities are ignored in performance measures, yet these externalities may influence system effectiveness over the long-term.

The disconnect between short term goals and long term goals creates problems for developing effectiveness measures (ICMA 1997; Nachmias 1980; Cozzens and Melkers 1997). Program managers are more concerned with short-term goals and objectives, while decision makers higher up may be more concerned with long-term goals. The effectiveness of a program will be significantly different based on these two perspectives, however. The focus on short term

objectives in the management systems can be seen in the relatively greater attention to performance measures over effectiveness measures.

An abundance of literature and cases exist on program evaluation. Simple models such as those described in Chapter 3 (Deniston, et al. 1968; Horst, et al. 1974) could have easily been inserted into the IFR, the work plans, or the subsequent management system development resource material, but nothing resembling these, or any other models of effectiveness measurement, show up. This illustrates one of the issues raised by Horst, et al., when they discuss the language of program objectives (Horst, et al. 1974). "Project packaging language," includes phrases that are supposed to describe the activities designed to reach a certain outcome, such as "improve decision making capabilities." These phrases, such as those referring to the effectiveness measure requirement, provide little, if any, real guidance in linking intent with substance. As the authors state, "rarely are useful measures or norms for these activities and outcomes provided." Project packaging language provides rulemakers with a means for avoiding specificity.

Another of the significant issues raised in evaluation theory relates to resource usage (Deniston et al. 1968). Problems ensue if resources are not used as planned, such as exhausting resources in the development of performance measures with little left over for effectiveness measures of system performance. Although this problem is not explicit identified in the work plans, as they were developed prior to most implementation efforts, the emphasis placed on performance measures could foreshadow the eventual development of this problem.

The inclusion of the effectiveness measure requirement in the management system mandate may, as Cozzens and Melkers note, be a by-product of the "age of assessment." One problem identified in this assessment is the tendency for mandated evaluation to be purely symbolic, in nature, rather than effective applications of evaluation research (Cozzens and Melkers 1997). The effectiveness measures requirement may have, in fact, been included merely because it was

the appropriate thing to do at the time, as other federal programs were including similar requirements. Further, the reiteration of the requirement in the state work plans, without inclusion of specific methods or techniques, can be seen as a symbolic response to the requirement. As McNeil (1995) also points out, some states were merely implementing management systems to comply with the letter of the law, not to actually achieve the desired results from the mandate. The final hypothesis from the Cozzens and Melkers' study also applies to this report, in that frequently measures of program performance were required from the beginning of a program, but were seldom implemented until long afterwards, and only then by a champion of the requirement. The effectiveness measure requirement was certainly obvious from the beginning of the rulemaking process, yet never achieved the attention that the more technical performance measures and data requirements received.

Finally, the Horst model (1974) is particularly useful in this study. Of the three major problems cited in their study, the effectiveness measure requirement appears to fall victim to all three. First, the problem requiring more and better information for transportation decision making and investment was not well defined. Second, the linkages between actions, such as the requirement to assess the effectiveness of the management systems, with the impact of the actions was not clearly understood. Was the intent of the requirement to measure effectiveness of the system process or system output? Third, rarely were the work plans specific in who was to be responsible for the effectiveness measures. Without a clear line of authority, an ambiguously defined objective can essentially be ignored.

Of the six symptoms identified in the model, three are significant to this issue. First, the timing of the effectiveness measures, which came always at the end of system implementation, may have encouraged the lack of concern over this requirement. Program developers may have felt that since the requirement to assess system effectiveness was always one of the final steps in the guidelines, it was appropriate to pay less attention to its development. Second, since there was

little mention of effectiveness measures in the integration efforts of the management systems, the need to develop compatible effectiveness measures was never addressed. One of the objectives of the management systems concept, was, however, the desire to be able to make system-wide evaluations and decisions, rather than mode-specific, as has been the norm in transportation decision making. The third symptom identified in the Horst model is the tendency for program effectiveness evaluations to focus on unanswerable questions. Is it even possible to evaluate the effectiveness of a management system, considering all the other problems associated with their development and implementation? It appears that this possibility was never considered during the rulemaking process, which would have been the appropriate venue for such a discussion. The overwhelming focus on data and data requirements, not on whether the management systems would actually do what they were intended to do, seems to underscore this symptom.

Effectiveness Measures Versus Performance Measures

One problem evident in this study, and briefly mentioned in the previous section, is the frequent confusion between "performance" measures and "effectiveness" measures, as illustrated in the comments to the ANPRM and the NPRM, and the state work plans. Many of the comments focused on specific performance measures, yet an aggregate of performance measures in any management system should not be assumed to make up a measures of system effectiveness. Effectiveness measures are intended to evaluate the overall performance of a program or system, while performance measures are traditionally indicators of single components within a system. While performance measures can inform the effort to measure effectiveness, they should not be confused or used interchangeably. The comments and work plans reveal this overemphasis on data and measures, which is understandable considering the traditional engineering focus of the transportation policy and decision making environment. Rather than attempting to learn from what was available, or using the data systematically, the emphasis on performance measures detracted from the need to evaluate whether or not program objectives were being met.

IMPLICATIONS FROM STUDY

This study suggests implications beyond those directly associated with the short-lived management systems mandate and effectiveness measures requirement. This section focuses on four broader implications: unintended consequences associated with the management systems, the technical response to the management systems, and what this study suggests about transportation policy making, in the United States, in general.

Unintended Consequences of the ISTEA Management Systems

An unintended consequence of a policy decision is one which diverges from an authorized or directed policy action (Lindquist 1998). One of the questions policy analysts frequently deal with is, why does the implementation of some policies achieve negative, or unintended, results? If we assume a positive objective for the management system policy, to provide transportation decision makers with better information to more effectively plan the nation's transportation system and improve upon existing planning and programming methods, how did the implementation of the mandate contribute to the legislative reversal of the mandate? What were the major problems in implementation, and can similar problems be recognized and mitigated for future transportation policies? In general, unintended consequences can result from four problematic conditions in the policy making context: linkages, communication, organizational capacity, and interpretation. These issues have been discussed in an earlier paper (Lindquist 1998), and will be summarized here.

Linkages

Linkages refer to the relationships between the primary rulemaking agency, in this case the USDOT, and the program implementing agencies, the state DOTs. This linkage can be assessed by considering two aspects of the policy implementation relationship between the USDOT and the state DOTs: the communications between these two levels of government, which is

considered in the next section, and the traditional relationship between these agencies in regard to policy implementation.

The relationship between the US DOT and the state DOTs for surface transportation policy has traditionally been focused on distributive policies, or those polices related to the distribution of federal revenue for design and construction of federal highways. The management system mandate, however, resembled a regulatory policy, in that the mandate requirements placed significant burdens, or the perception of burdens, on state DOTs for compliance with little, if any, additional funding. Different types of policies, regulatory, distributive, or redistributive, have been shown to elicit different responses from implementing agencies (Lowi 1964).

Part of the responsibility for assisting the state DOTs with management system implementation fell upon the US DOT regional offices. The relationships between state DOTs and regional offices of federal agencies vary according to available expertise, previous relationships, and willingness of the state implementors to seek assistance. Both the FHWA and the FTA have regional offices, and if a state sought regional assistance it could necessitate conferring with more than one regional office. The GAO report on management system implementation identified a perceived lack of support from the FTA on implementing the public transportation management system, compared to a more favorable opinion towards the FHWA and its efforts. In response to these claims, the FTA cited their traditional relationship to urban metropolitan areas, rather than to the state, as a contributing factor in this problem (U.S. General Accounting Office 1997).

Communication

The FHWA and the FTA were given the responsibility for rulemaking and providing assistance for management system implementation. The notice of proposed rulemaking was issued in June, 1992, and the proposed rule was issued in March, 1993. As noted previously, the interim final

rule did not become available until two years after the ISTEA legislation went into effect, in December, 1993. The lag time between legislative mandate and the availability of rules has been identified as a significant factor by the state DOTs in implementing the management systems. Those states without experience in any or all of the management systems were left to develop their work plans with little formal guidance in the form of rules and procedures. Those states with experience ran the risk of maintaining existing management system programs that might not meet the final rules, when they became available.

The responses to the proposed rules focused on three major problems: the significant data burden that the mandate placed on state DOTs; a lack of flexibility in the mandate, which prevented states from developing management systems suitable to their individual needs; and, a short compliance schedule. This feedback from the target agencies contributed to a condition of slow and ambiguous communication as the FHWA and FTA struggled with developing its rules.

Organizational Capacity

Organizational capacity refers to the ability of an organization, through its institutional structure, personnel, processes, and budgetary resources, to implement its policy preferences. Most of the assessment of how this factor encourages unintended policy consequences focuses on the internal structure and perspective of the target agencies, the state DOTs. However, one significant problem of organizational capacity at the federal level needs to be considered: the significant lag time experienced by the US DOT in providing the interim final rule to the states. One of the major reasons for the lag was the problem in developing guidelines for three of the management systems: congestion, intermodal, and public transportation. The other three systems, safety, pavement, and bridge, had been in development and use by many of the states prior to the ISTEA legislation and internal expertise was available at the federal level to develop the necessary mandate guidelines. Experience with the other three systems was lacking, which contributed to the slow response in developing guidelines for implementation.

This lack of internal capacity for rulemaking was mirrored in the state DOTs, which were likewise unfamiliar with the congestion, intermodal, and public transportation management systems. The situation facing most state DOTs, of familiarity with some of the systems, unfamiliarity with others, and a policy objective to integrate all of them into a state-wide process, translated into decision making conflicts. Decision costs and real program costs will vary according to an agencies familiarity with program specifics. In other words, decision and program costs for an existing management system, such as a pavement management system, are low as the resources needed to comply with the mandate are already allocated and the legitimacy of the system is generally accepted. Costs associated with an unfamiliar system, however, are assumed to be high, as decisions have to be made as to where in the organization it will be located and administered, what resources will be allocated, and how it will be integrated with existing programs. This disparity of costs associated with policy implementation leads to organizational conflict.

The management system integration policy objective was included to make the most efficient and effective use of management system data in an era of increasing limited funding for state transportation planning. Some systems duplicated data, creating the potential for wasted resources. Yet the coordination of internal divisions within any organization can be problematic as it often results in battles over turf and responsibilities.

The type of change that is mandated also influences organizational response. The ISTEA management system mandate represented major changes, both ideologically and technologically, in state approaches to transportation policy implementation. State DOTs were mandated to coordinate and integrate divisions and responsibilities that may have been separate, institutionally, for many years. The implementation of this mandate, in a short time frame with limited information, was an example of comprehensive, or non-incremental, change. This type of change can be problematic, as organizations are generally resistant to change.

Interpretation

How an implementing organization interprets a mandate or policy objective has a significant impact on policy implementation efforts. A mandate may be viewed from a positive or negative perspective, or the objective may be viewed positively, but the means may be viewed as burdensome or inflexible, as was the case with the ISTEA management systems. Considering the latter perspective, compliance may only satisfy the letter of the mandate, without actually accomplishing the objectives (Ingram 1990). The interpretive response to any policy mandate by the target agency could be to, either, 1) meet the deadlines with the work plans (comply with the standards of the mandate), or, 2) achieve the objectives of the policy to make better decisions (seek an improvement of services). The length of time it took for the US DOT to issue the interim final rule, and speculation that Congress would remove the mandate in the 1995 NHS legislation certainly could have contributed to a negative interpretation of the mandate.

Technical Responses to the ISTEA Management Systems

The review of the state management systems work plans shows that the sample states had a considerable amount of data available prior to ISTEA, particularly in the bridge and pavement management systems. Most of this data was generated from specific performance measures for specific problems found in these areas, rather than from an interest or need for system-wide assessment. The reduction of technical problems to smaller and smaller components that can be addressed by such techniques as performance measures is a characteristic of engineering and technical professions (Linstone 1984). One result of this characteristic is that reductionism of problems becomes institutionalized, to the extent that an agency may have difficulty in evaluating broader, or system-wide, impacts. This can be seen in the overall lack of experience with management systems, as expressed in the GAO report, and the lack of experience with effectiveness measures on a system wide basis, as opposed to performance measures of specific methods or techniques. Reducing transportation problems to smaller and smaller components,

that can be evaluated with performance measures, and solving them individually does little to address the system-wide problems, such as those that the management system sought to address.

Feedback mechanisms were early on identified as a weak link in the management system requirements (AASHTO 1994), yet there is little evidence from this study to show that this concern was taken seriously in the development of the IFR and state work plans. The linear construction of the IFR for each management system actually may have encouraged the emphasis on technical responses by placing the evaluation requirement at the end of the implementation process, rather than making it an on-going element of development and implementation. The relative location of effectiveness measures in the mandate, at the end of the process, suggests that little attention need be paid to them at the outset in the development of the work plans.

Implications for Transportation Policy Making

The federal mandate to develop and implement transportation management systems was only one small part of a much larger piece of groundbreaking legislation. In spite of this, this assessment of the effectiveness measures provides a glimpse into the institutionalized tendencies of transportation policy making in this country. The immediate questions that are raised are, what are the implications from the indifference to system-wide effectiveness measures, and are we, as a profession, paying enough attention to this component of the policy implementation process? There are also different implications for federal level policy making, compared with state-level transportation policy making.

Federal Implications

Once Congress passes legislation, the federal bureaucracy is left to make the initial interpretation of the policy message. This interpretation guides the rulemaking process and initiates the implementation stage of the policy process. It has been suggested that if Congress would pass more specific legislation in clearer, unambiguous language, that rulemaking and implementation

would be easier and more effective. The call for clear and direct policy language is unlikely to be heeded, however, leaving rulemaking agencies with the task of deciphering and linking ambiguous policy objectives to directed action (Ingram 1990). Federal agencies are also left to deal with the possibility of unintended policy consequences.

Federal-level transportation policymaking is changing. The traditional distributive policy relationship of providing state DOTs with federal highway construction dollars for the interstate system has been replaced with the innovative legislation of ISTEA, financial constraints on transportation planning, the influence of environmental policy on transportation, a greater involvement of previously excluded interests, and a need for integration of state transportation system components. All these suggest that the development of federal rules and guidelines will become more difficult, rather than less. Distributive policymaking and implementation is different from regulatory policymaking and implementation; each provoke diverse politics and reactions from target agencies. Integration of environmental issues, and the increasing number of participants in transportation policy, particularly from the general public and regional governments, implies that different perspectives and demands will have to incorporated into federal rules and regulations. If the "age of assessment" has reached the USDOT, we can expect more emphasis in the future on assessing whether or not programs are doing what they were intended to do. This will create greater expectations from lawmakers that federal agencies can effectively accommodate these assessments.

State Implications

How will the states respond to this changing environment of transportation policy? Decisions made in response to a mandate directly influences how it will be implemented. State agencies can choose between implementation for the sake of implementation or to firmly address the problem. Each state will interpret a mandate differently, through its own perception of what it needs and what resources it can use to comply.

One problem with the management systems mandate, from the perspective of the state DOTs, was that it was too inflexible to allow each state latitude in designing the systems according to their individual needs (U.S. General Accounting Office 1997). This suggests that as federal policy is designed, consideration needs to be given for a non-homogenous target. The question, and implication, is, how can states influence the design of federal policy that is flexible enough to address individual state needs and capacity, yet accomplish the legislative objectives of the policy? Allowing the states the option of continuing the management systems according to their own design allows states interested in innovation, and willing to initiate changes, an opportunity to do so in concert with other like-minded states. The management system mandate constituted a major change in how state DOTs conducted their planning and programming efforts. As such, the state response raises the question of how states respond to opportunity for change. Marginal changes, such as maintaining pre-existing management systems or implementing only one or two new systems may support planning and programming methods that are out of date, expensive, and non-responsive to public need. Lack of a mandate may actually discourage innovation and integration of management systems into the mainstream of transportation planning and programming.

Transportation planning and programming is traditional designed around the different modes. ISTEA, however, encouraged, and mandated, an intermodal perspective. This perspective is contrary to how state DOTs traditionally function. If state DOTs have problems working across modes in their own agencies, how can we expect them to be successful in interacting with the public and in their requirements for greater public participation?

RECOMMENDATIONS

The final section of this report focuses on recommendations, for the management systems, in general, for program evaluation in transportation policy making, and for future research into these issues.

The General Accounting Office (1997) outlines the current state of the management systems in their post-mandate context. In general, many of the state are continuing development and implementation of the management systems, without significant guidance from federal agencies. This suggests that the importance of the management system has been recognized, and that to a certain extent, states are thinking in terms of systems planning and programming. Addressing the issue of effectiveness measurement needs to be included in these efforts, however.

This report identifies an inability, or unwillingness, of state DOTs to spend much time or resources on the effectiveness measurement of the management system mandate. To the extent that this may be an unfortunate attribute of the profession, this needs to be addressed in future transportation policy. One of the solutions suggested by the Horst model is a recommendation for preassessment of programs during the development stages. What characteristics of the program under development will encourage or discourage program evaluation when then the time comes? This preassessment will ensure that measures are included that will be relevant in an evaluative context, not just in the short term.

The final recommendation focuses on avenues for future research. First, the systematic analysis of policy is rare in the engineering-dominant realm of transportation research. However, as this report shows, the rulemaking process can be a very conflictual and influential part of transportation policy making, with significant impact on policy implementation at the state level as final policy guidelines are constructed. State agencies are powerful proponents of the status quo when it comes to mandated change, yet little research has been conducted on the dynamics of transportation policy making from the intergovernmental perspective.

Second, and in a related context, what are the roles of interest groups in influencing transportation policy through the rulemaking process? This study shows that an overwhelming majority of respondents to the ANPRM and the NPRM were state highway and transportation

agencies. This implies that their collective voices were the dominant voices heard by the rulemaking agency, in this case the USDOT. What are the implications from this as far as the taxpaying public is concerned?

Third, this report suggests that many transportation policies or programs may be implemented without the means for evaluating their effectiveness. How widespread is this assumption, and can we systematically evaluate it in both the federal and state contexts? Content analysis can give us an introduction into the objectives of a particular program, but more systematic, and comparative, methods need to be applied to this question.

This report has raised many questions regarding transportation policy making, policy evaluation, the role of the state DOT in policy implementation, and the specifics of one particular effort at mandating system-wide assessments of program effectiveness. This represents only a small step in transportation policy evaluation, however. There is considerable more work that can and should be done.

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