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Congestion management systems development and implementation : four case studies

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ABSTRACT

Congestion Management Systems Development and Implementation: Four Case Studies

**by
Arlene Rose-Marie Willis**

To address concerns of poor air quality, congested highways and the need to manage and plan for transportation within budgetary constraints, the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) mandated the development and implementation of a Congestion Management System (CMS). Primarily, a CMS will fuel transportation decision making with information on system performance and alternate strategies to alleviate congestion and enhance mobility. Efforts through ISTEA are expected to produce a more efficient American transportation system -- this thesis takes a look at the preparatory activities.

It is based on a federally funded project with metropolitan planning organizations (MPOs) in Albany, New York; Dallas, Texas; Seattle, Washington and the Washington D.C. metropolitan area. The thesis examines the approach to specific elements of CMS implementation and identifies factors contributing to their effectiveness.

As expected, coordination and cooperation among participants has presented the greatest challenge. With regards to data collection, performance measures and the

application of new technology, MPOs report that building on existing analytical efforts and strengthening inter- agency relationships has been the best strategy.

Stepping back from the findings of the case studies, the author concludes that this information may arrive to states and localities with very little lead time to be effective technical assistance. Arguably, the case studies may provide insight into CMS as a whole and possibly predict the effectiveness of ISTEA. In that regard, this thesis is expected to aid future transportation policy making efforts.

**CONGESTION MANAGEMENT SYSTEMS DEVELOPMENT AND
IMPLEMENTATION: FOUR CASE STUDIES**

by
Arlene Rose-Marie Willis

**A Thesis
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This thesis is dedicated to the memory of
my Grandmother and good friend, the late Velma Leona Edghill.

Her life of courage, self-determination and preseverance
was a source of GREAT encouragement.

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LIST OF ACRONYMS AND MEANINGS

Acronyms	Meanings
CAAA	Clean Air Act Amendments, 1990. Legislation which designates standards and compliance actions necessary to maintain ambient air quality in metropolitan areas nationwide.
CDTC	Capital District Transportation Committee. The metropolitan planning organization for the Albany, New York metropolitan area.
CMS	Congestion Management Systems. One of six management systems mandated in recent transportation legislation, is primarily concerned with the mitigation of traffic delays and air pollution caused by vehicles.
DOT	Department of Transportation. A Department of the Federal government charged with monitoring statewide transportation plans. Preceded by the name of a state, the acronym designates that state's transportation authority. e.g. WashDOT - Washington State Department of Transportation.
DPW	Department of Public Works. This agency serves the purpose of a State DOT in the District of Columbia.
FHWA	Federal Highway Administration. One of the ten agencies of the DOT. The FHWA monitors and initiates surface transportation regulations, maintenance and planning guidelines, especially for the National Highway System facilities.
IMS	Intermodal Management System. One of six management systems mandated by ISTEA, primarily concerned with the connectivity between and accessibility to various modes.

LIST OF ACRONYMS AND MEANINGS
(Continued)

Acronyms	Meanings
ISTEA	Intermodal Surface Transportation Efficiency Act, 1991. Recent legislation regarding the United States transportation. The major difference from previous laws is the recognition of the intermodal nature of transportation and its relationship to the quality of the environment.
MPO	Metropolitan Planning Organization. Local planning agencies in urban areas which fulfill transportation responsibilities.
MWCOG	Metropolitan Washington Council of Governments. The MPO for the Washington, D.C. metropolitan area.
NCTCOG	North Central Texas Council of Governments. The MPO for the Dallas/Fort Worth, Texas metropolitan area.
NAAQS	National Ambient Air Quality Standards. Standards used to levels of air pollutants around the country.
PSRC	Puget Sound Regional Council. The MPO for the Seattle Tacoma, Washington metropolitan area.
PTMS	Public Transportation Management System. One of six management systems mandated by ISTEA, primarily concerned with the management and planning of transit service to meet the needs of the traveling public.
SIP	State Implementation Plan. A strategic management tool -- a report that lists priority projects for a three year period that is updated every two years. The purpose of the SIP is to reduce emissions to meet NAAQS.

Acronyms Meanings

TIP **Transportation Improvement Program.** Developed by the MPO, the TIP includes projects in a region proposed for funding.

TMA **Transportation Management Area.** A federal designation for any urban area over 200,000 population and for which the MPO is responsible for planning.

CHAPTER 1

INTRODUCTION

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), mandated management systems for Highway Pavements, Bridges on and off Federal Highways, Highway Safety, Traffic Congestion, Public Transportation Facilities and Equipment, and Intermodal operations. This thesis is particularly concerned with the development and implementation of efficient congestion management systems (CMSs).

Collectively, the systems will introduce mechanisms that ensure sound transportation investment decision making and transform the process over time. Constrained by limited resources, the main objective of the management systems is to efficiently maximize the mobility of people and goods within and through urbanized areas while simultaneously minimizing adverse effects on the environment. As the law clearly states:

The primary purpose of the management systems is to provide additional information needed to make effective decisions on the use of limited resources in order to improve the efficiency of, and protect the investment in, the nation's existing and future transportation infrastructure at all levels of jurisdictional control.

Basically, the ISTEA mandates require a transformation of present transportation planning. However, existing literature reveals that the public sector is more reluctant and resistant to change than the private sector -- therein lies the challenge for ISTEA. In the endeavor to ensure change, ISTEA prescribes that transportation planning should be *comprehensive* and conducted within an environment of *coordination* and *consistency*, and promote *cooperation* between state and local governments, metropolitan planning organizations (MPO), representatives of transit, business developers, community interests and other interested parties. Essentially, the Act promotes the current trend to participatory democracy. The ISTEA framework presents the greatest challenge for transportation planners because it involves a number of non-traditional (or new) decision makers conducting newly designed activities, with flexible regulations (Weinheimer, 1993), (Deakin, 1993).

A combination of trends contributed to the need for a CMS. Aside from the Presidential dictate to streamline government, renewed environmental concerns, and the harsh reality that American highways are significantly congested all contributed to the need for efficient transportation planning. Roadway congestion has contributed to dangerously high air pollution levels and standstill traffic. Without future plans on the drawing board for expansion of the D. D. Eisenhower Interstate System it became imperative to maximize existing resources. Most important is the issue of economics. United States government is becoming thrifty and needs to establish ways to make better transportation investment decisions for the future.

CMS, the topic of this research effort, is intended to provide information primarily for “. . . *the relief and prevention of congestion, the development of methods to enhance*

freight movement, and the consideration of overall social, economic, energy and environmental effects of transportation decisions. . . ." CMS development and implementation is the responsibility of State Department of Transportation (DOT) in cooperation with their respective MPOs. As of this writing, the deadline for CMS implementation is October 1995 for areas in nonattainment¹ for ozone and carbon monoxide -- and October 1996 for all other areas.

In preparation for timely compliance, and to assist States in their compliance efforts, the Federal Highway Administration (FHWA) awarded grants to four MPOs to expedite their already exemplary CMS development efforts. Aside from respective State budgetary constraints and the MPOs ability to accept Federal funds, other factors considered during early site selection were the areas' current land use practices, growth forecast and air quality nonattainment status. The project was designed to benefit as many metropolitan areas as possible therefore sites were selected for their variety in geographic characteristics and demographics, growth patterns, and air quality designations. MPOs in Albany, New York; Dallas/Fort Worth, Texas; Seattle, Washington; and Washington D.C. were selected from that process and are highlighted in Table 1. The case studies were funded under an ISTEA category with requirements for 20% local match from recipients, therefore, strong consideration was also given to the MPOs ability to provide local matching funds and complete the necessary administrative work in time.

¹ A designation for areas that do not meet national primary or secondary ambient air quality standards. Usually classified as *sub-marginal*, *marginal*, *moderate*, *serious*, *severe* or *extreme* nonattainment for Ozone where marginal refers to 0.121 - 0.127 parts per million and extreme refers to 0.280 ppm and above. Appendix C provides a table of design values for each classification.

Similarly, the prescribed elements assigned to the MPOs embody some of the important policy, programming and technical issues faced by states and MPOs alike in their CMS planning and implementation efforts. Table 2 provides a list of major participants and focus areas for the cases undertaken. Recognizing that freight mobility is still a relatively new area of concern (now being researched in the development of multimodal performance measures), the FHWA project focused on passenger congestion issues. Overall, metropolitan areas respond better to passenger mobility issues because of the availability of relevant data. The case studies share the experiences of four different MPOs and serve as technical assistance models for areas that have similar characteristics.

Table 1. Profile of CMS Case Study Areas

CASE STUDY AREA	Albany/ Schenectady/ Troy, NY	Dallas/ Ft. Worth, TX	Seattle/ Tacoma, WA	Metropolitan Washington
AIR QUALITY STATUS³ Ozone Carbon Monoxide	Serious [0.165ppm] In attainment	Moderate [0.140 ppm] In Attainment	Marginal [0.131 ppm] Moderate [13.4 ppm]	Serious[0.165 ppm] Moderate [11.4 ppm]
MPO PLANNING AREA DEMOGRAPHICS⁴ Urban Land Area Population <i>Forecast</i> Type of Development	365 sq. miles .76 million ('93) .83 million (2015) 4 central cities	4,962 sq miles 3.8 million ('90) 5.0 million (2010) 50 local governments	6,300 sq. Miles 2.7 million ('90) 4.1 million (2020) 60 municipalities	3,021 sq. Miles 3.7 million ('90) 5.1 million (2020) 3 major jurisdictions (MD, VA, D.C.) and 16 local governments
TRANSPORTATION STATISTICS Highway Network Transit Network	136 freeway miles Bus only	570 freeway miles Bus, Rail (light & commuter)	330 freeway miles Bus only, Auto and passenger-only ferries	374 freeway miles Bus, Rail (commuter and rapid transit)

³ Source: Environmental Protection Agency. *Ozone and Carbon Monoxide Areas Designated Non-Attainment*. October 26, 1991. Design standards can be found in Appendix D.

⁴ Sources for these figures are, respectively: CDTC, NCTCOG, PSRC and MWCOG.

Table 2. Major Participants and Elements of CMS Examined

CASE STUDY AREA	Albany, NY	Dallas/ Ft. Worth, TX	Seattle/ Tacoma, WA	Metropolitan Washington
STATE AGENCY	New York State DOT	Texas DOT	Washington State DOT	Government of D.C., Department of Public Works
LOCAL AGENCY	Capital District Transportation Committee (CDTC)	North Central Texas Council of Governments (NCTCOG)	Puget Sound Regional Council (PSRC)	National Capital Region Transportation Planning Board (COG\TPB) of the Metropolitan Washington Council of Governments (MWCOG)
CASE STUDY ORIENTATION	policy, programming	policy, programming	policy, technical, programming	policy, technical
FOCUS AREA	<ul style="list-style-type: none"> • CMS integration into planning & programming • Multi-modal activities enhanced through CMS • Public Participation 	<ul style="list-style-type: none"> • <i>Non-traditional</i> participants in decision making • CMS information distribution channels to local government in decision making 	<ul style="list-style-type: none"> • ITS potential to support data monitoring requirements • Integrating congestion management efforts with planning & programming 	<ul style="list-style-type: none"> • Regional transportation data management • Performance measures development & testing
LEVEL OF EFFORT	\$50,000	\$100,000	\$50,000	\$100,000

1.1 General Background

1.1.1 Current Trends

Nationwide, both the private and public sectors are going through a fast-paced transformational period. Organizations are focused on becoming more efficient -- revising the way they do business to involve and incorporate the opinions of those who may

become affected by the decisions. Other studies suggest that no single organizational structure is universally applicable - forums and joint decision-making by state and local actors is preferred, although the process may be tedious and lengthy⁴ (Pressman, 1984 and Booth, 1994).

It is public knowledge that restructuring is taking place at numerous agencies such as NASA (National Aeronautic and Space Administration), the Small Business Administration, FEMA (Federal Emergency Management Agency) and Department of the Interior. The transportation field is no exception. More authority is being delegated to local jurisdictions, the notion being that *'they know best what their needs are and how they feel most comfortable meeting them.'*

1.1.2 The Future USDOT

Since its inception in January 1967, the United States Department of Transportation (USDOT) has evolved into an organization comprised of ten agencies. Two of these agencies - the FHWA and the Federal Transit Administration (FTA) - were instrumental in the passage of ISTEA and subsequently in the development of the management systems.

Traditionally an umbrella for these agencies, the USDOT announced its plans for reorganization in December 1994. In keeping with Presidential plans to "rebuild America," regain the confidence of Americans in government, and sustain the American economy, the department has held several conferences to discuss options and educate the

⁴ Of 44 factors identified in the implementation of a health program, 23 fell under the category of *Difficulties Arising from the Need to Share Authority* (Pressman, 1984).

public about the imminent change. The strategies being employed are not new as the buzzwords have been around for quite some time.

Essentially, the department plans to revise its structure based on a core mission of safety and investment. The ten agencies would be consolidated to form three aligned around surface, aviation and maritime functions.⁵ Further, plans to downsize the workforce by 50% of 1992 employment levels are expected to save the department some \$6.7 billion over a five year period. Plans to streamline the grant, loan and subsidy programs are also in the pipeline. Streamlining from thirty such programs to three is supposed to induce better accountability and less 'red-tape'.⁶ Appendix A gives a more detailed account of the 'new' USDOT structure that was proposed to Congress in April 1995 to amend the DOTs governing legislation, 49 United States Code.

The FHWA has adopted the hat of a 'change agent'. As FHWA Administrator, Rodney Slater said at the FHWA Annual Meeting in November 1994, "... mastering change is ... the key to our future. ...". The Metropolitan Planning Division of the Office of Environment and Planning has been very active in change activities and is discussing plans to form cross-functional, project teams that serve for short terms.

Given the flexibility of the legislation and close deadlines, several states expressed varying degrees of uncertainty surrounding what the CMS should contain, and how it should be integrated into transportation project planning and programming. It is necessary to strengthen relationships between and within organizations to effect timely compliance with the mandates and implement an effective CMS.

⁵The three administrations proposed are an Intermodal Transportation Administration, Aviation Administration and the United States Coast Guard respectively.

Despite the compliance factor, incorporating CMS into transportation planning will be beneficial in the long run. Activities to date indicate positive effects of increased cooperation between transportation planners, providers and users, and a consistency in local transportation planning not previously practiced. Furthermore, some states have actually incorporated some of the principles into state legislation. Washington State's Growth Management Act is one example. In addition, the adoption of a single measure for transportation performance consolidates data collection activities for the region and enables easily obtained indices for comparison.

1.2 Project Statement

'Case studies' refers to a FHWA technical assistance effort undertaken in fiscal year 1995 (October 1994-October 1995) that was conducted in two phases. The first phase, which was also managed by the author, constituted the documentation of experiences in late CMS developmental and early implementation stages. The second phase, to be completed in October 1995, will include additional implementation experiences to those presented in Chapter 4.

This thesis is based on the first phase and on findings related to specific elements of CMS that were assigned to each MPO. Techniques described in Chapter 4 encourage

⁶ Source: News Release. "Peña unveils Plans for Major DOT Restructuring." December 19, 1994.

the accessibility and use of alternate modes and effectively reduce single occupancy vehicle (SOV) travel -- a major contributor to air pollution.

It is expected that because of the interactions among participants involved, and in some cases, the geographic proximity of jurisdictions, the effectiveness of the respective CMSs will depend a great deal on the cooperative efforts of all concerned, a view also supported by Deakin (1993). In addition to flexible guidelines published late 1993⁷, localities are further challenged by the necessity to incorporate the opinions of all concerned -- private citizens, bicycle and environmental special interest groups, commercial business interests, and many others.

While the case studies were being conducted, several factors were observed to contribute greatly to the smooth administration of the projects: pre-existing internal mechanisms to expedite the project, adequate staff and the availability of technical expertise. These factors were found to affect the timeliness with which findings could be disseminated to the field and are therefore deemed important to the ability of metropolitan areas to comply with the regulations.

One major consideration at the Federal level is the appropriateness of deadline dates for compliance with CMS relative to the publication of guidelines for the management systems and the complexity of necessary developmental activities⁸. The need to address this concern further justifies this research effort (the thesis) and gives it value

⁷ Federal Register, Vol. 58, No. 229. December 1, 1993.

⁸ As of this writing, a series of forums including a recent *listening session* hosted by both the Federal Highway and Transit Administrations have been held. Several state and local officials from MPOs voiced strong support for either a postponement of the October 1995 deadline, or elimination of the mandate altogether.

for the reasons previously mentioned as well as its ability to help in understanding CMS and in shaping future regulatory actions taken in that regard.

More specific and unique to this research effort are the following concerns:

- How are the states progressing in CMS development and implementation efforts⁹?
- What are the strategies and techniques being used?
- What are the setbacks to progress?
- How are metropolitan areas overcoming these setbacks?
- Will the CMS they develop be in compliance with general Federal guidelines?
- Are the CMS mandates too flexible/ stringent?
- Are more/ less specific guidelines needed?

These are but a few of the questions that can only be addressed after a systematic examination of the experiences of participants in the development and implementation of the management systems - herein lies the fundamental value of this work.

This thesis discusses and responds to the more procedural context of these questions, namely, the first five that deal with the techniques being utilized to accomplish the development of effective CMSs, and explore the implications to effectiveness of the original intent of the CMS. The two remaining concerns require comprehensive analysis of the other factors to consider in transportation planning and more specifically, the other components of CMS.¹⁰ Examination of strategies that address the outlining factors and

⁹ Documenting these findings is the more comprehensive source, FHWA, Office of Environment and Planning Division. Technical Report. Report Number 2. July 1994.

¹⁰ This thesis examines experiences in a few, however, 23 U.S.C. §134 (f) outlines 15 such factors that are listed in Appendix B. CMS components are outlined in 23 C.F.R. 500.507.

their consequences, or implications of setbacks experienced and techniques to overcome them would be a natural course for further study.

1.2.1 Scope of Work and Methodology

There are many components to the CMS that go beyond the scope of this thesis. One of the limits to the thesis is that it investigates four elements of CMS and represents only a subset of all CMS-related ongoing activities in each metropolitan area. Furthermore, the project participants were charged with sharing experiences in portions of the four elements: each study encompasses one or two of the four elements. This thesis records the cooperative efforts necessary for incorporating CMS into the metropolitan transportation planning and programming process. In particular, it focuses on the development of procedures to facilitate institutional cooperation between local governments and industry participating in the process. It further investigates how MPOs attempt to communicate effectively with other participants in the transportation planning process, and make decisions for CMS development within the general framework of the ISTEA mandate to cooperate and coordinate institutional, technical and political efforts.

The research for this thesis was conducted as a series of case studies. As previously mentioned, specific elements of CMS were assigned to each MPO. Through the documentation of the MPOs unique experiences, information pertaining to institutional challenges and existing multi-organizational relationships were obtained and analyzed for identification of exemplary practices. Technical issues related to data collection and

performance measures were also investigated. During the course of the research, informal discussions were held with participants in the field at the state and local levels to gain insight on the individual cases from the local perspective.

Finally, literature on the topics of transportation planning and policy, organizational structure and relationships, group decision-making and team approach were reviewed. The review provides a brief history of metropolitan transportation planning and examines the shift in organizational structure to a more decentralized environment. It supports present activities geared at strengthening the links between state, local government and other agencies to facilitate coordination in transportation planning. Periodic progress reports from the MPOs were analyzed and combined with the literature review to identify factors contributing to the effective implementation of plans.

1.2.2 Thesis Structure

This thesis is comprised of four additional chapters. Chapter two presents a literature review of current trends influencing CMS development and implementation, namely a tendency towards environmental preservation and *open* or *flat* organizational structures. Chapter two closes with a section on research validation that distinguishes this work which is more policy oriented from traditional theses in the field that tend to be more technical. Chapter three presents a detailed discussion of the regulatory and institutional issues faced in the implementation of CMS.

Chapter four, the focus of this thesis, describes the case studies in detail. Most of chapter four constitutes a report compiled by the author under the auspices of the FHWA (Technical Report, GRF-FHWA 94-13). The technical report is meant for nationwide distribution to some 400 Federal, state and local agencies responsible for carrying out metropolitan transportation planning activities. The final chapter summarizes the findings and draws some conclusions about their implications to future transportation planning and policy-making. Chapter 5 also highlights areas of concern arising from this thesis that can “piggy-back” for future.

CHAPTER 2

LITERATURE REVIEW

The purpose of this literature review is to explore the previous body of literature and provide a framework regarding emerging trends to global environments that have effected change in the organizational structure of public transportation agencies and that promote the development of stronger links between organizations. Exploration of previous literature helps to describe the existing relationships between participants in CMS development and implementation. A brief history of transportation planning leading to the emergence of the two most recent pieces of legislation provide a context for this thesis.

The literature review reveals traditional organizational structures and linkages, particularly in public-public and private-public relationships as well as the nature of relationships and the issues at stake motivating such links.

2.1 Current Trends Influencing CMS

Naisbitt (1984) documents a change in organizational structure from the traditional *line-of-command* hierarchical (pyramidal) structure which fosters vertical communication to a flat, *open* structure that encourages round table discussion and requires agreement between all

parties for progress¹. The latter structure has gradually been introduced to the transportation field through a series of regulations in recent years. For example, the Federal Aid Highway Act of 1962 was amended in 1975 to require regional decision making authority; and in 1973, the USDOT called for joint efforts in planning highways, mass transit and airports within a single organization for each state. Pressman (1984), Naisbitt (1984), Chisholm (1989) and Booth (1994) examine the tendency towards decentralized, more inclusive decision-making that has continued to be at the fore of many industries. Transportation planning for metropolitan areas is no exception. Since its inception, the USDOT structure has also changed to mirror the general trends mentioned here. More information dealing with USDOT restructuring plans which are still on the drawing board can be found incorporated throughout this text, and in Appendix A.

In revising institutional arrangements, the whole idea has been to “. . . *keep metropolitan planning realistic ensuring that proposals are such that some organization has the authority, funds and willingness to implement. . .*” -- Thus limiting projects that are based on available financial sources.

2.2 From Facility to Service-Oriented Transportation Planning

Transportation planning, once synonymous with highway construction and expansion has evolved to a style of planning concerned with environmental, social and economic impacts,

¹ According to Kunde (1992), flat structures are more complex because communication is informal and diagonal, cutting across all levels of authority.

otherwise known as Transportation System Management (TSM). TSM evolved from a main stream of events in the late 1950's. For instance, Federal concern for urban traffic engineering and traffic management for the purpose of increasing traffic capacity and safety, and transition from long-range planning to emphasis on immediate concerns. After a period of expansion in the early 1960's, the fields of social service, urban development planning and transportation experienced a decline due to pressure on government to reduce spending. In addition, the traditional bias of Federal policy to highway travel began to shift to transit.

In February 1995, the Secretary of Transportation, Frederico Peña outlined the new proposed structure for the USDOT which was a model embracing different forms of transportation and aimed at promoting the most efficient movement of people and goods. According to Peña, “. . . restructuring decisions are critical to our becoming a more responsive, customer-driven organization. . . .”² Details of the proposed new structure can be seen in Appendix A. The compendium of papers edited by Alan Altshuler (1979) in Current Issues in Transportation Policy, assert that environmental clout has influenced DOT programs since its inception in 1967. Advocates for the environment gain support from mandates of the National Environmental Policy Act of 1969 (NEPA) that require detailed Environmental Impact Statements (EIS) for all proposed Federal aid projects. Consideration for environmental impacts especially long-term and secondary effects has greatly influenced the way transportation planning has been conducted since the late 1970's. NEPA has resulted in major improvements in coordination within the Federal executive branch. Over the years, the DOT has been challenged to foster coordination

² Peña, Frederico. *Interoffice Memo to All DOT Employees*. February 2, 1995.

with non-traditional players in decision making. Efforts to avoid adverse comments appearing on public record has had a major influence in getting agencies to talk. The EIS comment process has resulted in improved communication between the Environmental Protection Agency (EPA) and DOT field offices. Land use considerations have gradually become an important aspect of transportation decision-making.

According to Meyer and Gakenheimer, the 1960s to early 1970s “highway-revolt” resulted from a growing awareness that addition to the capacity of the transportation system caused a strain on fiscal resources, negative social and environmental impacts and induced additional travel thereby generating a need for expansion the of facilities (roadways). In response, metropolitan and statewide transportation planning regulations require strategic planning that considers the environmental impacts (TSM), fiscal constraints and utility of already existing facilities. This new comprehensive approach to transportation planning requires professionals with a wide variety of skills. To meet this challenge, universities nationwide strive to include urban planning courses in their Transportation curriculum, and Urban Planning degree candidates are required to have completed some electives in Transportation, or covered aspects of transportation in one course or another.

2.3 Legislative Mandates of ISTEA and CAAA

The period from 1980 till today (mid-1990’s) is characterized by “social responsiveness,” as a natural afterward to a period of “social responsibility” (Murphy, 1980). According to

views expressed by Ackerman and Bauer in Murphy (1980), the term *responsibility* connotes an obligation whereas *responsiveness* is the strategy employed to meet that obligation. The era of social responsibility lasted from 1974 to the early 80's and was characterized by significant concern for preservation of the environment, especially air quality. Extensive investigations to determine the sources of air pollution singled out the automobile as a leading source of Ozone and Carbon Monoxide pollutants. Subsequently, authorities embarked on efforts to heighten the awareness of car manufacturers and users alike, for pollution levels to be claimed as a social responsibility and as such, addressed accordingly. The realization that highways were being utilized beyond their capacity and the reality of long term budget cuts compounded the issue. For the future, dangerous air pollution levels and standstill traffic on the roadways loomed ahead. This paved the way for the development of two major creative and decisive political mandates: ISTEA and CAAA -- Clean Air Act Amendments of 1990.

Both pieces of legislation represent the government's attention to social responsibility. The CAAA stipulates planning guidelines for areas which have been designated nonattainment for one or more pollutants according to the current National Ambient Air Quality Standards (NAAQS); and ISTEA stipulates transportation planning and project approval guidelines. To prevent conflict, ISTEA requires compliance with the relevant CAAA mandates, specifically Section 101, Title 1 (f) Parts (2), (3) and (4). Together, they present strategies of responsiveness and factors to consider in statewide and metropolitan planning to reduce poor air quality and the growth of traffic congestion.

In general, the strategies comprise a variety of techniques to increase vehicle occupancy while decreasing the number of vehicles on roadways, promoting mass transit

and simultaneously providing disincentives for SOVs. Not surprisingly, the strategies have encouraged changes in travel behavior through trip-chaining, flexible work hours, car and van pooling and choice of home location in relation to job site as viable alternatives to SOV. On a more personal level, natural and contrived reinforcement for SOV over the past few decades has caused attitudinal change to be even more challenging. A more comprehensive discussion of the regulatory issues is presented in chapter three.

2.4 Research Validation

This thesis does not seek to prove or disprove a proposed theory. Instead, it is primarily of an applied nature - similar to research in public administration (Box, 1992). It documents the activities of real people, engaged in real, ongoing work - namely, MPOs, their staff and the work they do with regard to the themes explored in the CMS case studies. It is intended to be a combination of applied and theoretical research such that it integrates knowledge and practice to make it useful (Haunschild, 1993), (Suchan 1993), (Symons 1993) -- to transportation practitioners.

With regard to congestion management systems, one central issue of importance to the transportation field is whether or not the management systems will help to achieve the overall, generally stated goals of ISTEA -- “ . . . *an economically and environmentally sound transportation system. . . .*” The CMS is expected to act in concert with the activities of the intermodal (IMS) and public transportation facilities and equipment

management (PTMS) systems. The IMS will ensure smooth transfers between modes for both passengers and freight while the PTMS will provide information on transit capital needs. The CMS is at the heart improving flow on America's roadways and reduce air pollution caused by vehicle emissions.

Whilst literature on organizational structure and decision-making have a long history, existing literature on CMS consists of reports and papers, both published and unpublished, completed over the past four years since the passage of ISTEA in 1991. The pertinent reports that precede this thesis are mostly from individual states and local agencies regarding various approaches to the development and implementation of the management systems based on interpretations of the regulations³.

In view of previously mentioned concerns, it is hoped that this thesis will aid policy makers in the decision-making exercise that will determine the appropriateness of the guidelines as well as related legislation. It is also expected that lessons learned from the case studies will be fed back into subsequent iterations for future guidance and/or regulations (DuPraw 1992).

³'Regulations' refer to the Interim Final Rule for Management and Monitoring Systems (49 C.F.R. Part 614).

CHAPTER 3

ISSUES IN CONGESTION MANAGEMENT SYSTEMS

3.1 REGULATORY ISSUES

“Most likely, it is this sharing of responsibilities - the partnership aspects of ISTEA - that will be one of the greatest challenges posed by the legislation.”

*-- Elizabeth Deakin, Professor
U of California at Berkeley*

It is said that auto dependence and declining public transportation is a by-product of diverse metropolitan development which is partly a consequence of Federal transportation policies (Lede, 1991). The Federal Transit Act and sections 134 and 135 of the US Code Title 23 have traditionally set the parameters within which transportation related activity is carried out. However, ISTEA has revolutionized the way transportation and the national transportation system is viewed now and will be viewed in the future. A Bill proposing the reorganization of the USDOT is awaiting approval therefore, change is contingent upon appropriation legislation. It is proposed that the ‘new’ system be called the intermodal transportation system. This chapter is a discussion of the most recent legislative mandates of ISTEA and pertinent sections of the CAAA. Priority is given to the CMS and elements being investigated in the case studies.

Researchers argue that social systems which invite change have participatory decision-making leadership style and promote team building. Historically, the MPO

played a more subdued role in transportation planning due to lack of clout in the decision making process. As local contributions to transportation projects increased and MPOs were vested with greater authority, they began to have more say in prioritizing projects for funding. ISTEA and CAAA put political decision-making responsibilities in local hands - - demanding the need for increased communication across all levels of government.

3.1.1 The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA)

ISTEA was developed in response to a growing concern that local transportation decisions were exclusive of social goals. Historically, each State was charged with the task of developing plans to meet individual metropolitan areas' transportation needs. Individual and regional political goals were the main proponents for development during the 1980s (Howe and Brail, 1994). As a result of traditional pro-highway Federal policies and the realization by many of the American dream to own a car, the highways of this country have become significantly congested. Additionally, air quality has diminished over the years. Prior to 1991, studies to identify the major contributors of air pollution have revealed vehicle emissions as a major source with rates comparable to stationary (industrial) sources. Consequently, provisions of the CAAA and ISTEA (23 U.S.C. §§134, 135) linking transportation to air quality were made. As previously mentioned, transportation projects designed under ISTEA must also comply with the mandates of the CAAA (42 U.S.C. §7506 (c) (2) (A-C)). All transportation plans and programs must conform with CAAA mandates and no plans or TIPs may be adopted in nonattainment

areas for air quality without an evaluation for emissions compliance or appropriate transportation control measures.

ISTEA is divided into eight parts (titles) and was signed into law by President George Bush in 1991. The legislation aims to redefine the role of government and transportation-related agencies in the provision of transportation services. It is focused on the alteration of individual travel behavior, continued maintenance and modifications which improve efficiency of existing systems and the development of systems which will enhance those already in place. These improved systems must adhere to CAAA regulations, violations of which may cause Federal funds to be withheld at the request of special interest groups who have advocacy power to sue decision making bodies for noncompliance.

Commuters will be provided with more choices of efficient systems to improve their quality of life. The concept is to cause attitudinal change through a variety of public education means about the positive effects of ISTEA. The legislation makes provisions for Surface Transportation, Highway Safety, Transportation Research and Development, the Metropolitan Airports Act of 1986, Motor Carriers, new funding methods, and funding sources for the various programs mandated. Funds of specific amounts have been earmarked to cover expenses for each of the programs created. Under Title I, \$121 billion has been authorized for Surface Transportation and approximately \$836 million has been authorized for Research and Development under Title IV. ISTEA also awards more funds to metropolitan areas in exchange for better planning practices -- or practices modeled from Federal guidelines, greater control of funds by MPOs and provision for the

introduction of new participants from the private sector to the transportation planning process.

One might say that ISTEA and CAAA have a symbiotic relationship. ISTEA reinforces CAAA by placing emphasis on environmental factors in transportation decision making and CAAA emphasizes transportation strategies for cleaner air in addition to strategies for industrial sources. Guidelines in both are aimed at transportation planning at both the statewide and MPO level. Deakin's paper is an excellent source of reference for explaining the 20 factors in ISTEA to be considered for metropolitan area plans and programs and the 15 factors in the development of state transportation plans.

3.1.2 The Clean Air Act Amendments of 1990 (CAAA)

Although the CAAA is not a predominantly transportation legislation, but rather, a response to environmental concerns, transportation issues are incorporated because air pollutants, (ozone and carbon monoxide) are tied to vehicle emissions. The CAAA legislation addresses transportation planning in nonattainment areas by focusing on approaches and methods that effectively reduce the level of air pollutants. This presents a greater challenge for nonattainment areas which need to define congestion such that it allows a compromise of efforts to mitigate vehicular traffic that also enhances (or does not diminish further) air quality. Other criteria for planning such as conformity dates and more extensive requirements for polluted areas are described in detail in the law. The concept is that strategies that reduce traffic congestion (reduce vehicle miles traveled (VMT) and number of vehicle trips) will also reduce pollution caused by vehicle emissions. Areas in

nonattainment view these strategies as priority. However, new research claims that vehicle emissions reductions alone do not significantly reduce the levels of carbon monoxide and ozone, hence other strategies will have to be implemented. The new pollution reduction strategies may not relate to transportation in any way, therefore compliance with the State Implementation Plan (SIP) may yet be revised for the future.

3.1.3 Guidelines for CMS Development and Implementation

Federal regulations¹ for the development, establishment and implementation of the six management systems also provide a compliance schedule and minimum standards for each management system. Each section is preceded by comments and responses to pertinent questions to the respective management system. More specifically, Sections 500.501-509 address CMS and state what the results of the CMS are expected to be and provide implementation strategies. Aside from vehicle movement, strategies to consider should also include parking management and bicycle and pedestrian facilities.

“Strategies that may relieve congestion may not have equal air quality benefits.”

This view if validated by new research will probably have a great effect on the compliance schedule for CMS. Since June 1995, frequent meetings have been held to address the air quality question while MPOs in nonattainment areas wait with bated breath to lobby for

¹ USDOT. Federal Register. 58.229(1993):63442-85. These regulations, the interim final rule on the management and monitoring systems, amends 23 C.F.R. Parts 500 and 626. This information (from Section 1034 of the ISTEA (PL 102-240, 105 Stat.1914, 1977)) also amended Title 23, United States Code, Highways (23 U.S.C.) in section 303 entitled Management Systems (23 U.S.C. 303).

extension dates, or, for the elimination of the mandate altogether--making CMS an optional transportation management tool.

3.2 INSTITUTIONAL ISSUES

3.2.1 Organizational Structures: CMS Task Forces and Sub-Committees

“While individuals do make decisions and take actions on their own, today’s holographic organization requires multiple inputs from members of one or more groups on all complex problems.”

*-- Ralph H. Kilmann, Author
Beyond the Quick Fix*

In the development of CMS, the forum for discussion of the issues to be resolved occurs in the form of Task Forces or committees and sub-committees, and is consistent with the concept that ‘*two heads are better than one*’. The various groups are diverse and draw from the experience of politicians, government officials, engineers, planners, community residents and special advocacy representatives. Casting aside the subtleties that limit free expression from members in a group, the participatory decision making process yields collective decisions through consensus and may be correct.

Generally speaking, the main “team” (CMS Task Force) consists of three to twenty members and is supported by other teams or sub-committees with varying functions. The task force is “cross-functional” and comprises members from various areas

of expertise and interest. Whilst the CMS task forces are focused on related political, technical and administrative issues, the parent organization, or MPO, is focused on coordinating the efforts of all such task forces (or committees) to produce viable work plans for the area. Figure 1 gives a generic view of the relationships of various participants to CMS activities.

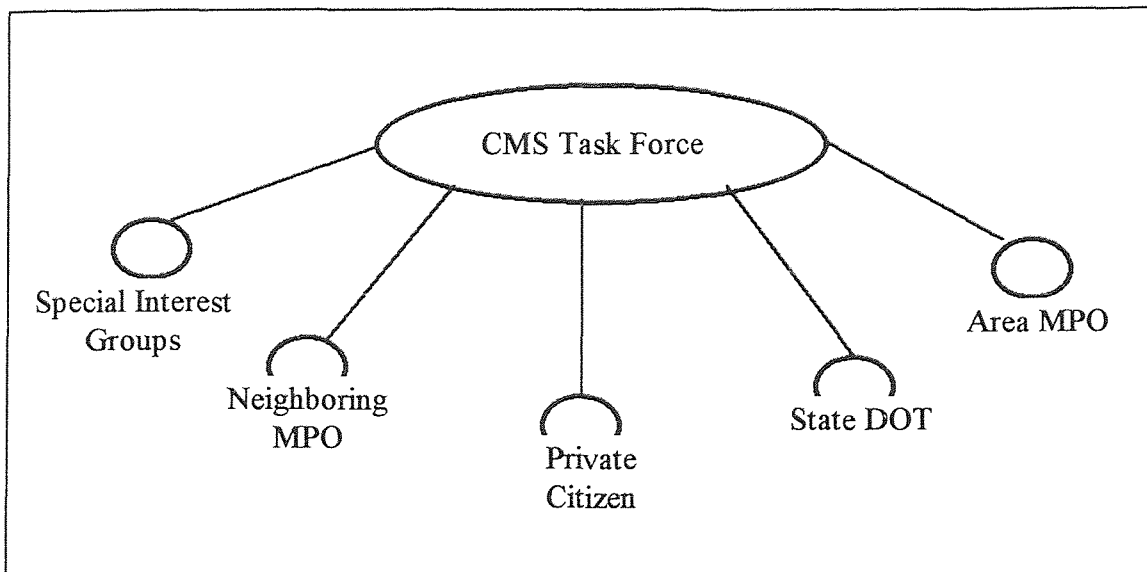


Figure 1. Generic Representation of a CMS Task Force

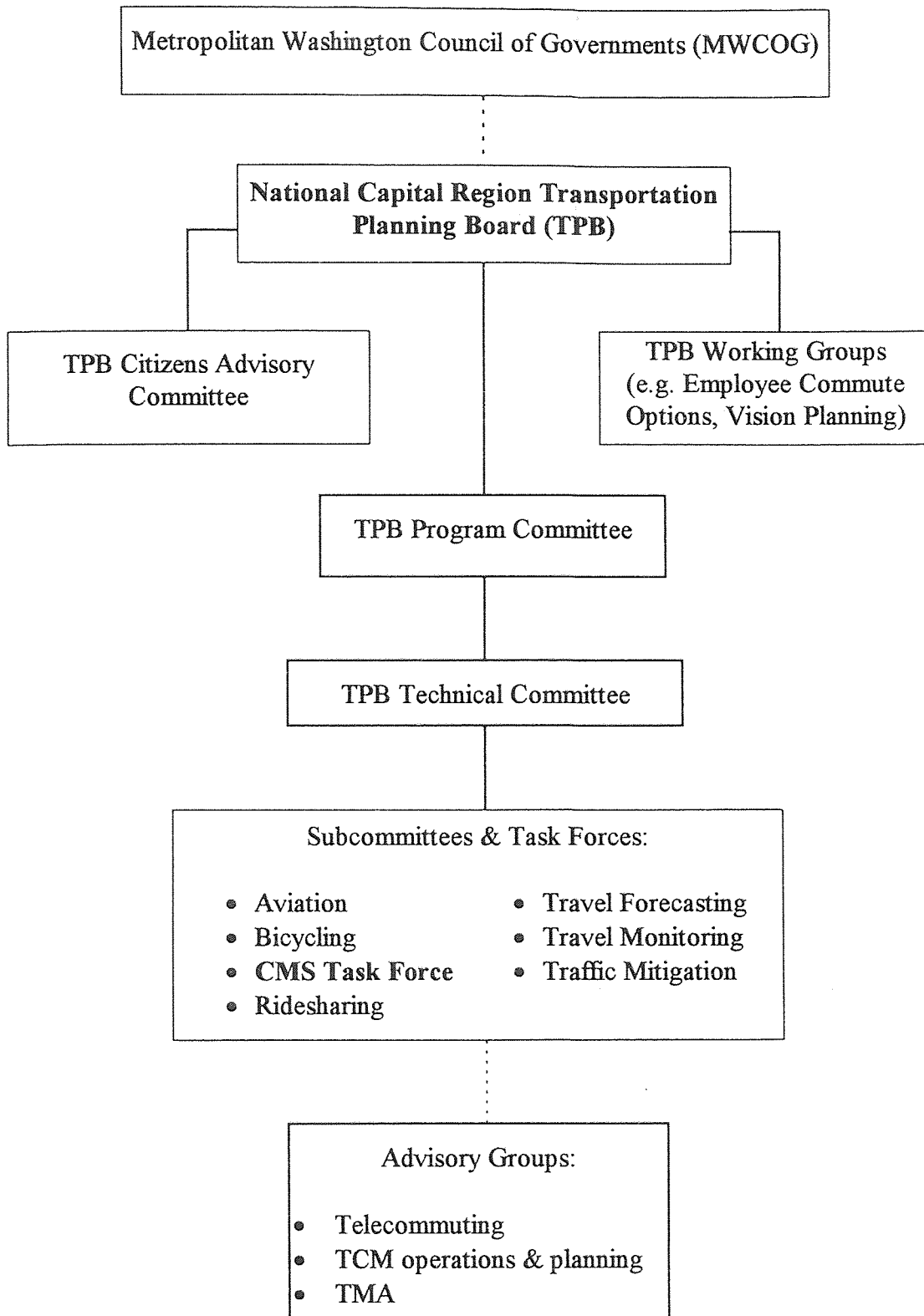
Using MWCOG as an example, figure 2 outlines the line-of-command, and flow of CMS activities for the MPO. The subcommittees address technical and policy issues and are responsible for conducting feasibility studies and analyzing data. They inform the Task Force of the legal parameters for proposed future actions and support proposals with sound data related analyses. Because the task force consists of individuals with varying

perspectives, it is difficult to label it as a microcosm of any one organization , but rather, an outgrowth of the natural synergy from several organizations. ²

It was observed in the cases presented that the need to (1) “think insightfully about complex issues”, (2) plan for “innovative coordinated action” and (3) stress importance of the “role of team members on other teams” has combined to fuel the success of CMSs.

In Figure 2 on the following page, the dotted line between TPB and MWCOG indicates that TPB is an independent body even though it is housed by MWCOG. That is to say, it is not a subset of MWCOG and does not report to MWCOG. Similarly, the Advisory Groups act in concert with the Subcommittees and Task forces which are responsible for producing reports for the Technical Committee.

Figure 2. CMS Activities in Metropolitan Washington D.C.



3.2.2 Decision-Making: Individual versus Multi-Organizational

Vestiges of person-to-person relationships can be found in organizational relationships, and group decision making has similarities to multi-organizational decision making, hence, sources that explore person-to-person and group decision making have been extrapolated to multi-organizational decision making. Broader understanding, recommendations based on solid data, follow-through and recognition, management alignment on purpose and expectations, and rewards for teamwork are some of the possible ingredients for success in group decision making (Logan, 1993). The literature offers a historical overview of organizational structure and how basic trends have effectively caused the integration of team approach and group dynamics into mainstream business culture. By observation, it is safe to infer that trends in other industries are similar to those in transportation -- albeit the public sector. The team approach will foster quality decisions and commitment to implementation of the CMS and serve as the most comprehensive source of information and expertise. Kilmann (1984) is an excellent source of reference on the topic of team approach. Teams are usually characterized by their role, power, influence and cohesion.

For the CMS task forces, the characteristics of 'power and influence' and 'cohesion' are of interest in this thesis. **Power and influence** are determined by level of skill, information and financial status (or dependency on the other), and dictate how groups relate to other units within the group and with outside groups. **Cohesion** refers to the degree of attachment or involvement members have with the group. The level of cohesion determined by the type of group and its longevity (project or cross-functional group, short or long term) is an indicator of commitment to objectives and the ease with which consensus on issues can be achieved. One might ask, *'Once the CMS is*

established, then what -- will the task force disband or will it remain intact to coach the CMS into continued use? Essentially the regulations [23 C.F.R. 500.507] require periodic assessments of the strategies implemented which may become either a staff function, or a requisite for MPO certification.

Early on, CDTC recognized the benefits of staff exposure to team problem-solving and decision-making techniques. Through scheduled training sessions with the Dale Carnegie Training Group, they prepared for action. They report that the experience gained was the single most critical effort that propelled them into action so fast. Another feature which they say contributes to their success is open management commitment to CMS. There seems to be no 'hidden agendas' to impede progress.

3.2.3 The 'New' Transportation Planning Process

Kellogg, Wilkerson and Freas (1992) examines and compares management styles in the public and private sectors. They conclude, as others do (Logan 1993), that the public sector is less likely than the private sector to embrace change. Organizational differences between the two sectors have also been investigated by writer, Bernard Ross, on faculty at American University, Washington, D.C. However, this difference is not a function of individual management style as originally speculated, but rather, it is due to the environmental-social systems in which the managers operate.

Table 3 presents characteristics of both sectors which may account for resistance to partnering between them -- as the public sector wrestles with the natural tendency to

Table 3. Differences Between Public and Private Sector Organizations

Elements of Organizations	Private Sector	Public Sector
hierarchy	cone-shaped with individual decision makers	inverted cone, with groups of competing decision makers at the top
upper level management,	relatively stable	top-level positions (about 2,000) are unstable and open to change with each presidential and congressional election
goals environment	clear-cut, bottom-line oriented	ambiguous, unclear
managerial process	closed, no outside influence unless profitable	Influenced by public opinion.

Source: Adapted from Kellogg, Jefferson, D Wilkerson, Alyssa Freas. *Resistance to Change: A Comparison of Public and Private Sector Organizations*. Productivity & Quality Improvement in Government Proceedings: First International Symposium on Productivity and Quality Improvement with a Focus on Government. Ed. John S. W. Fargher Jr. Washington D.C., 1992. 395-99.

to maintain the status quo and the private sector attempts to be diplomatic while waiting for it to catch up. Chisholm (1989) argues that there is over-confidence in formal centralized structures versus informal decentralized structures and that actual coordination of tasks will occur only through negotiation, rather than by prescription. In other words, no matter what ISTEA or CAAA require, if the parties mandated to cooperate and coordinate, neither negotiate the terms of such an agreement, nor compromise, coordination will not occur. In essence, the accolades go to the local entities who communicate with each other and not to the legislation itself. One would further venture

to say that the State-MPO relationship is the critical link in the coordination of efforts to achieve an effective CMS.

The extent to which the MPO has a smooth decision-making process is greatly dependent on the pre-existing culture of the organization - *was innovation promoted or was it typically one which maintained the status quo?*

Many authors agree that success in the 1990's environment requires frequent 'self-checks' and posture for change as needed. Michael Purello (1992) in *Overcoming Resistance to Change* identifies teamwork, involvement and communication as key to successful change. Coupled with change is the impending downsizing and restructuring activities that must occur. To employees in the trenches (and those managerial staff whose entire departments may be disbanded), this reads like a nightmare and questions regarding employment stability are the number one concern. This was made evident in November 1994 after the Congressional elections in which there was a dramatic shift in the political landscape and renewed interest in reducing government.

Indirectly, requests for extension of CMS implementation deadlines may be justified. As Purello (1992) suggests, flexibility is necessary to allow for the inertia surrounding change. Time must be allowed for a period of adjustment, in addition to incentives to encourage timely, effective change. Some of the incentives suggested are more open communication, economic incentives, agreement on a trial period, and compromise.

In other words, create an environment which favors the change and makes it easy for organizations to transform. One aspect rarely dealt with is the effect people (and individuals' actions) have on organizational change. Recognizing that it is people who

make things happen, or keep them from happening goes a long way in having successful change (Sedwick, 1974), (McCall, 1980), (Senge, 1990). *The Fifth Discipline* by Peter Senge is an excellent reference that explores the implicit goals people have and how they affect the personal decision making process. In the words of the author, “ the central message of *The Fifth Discipline* is that our organization s work the way they work, ultimately, because of how we think and how we interact.”

Delegation of authority to MPOs is two-fold. On the one hand, the Federal government justifies downsizing and streamlining activities, and relinquishes financial ties. On the other hand, MPOs and other local officials exercise authority in their geographic domains. Newly embraced customer-oriented goals have helped to reinforce ISTEA and CAAA by stimulating the change process.

CHAPTER 4

FOUR CMS CASE STUDIES

4.1 Introduction to the Case Studies

Every state is presently developing and implementing a CMS using their own unique approach. Several common themes have been identified among them. In each case, efforts are being made to provide or strengthen the link between technical and policy bodies. In addition, many MPOs have formed task forces and technical support committees, and developed mechanisms that allow for public involvement. Together they advise and inform planners and policy makers who are empowered to make investment decisions and final project selections -- thus strengthening the regional long term plan and transportation improvement program (TIP).

The first section of this chapter presents background information to the case studies. The second section presents a detailed account of ongoing CMS activities in each of the metropolitan areas as they pertain to the elements being examined.

4.1.1 Background

Toward the end of fiscal year 1994, FHWA funded four case studies to be used as technical assistance models by state transportation planners and consultants nationwide in the development and implementation of congestion management systems mandated by ISTEA(1991). The Federal share for the case studies totaled \$300,000 and each site

provided a match of 20% with state or local funds. The project time frame was set for one year, October 1, 1994 through October 1, 1995. A partnership between MPO and respective State Department of Transportation (DOT) offices facilitated the projects.

General Criteria for Evaluating Candidates. The sites were chosen through a collaborative effort of Planning personnel in the Office of Environment and Planning, a group comprised of members with different areas of specialization and years of experience in the field. Criteria for site selection and level of funding for each project were set by the same group. After consultation with the *State of the Practice Review* (July 1994), a list of candidates was developed. Some of the criteria used were as follows:-

Nominal Information

- air quality classification
- whether minimum requirements of a CMS workplan were in place
- whether coordination existed/ did not exist among MPO, State, transit agencies and other key agencies in workplan development

Interval Information

- affected population size
- number of jurisdictions included in CMS (i.e. state, metropolitan area(s), counties, cities etc.)

Ordinal Information (*rated on a scale of 1-3*)

- match between MPO/ State interests and FHWA needs (preliminary assessment)
- relative strength of the following components:-

- performance measures
 - performance objectives
 - data collection and availability
 - strategy identification and evaluation
 - effectiveness monitoring
- capacity and willingness to use funds effectively: enthusiasm, resources, expertise, etc.
 - integration with other management systems (especially IMS and PTMS)
 - ties to programming processes

There were several metropolitan area candidates with commendable practices.

However, a combination of limited funds, the respective states' readiness to accept Federal funding, their capability to match funds, the availability of support staff and technical resources helped to narrow the list further. The grant was allocated according to FHWA experience with previous projects of comparable nature. The amount was based on the level of complexity of individual projects and availability of funds. In some cases, the tasks for the projects were modified in keeping with funding constraints. Subsequent to project selection, work statements were developed, reviewed by the respective MPOs and later approved by the FHWA with few modifications.

Preliminary Setbacks. Initially, several MPOs were under the impression that the Federal grant would cover 100% of the expenses. However, ISTEA required a 20% match¹. Having already entered into agreements with the states and MPOs prior to them finding match for the

¹ ISTEA, Section 6005 (E) (12)

funds, both MPOs and State DOTs were motivated to meet the requirement. Either local funds or in-kind contributions were necessary to avoid losing the grant, and be replaced by other candidates. The MPOs that provided match up front started and continued their project without many hitches. FHWA-MPO relations were open and reports were submitted relatively on time. Table 2 in Chapter 1 indicated the level of effort for the individual projects.

4.1.2 State of the Practice Review: Ongoing CMS Activities

Coincidentally, the elements of CMS chosen for the case studies align with several goals outlined in the fiscal year (FY) 1995 Agreement between the Secretary of Transportation, Frederico Peña and the FHWA Administrator, Rodney Slater. The agreement was signed in April 1995 -- halfway through the CMS project. The rest of this section describes pertinent ongoing CMS activities in the metropolitan areas that participated in the FHWA case studies.

Nine Task Forces within the MPO - Capital District Transportation Committee (CDTC) coordinate CMS activities for that area bounded by the cities of Troy, Albany and Schenactady that has the interstate 87 as its major corridor. Membership on the task force includes city and county elected officials, transportation planners, transportation engineers, and transit operators in the region.

The task forces address a number of issues and are named for their area of focus:

- Arterial Management
- Demographics & Growth
- Expressway Management
- Futures

- Goods Movement
- Pedestrian & Bicycle
- Incident Management
- Transit Futures
- Land Use
- Urban Issues

All CDTC's efforts are focused on the development of a CMS that makes the TIP and other planning processes more robust. Through their regional plan, *'New Visions'*, the entire planning process is directed by clearly stated goals for the region, goals for which consensus has been reached.

In the Dallas-Fort Worth region, the North Central Texas Council of Governments (NCTCOG) is the initiator and facilitator of dialogue that aims to achieve "workable" long term goals. NCTCOG also acts as a transportation data clearinghouse for the region. This area was historically known as a pro-highway, limited transit territory. Since population has increased and significant growth is expected for the region, efforts to provide alternatives to highway travel has been on the rise. By the end of 1996, the region will have a fully operational 20 mile light rail and 34 mile commuter rail service. Both facilities are in the construction phase.

NCTCOG is incorporating a "congestion management philosophy" into all aspects of planning and programming. Strong communication and information dissemination systems are in place, and efforts are underway to connect with individuals, agencies and groups which are not traditionally reached. The Council of Governments has long had an informed, active policy body in the Regional Transportation Council, and they continue to provide the leadership necessary to solve difficult, complex transportation problems.

Through new outreach mechanisms like interagency coalitions, seminars and

forums, and video presentations, NCTCOG endeavors to enhance public participation in the provision of transportation systems and services in the Dallas-Fort Worth region. Such new developments have been credited to the effective incorporation of CMS activities into transportation planning and programming, and to the dialogue created from efforts to meet the Federal mandates of ISTEA. In essence, NCTCOG is involved in a breakthrough in which the paradigm that resists long term planning and regional thinking is being altered.

The Seattle -Tacoma metropolitan area MPO, Puget Sound Regional Council (PSRC), has been investigating the potential of intelligent transportation system (ITS) to simultaneously support local operations, the region's long range plan, and CMS performance monitoring requirements. Essentially, transportation system performance data, collected using ITS technologies, will be delivered through an information pipeline (Internet) by various sources, and then accessed on an on-going basis for the development of reports to support decision making, or as an information provider to state and local governments. The data will also be used to derive travel time performance by mode (i.e. SOV, HOV, transit, ferry, freight and non-motorized) as well as other transportation performance information.

Similar to the MPO in other case areas, PSRC acts as a coordinator of activities. The MPO developed the region's growth and transportation strategy, '*Vision 2020*', as a framework for managing future growth and identifying appropriate transportation strategies to be included in its metropolitan transportation plan. The CMS is designed to help PSRC and other localities assess their progress in achieving Federal, state and local policy aims.

In the metropolitan Washington area, CMS activities have to be coordinated among three jurisdictions (parts of the states of Maryland and Virginia and the entire District of Columbia). The Metropolitan Washington Council of Governments (MWCOCG) is comprised of 17 local governments and is the umbrella organization for the MPO - Capital Region Transportation Planning Board (COG/TPB). The District of Columbia Department of Public Works (DPW) conducts state DOT responsibilities. Prior to ISTEA, the area had already started a regional monitoring program and a regional transportation data clearinghouse -- both in keeping with ISTEA mandates and CMS requirements.

The CMS Task Force, a subcommittee of the MPO's Technical Committee, was created to study and respond to the Federal management systems requirements, and provide recommendations on how to address these requirements. It was comprised of members from the Maryland and Virginia state DOTs, transit officials, and DPW staff members, who have been working together to refine the clearinghouse. The CMS Task Force's efforts culminated in the production of the *CMS Work Plan for the Washington Region* based on a list of issues to be addressed, two of which were assigned for MWCOCG's case study -- data management and regional performance measures /indicators.

Data management is important because ISTEA and the CMS regulations require timely analysis of sound data more now than in the past. Regional performance measures/indicators are important to study, again, because of the "putting together" emphasis of ISTEA--putting together comparisons of different modes, of combinations

congestion management strategies, and of understanding the ensuing effects of instituting a unique solution to surrounding areas.

4.2 Elements Addressed in the Case Studies

CMS comprises several components (refer to Appendix C), however the case studies investigate four into which the focus areas assigned to the participating MPOs shown previously in Table 2 (Chapter 1) can be further categorized:-

1. Integration of CMS into Transportation Planning and Programming

- CMS integration in planning and programming decisions (NY)
- CMS integration to the decision-making process (TX)

2. Public Involvement

- Public participation process (NY)
- Participants and criteria for involvement *and* CMS information distribution(TX)

3. Multimodal Activities

- Multimodal activities enhanced through CMS (NY)
- Performance Measures: Development and Testing (D.C.)

4. Data Collection and New Technology Applications

- ITS Potential to support CMS data monitoring requirements (WA)
- ITS-CMS relationships that influence plans and program development (WA)
- Regional transportation data management (D.C.)

Each of these elements of CMS are mandated by ISTEA and have specific guidelines for their development and implementation. By using these groupings, it was possible to examine the different perspectives on similar issues.

Transportation Decision Making. Providing decision-makers the information they need to make economically, environmentally, and socially acceptable decisions regarding transportation investment and future programming is the intent.

Public Involvement. Educating and keeping the public well informed about the issues and proposed actions and providing scope for feedback is the intent here.

Multimodal Activities. Investigation of alternatives to SOVs and emission-giving vehicles is of interest here. Strategies aimed at providing safe bicycle and pedestrians facilities and better coordinated transit services is the focus of this element.

Data Collection and New Technology. The concept being to *'use what we already have'* is supported and encouraged, however, provisions for the use of new technology have also been legislated.

The following sub-sections describe the activities taking place with regard to the designated elements. Each section emphasizes the benefits of the strategies being applied and highlights some of the drawbacks and how they are being addressed.. Although listed along with data collection efforts, the use of ITS technology in Seattle-Tacoma, WA is treated in a separate section because of its newness to the industry and widespread interest in its use.

4.2.1 CMS in Transportation Planning and Decision Making

This section describes the approaches to integrating CMS in transportation planning and decision making used by CDTC in Albany, New York and NCTCOG in Dallas, Texas.

Attention in this effort focused on how CDTC approaches integrating CMS decisions into the planning and programming process, as well as what impact these approaches are having on the process. In general, CDTC integrates the management systems into transportation planning and programming as a means of aiding decision-making, rather than as independent systems which act as filters or separate screening criteria. CDTC found it beneficial to develop a vision statement from a joint effort between its nine task forces mentioned previously. The vision statement provides transportation decision makers with a reference point -- a direction in which to go in the coming years and a way to avoid conflict with overall vision and goals for the region.

As part of the process, CDTC established a set of Congestion Management and Planning and Investment Principles that call for consideration of demand management, cost effective operational actions, incident management, land use management and corridor protection. Together, they inform CDTC's decision process, helping to determine which multimodal activities will be investigated and which persons and organizations should be encouraged to participate in the planning process.

CDTC's perspective suggests that the management systems are the most logical location for data collection and basic interpretation of system performance. As a result, CDTC's CMS describes principles, future goals priority setting and 'scoping' processes as well as data collection and analysis. Integration of the CMS into transportation planning and programming has been based on the development of core system performance

measures which fall into three main categories: transportation service, resource requirements and external effects. Together they cover the quantitative and qualitative costs involved in transportation systems. Use of multimodal performance measures allows the MPO to ensure that congestion needs are adequately considered in the decision making process.

CDTC's approach to integration of the CMS into transportation planning and programming has resulted in positive impacts. Some benefits associated with CMS include those listed below.

- information supporting TIP project selection and 'New Visions' long range plan development,
- identification of travel demand management's (TDM) regional importance,
- ability to program TDM initiatives in the TIP,
- encouragement of arterial management ,
- closer link between design and planning processes,
- ability to support other demand management programs (e.g. commuter register, and new transit initiatives),
- ability to make tradeoffs between different objectives (e.g. trade off analysis must compare incremental cost with current critical capacity needs for such projects as Interstate bridge replacements),
- ability to program projects in the TIP that require significant private funding through development mitigation fees or transportation development district fees,

- high prioritization of transit, bicycle, pedestrian components to urban highway improvement projects, and
- high prioritization of projects fostering intermodal connections.

Overall, the CMS has been helpful in making tradeoffs between different objectives. For example, for bridge replacement over an Interstate highway, congestion management principles say that instead of automatically increasing capacity to fully accommodate thirty year traffic needs, a trade off analysis must compare the incremental cost with critical capacity needs present today. The CMS has also helped to program into the TIP several projects requiring significant private funding through development mitigation fees or transportation development district fees. CMS also plays a role in the prioritization of improvement projects; inclusion of transit, bicycle, pedestrian components to urban highway projects and projects that foster intermodal connections are identified and targeted for improvements as a high priority.

The task assigned to NCTCOG required documentation of how CMS was being integrated into the decision making process and how various participants impact the process. The MPO, NCTCOG, views the CMS as a dynamic decision-making tool which helps them to make an initial assessment of congestion, identify congested facilities and subsequently develop regional strategies and target resources for implementation purposes. Over time, the CMS is expected to supply information on regional congestion (areas, systems, facilities) and trends to the other management systems for more comprehensive transportation planning. It will also support development and implementation of the TIP by several means.

NCTCOG's "*State of the Region Report*" will be instrumental in the development of project selection criteria which promote cost-effective strategies for mitigating traffic congestion. To facilitate project implementation, an information system is maintained of all recommended and implemented congestion management projects, cross-referenced by type, projected year of implementation, and implementing agency. Information includes anticipated benefits, costs and project location. This database is updated continually as project status changes. An information system of this type ensures the integration of the CMS with the implementation of Dallas-Ft. Worth Regional Transportation Plan.

4.2.2 Public Involvement

Both CDTC and NCTCOG were assigned focus areas that addressed certain aspects of their public involvement activities. This section describes CDTC's experiences in developing a public outreach program and highlights their methodology. It also describes NCTCOG's activities, namely, the participants involved and the impacts they have had on the decision making process.

CDTC shared their priority setting process and highlighted those areas where public involvement occurs. They disclosed the nature of involvement of the participants and the impact they had on the prioritization process. Public outreach plays a major role in the CMS for the Capital District. According to CDTC, their public involvement efforts have paid unforeseen dividends. Highly involved are members of the Expressway Management Task Force, which include the State Police and representatives from the New York State Thruway Authority. Expressway Management has been enthusiastically

pursuing incident management and requested that CDTC mediate between local police departments, fire departments, and emergency medical service providers regarding procedures for traffic management during an incident. This was an unexpected dividend that CDTC did not discover until they had formed the Task Force.

Similar experiences have been reported from the other task forces. CDTC plans to extend outreach beyond the task forces in the future, however contributions to congestion management have already been made.

Some of CDTC's exemplary practices in public involvement are:

1. **Design of the public involvement program** that used a mail-back survey and two public meetings. Following the survey, agency staff brain stormed and identified over 500 stakeholders who could be involved in some way.
2. **Public input was encouraged** through formal and informal meetings as opposed to more general *'one-size-fits-all'* meetings.
3. **Public education** to develop general understanding of transportation planning processes and planning issues, CDTC developed *A Guide to Advancing Transportation Projects in the Capital District* -- an educational 10-page brochure written in simple language.
4. **Open TIP development process** to ensure adequate local support, and demonstrated public involvement. Aside from opinions gathered through the outreach program, special effort is made to reach populations not usually involved, yet significantly impacted by the actions.
5. **Performance Measure development.** The development of a *"community quality of life"* (CQOL) performance measure by the Urban Issues task force is a testament to CDTC's commitment to public involvement. The CQOL measure attempts to paint a

picture of how transportation and its interaction with land use, has influenced “quality of life” at the community level. It is a core performance measure in the Regional Transportation Plan that cuts across issue areas and is at the heart of New Visions is trying to achieve goals.

The *CQOL* measure has increased visibility of the following issues:

- Increasing pedestrian activity for recreation.
- Increasing transportation costs relative to other costs of living.
- Continued isolation of communities and neighborhoods caused by auto accommodation (wide streets, few pedestrian, bicycle and transit facilities).

NCTCOG developed a comprehensive list of participants and criteria for their involvement. In particular, they listed the many local governments and non-traditional decision makers, their level of involvement in the planning and programming processes, and the impacts of their involvement in the process. Table 4 gives a summarized version of that list.

Four technical committees support the policy body of NCTCOG, the Regional Transportation Committee (RTC) is supported by with input for the planning process. The technical committees comprise personnel city and county agencies, public works, engineering and planning. The policy body consists of elected local government representatives in the metropolitan area in addition to transit operators.

Table 4. Participants in Dallas/ Ft. Worth, Texas CMS Activities

Who	Why	Level of Involvement	Impact
<ul style="list-style-type: none"> - City/ council government - engineers, - transit authority, - chamber of commerce, - private companies, - general public - emergency response personnel 	<ul style="list-style-type: none"> - political interests - technical interests - commercial (economic growth of region) - broad interest of private citizens - expertise/ high stakes 	<ul style="list-style-type: none"> - based on issue at hand 	<ul style="list-style-type: none"> - consensus on strategies - less resistance to change - synergy from joint efforts to achieve common cause

Through a symbiotic relationship, regulatory and technical issues are addressed simultaneously. Some public/private partnerships are also used within the technical committee structure, taking advantage of the contributions to be had from management-level professionals.

NCTCOG develops plans for 16 counties which are represented on one committee or another. Several subcommittees, working groups and task forces also participate in transportation planning dialogue and activities. Each group makes essential input to future planning and programming. For example, the CMS Working Group assisted the staff in the development of performance measures and has explored issues *before* they reach the technical and review bodies. Although there is no established 1-2-3 format for planning activities in which the involvement of each group can be easily identified, they all have proven to be important in some way.

Some non-traditional participants being solicited for involvement are emergency response personnel (i.e. fire, ambulatory, police), hazardous material handlers and others who deal with incident management. The non-traditional participants play important roles

in activities that lead to incidents, both recurring and non-recurring, have been identified as a key cause of severe congestion on the roadways in the region.

Primary criteria for involvement in each committee hinges on the expected role and degree to which persons are likely to contribute to achieving established objectives. For example, input from emergency response personnel has been significant to the development of incident management strategies for areas which mainly experience non-recurring congestion. As a rule, the more technical the issue, the more effort is expected of engineers and other technical experts. Similarly, politically charged, or legal issues are handled by committees with high representation from local government and business interests.

Overall, the synergy in creating such a diversity of participants has resulted in an elevated level of consensus on congestion management strategies, and limited resistance to change. Citizens in the region are more educated about the air quality and traffic volume implications to their personal mobility choices and feel more involved in decision making than ever before.

Taking the issue further, NCTCOG also shared the various methods by which CMS information is disseminated to local government officials and the public at large. Basically, public involvement activities were traditional: public meetings and printed media. However, NCTCOG is always striving to harness the opinions of a more diverse population through more direct, proactive means.

Some of the innovative techniques used are:

- mail-back surveys
- notices for meetings
- newsletters
- public “open” meetings
- planning/ technical committee/ task force meetings
- presentations
- training

Notices are mailed out for committee meetings, advertised in the news media and attendance is confirmed through follow-up phone calls. Essentially, the visibility of the committee is raised and the invitee should be reached *at least once* through this method.

The nature of communication has been such that there is increased and improved interaction and rapport leading to consensus.

4.2.3 Multimodal Activities

CDTC’s experience with integrating alternatives to SOV: transit, pedestrian and bicycle needs into priority setting was of interest. In particular, how the needs could be addressed through the CMS.

Based on the principles developed by the Transit Futures Task Force, CDTC aims “to offer an alternative travel mode to reduce dependence on the auto, to provide essential mobility for those who do not operate a private vehicle, and to serve as a tool to support regional and local land use policies.”² In New York, CDTC was applying a consistent approach to measuring effectiveness across modes and in so doing enhances

²Source: *CMS Case Study Task 1 Report*. CDTC, Albany, New York. April 1995.

multimodal activities through the CMS. Performance measures are developed with a focus on the determination of excess delay; units are in *person hours* for people movement and *vehicle hours* for freight.

Challenged by time constraints, the Bicycle and Pedestrian Task Force addressed issues incorporating features to improve bicycle and pedestrian mobility into projects already on the TIP but not yet designed. This was an innovative move by CDTC, accomplished by reviewing TIP projects and drafting methodology to include arguments for bicycle and pedestrian treatments.

CDTC identified standards for bicycle and pedestrian treatment using FHWA's manual *Selecting Roadway Design Treatments to Accommodate Bicycles*. Through application of these guidelines, **facility** (bike path and walkway), and **accessibility-based** needs (safe access/egress points, surface drainage and maintenance, safe interaction between modes and away from motorists) were addressed. In addition, CDTC identified 1,000 miles of bicycle and pedestrian facilities - mostly existing trails and some surface streets which will enhance the present transportation system. The designated bicycle network, including storage facilities at intermodal connection points has been developed as a reference for long range statement of direction for enhancement activities.

At the project level, multimodal consideration is broadened to include bicycle, pedestrian and transit service opportunities, design considerations and freight transportation requirements. At the sub-regional level, the programming decision is based upon factors such as system consistency and land use plans, provision of alternative modes and public participation. As a tie into the public involvement process, CDTC identifies the

need to improve the connectivity of neighborhoods and communities through a serious investment in *'walkability'*.

With regard to multimodal issues, the approach to CMS has been beneficial in identifying TIP projects for bicycle and pedestrian treatments, encouraging maintenance practices to enhance the safety and comfort of bicycle and pedestrian travel (for example, holding bike routes to higher standards of pavement condition), and identifying major barriers to bicycle and pedestrian travel.

COG/TPB is putting together a regional scan of congestion based on the model outputs, and on results of the aerial survey projects, in combination with other available data, for the region's limited access highways. It will highlight locations of suspected congestion problems which can be double-checked against the corridors identified in the CMS Work Plan, perhaps with some changes to corridor definitions recommended. Then COG/TPB will proceed with the task of analyzing strategies to relieve the identified congestion.

The most commonly used tool to report transportation system usage and congestion so far has been Lotus 1-2-3 spreadsheets that allow side-by-side comparison of raw data with calculations, and manipulations of the data requested by the committees. Spreadsheets have been used with mixed results; the many factors and variables of interest in the CMS, as well as the many geographic locations of analysis even in one corridor, make for unwieldy matrices. In the future, COG/TPB will use map-based displays of data. GIS is a natural home for this. However, the agency's GIS was not developed where it could be used for this purpose. The GIS will start producing maps

later this year (1995), and is expected to become the ultimate display tool of the CMS and the data that support it.

In the interim, two alternatives explored so far are hand-drawn information on maps,(takes a lot of time) and plotting sketch maps on a pen plotter with data from the MINUTP model chain. Although the plots have shown some patterns of congestion in the area, they are not as clear, detailed, or user-friendly as GIS maps potentially could be.

4.2.4 Technical Issues: Performance Measures and Data Collection

Both COG/TPB and PSRC focused on data collection activities in their respective cases. However, because MWCOG's data collection activities are intimately related to their data collection activities, both are treated in this section. This section describes performance measures development and data collection activities for the metropolitan Washington area. Section 4.2.5 which follows this section deals with ITS applicability to CMS data monitoring requirements.

COG/TPB developed an extensive list of all conceivable performance measures and completed a data needs analysis for each indicator. They found that some of the measures needed data that was either too expensive or time consuming to gather. Rather than ditch those measures COG/TPB has set them aside as investigated but usable measures at this time, and concentrated on building on previous data collection efforts to support some of the less "data-hungry" performance measures.

MWCOG's efforts have yielded some two dozen measures/ indicators that can be used to measure transportation system performance in the region for multiple modes of

travel. Historically, travel monitoring reporting procedures have relied on traffic volumes, vehicle classification, vehicle occupancy, transit ridership reports, and speed. The choice of performance measures/indicators used up to the present has been dictated by the types of data that have been collected and are available for analysis and the computer models available for travel forecasting which have concentrated on traditional performance measures/indicators. The Washington region has concentrated on measuring, describing, and forecasting motor vehicle movement, with some attempts at reflecting other modes or multi-modal comparisons.

Through use of draft material from an FHWA instructional course, a list of possible performance measure was developed. A stratified list of CMS performance measures/indicators was developed after a long process of debates.

Delay required designation of an "optimum" travel time or speed (free-flow conditions) to gauge against, this optimum being debatable for numerous reasons. On the positive side, people, vehicles, and goods can all experience free-flow travel. But does free-flow include stopping at traffic signals or not? Does it include the realistic reflection of travel significantly above the speed limit? And one direction's free-flow conditions may create delay in the cross-direction.

Level-of-service (LOS) had been used frequently in the past and seemed the best alternative to using delay. Furthermore, there is a level of understanding and buy-in from regional decision makers and from the public. However, LOS has some well-known drawbacks, including not being multi-modal. LOS also has limitations in that so many locations in the Washington region are at LOS F. There would have to be a way of distinguishing among varying degrees of LOS F.

(CMS Case Study . . . Task I Report: MWCOG, 1995).

Use of *delay* and *LOS* as measures was discussed at length and it was decided that a whole list of indicators would be used and applied where and whenever relevant. Table 5 shows the current thinking that classifies the performance measures/indicators into

(i)"direct" or raw data; (ii) "calculated" data; and (iii) performance measures/indicators held from use for further research, but kept on the drawing board. The two main aspects of the research necessary on these performance measures/indicators are finding appropriate sources of data to supply them and developing methodologies with which to determine, report, or apply them. The CMS Task Force suggested analyzing the problem in tiers: regional, corridors, and activity centers or specific pinpoint locations in order to effectively identify congestion problems and benefits of their elimination.

Category	Description	Performance Measures/Indicators
<p>“Data for direct assessment of current (or future background) conditions.</p>	<p>can be directly measured from observation of the transportation system, and are the basis for many of the other performance measures/indicators. may be outputs of an analysis process in some cases, but are distinct from most of the other performance measures/indicators because they are <i>stand-alone</i>, observable from the transportation system.</p>	<ol style="list-style-type: none"> 1. Traffic volumes; 2. Facility capacity; 3. Speed; 4. Vehicle density; 5. Vehicle classification; 6. Vehicle occupancy; 7. Transit ridership.
<p>Calculated performance measures/indicators for congestion assessment.</p>	<p>important for gauging existing or projected conditions in comparison to what is feasible, desired, theoretically possible, and the like. They are the products of manipulations of other data or of computer models.</p>	<ol style="list-style-type: none"> 8. Volume-to-capacity ratio; 9. Level of service; 10. Person miles of travel/vehicle miles of travel; 11. Travel time by mode; 12. Person hours of travel/vehicle hours of travel; 13. Truck hours of travel; 14. Person hours of delay/vehicle hours of delay; 15. Modal shares; 16. Safety considerations; 17. Vehicle trips; 18. Emissions reduction benefits.
<p>Require further research before use in the CMS.</p>		<ol style="list-style-type: none"> 19. Bicycle usage and pedestrian counts; 20. Number of congested intersections; 21. Hours per day of congestion; 22. Percent person miles of travel by congestion level; 23. Percent delay; 24. Number and average duration of incidents; 25. Truck and freight movement involvement with congestion; 26. Percent of person miles of travel by transit load factor; 27. Person volume-to-person capacity ratio.

Table 5. Performance Measures/Indicators for the Metropolitan Washington D.C. Region

Typically, traffic congestion occurs in two major forms: the “bottleneck” (that occurs at specific points along a facility) and that which is “systemic,” (where demand exceeds supply throughout the length of a transportation facility). Although the bottleneck phenomenon is generally far more common than the systemic phenomenon, it is also true that bottlenecks may have underlying systemic causes. COG/TPB took a multi-faceted approach to determining congestion, whether systemic or bottleneck.

1. Professional knowledge and experience of the region's elected officials, transportation professionals, and other public officials helped establish a core of corridors for the CMS. These corridors have some of the strategically most important transportation facilities of the region, both highway and transit, as well as other associated facilities.
2. The body of knowledge from the region's travel monitoring programs includes traffic counts, travel times, vehicle occupancy, vehicle density, volume-to-capacity ratio, and transit ridership. The CMS Task Force has expressed its preference for analyses to be based on actual data to the extent possible, so COG/TPB has worked to improve its compilation, understanding, and dissemination of these data. To date, however, the CMS Task Force has been at the stage of investigating ways of compiling, formatting, and analyzing data, with only limited analysis done based on these data.
3. Look at the outputs of the regional travel forecasting computer model chain. COG/TPB has put much effort over the years to base its modeling chain on the best available background information on transportation system usage, land use, auto

ownership, and other input characteristics. The model chain can give estimates of many of the performance measures/indicators of congestion and will be the main source of information about future congestion. Currently it is the source of information on congestion on the region's arterial highways.

1995 Upcoming Activities (Performance Measures/Indicators) for MWCOCG

For the future, the CMS Task Force will continue working with data available from previous studies and activities to build a picture of congestion in the Washington region.

- putting together analysis structures for the identified CMS *priority* corridors because of impending projects or major, high profile associated issues; and
- inventory and document the array of analytical techniques available for use in the CMS as a guidance document and critique of current analysis capabilities, perhaps fostering discussion of what improvements could be made.

The analytical techniques available and the performance measures/indicators used are intertwined. In the process, COG/TPB will learn how workable certain performance measures/indicators are, how easily they are understood, and how straightforward they are in portraying results accurately.

The CMS Task force will also produce a CMS Annual Report with four major components: (1) a review and assessment of overall system conditions, (2) the identification of congested locations in the region, (3) the results of the CMS strategies identified and analyzed for subsequent or future implementation, and recommendations based on those results, and (4) an assessment of the effectiveness of CMS strategies

previously implemented (post-implementation monitoring). The annual report will be subsequently distributed to the other two jurisdictions (Maryland and Virginia), and applied to the TIP and statewide CMS plans.

As mentioned previously, MWCOG benefited from a head start on the regional data management activities having established the Transportation Data Clearinghouse prior to ISTEA. Since the necessary mechanism was already in place, the region used ISTEA as an opportunity to enhance the existing system as opposed to creating a new one. FHWA was particularly interested in CMS data integration with respect to the IMS and PTMS. A natural follow-up to the section on performance measures, this section outlines the many types of data that MWCOG considers useful or important for the CMS or other regional planning analysis.

The following is a list of minimum requirements:

- Traffic volumes
- Traffic speeds
- Traffic density
- Vehicle classifications
- Vehicle occupancy
- Transit ridership

MWCOG/TPB staff concentrated on getting data from 1986 to the present. In addition to average daily traffic counts, COG/TPB pursued demand information as well as information on roadway characteristics, such as signalized intersections, variable message signs, National Highway System (NHS) status, and political boundary information.

COG/TPB typically collects information on traffic speeds and vehicle occupancy and occasionally collects information on traffic volumes, vehicle classifications, and transit ridership, but generally relies on state and local transportation agency data for these. Recently, COG/TPB has collected information on traffic density for freeways in the region, and is embarking on a more detailed travel monitoring program of speed and travel time data collection through several of the projects described below.

Aerial Surveys have been used to monitor traffic density on the region's limited-access highways. Aerial surveys are comprehensive and relatively inexpensive. The cost was \$70,000 for all data collection and analysis for a peak hour study performed in fiscal year 1993. They provide a uniform way to gauge performance of a freeway system operated by different agencies. Additionally, photographs taken for the survey are available for detailed analyses of traffic.

The Travel Monitoring Program will analyze accident data on the freeway system and develop regional accident database to gauge the impacts of accidents on congestion over time. Speed, and its conversion into travel time and delay, will be a primary indicator on a regional and corridor basis of congestion.

Speed and Delay Studies. An arterial speeds model will be used to gauge travel time and congestion on the region's arterial highways. Speed and its conversion to travel time and delay, will be the primary indicator on a regional and corridor basis.

Cordon Counts. This program originated from the desire to assess the impact of the construction of the region's Metrorail system, starting in the late 1960's and are also used

to calibrate the regional travel demand forecast (TDF) model. Three cordon count programs performed on a three-year cycle help to provide an opportunity for trend analysis.

Travel Surveys (Home interviews and External surveys). While telephone or mail-back household travel surveys are useful, they are also very expensive to perform; thus they are conducted only rarely. COG/TPB conducted a telephone home interview survey and an external survey in 1994 to help upgrade regional travel models.

Freight and Goods Movement. The CMS Task Force plans to continue research and to develop ways to address goods movement. Of particular interest are delivery trucks with frequent stops in urban areas, and freight generation at airports.

Visitor and Tourist Travel is a much more significant component of the region's travel than it would be for other metropolitan areas. Taxi movement is a related issue, and is significant for portions of the region. Ways to address the relationship between visitor travel and congestion are being investigated.

One of the central ideas of the Regional Transportation Data Clearinghouse was that the transportation agencies of the Washington region were already collecting and compiling large volumes of transportation systems usage data, so these data could be easily obtained by COG/TPB. However, numerous difficulties were encountered with this approach and the future activity is geared at overcoming the setbacks encountered.

For the future, COG/TPB plans to conduct

- a limited amount of additional aerial surveys;

- one cycle of cordon counts to feature additional sites for bicycle usage;
- further investigation of vehicle occupancy to determine whether facilities need to be changed from HOV-3 (three persons per vehicle minimum) to HOV-2 (two persons per vehicle minimum); and
- activities for establishing the Regional Transportation Data Clearinghouse on a GIS.

For example:

- * Formatting and transferring data into the GIS's relational database management system.
- * Creating a base network on the GIS, defined using Census TIGER files and existing computer model networks on MINUTP.
- * Define data needs, formats, and access to that data in cooperation with regional transportation agencies.

4.2.5 New Technology: Data Monitoring with ITS

The focus for PSRC was the development of technical and institutional mechanisms for using ITS-based travel time to meet the data monitoring needs of a multimodal CMS, oriented to both passenger and goods movement.

Travel Time information allows one flexibility to compare performance of single occupant vehicles (SOVs), transit, vanpools, carpools, goods movement, and potentially, bicycles. Recognizing the value of such flexibility, the Central Puget Sound region selected travel time performance as its primary measure for CMS data monitoring

purposes. Early on, the region assessed that the expense of collecting travel time information for CMS would be difficult to justify unless included as part of existing efforts. Thus, in the interest of keeping costs down and creating a viable performance monitoring plan, PSRC made several decisions:

- to initially focus efforts regarding extensive data collection on the facilities identified in the CMS work plan;
- to achieve travel monitoring goals by building on advanced data collection activities already being implemented; and
- to stage a transition over the next few years from the volume-to-capacity measure in use to a travel time measure, as plans for advanced data collection move to implementation.

PSRC sees adopting a travel time measure for performance as an important opportunity to develop linkages to new data collection systems in the region, including:

- the **North Seattle Advanced Traffic Monitoring System (ATMS)**,
- the **loop detection** system run by Washington state DOT (WSDOT),
- **Metro and Community Transit's Traffic Signal Priority Project**,
- the Metro Transit and University of Washington **automatic vehicle location systems (AVLs)**,
- and other locally based systems.

A key factor in establishing linkage among these systems is expected to be the success of the *ITS Backbone Project*, co-sponsored by PSRC and WSDOT. The Backbone project is designed to create a common pipeline over the Internet for advance data collection systems, allowing the region to eavesdrop on travel data and use it to inform decisions.

The Backbone gathers travel times for automobile, freight and transit traffic in a dynamic exercise involving many agencies and extensive use of the region's ITS data collection activities. For example, by interfacing with an existing AVL system owned and operated by Seattle Metro, real time transit vehicle locations can be obtained. Freeway congestion information is also obtained by interfacing with the existing loop detection system owned and operated by WSDOT. Then using system components such as *data acquisition control systems, GIS command and control consoles, display systems and communication ports* -- the data from the AVL and loop sources are fused, yielding detailed information in the Backbone about the region's transportation system travel conditions.

Though the data collection process is complicated, from the perspective of the users, each system connected to it actually represents a single data source. The Backbone actually makes accessing information from multiple sources a manageable exercise. Furthermore, with the Internet connection provided, agencies can access the data remotely without impact to either the data's integrity or the source agency's use of it.

The cost of making data available through the ITS Backbone and Internet connection is minimal to agencies in the Puget Sound; yet the benefits are considerable.

The effort recognizes that independent agencies are often unwilling to share data for joint development if it means they must adjust current procedures or sacrifice the security and integrity surrounding their data. Thus, this project addresses such issues head on. The ITS Backbone encourages regional cooperation of transportation agencies, following principles of enlightened self-interest. The project makes information available without impacting the operations, philosophies, or integrity of agencies' objectives in gathering the data. The agencies are able to access and benefit from information from a variety of sources, "despite the fact that they are geographically separate, philosophically distinct, and highly conscious of data integrity"³.

Despite the potential for success, several issues have been identified in the region which need to be addressed as the ITS Backbone project and other ITS data collection activities move to full implementation. Some of the collection systems used are proprietary in nature, a fact which can complicate the design and development of information sharing techniques, as well as make it difficult to fine tune the data collected. Additionally, real time validations and processes for ensuring systems maintenance must be addressed if real time information is to be openly broadcast to transportation agencies.

³D.J. Dailey and M.P. Haselkorn. *Demonstration of an Advanced Public Transportation System in the Context of an IVHS Regional Architecture*. Presented at the First World Congress: Paris, France. December 1994.

CHAPTER 5

CONCLUSIONS AND IMPLICATIONS TO FUTURE TRANSPORTATION PLANNING AND POLICY MAKING

5.1 Summary and Findings

Only those metropolitan areas that have actively “*taken the bull by the horns*” and run with the ideas and concepts behind congestion management systems will be in a position to realistically meet the present deadlines. Some areas may meet the minimum requirements and others may experience the penalties of non-compliance¹. This thesis has taken a bird’s eye view of the development and implementation activities surrounding efficient congestion management systems. The view is based on the analysis of *specific* focus areas that were assigned to MPOs in Albany, New York; Dallas, Texas; Seattle-Tacoma, Washington state and the metropolitan area of Washington, D.C.

The MPOs, recently vested with additional authority in investment decision making are being challenged to consider many new factors in metropolitan and statewide transportation planning. In particular, the CMS aims at a series of issues:

- the preservation of existing facilities;

¹ Penalties for non-compliance include the withholding of Federal funds, including funds for Capital expenditures. Refer to 23 U.S.C. 133 (d), (3) for details.

- methods to relieve congestion, or prevent it;
- the connectivity of roads within and between neighboring localities;
- the enhancement of freight (goods) movement; and
- the expansion and improvement of transit services, bicycle and pedestrian facilities coupled with strategies to increase their usage².

In the quest for *comprehensive, coordinated and consistent* transportation planning, the four MPOs examined in this thesis were engaged in genuine cooperative efforts with non-traditional decision makers. For example, CDTC in Albany has established ties with emergency personnel in their incident management efforts; and NCTCOG in Dallas has established a variety of outreach mechanisms tailored for business interests, elected officials and the public at large. In Seattle-Tacoma, the *ITS Backbone* project will continue to draw from input by academia, transit and traffic operations; and in the metropolitan D.C. area, extensive cooperative efforts between officials across political boundaries are underway to fuel regional data collection efforts.

In Chapter three, decentralized government and reorganization activities in both public and private sectors were discussed. Reorganization and an increased number of participants have made the decision-making process longer. However, the feeling is that there is more widespread knowledge of the issues and greater awareness of the effects of decisions, since there was open discussion before implementation. The MPOs approach to more inclusive decision making utilizes forums, diverse task forces and sub-committees

² Refer to Appendix B for details of(23 U.S.C. §134 (f) - 1, 2, 8, 11, 14; and 23 U.S.C. §135 (c) - 3, 7, 11, 12, 19.

and has been very beneficial to the initiation and continuation of dialogue. Forums have fostered relationships -- both personal and professional between local and state agency officials. During the course of the case studies, the author observed similar interactions at a monthly meeting held by the metropolitan Washington area MPO. Private citizens, local and state transportation officials from the neighboring jurisdictions of Maryland and Virginia were in attendance.

It appears that the case areas shared similar motives for their approaches to the focus areas, irrespective of the different regional interests represented. The technical issues investigated were focused on data collection activities and their applicability to performance measures that are being developed to provide information about a region's entire transportation system for all possible modes. The concept behind the ISTEA mandates is to stimulate a cooperative environment that is economical, and provide a basis for agreement between localities; therefore, the collection of transportation data outside one's jurisdiction to support regional planning becomes easier.

If the proposed restructuring plans for the USDOT are adopted, metropolitan and statewide transportation planning may continue to be carried out by the present respective departments with an added requirement to coordinate with port planning activities. In essence, multimodal experience would probably become an essential staffing requirement more now than ever before.

5.1.1 Key Factors for Future Metropolitan Transportation Planning

Faced with a combination of both technical and institutional issues, the MPOs have pursued the establishment of CMS with alacrity and with a unified vision for its success. This thesis extrapolates the effectiveness of the case studies to the effectiveness of the eventual CMS formed in the respective areas. The following section lists some key factors that rely heavily on suggestions made by MWCOG in their *CMS Case Study Task I Report* that may contribute to better planning and implementation of an effective CMS.

1. *Utilize a Strategic Approach*

- Prioritize studies to the most important facilities or areas.
- Prioritize CMS activities, including travel monitoring.
- Review the locations and extent of counts already taken.
- Prioritize the types and locations of data collection activities that the MPO might have to undertake.
- Define facilities for study and consider whether there is adequate existing data for the location or facility, as well as the location or facility's functional importance for the region.

2. *Build on existing efforts*

- Use existing data collection as effectively as possible.
- Develop an understanding of the data collection activities already undertaken by the region's transportation agencies.

3. *Relevance is the key*

- Define particular facilities or geographic areas to be studied in collaboration with member agencies, then request relevant data from the region's transportation agencies.

4. *Gain buy-in from participants*

- Use planning meetings to gain buy-in from participants (such as the state transportation agency) on collecting and providing data expressly for, or compatible with the regional planning process. Criteria for locations should be based as much as possible on where member agencies want to collect data, or where they already collect data, or on the designated HPMS locations.
- Seek buy-in from member agencies' planners or engineers to build consensus on the overall goals and achieve greater levels of success.

5. *Keep performance measures/indicators simple and understandable*

- Keep tried and true mode-specific indicators such as volume-to-capacity ratio and transit peak load factors, and add to them indicators that may begin to address intermodalism, such as delay and person hours of travel.
- Develop standard performance measures/indicators across segments of the region, particularly those measures/indicators that compare travel forecasts and air quality.

5.1.2 FHWA Project Administration

So far, this thesis has explored technical and institutional issues. There are also some administrative issues that warrant discussion. As mentioned in previous chapters, several factors were observed to contribute greatly to the smooth administration of the individual case studies; namely pre-existing internal mechanisms to expedite the project, adequate staff and the availability of technical expertise. The availability of technical expertise is important to the progress of any project. If not in-house, procurement of consultants can be lengthy. It is suggested that FHWA play a more proactive role in determining the technical capabilities of its clients, the MPOs. In that regard, state and local agencies should be evaluated in order to identify those that may need technical support. Subsequently, FHWA should respond by designing future research and technical assistance projects that consider those needs.

In order to meet the expectations of FHWA and other agencies that are to benefit from technical assistance efforts, more realistic deadlines can be designed into FHWA grant projects such as the ones used here. The present process, represented in Figure 2, has been known to cause delays of up to eight months. Considering FHWA the starting point for each case explored in Chapter 4, the grant “passed through” the respective State DOT then on to the local MPO. In return, the MPOs submitted information to FHWA who coordinated and later distributed it to the field (Federal, state and local agencies). MWCOCG experienced such a delay for four months. In order to provide technical assistance to the field, the grant was intended as “buy-in” to MWCOCG’s CMS experiences, however, reports were not forthcoming until the funds had been transferred to COG/TPB from the Department of Public

Works. Fortunately, the project was part of ongoing CMS work hence the effect of delay due to transfer of funds was mainly on the Federal side and did not hinder local activities.

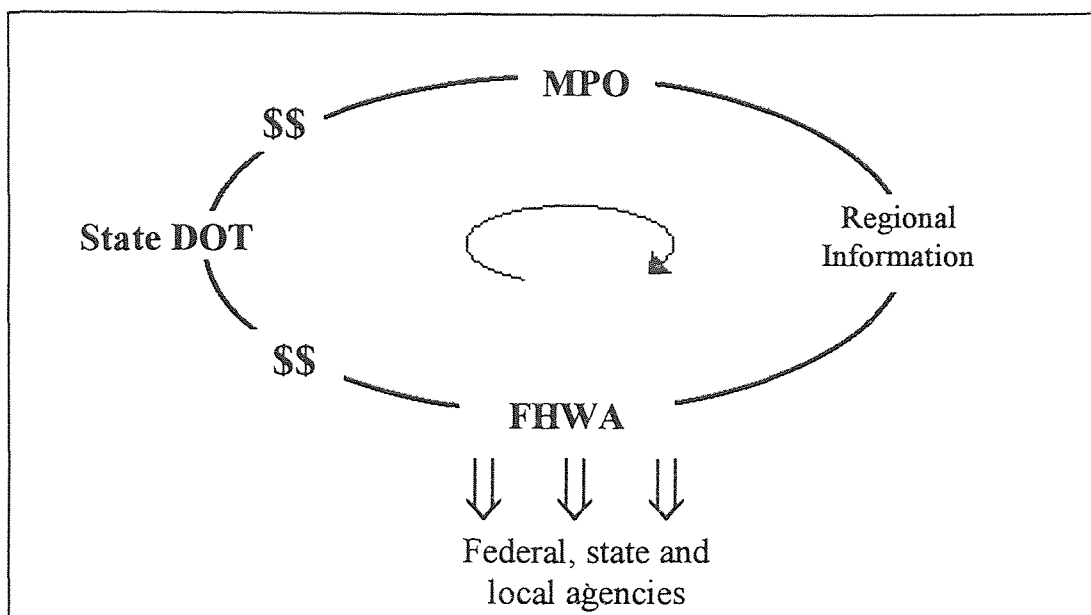


Figure 3. Flow of Funds and Information for the Case Studies

For the future, the implementation of a more streamlined process that carefully considers the duration of the steps shown in Figure 2 (listed below) and that engenders the designation of more realistic deadlines is recommended for future similar FHWA / MPO projects.

1. Transfer of funds from Federal agency (FHWA) to State (DOT)
2. Transfer of funds from State (DOT) to local agency (MPO)
3. Notice to proceed with project (usually from the DOT to MPO)
4. Submittal of reports from MPO to FHWA.

5.2 Conclusions

In response to broad political and social issues, it is transportation policy that spurs facility designs, travel demand forecasts and data collection activities. This statement is further supported by Gawthorp (1984) who explains that policy usually establishes goals and provides governance for systems. In this thesis, policy referred to ISTEA and system referred to CMS. Collectively, the mandates of ISTEA parallel the design and operation of 'plans' or systems. Projects (e.g. road widening, rail construction, intersection signalization) are carried out only *after* the system has been activated. The analogy for *project* in this thesis is the technical assistance research effort, results of which will eventually feed back into future transportation policy-making efforts, thereby making the circle complete.

Given the time frame for the establishment of CMS, the cases examined displayed exemplary practices and will probably meet the October 1995 deadline. The MPOs believe their experiences have culminated in the adoption of practices that will benefit the field regardless of whether CMS remains a mandatory requirement of ISTEA or becomes optional. Furthermore, several states have adopted similar principles in their state legislation. For example, the Growth Management Act in Washington state mandates coordination of efforts across local jurisdictions in the area of reporting transportation system performance.

Collectively, the MPOs view the more lengthy and rigorous transportation planning process as comprehensive: more economically, socially and environmentally sound, and in keeping with the original intent of ISTEA. To this end, it is suggested that the CMS

compliance date be extended to reflect the delay between the management systems guidelines publication (February 1993) and compliance deadlines (October 1995 and October 1996). In the interim, greater visibility of exemplary practices around the nation would go a long way in demonstrating the benefits of CMS thereby gaining more support for its need.

Progress in the development and implementation of CMS has come amidst concerns for more technical expertise in local agencies and models that demonstrate the benefits to cooperation and coordination in less complex or technical terms. In this regard, FHWA has scheduled future CMS projects in the pipeline that will showcase areas supporting CMS and demonstrate the benefits. One such effort is the Congestion Management Newsletter which appears as an insert in the Institute of Transportation Engineers journal on a quarterly basis. Demonstration projects are especially needed to showcase data sharing and new technology application efforts which tend to command a substantial amount of resources.

‘Will the CMS they develop be in compliance with general Federal guidelines?’

The effectiveness of CMS in transportation planning and programming will become evident in a few years after projects that were prioritized and approved through the new management systems will have been evaluated against the original goals.

5.3 Future Research

It will be interesting to follow-up on the CMS activities of these four metropolitan areas to determine how closely the strategies they implement meet stated objectives. This thesis covered the more procedural aspects of CMS and was geared at expediting related information to the field for immediate use. In view of time constraints and the urgency with which this effort was pursued, several issues which may warrant further in-depth study were not included. A more detailed investigation into the technical and political issues faced in the procurement of data for CMS monitoring requirements in the application of ITS is one such issue.

With regard to recent dialogue about the appropriateness of deadlines for the CMS, it would be interesting to see what the changes to ISTEA will be, if any, and how they will affect MPOs that have been enthusiastic about CMS since the beginning and those that were not.

Also, if compliance is eliminated and CMS becomes optional, what are the implications to future transportation systems in metropolitan areas that decide not to continue? Economically, CMS has been costly -- will those areas that expended efforts be remunerated any for either lost time or funds? Further investigation would respond to the last two questions raised in Chapter one.

- Are CMS mandates too flexible or stringent?
- Are more of less specific guidelines needed?

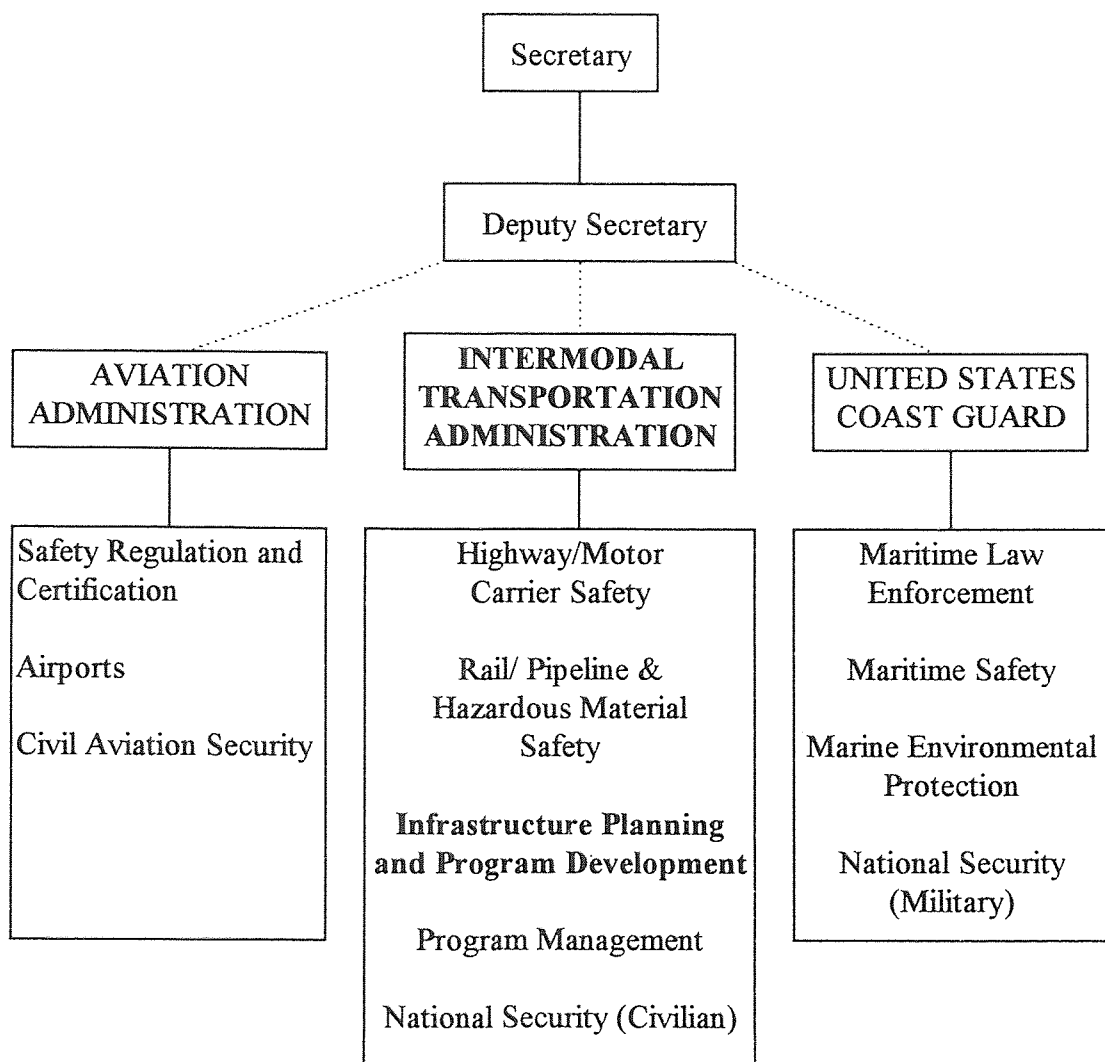
Stepping away from the project itself, the author wishes to emphasize that the quality of face-to-face communication cannot be substituted by the various other media that are available (fax, phone, electronic mail or conventional mail). Meetings with representatives from two of the participating MPOs resulted in substantial progress for the case studies underway that the author attributes to the resulting rapport that it stimulated. Being able to “put a face to the voice on the phone or to the words in correspondence,” transmitting the urgency of the project, and getting unencumbered feedback were just a few of the results that helped to spur the projects forward.

An element of bonding between local and Federal staff working on the project is lost when one considers the impersonal nature of state-of-the-art media. The author further proposes that just as early buy-in, rapport and consensus building efforts cement the CMS process, it also strengthens the project funding process, resulting in “better” reports and more open communication. On that basis, it is recommended that future projects of this type budget for either video conferencing or in-person contact early on in the project. McCall (1985) extols the virtues of face-to-face contact as necessary for understanding other perspectives and in negotiating for mutual benefits based on mutual respect. Besides this thesis, other sources used in its preparation may spark ideas for future research in CMS and transportation policy. An annotated bibliography of a few of the sources appears in Appendix E. Essentially, the underlining intent is that all future activity should be directed at better ‘intermodal’ planning and coordination prior to implementation of new projects and programs.

APPENDIX A

THE "NEW" USDOT STRUCTURE

USDOT (Proposed - February 2, 1995)



[It has been proposed that Metropolitan and Statewide Transportation Planning activities be conducted under the auspices of the Intermodal Transportation Administration in Infrastructure Planning and Program Development].

Description of DOT's Restructuring Plans

The new Department of Transportation will have three administrations reporting to the Secretary and Deputy Secretary:

- I Intermodal Transportation Administration:** Includes the functions now performed by:
- Federal Highway Administration
 - Federal Railroad Administration
 - Federal Transit Administration
 - Maritime Administration
 - National Highway Traffic Safety Administration
 - Research and Special Programs Administration functions pertaining to pipeline safety and hazardous materials
 - USCG bridge permitting
- II Aviation Administration:** Includes the functions now performed by:
- Federal Aviation Administration (less air traffic control)
 - Office of Commercial Space Transportation
 - Certain domestic and international aviation functions now performed in OST
- III United States Coast Guard:** Includes USCG activities less permitting for bridges crossing navigable waterways.

Two organizations will be transferred out of DOT:

IV United States Air Traffic Services Corporation: Air traffic control functions currently performed by the FAA will be corporatized. Detailed legislation is currently being drafted.

V St. Lawrence Seaway Development Corporation: The Seaway will be transferred out of DOT and become a free standing self-sustaining entity, with details to be worked out at a later date in consultation with the government of Canada.

Cross-cutting activities will be streamlined and focused to minimize duplication:

VI Office of the Secretary of Transportation: Refocused as a leaner organization with the role of providing strategic direction for the Department, advice to the Secretary, research and technology leadership, policy coordination, resource management and allocation, and international relations. Operations (e.g., facilities maintenance, accounting) will be delegated to entities outside of OST. Coordination and oversight functions will re-engineered and streamlined to allow managers and staff to deliver programs without multiple layers of concurrence and review.

VII Research and Technology: Details are still being worked out, but the concept is that research and technology resources would distributed throughout the three component administrations of the Department. Department-wide research and technology activity would be coordinated through a proposed office of transportation technology in OST. This office, comprising no more than 10-15 people drawn from existing resources, would

handle strategic planning, interagency issues, and intermodal technological coordination. Framework and reporting lines of DOT managed research organizations (e.g., Volpe Center) have not yet been finalized.

VIII Bureau of Transportation Statistics: DOT data functions performed in BTS and throughout the Department will be streamlined and coordinated. Appropriate reporting relationships will be finalized at a later date.

IX Field Structure: DOT's field offices are the heart of its service delivery mechanism and they will assume an added level of importance in the new organization. Special attention will be paid to the needs of our customers and partners in metropolitan and rural areas as well as in locations where we have traditionally had offices. In the next phase of our restructuring work, we will assess existing field resources and customer needs to determine the best distribution of service in the field. We expect that a major benefit of the new structure will be integrated and co-located Department of Transportation offices rather than more narrowly focused modal administration office we have had in the past.

Infrastructure Planning and Program Development

This area includes the planning activities associated with transportation infrastructure development. It includes reviews and coordination of state and local planning and programming for highways, rail, and transit. The Department's port planning activities, while not as extensive, would be coordinated in this area. The Intermodal Transportation Administration will coordinate airport access plans with the Aviation Administration. This area also includes establishing project eligibility and selection criteria for the Department's funding programs and reviews for compliance with environmental laws and regulations. AMTRAK's capital and other plans would also be reviewed here. These activities would be supplemented with technical assistance and training for DOT's partners and customers.

APPENDIX B

FACTORS TO CONSIDER IN TRANSPORTATION PLANNING – 23 U.S.C. §§134 (f) AND 135 (c)

23 U.S.C. §134. Metropolitan Planning.

(f) Factors To Be Considered. - In developing transportation plans and programs pursuant to this section, each metropolitan planning organization shall, at minimum, consider the following:

- (1) Preservation of existing transportation facilities and, where practical, ways to meet transportation needs by using existing transportation facilities more efficiently.
- (2) The consistency of transportation planning with applicable Federal, State, and local energy conservation programs, goals, and objectives.
- (3) The need to relieve congestion and prevent congestion from occurring where it does not yet occur.
- (4) The likely effect of transportation policy decisions on land use and development and the consistency of transportation plans and programs with the provisions of all applicable short- and long-term land use and development plans.
- (5) The programming of expenditure on transportation enhancement activities as required in section 133.
- (6) The effects of all transportation projects to be undertaken within the metropolitan area, without regard to whether such projects are publicly funded.

- (7) International border crossings and access to ports, airports, intermodal transportation facilities, major freight distribution routes, national parks, recreation areas, monuments and historic sites, and military installations.
- (8) The need for connectivity of roads within the metropolitan area with roads outside the metropolitan area.
- (9) The transportation needs identified through the use of the management systems required by section 303 of this title.
- (10) Preservation of rights-of-way for construction of future transportation projects, including identification of unused rights-of-way which may be needed for future transportation corridors and identification of those corridors for which action is most needed to prevent destruction or loss.
- (11) Methods to enhance the efficient movement of freight.
- (12) The use of life-cycle costs in the design and engineering of bridges, tunnels, or pavement.
- (13) The overall social, economic, energy, and environmental effects of transportation decisions.
- (14) Methods to expand and enhance transit services and to increase the use of such services.
- (15) Capital investments that would result in increased security in transit systems.

23 U.S.C. §135. Statewide Planning.

(c) STATE PLANNING PROCESS. - Each State shall undertake a continuous transportation planning process which shall, at a minimum, consider the following:

- (1) The results of the management systems required pursuant to subsection (b).
- (2) Any Federal, State, or local energy use goals, objectives, programs, or requirements.
- (3) Strategies for incorporating bicycle transportation facilities and pedestrian walkways in projects where appropriate throughout the State.
- (4) International border crossing and access to ports, airports, intermodal transportation facilities, major freight distribution routes, national parks, recreation and scenic areas, monuments and historic sites, and military installations.

The transportation needs of nonmetropolitan areas through a process that includes consultation with local elected officials with jurisdiction over transportation.

- (1) Any metropolitan area plan developed pursuant to section 134.
- (2) Connectivity between metropolitan areas within the State and with metropolitan areas in other States.
- (3) Recreational travel and tourism.
- (4) Any State plan developed pursuant to the Federal Water Pollution Control Act.
- (5) Transportation system management and investment strategies designed to make the most efficient use of existing transportation facilities.
- (6) The overall social, economic, energy, and environmental effects of transportation decisions.

- (7) Methods to reduce traffic congestion and to prevent traffic congestion from developing in areas where it does not yet occur, including methods which reduce motor vehicle travel, particularly single-occupant motor vehicle travel.
- (8) Methods to expand and enhance transit services and to increase the use of such services.
- (9) The effect of transportation decisions on land use and land development, including the need for consistency between transportation decision making and the provisions of all applicable short-range and long-range land use and development plans.
- (10) The transportation needs identified through use of the management systems required by section 303 of this title.
- (11) where appropriate, the use of innovative mechanisms for financing projects, including value capture pricing, tolls, and congestion pricing.
- (12) Preservation of rights-of-way for construction of future transportation projects, including identification of unused rights-of-way which may be needed for future transportation corridors, and identify those corridors for which action is most needed to prevent destruction or loss.
- (13) Long-range needs of the State transportation system.
- (14) Methods to enhance the efficient movement of commercial motor vehicles.
- (15) The use of life-cycle costs in the design and engineering of bridges, tunnels, or pavement.

APPENDIX C

CMS COMPONENTS – 23 C. F. R. SECTION 500.507

§ 500.507 CMS components.

(a) *Performance measures.* Parameters shall be defined that will provide a measure of the extent of congestion and permit the evaluation of the effectiveness of congestion reduction and mobility enhancement strategies for the movement of people and goods. Since acceptable system performance may vary among local communities, performance measures shall be established cooperatively by the State and affected MPO(s) or local officials in consultation with the operators of major modes of transportation in the coverage area.

(b) *Data collection and system monitoring.* A continuous program of data collection and system monitoring shall be established to determine and monitor the duration and magnitude of congestion and to evaluate the effectiveness of implemented actions. To the extent possible, existing data sources, such as, the HPMS and FTA Section 15 data, should be used.

(c) *Identification and evaluation of proposed strategies.* The anticipated performance and expected benefits of traditional and nontraditional strategies that will contribute to the more efficient use of existing and future transportation systems shall be identified and

evaluated based on the established performance measures. Strategies, or combinations of strategies, to be appropriately considered include, but are not limited to:

- (1) Transportation demand management measures, such as; carpooling, vanpooling, alternative work hours, telecommuting, and parking management;
- (2) Traffic operational improvements, such as, intersection and roadway widening, channelization, traffic surveillance and control systems, motorist information systems, ramp metering, traffic control centers, and computerized signal systems;
- (3) Measures to encourage high occupancy vehicle (HOV) use, such as, HOV lanes, HOV ramp bypass lanes, guaranteed ride home programs, and employer trip reduction ordinances;
- (4) Public transit capital improvements, such as, exclusive rights-of-way (rail, busways, bus lanes), bus bypass ramps, park and ride and mode change facilities, and paratransit services;
- (5) Public transit operational improvements, such as, service enhancements or expansion, traffic signal preemption, fare reductions, and transit information systems;
- (6) Measures to encourage the use of nontraditional modes such as bicycle facilities, pedestrian facilities, and ferry service;
- (7) Congestion pricing;
- (8) Growth management and activity center strategies;
- (9) Access management techniques;

(10) Incident management;

(11) Intelligent vehicle-highway system and advanced public transportation system technology; and

(12) The addition of general purpose lanes.

(d) *Implementation of strategies.* For each strategy (or combination of strategies) proposed for implementation, an implementation schedule, implementation responsibilities, and possible funding sources shall be identified.

(e) *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 implemented. The results of this evaluation shall be provided to decision makers to provide guidance on selection of effective strategies for future implementation.

APPENDIX D

AIR QUALITY DESIGN VALUES (CO & O₃)

1. Design Values for Ozone Attainment,¹ (measured in parts per million)

Area Classification	Design Value
Marginal.....	0.121 - 0.138 ppm
Moderate.....	0.138 - 0.160
Serious.....	0.160 - 0.180
Severe.....	0.180 - 0.280
Extreme.....	0.280 and above

2. Design Values for Carbon Monoxide Attainment²

Area Classification	Design Value
Moderate.....	9.1 - 16.4 ppm
Serious.....	16.5 and above

¹ Clean Air Act, Subpart 2, Section 181. Classifications and Attainment Dates.

² Clean Air Act, Subpart 3, Section 186. Classifications and Attainment Dates.

APPENDIX E

ANNOTATED BIBLIOGRAPHY

This section summarizes several articles, reports and papers written since the passage of ISTEA. They raise concerns about and address the management systems, in particular, Congestion Management Systems. Also covered in these sources are examples of effective partnering between public and private entities to achieve practical plans, effective public involvement strategies, and guidelines to select roadway design treatments to accommodate bicycles. The intent is to aid the researcher planning to build on the material in this thesis. In this vein, the sources have been categorized for simplicity.

L Management Systems: ISTEA Legislative Provisions

Howe, Linda. "Winging it with ISTEA". Planning. 60.1(1994):11-14.

Attitudinal shifts are predominantly as a result of some internal or external stimuli. The recent change in attitude to transportation planning is a result of the legislative mandates of ISTEA. This article examines the new "attitude" which ISTEA causes in transportation planning. Basically a restructuring of traditional relationships among State DOT, MPOs, transit agencies and local government officials make up the core of this new process.

The article suggests incentives for involving special interest and private citizen groups in the decision-making process. It concludes that the greatest challenge for State DOTs will be '*giving up control over project selection to [local/ regional] stakeholders*'.

Plous, F K Jr. "Refreshing ISTEA". Planning. 59.2(1993):9-12.

Plous briefly explains the mandates of ISTEA and its implications for the way transportation is to be planned for the future. It explains the levels of funding and categories of projects for which ISTEA authorizes, for example, traffic signals, bikeways, pedestrian walkways, safety improvements and grade crossings.

Plous forecasts hitches in the planning process concerning public involvement and identification and incorporation of "other interested parties". Both of these requirements represent the bulk of the change in the new planning process relative to the traditional statewide planning process.

This article highlights some areas of challenge to planners both at the state and local levels as regards to carrying out ISTEA mandates. Traditionally, the stance of politicians has been greatly motivated by the voices of their campaign contributors -- the contractors, civil engineers, asphalt and concrete suppliers. With the passage of ISTEA, the introduction of non-auto and environmentalists to the decision-making process figuratively dilutes the planning process and gives a voice to those who would not otherwise be involved in transportation planning.

II. Congestion Management Systems – Data Requirements, Air Quality

Byrne, Greace E, Shawna M Mulhall. "Congestion Management Requirements and Comparisons". 74th Annual Meeting, Transportation Research Board. 1995.

This paper reviews several existing congestion management and performance monitoring systems and determines common data sets. It presents an overview of the data requirements of

congestion management with a brief review of federal requirements and a discussion of their implications. Congestion management and performance monitoring programs are reviewed and followed by an analysis of the data. The last section of this paper recommends several measures of effectiveness for use in congestion monitoring programs.

Environmental Protection Agency et al. "Ozone and Carbon Monoxide areas Designated Non-Attainment." North Carolina: Office of Air Quality Planning and Standards, Research Triangle Park. October 26, 1991.

This document lists classifications of air quality non-attainment designations for the federal-aid urbanized areas. The pollutants measured are Carbon Monoxide, Ozone, Lead, Sulphur Dioxide and particulate matter. The document also gives a macroscopic view of the levels of congestion by pollutant through several shaded maps of the country.

FHWA, Office of Environment and Planning, Metropolitan Planning Division. Technical Report. Report No. 2. July 1994.

This report is one of a series of reports periodically issued for the purpose of sharing the latest information on metropolitan planning techniques and analytical procedures. It includes a summary of CMS activities in states and MPOs as well as an overview of analytical procedures to support a CMS. Also included is an extensive review of literature covering data collection and monitoring, performance measures, analytical methods, IVHS, GIS, TDM and Land Use.

III. Effective Public-Private Partnerships, Public Involvement

Hawkinson, David. "Partners in Development: The Central Illinois Corridor Council and the Illinois Corridors of Opportunity Program". Economic Development Review. 12.1(1994):38-40.

The *Corridors of Opportunity Program* was officially introduced by Illinois Governor Jim Thomson in 1986 during his State of the State address. The move to bring together regions with common resources and development targets was launched. Thompson's plan was built around the idea that local entities knew best what their economic development future would be and also that certain geographical areas have many things in common with one another.

This source identifies the pros and cons of cooperative planning efforts among local government planners and advocacy /citizen groups. The Illinois case indicated that a unified approach to problem solving can be mutually beneficial to state and local community.

IV. Other

De-Corla Souza. "Comparing Cost Effectiveness Across Modes". Compendium of Papers, Fourth National Conference on Transportation Planning Methods Applications. Ed. Jerry M Faris, Tallahassee, Florida. September 1993. 411 - 426.

This paper proposes a new approach for evaluation of transportation alternatives which effectively accommodate the trips forecasted for the next 20 years. The transportation alternatives evaluated are (1) expansion of present system, (2) accommodation of growth in an alternate location and (3) use of the present system with the application of some Transportation System Management (TSM) techniques. Various costs and benefits are considered in the evaluation.

Prendergast, John. "MPOs Become VIPs". Civil Engineering. 64.4(1994):40-43.

This article gives an overview of MPO organizational structure and identifies some early ongoing CMS activities in Minnesota and Washington State. In Minnesota, the relationships for channeling planning funds were already in place and Puget Sound Regional Council (PSRC), MPO for the Seattle-Tacoma area of Washington State had developed a state conceptual plan in response to ISTEA, prior to the passage of the federal regulations.

The article outlines some of the institutional challenges which exist for state and MPO relations, similar to other sources on this topic. It presents comments from Federal practitioners and academicians on the proponents for public involvement and their skepticism of the capability about MPOs to assume and meet the new responsibility bestowed on them by ISTEA.

FHWA. Bicycle and Pedestrian Treatments. n.d.

This manual is designed to assist transportation planners and engineers in selecting roadway design treatments to accommodate bicycles. This is the first attempt to provide comprehensive guidelines for this process. The recommendations are based on assumptions regarding policy goals and the types of bicyclists to be accommodated, the state of the practice, and professional judgment.

It is not intended to serve as a comprehensive guide to the design of bicycle facilities. The user is referred to the current edition of the American Association of the State Highway and Transportation Officials' *Guide to the Development of Bicycle Facilities* for detailed specifications.

The manual describes the assumptions, principles, and approaches used to develop the recommendations; provides a model planning process for identifying a network of routes on which designated bicycle facilities should be provided to accommodate bicyclists of moderate ability (casual adult riders and children); and recommends design treatments and specifications for roadways to serve different types of bicyclists under various sets of traffic operational factors. This manual can be received by contacting the National Bicycle and Pedestrian Clearinghouse at 202-463-8405/8406 or 800-760-6272.

BIBLIOGRAPHY

- Advisory Commission on Intergovernmental Relations, (AICR). Towards More Balanced Transportation: New Government Proposals. Washington, D.C. GPO, 1974.
- Altshuler, Alan. Current Issues in Transportation Policy. Lexington, MA: Lexington Books, 1979.
- Axelrod, Robert. Structure of Decision: the Cognitive Maps of Political Elites. Princeton, New Jersey: Princeton University Press, 1976.
- Booth, Patricia. "Embracing the Team Concept." Canadian Business Review. 21.3(1994):10-13.
- Box, Richard C. "An Examination of the Debate Over Research in Public Administration." Public Administration Review. 52.1(1992):62-69.
- CDTC. "Bicycle and Pedestrian Issues Task Force: Status Report on Phase two Products." October 1994.
- . "Draft Discussion: Possible Bicycle/Pedestrian Elements on the 1994-99 TIP to be designed between 1995 and 1998." (New York: Albany), n.d.
- . "Record of Meeting: Bicycle and Pedestrian Task Force held December 28, 1994."
- . "Record of Meeting: Bicycle and Pedestrian Task Force held February 22, 1994." (New York: Albany, 1995).
- Chisholm, Donald. Coordination without Hierarchy: Informal Structures in Multi Organizational Systems. U of California at Berkeley, 1989.
- Cohan, Paul. "Law Places Emphasis on MPOs." American City & County. 108:3(1993):16.

- De-Corla Souza. "Comparing Cost Effectiveness Across Modes." Compendium of Papers, Fourth National Conference on Transportation Planning Methods Applications. Ed. Jerry M Faris. Florida: Tallahassee, September 1993. 411-426.
- Deakin, Elizabeth. "The Changing Context of Transportation Planning: The Intermodal Surface Transportation Efficiency Act of 1991, The Clean Air Act Amendments of 1990, and their Implications for Transportation Planning and Programming." Background Paper Prepared for the Series of Seminars on Multi-Modal Transportation Planning. Berkeley, CA: U of California at Berkeley, October 1993.
- DuPraw, Marcelle E; Potapchuk, William R. Guidelines for Collaboration: Implementing the Intermodal Surface Transportation Efficiency Act of 1991 and the Clean Air Act Amendments of 1990. Washington, DC: Program for Community Problem Solving and The Business Transportation Council, (1992).
- Edner, Sheldon M. Seymour Adler, Peter B. Davis. "Challenges Confronting Metropolitan Portland's Transportation Decision Making Regime." Seattle, Washington: Transportation Northwest, Department of Civil Engineering, U of Washington, 1990.
- Edner, Sheldon, G. B. Arrington, Jr. Urban Decision Making for Transportation Investments: Portland's Light Rail Transit Systems. Washington, D.C.: US Department of Transportation, 1985.
- FHWA, Florence W. Mills. Public Involvement in Small and Mid-Sized MPOs: A Reconnaissance of Current Experiences. Proceedings, 4th National Conference for Small and Medium-Sized Areas (TRB), 1994.
- . Interoffice Memo: Speech delivered by Rodney Slater. FHWA Annual Meeting. Albuquerque, New Mexico. November 11, 1994.
- . Selecting Roadway Design Treatments to Accommodate Bicycles. Office of Environment and Planning, HEP-22. n.d.

- Gakenheimer, Ralph, Michael Meyer. *Urban Transportation Planning in Transition: The Sources and Prospects of TSM* in Current Issues in Transportation Policy by Alan Altshuler. 1979.
- Gawthrop, Louis C. Public Sector Management, Systems, and Ethics. Bloomington, Indiana: University Press, 1984.
- Gifford, Jonathan L. William J. Mallet, Scott W. Talkington. Implementing the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA): Issues and Early Field Data. The Institute of Public Policy, George Mason U. Washington, D.C. 1994.
- Goldhaber, Gerald M. Organizational Communication. 3rd edition. Dubuque, Iowa: W C Brown, 1983.
- Haunschild, Pamela R. "Interorganizational Imitation: The Impact of Interlocks on corporate Acquisition Activity." Administrative Science Quarterly. 38(1993):564-92.
- Hawkinson, David. "Partners in Development: The Central Illinois Corridor Council and the Illinois Corridors of Opportunity Program." Economic Development Review. 12.1(1994):38-40.
- Hill, Percy, et al. Making Decisions: A Multi disciplinary Introduction. Massachusetts: Addison-Wesley, 1992.
- Howe, Linda. "Winging it with ISTEA." Planning. 60.1(1994):11-14.
- Kellogg, Jefferson, D. Wilkerson, Alyssa Freas. "Resistance to Change: A Comparison of Public and Private Sector Organizations." Productivity & Quality Improvement in Government Proceedings: First International Symposium on Productivity and Quality Improvement with a Focus on Government. Ed. John S W Fargher Jr. Washington, DC, February 1992. 395-99.
- Kilman, Ralph. Beyond the Quick Fix. California: Josey-Bass. 1984.

King, Julia. "Interview with the Coach." Computerworld. 28.41(1994):95-97.

Kunde, James E.; Dale E. Bertsch. "Partnership and Partnership Development: ISTEA and CAAA -- Breakthrough or Mire?" Transportation Research Board Special Report. 237(1992):114-127.

Lede, Naomi W. The Impact of Changing Demographic Trends on Transportation Planning. Houston, Texas: Texas Southern U. 1991.

Logan, Linda R. "Team Members Identify Key Ingredients for Team-building Success." National Productivity Review. 12.2(1993):209-223.

McCall, Morgan W, Robert E. Kaplan. Whatever It Takes: Decision Makers at Work. Englewood Cliffs, New Jersey: Prentice Hall, 1985.

Meyer, Michael, Ralph Gakenheimer. "Urban Transportation Planning in Transition: The Sources and Prospects of TSM" in Smith, H.R. et al. Readings in Management: Making Organizations Perform. New York: Macmillan Publishing Co., Inc., 1980.

Murphy, Patrick E. "An Evolution: Corporate Social Responsiveness" in Smith, H.R. et al. Readings in Management: Making Organizations Perform. New York: Macmillan Publishing Co., Inc., 1980.

Naisbitt, John. Megatrends: Ten New Directions Transforming Our Lives. Second edition. New York: Warner Books, 1984.

Nelson, Martin E. Nancy H. Taylor. "Is Style Enough to Make It Work in the Public Sector? Conceptual Tools to Make Participation Work for You." Journal for Quality and Participation. 3(1990):64-69.

Pedersen, Neil. The Impacts of ISTEA on the Environment: A State DOT Perspective. 74th Annual Meeting of the Transportation Research Board. Maryland State Highway Administration, 1995.

Plous, F K Jr. "Refreshing ISTEA." Planning. 59.2(1993):9-12.

Prendergast, John. "MPOs Become VIPs." Civil Engineering. 64.4(1994):40-43.

Pressman, Jeffrey L. Implementation: How Great Expectations in Washington are Dashed in Oakland. U of California Press, 1984.

Purello, Michael. "Overcoming Resistance to Change". Productivity & Quality Improvement in Government Proceedings: First International Symposium on Productivity and Quality Improvement with a Focus on Government. Ed. John S W Fargher Jr. Washington, DC, February 1992. 400-405.

Scott, K Dow, Anthony Townsend. "Teams: Why Some Succeed and Others Fail". HRMagazine. 39.8(1994)62-67.

Sedwick, Robert C. Interaction: Interpersonal Relationships in Organizations. Englewood Cliffs, New Jersey: Prentice Hall, 1974.

Senge, Peter M. The Fifth Discipline. New York: Doubleday. 1990.

Smeltzer, Larry R. "Relevance is the Issue." Journal of Business Communication. 30.4(1993):477-78.

Stone, Daniel. Organizational and Transit Performance in the Bay Area: A theoretical and Empirical Review. Research Report UCB-ITS-RR-90-5, Institute of Transportation Studies. U of California at Berkeley. 1990.

Suchan, J. "Response to Mohan Limaye: *The Need for Contextually Based Research*." Journal of Business Communication. 30.4(1993):473-76.

Symons, Paula. "Meeting the Challenges of Success Through Research." Credit Union Management. 16.6(1993):39.

USDOT, FHWA. Performance Agreement Between The Secretary of Transportation, Frederico Peña and The FHWA Administrator, Rodney E. Slater FY 1995. 1995.

---. "Letter (and Bill to amend 49 U.S.C. (Transportation)) from The Secretary of Transportation, Frederico Peña to The Honorable Newt Gingrich, Speaker of the House of Representatives." Washington, D.C. 4 April 1995.

---. DOT Talk. 1.24(1995).

---. Press Release News: 19 December 1994. "Peña Unveils Plans for Major DOT Restructuring."

Weinheimer, Christopher F. "The Importance of Forging Relationships." Healthcare Financial Management. 47.12(1993):10.

Weiss, Martin. "New Directions in Statewide Planning." Fourth National Conference for Small and Medium-Sized Areas. 1994.