U.S. Department
of Transportation

Identification of Transportation Planning Data Requirements in Federal Legislation

July, 1994

TMIP

Travel Model Improvement Program

Department of Transportation
Federal Highway Administration
Federal Transit Administration
Office of the Secretary

Environmental Protection Agency

Department of Energy

Travel Model Improvement Program

The Department of Transportation, in cooperation with the Environmental Protection Agency and the Department of Energy, has embarked on a research program to respond to the requirements of the Clean Air Act Amendments of 1990 and the Intermodal Surface Transportation Efficiency Act of 1991. This program addresses the linkage of transportation to air quality, energy, economic growth, land use and the overall quality of life. The program addresses both analytic tools and the integration of these tools into the planning process to better support decision makers. The program has the following objectives:

1. To increase the ability of existing travel forecasting procedures to respond to emerging issues including; environmental concerns, growth management, and lifestyle along with traditional transportation issues,

2. To redesign the travel forecasting process to reflect changes in behavior, to respond to greater information needs placed on the forecasting process and to take advantage of changes in data collection technology, and

3. To integrate the forecasting techniques into the decision making process, providing better understanding of the effects of transportation improvements and allowing decisionmakers in state governments, local governments, transit operators, metropolitan planning organizations and environmental agencies the capability of making improved transportation decisions.

This program was funded through the Travel Model Improvement Program.

Further information about the Travel Model Improvement Program may be obtained by writing to:

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Final Report
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EXECUTIVE SUMMARY

This report identifies the new planning and associated data collection requirements set forth in the Clean Air Act Amendments (CAAA) of 1990 and the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. Even though these requirements differ in terms of their specificity, they promote the integration of transportation and air quality planning processes.

While mobile source emissions have been declining over the past two decades due to stricter auto emissions standards, increases in vehicle miles traveled (VMT) and associated levels of congestion are expected to reverse this favorable trend. The CAAA of 1990 recognize the important role that transportation plays in determining the air quality. The CAAA mandates state implementation plan (SIP) revisions which include emissions estimates for current and future years, annual VMT reports and forecasts based on transportation network models, demonstration of attainment of the National Ambient Air Quality Standards (NAAQS), and the implementation of transportation control measures (TCMs) when milestones are not met.

The ISTEA represents the first transportation legislation that has specific mandates with regard to achieving the objectives of the Clean Air Act. Recent implementing regulations for ISTEA set forth requirements for both statewide and metropolitan area planning. In addition to requiring coordination of planning activities between environmental agencies, transportation agencies, and other interested parties, the regulations require an extensive public process. The metropolitan planning process must consider 15 different factors, and the statewide process must consider 23 different factors. These factors include the interaction between land use and development and transportation; the need to relieve congestion; utilization of the management and monitoring systems to identify transportation needs; the overall social, economic, energy, and environmental effects of transportation; methods to increase transit use; methods to increase the use of walking and bicycles; and transportation system management (TSM) and other investment strategies to make the most efficient use of existing transportation facilities.

Other implementing regulations for ISTEA provide for the establishment of six management and monitoring systems, which together with a traffic monitoring system will provide better information on the condition and use of existing transportation facilities. The congestion management system (CMS), in particular, requires the identification and evaluation of strategies to improve transportation system performance and reduce single-occupant vehicle travel.

Conformity regulations link the transportation planning requirements of ISTEA with the requirements of the CAAA. These regulations require that a transportation plan and transportation improvement program (TIP) conform to a state implementation plan's air quality objectives. These objectives specifically address the severity and number of NAAQS violations, and the achievement of NAAQS attainment as soon as possible. Existing transportation planning models will have to be significantly modified to satisfy the requirements of the conformity regulations.

This report identifies the shortcomings of the existing set of transportation planning models in terms of their ability to fulfill the new requirements. The four-step transportation modeling process has been under development for four decades, but retains essentially the same structure. This process was established to evaluate new regional transportation facilities, however, the new planning requirements emphasize strategies which promote more efficient use of the existing transportation facilities. These strategies include intermodalism; congestion management; and various TCMs such as improved public transit, trip reduction ordinances, traffic flow improvements, encouragement of non-motorized uses, employer-based programs, etc. Conformity determinations include requirements that plans or projects provide for timely implementation of TCMs, reduce localized carbon monoxide (CO) violations, and not contribute to new violations.

The degree of sophistication of the transportation planning process differs from metropolitan planning organization (MPO) to MPO, and there is a need to improve many existing models to the level of the state-of-the-art. The conformity regulations set forth minimum standards, which include requirements that travel times be recycled between traffic assignment and trip distribution, that model speeds be based upon empirical observations, that travel be sensitive to pricing, and that peak and off-peak travel times be provided.

While improvements in the four-step transportation modeling process can accommodate some of the new requirements, other requirements point out the need for alternative approaches or model structures. For example, the modeling process needs to be modified to provide information on tripmaking by time of day, and to be sensitive to transportation policies which may alter the time that tripmaking occurs. Trip-chaining behavior, along with its effect on work and non-work tripmaking, VMT, and modal split must be also represented in the models. In addition, the level of detail represented by the models must be increased in order to provide information on CO hot spots, and VMT, trips, and speeds by small geographic areas. The models need to include variables relevant to tripmaking such as demographic variables, urban design variables, and accessibility measures. Methods for accounting for walking and bicycling need to be incorporated into the models.

The planning and data collection requirements of the CAAA and ISTEA therefore reinforce the approach being undertaken by the Travel Model Improvement Program. Work needs to be done to bring current practice to the state-of-the-art as well as to advance the state of the art with research into new model structures and approaches.

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LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act of 1990
ADT	Average Daily Traffic
ATMS	Advanced Traffic Management Systems
BMS	Bridge Management System
BPR	Bureau of Public Roads
BTS	Bureau of Transportation Statistics
CAAA	Clean Air Act Amendments of 1990
CFR	Code of Federal Regulations
CMS	Congestion Management System
CO	Carbon Monoxide
COG	Council of Governments
CVO	Commercial Vehicle Operations
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DVMT	Daily Vehicle Miles Traveled
EIS	Environmental Impact Statement
EKMA	Empirical Kinetic Modeling Approach
EO	Executive Order
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FAUA	Federal Aid Urbanized Area
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GIS	Geographic Information System
HOV	High-occupancy Vehicle
HPMS	Highway Performance Monitoring System
HPPM	Highway Planning Program Manual
HUD	Department of Housing and Urban Development
IMS	Intermodal Facilities and Systems Management System
IFR	Interim Final Rule
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ISTEP	Intermodal System Transportation Evaluation Program
IVHS	Intelligent Vehicle-Highway Systems
MPO	Metropolitan Planning Organization
MTC	Metropolitan Transportation Commission (Oakland, CA)
NAA	Nonattainment areas
NAAQS	National Ambient Air Quality Standards
NARC	National Association of Regional Councils
NEPA	National Environmental Policy Act
NHS	National Highway System
NPRM	Notice of Proposed Rulemaking
OST	Office of the Secretary of the U.S. Department of Transportation

LIST OF ACRONYMS (continued)

PMS	Pavement Management System
ppm	parts per million
PTMS	Public Transportation Facilities and Equipment Management System
RACM	Reasonably Available Control Measure
RACT	Reasonably Available Control Technology
RFP	Reasonable Further Progress
RPA	Regional Planning Agency
SCAG	Southern California Association of Governments
SIP	State Implementation Plan
SMS	Highway Safety Management System
STIP	Statewide Transportation Improvement Program
TCM	Transportation Control Measure
TCP	Transportation Control Plan
TDM	Transportation Demand Management
TIP	Transportation Improvement Program
TMAs	Transportation Management Areas
TMIP	Travel Model Improvement Program
TMS	Traffic Monitoring System
TSM	Transportation System Management
UMTA	Urban Mass Transportation Administration
UPWP	Unified Planning Work Program
USC	United States Code
VMT	Vehicles Miles Traveled
VOC	Volatile Organic Compound

1 INTRODUCTION

The Travel Model Improvement Program (TMIP) is a program jointly sponsored by the Office of the Secretary of Transportation (OST), the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), the Bureau of Transportation Statistics (BTS), the Environmental Protection Agency (EPA), and the Department of Energy (DOE). This program is also being carried out cooperatively with states, metropolitan planning organizations (MPOs), local governments, and private entities. The purpose of the TMIP is to remedy current transportation planning model deficiencies in order to meet the requirements of the Clean Air Act Amendments of 1990 (CAAA) as well as the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).

"The objectives of the Program are:

- To increase the policy sensitivity of existing travel forecasting procedures and their ability to respond to emerging issues including environmental concerns, growth management, and changes in personal and household activity patterns, along with the traditional transportation issues.

- To redesign the travel forecasting process to reflect today's traveler behavior, to respond to greater information needs placed on the forecasting process, and to take advantage of changes in data collection technology; and

- To make travel forecasting model results more useful for decision makers."[1]

There are four tracks to the TMIP. These are

Track A Outreach to assist practitioners to improve their existing planning procedures to be in line with current good practice;

Track B Near term improvements to assist MPOs and state DOTs to improve current practice to the state-of-the-art;

Track C Longer term improvements including major research and development of new approaches to travel and land use forecasting; and

Track D Data collection to "identify, design, and develop improved data collection procedures that will meet decision makers' current and future needs."[2]

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[1] "Travel Model Improvement Program," brochure from the Texas Transportation Institute, 1994, p. 2.

[2] IBID, p. 3.

One of the elements of the last track is to identify the planning strategies and requirements, and data collection requirements of the Clean Air Act Amendments of 1990 (CAAA) and the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).

1.1 Purpose of this Report

This report presents a brief overview of the new planning requirements in federal legislation and regulations related to the CAAA and ISTEA, and the data that will be needed to fulfill those requirements. In addition, the report will provide insight into the ability of the current set of transportation planning models to address these requirements.

1.2 Contents of this Report

This report is divided into four sections. Section 2 provides an brief overview of current planning and data collection requirements in the CAAA and ISTEA. Section 3 provides a discussion about the adequacy of the current set of transportation planning models for addressing the planning requirements. Section 4 presents the conclusions of this effort. Detailed descriptions of the history of transportation planning, and the planning and data collection requirements of the CAAA and ISTEA are provided as appendices. Appendix D discusses the potential for GIS and IVHS to improve existing models and their associated data collection activities. A list of references is presented in Appendix E.

2 REQUIREMENTS FOR TRANSPORTATION PLANNING IN FEDERAL LEGISLATION

Urban transportation planning was first mandated by the Federal-Aid Highway Act of 1962. This act established the "3C" planning process - comprehensive, cooperative and continuing, - and required this type of planning as a condition for receiving Federal funds in urbanized areas. Further, it officially introduced the idea of integrating land use with transportation, and declared that planning be intermodal.

Currently, Federal legislation has mandated specific metropolitan and statewide transportation planning requirements, has required the establishment of six management systems to collect, maintain and analyze transportation-related data, and has introduced strict air quality planning and compliance requirements. Even though the planning requirements have changed significantly since 1962, the transportation planning models use methodologies which have changed little since the 1960s.

In order to identify the specific transportation planning and data collection requirements from the aforementioned legislation, it was necessary to perform in-depth research into all the pertinent regulations and guideline documents that were written regarding the legislation. Detailed summaries of those requirements are included in the appendices. A briefer overview is presented below for each relevant law or regulation.

2.1 Clean Air Act Amendments of 1990 (CAAA)

While mobile source emissions have been declining over the past two decades due to stricter auto emissions standards, increases in vehicle miles traveled (VMT) and associated levels of congestion are expected to reverse this favorable trend. The CAAA of 1990 recognize the important role that transportation plays in determining the air quality. Title II of that Act is entirely devoted to provisions relating to mobile sources.

The transportation-related requirements of the CAAA are important because the CAAA provide for sanctions related to transportation programs. While sanctions could be applied in the past, they were triggered only by the failure to submit a state implementation plan (SIP). Under the CAAA, sanctions can be triggered by either failure to make submissions required under the act, or by Environmental Protection Agency (EPA) disapproval of a SIP, or by failure to implement any SIP provisions. Because the CAAA reduced the mandatory sanctions, highway funding restrictions could become the primary sanction.[3]

The CAAA of 1990 define different categories of nonattainment areas (NAA) for different air pollutants, depending upon the severity by which the National Ambient Air Quality Standards (NAAQS) are exceeded. The CAAA then set up different schedules and requirements for the

[3] Gary Hawthorn, "Transportation Provisions in the Clean Air Act Amendments of 1990," ***ITE Journal***, April 1991, pp. 17-24.

various NAA categories. The worse the air pollution, the longer a region has to comply with the NAAQS. Also, the worse the air pollution, the more stringent are the planning requirements and measures mandated for compliance. While there are NAAQS for many different air pollutants, the ones most relevant to transportation planning are those for ozone, and carbon monoxide (CO). Particulates (PM_{10}) are relevant for a limited number of areas, but planning requirements and models for these are much less well defined. NO_2 is also a transportation-related pollutant, although California's South Coast is the only NO_2 NAA. Both ozone and PM_{10} have precursors (volatile organic compounds and nitrogen oxides) which must be considered for the purposes of SIP planning and conformity.

The CAAA of 1990 set forth major transportation planning requirements for the development of the SIPs and for conformity determinations. The SIPs must show how NAA will meet the NAAQS by the attainment deadline, and adequate real progress in intermediate future years. The following discussion is based largely on the NPRM for SIPs.[4]

The SIP revisions required by the CAAA include:

- Estimates of emissions for current years and forecasted years;
- Annual VMT forecasts and reports;
- Demonstration of attainment of the NAAQS;
- Milestone compliance and reasonable further progress (RFP);
- Transportation control measures (TCMs) as needed to meet the NAAQS; and
- Contingency measures when milestones are not met.

The requirements listed above and the timing depend upon the type of pollutant and the particular category of the NAA.

2.1.1 Estimates of Emissions for Current Years and Forecasted Years

All ozone NAA and CO NAA were required to submit by November 15, 1992, base emissions inventories of 1990 emissions from point, area, and mobile sources. The contribution of mobile sources to pollution in 1990 are determined by estimating VMT in 1990, and applying emissions factors from the EPA MOBILE model. MOBILE estimates emissions levels based upon the calendar year, ambient temperatures during the peak ozone or CO season, fleet mix and year, and several other factors.

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[4] "State Implementation Plans; General Preamble for the Implementation of Title I of the CAAA of 1990: Proposed Rule," 57 FR 13498-13570 (April 16, 1992).

Transportation related inputs to the MOBILE model include [5]:

- VMT by 8 vehicle types;
- Annual mileage accumulation rate by 8 vehicle types;
- Vehicle registration distribution by vehicle type and 25 vehicle age categories;
- Trip length distributions;
- VMT by speed class (or by 12 roadway functional classes as a minimum -- six functional classes for rural and for urban areas);
- VMT by time of day (as characterized by average speeds for the time period) by functional class.
- Seasonal variation in VMT, vehicle mix, etc.

In addition to the base emission inventories, areas are required to submit updated inventories every 3 years until the area reaches attainment. VMT estimates for these inventories would be computed in the same way as for the base inventory, except that the Highway Performance Monitoring System (HPMS) must be used for 1993 and later VMT.

Target level inventories are also required for ozone NAA which must come into attainment by November 15, 1996 or later. In addition, ozone NAA which must come into compliance after November 15, 1996 must provide target level inventories for each three year period from 1996 until the attainment date. *The target inventories are important, because control strategies must then be developed so that actual emissions will meet the target levels.* The target levels already account for tailpipe emissions improvements, so that mobile source emissions reductions must come from VMT reductions, trip reductions, or other means.

2.1.2 Annual VMT Forecasts and Reports

Annual actual VMT estimates and forecasts are required for all CO NAA classified as Moderate, but with CO concentrations above 12.7 ppm. In addition, VMT estimates and forecasts are required to develop the emissions inventories both for ozone and CO as covered above. EPA has provided a guidance document for developing the VMT estimates.[6]

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[5] "Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources," U.S. EPA, EPA-450/4-81-026d (Revised), 1992, pp. 13-61.

[6] "Section 187 VMT Forecasting and Tracking Guidance," U.S. EPA, January 1992.

This document specifies that estimates of actual VMT for the NAA are to be based upon the FHWA Highway Performance Monitoring System (HPMS).[7] In addition to the estimates of actual VMT, forecasts are required of annual VMT from 1993 up until the year of attainment. Moderate CO NAA areas above 12.7 ppm are encouraged to use a travel demand modeling process, but also may base VMT forecasts on historical trends. All Serious or higher ozone NAA can use the guidance specified for Moderate CO NAA for forecasts to 1996. *After 1996, the network based travel demand modeling process must be used.*

2.1.3 Demonstration of Attainment of NAAQS

The SIP revisions must demonstrate attainment of the NAAQS with a schedule which depends upon the NAA category. Demonstrating attainment requires photochemical grid modeling for ozone NAAs which are serious or worse, with inputs which include the projected emissions inventories as described above. An attainment demonstration with photochemical grid modeling also provides target emissions levels required for attainment and target VMT levels.

Photochemical grid modeling requires input on emissions for each grid represented in the model. These grids are typically 2km or 5km square. *This implies the need for VMT forecasts in the detailed VMT categories required for the MOBILE model for each grid square represented in the dispersion model. In addition, hourly VMT may be required for these models.*[8]

2.1.4 Milestone Compliance and Reasonable Further Progress (RFP)

The CAAA set forth a series of intermediate milestones to be met by NAA, with a schedule depending upon the pollutant and the non-attainment category. In the case of ozone NAA, the milestones are specific emission reduction targets. In the case of CO NAA, the milestones are VMT targets.

In addition to the specific milestone requirements for different pollutants, the CAAA specify a general requirement for RFP which is annual incremental reductions in emissions. However, rather than make additional requirements for NAA for RFP, EPA has decided to rely on existing requirements such as the periodic inventories and other reports and certifications.[9]

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[7] ***Highway Performance Monitoring System Field Manual***, FHWA Office of Highway Information Management, December 1987 updated through April 20, 1990, FHWA Order M5600.1A, OMB No. 2125-0028.

[8] Peter R. Stopher, "Deficiencies in Travel Forecasting Procedures Relative to the 1990 Clean Air Act Amendment Requirements," prepared for Conference Session on Implications of the 1990 Clean Air Act Amendments on Travel Demand Forecasting Techniques, 1992 Transportation Research Board Annual Meeting, December 1991.

[9] "State Implementation Plans; General Preamble for the Implementation of Title I of the CAAA of 1990; Proposed Rule," 58 FR 13512 (April 16, 1992).

2.1.5 Transportation Control Measures (TCMs) as Needed to Meet the Milestones and NAAQS

The SIP revisions must contain TCMs and other measures as necessary for the NAA to meet the milestones and NAAQS. The schedule and types of requirements depend upon the category of the NAA. Section 108(f) of the CAAA specify TCMs which include improved public transit, HOV lanes, employer sponsored trip reduction programs, programs to encourage bicycles and pedestrians, parking programs, and so forth.

These SIP requirements have implications for transportation planning. VMT projections must be undertaken as previously described. *Then TCM's need to be analyzed for their potential for reducing VMT and emissions.* The SIP revisions must provide evidence of adequate financial and human resources for each TCM, and must describe the process of implementation, enforcement, monitoring, and maintenance, where applicable.[10] Where state regulations or laws are required for TCM implementation, these should be submitted as part of the SIP.

2.1.6 Contingency Measures When Milestones Are Not Met

The CAAA have many requirements for contingency measures should milestones not be achieved in the case of ozone NAA, or VMT targets not be achieved for CO NAA. These measures are supposed to be planned in advance, and submitted in implementable form in the 1992 or 1993 SIP revisions. These measures are in addition to those required to show compliance with the milestones.

2.2 Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA)

The ISTEA represents the first transportation legislation that has specific mandates with regard to achieving the objectives of the Clean Air Act. It establishes a Congestion Mitigation and Air Quality Improvement Program to fund the implementation of projects and programs that will contribute to achieving attainment of the National Ambient Air Quality Standards (NAAQS). In addition, ISTEA specifies the designation of urbanized areas over 200,000 population as Transportation Management Areas (TMAs), each of which will have a congestion management system that provides for the use of travel demand reduction and operational management strategies (see Section 2.2.3).

ISTEA also set forth requirements for metropolitan planning and statewide planning. The final rule for these requirements was issued on October 28, 1993.

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[10] ***Transportation Control Measure Information Documents***, Cambridge Systematics, Inc., Report No. EPA 400-R-92-006, March 1992.

2.2.1 Metropolitan Planning

The rule defines the metropolitan transportation plan as the "official intermodal transportation plan that is developed and adopted through the metropolitan transportation planning process for the metropolitan area."[11]

All MPOs serving an urbanized area of at least 50,000 are required to submit a metropolitan transportation plan and a TIP which must conform to SIPs. A metropolitan plan must have a planning horizon of 20 years; must broadly consider environmental and intermodal issues and functions; must coordinate with TCM development in NAA; and must incorporate uniform FHWA and FTA requirements for the analysis of major metropolitan transportation investments. The plan must "include both long- and short-range strategies/actions that lead to the development of an integrated intermodal metropolitan transportation system that facilitates the efficient movement of people and goods."[12]

The planning requirements set forth in the regulation include the consideration of 15 factors covering a wide variety of environmental, energy, transportation, land use and economic issues. These factors include the need to relieve and prevent traffic congestion and the consideration of the effect of transportation on land use.

The majority of the data required to support the planning requirements for development of the transportation plan will eventually come from the management systems that are required to be implemented by fiscal year 1995. Out of the six systems required, three have a direct relationship to the planning process: Congestion Management System (CMS), Public Transportation Facilities and Equipment Management System (PTMS), and Intermodal Facilities and Systems Management System (IMS). These management systems are described later on in this section.

The development of the metropolitan TIP has a different focus than the plan. "The TIP must serve as the mechanism that focuses and prioritizes the projects, establishes the relationships among projects, and notifies the public of project status for the metropolitan area."[13] The TIP is developed by the MPO in cooperation with the state and public transit operators. There must be a reasonable opportunity for public comment on the TIP.

The TIP covers a three-year period (at a minimum), and must be updated every two years. It contains all projects proposed for funding under Title 23 and the Federal Transit Act, and all regionally significant projects in NAA. The TIP must be consistent with the transportation plan. It must identify those projects which are TCMs and give priority to the timely implementation of TCMs contained in the applicable SIPs. In NAA and maintenance areas,

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[11] "Statewide Planning; Metropolitan Planning; Rule," 58 FR 58065 (October 28, 1993).

[12] "Statewide Planning; Metropolitan Planning; Rule," 58 FR 58070 (October 28, 1993).

[13] "Statewide Planning; Metropolitan Planning; Rule," 58 FR 58061 (October 28, 1993).

projects are to be specified in sufficient detail to permit air quality analysis in accordance with U.S. EPA conformity requirements (40 CFR Part 51). More specific conformity requirements are covered in Section 2.3.

2.2.2 Statewide Transportation Planning

The requirements for statewide transportation planning are new with the ISTEA. These requirements include:

- Data collection and analysis
- Consideration of 23 factors in the statewide transportation planning process, including results of the management systems; TSM strategies; methods to reduce congestion; enhancing transit, bicycles, and pedestrians; the effect of transportation on land use; and so forth
- Coordination of all planning activities relating to the development of the state transportation plan
- Pro-active public involvement process
- Development of a statewide transportation plan
- Development of a statewide transportation improvement program (STIP)

A statewide transportation plan is due on January 1, 1995. The plan must be intermodal; cover a 20 year period; contain a plan for bicycle transportation and pedestrian walkways; be coordinated with the metropolitan transportation plans; contain short-range planning studies, strategic planning, and/or policy studies; and contain information on the availability of financial and other resources needed to carry out the plan.

Requirements for the STIP are very similar to those for the TIP:

- The STIP must include a priority list of transportation projects to be carried out in the first three years of the STIP. Metropolitan planning area TIPs must be included, without modification, once approved by the MPO and the Governor, and found to conform by FHWA and FTA.

- In NAA and maintenance areas, the STIP will contain only those transportation projects found to conform, or from programs that conform, to the conformity regulations.

- The STIP must be consistent with the statewide plan.

- The STIP must be financially constrained and must include information to demonstrate that funds can reasonably be expected to be available to implement the projects.

- The STIP must contain all capital and non-capital transportation projects. It must include projects requiring approvals by FHWA and FTA, even if these agencies are not providing funding. For information purposes, the STIP should include all regionally significant transportation projects funded by other Federal agencies or by non-Federal funds.

2.2.3 Management and Monitoring Systems[14]

Section 1034 of the ISTEA amended title 23 USC, Highways by adding new section 303, Management Systems which requires the issuance of regulations for State development, establishment, and implementation of a system for managing each of the following:

- Highway pavement of Federal-aid highways;
- Bridges on and off Federal -aid highways;
- Highway safety;
- Congestion Management System (CMS);
- Public Transit Management System (PTMS); and
- Intermodal Management System (IMS).

In addition to the six management systems the regulation specifies a Traffic Monitoring System (TMS) to support the data required by the six management systems.

The management systems must be developed and implemented in cooperation with MPOs in metropolitan areas and with affected agencies receiving assistance under the Federal Transit Act. States must be implementing each management system beginning in Federal fiscal year 1995. The FHWA and FTA agree that the metropolitan and statewide transportation planning processes are the appropriate forums for coordinating the outputs of the management systems, as well as other transportation needs, particularly since the legislation specifically requires the outputs of the systems to be considered in these planning processes. The regulation states that to the extent possible, the CMS, PTMS, and IMS are to be part of the transportation planning processes in all metropolitan planning areas. In TMAs, a CMS must be part of the metropolitan planning process.

Each of the management systems will require data to define and monitor the magnitude of the problems, identify needs, analyze alternative solutions, and measure the effectiveness of the implemented actions. Some data needs, such as traffic volumes or travel demand, may be common to all systems while other data will be unique to the particular system.

The CMS will provide the most comprehensive data for planning, since it is required to continuously collect and monitor data in order to determine the duration and magnitude of traffic congestion. Also, it is required to identify and evaluate many of the same strategies that must be identified in the plan as addressing current and future transportation demand. The PTMS will identify and evaluate strategies related to public transportation. Beside a comprehensive inventory, the PTMS will collect data on the number of vehicles and ridership for dedicated right-of-way at the maximum load points in the peak direction and for the daily time period. The IMS expands the identification and evaluation of strategies to intermodal facilities and efficiency. Volume and patterns of goods and people carried by intermodal transportation will be collected and monitored.

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[14] "Management and Monitoring Systems; Interim Final Rule," 58 FR 63442-63485 (December 1, 1993).

The primary sources of data needed for these management systems include, but are not limited to:

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

The data for the TMS will be consistent with HPMS, and based on the American Association of State Highway and Transportation Officials (AASHTO) ***Guidelines for Traffic Data Programs*** [15] and FHWA's ***Traffic Monitoring Guide***.[16] These two guides suggest that the data to be included in the TMS will result from continuous traffic counts, short-term traffic monitoring, and vehicle occupancy monitoring. Typical data elements regarding traffic volume include, but are not limited to:

- Annual average daily traffic
- Design hourly volume
- Peak hour traffic percentage
- Directional split
- Peak period volume
- Diurnal distribution
- Turning movements
- Vehicle miles of travel

2.3 Conformity of Transportation Plans and Programs to Air Quality Implementation Plans

The Clean Air Act [(Section 176(c)(4)(c)] requires each State to submit an implementation plan revision which includes criteria and procedures for assessing conformity. "Conformity to an implementation plan is defined in the Clean Air Act as conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards and achieving expeditious attainment of such standards".[17] The conformity regulations integrate the transportation and air quality planning processes by requiring interagency consultation in the development of transportation plans, programs, and SIPs.

The final conformity rule sets forth additional requirements for the content of the metropolitan transportation plan. Transportation plans adopted after January 1, 1995 in serious, severe, or

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[15] ***AASHTO Guidelines for Traffic Data Programs***, 1992, ISBN 1-56051-054-4.

[16] ***Traffic Monitoring Guide***, Office of Highway Management, October 1992, FHWA-PL-92-017.

[17] "Air Quality Transportation Plans, Programs, and Projects; Federal or State Implementation Plan Conformity; Rule," 58 FR 62188 (November 24, 1993).

extreme ozone NAA and in serious CO NAA must describe the transportation system envisioned for future years called horizon years. For the horizon years, the plan must:

- quantify and document the demographic and employment factors, including land use forecasts influencing expected transportation demand.

- describe the regionally significant additions to the highway and transit network in sufficient detail to allow modeling of travel times under various volumes, and transit ridership. Also, be specific enough to show a relationship between land use and the transportation system.

- describe future transportation policies, requirements, services, and activities, including intermodal activities.

The final rule specifies the criteria for conformity which differ by time period, by type of pollutant, and by the level of non-attainment. In addition to the criteria for conformity, the final rule establishes a number of other criteria. These are:

- Use of the latest planning assumptions- These include the latest assumptions for current and future population, employment, travel, congestion, and background concentration of pollutants. There is a requirement to discuss how transit operating policies have changed since the previous conformity determination, and there is a requirement to use reasonable assumptions about transit service, fares, and road and bridge tolls over time. The conformity determination must use the latest information about TCM effectiveness.

- Use of the latest emissions model.

- The transportation plan, TIP, and projects which are not from a conforming plan or TIP must provide for the timely implementation of TCMs.

Lastly, the final rule establishes detailed criteria for determining regional transportation-related emissions. This includes very specific modeling requirements after January 1, 1995 for serious, severe, and extreme ozone NAA and serious CO NAA. The modeling requirements include:[18]

- The network-based model must be validated against ground counts for a base year that is not more than 10 years prior to the date of the conformity determination.

- For peak-hour or peak-period traffic assignments, a capacity sensitive assignment methodology must be used;

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[18] IBID, p.62230-62231.

- Zone-to-zone travel times used to distribute trips between origin and destination pairs must be in reasonable agreement with the travel times resulting from the assignment of trips to network links. These times should also be used for modeling mode splits if transit use is anticipated to be a significant factor;

- Free-flow speeds on network links must be based on empirical observations;

- Peak and off-peak travel demand and travel times must be provided;

- Trip distribution and mode choice must be sensitive to pricing, where pricing is a significant factor;

- The model must utilize and document a logical correspondence between the assumed scenario of land development and use, and the future transportation system for which emissions are being estimated, but reliance on a formal land-use model is not specifically required;

- A dependence of trip generation on the accessibility of destinations via the transportation system is not specifically required, unless the network model is capable of such determinations and the necessary information is available;

- A dependence of regional economic and population growth on the accessibility of destinations via the transportation system is not specifically required, unless the network model is capable of such determinations and the necessary information is available;

- HPMS estimates of VMT shall be considered the primary measure of VMT. A factor or factors shall be develop to reconcile and calibrate the network-based model estimates of VMT in the base year of its validation to the HPMS estimates for the same period, and these factors shall be applied to model estimates of future VMT;

- Reasonable methods shall be used to estimate NAA vehicle travel on off-network roadways within the urban transportation planning area, and on roadways outside the urban transportation planning area;

- Reasonable methods in accordance with good practice must be used to estimate traffic speeds and delays in a manner that is sensitive to the estimated volume of travel on each roadway segment represented in network model; and

- Ambient temperatures shall be consistent with those used to establish the emissions budget in the applicable implementation plan.

CO hot-spot analysis must be based on the applicable air quality models, data bases and other requirements specified in 40 CFR Part 51, Appendix W. Assumptions used in hot-spot analysis must be consistent with the assumptions used in the regional emission analysis.

3 CAN THESE REQUIREMENTS BE SATISFIED BY THE CURRENT SET OF TRANSPORTATION PLANNING MODELS?

3.1 Why the Current Set of Models Are Inadequate

The information presented in this report illustrates the extensive modeling and data collection requirements now required by federal law and regulation. These new requirements are difficult to meet with the four-step modeling process, which has changed little over the past thirty years. This four-step process includes models for trip generation, trip distribution, modal split, and network assignment. Land-use models may also be included as an additional step prior to trip generation.[19]

Transportation planning models were developed to perform regional highway analyses, and in particular, they were developed to analyze the impact of major highway additions to the regional network. The CAAA and ISTEA focus on strategies which promote more efficient use of the existing transportation network. These include strategies such as intermodalism, congestion management, and various TCMs such as improved public transit, trip reduction ordinances, traffic flow improvements, encouragement of non-motorized uses, employer-based programs, etc. Conformity determinations include requirements that plans or projects provide for timely implementation of TCMs, reduce localized CO violations, and not contribute to new violations. Transportation planning models lack the spatial and temporal detail, the behavioral sensitivity, and sensitivity to alternative modes of trip-making needed to provide the forecasts required by the current regulations. Following are some of the issues:

3.1.1 Model Shortcomings in Meeting the Requirements of the CAAA

The CAAA requires transportation system inputs for emissions inventories, for CO hot-spot analyses, and for photochemical modeling. It also requires network based VMT estimates and forecasts. *However, the CAAA requires much greater disaggregation and detail than the urban transportation models have been designed to provide.* For example:

- Time-of-day situations, such as travel in the am peak, midday, and pm peak, are not well represented in the models. Air quality, however, is very sensitive to time of day. In determining base 1990 emissions inventories from mobile sources, EPA's MOBILE model requires the input of VMT by hour of the day. Likewise, for forecasting VMT in CO NAA, the models need to distinguish peak and off-peak travel times.

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[19] See Peter R. Stopher and Arnim H. Meyburg, ***Urban Transportation Modeling and Planning***, Lexington, MA: Lexington Books, D.C. Heath and Co., 1975.

- Typical transportation planning model networks are not set up to accurately represent localized congestion problems which result in CO violations. While the models can handle congestion on network links, CO hot spot analysis requires that such things as turning movements, intersection delays, and acceleration at on-ramps be represented.

- Typical transportation planning model networks tend to be too coarsely defined to facilitate apportioning regional VMT for use in a photochemical grid model. Currently, most existing transportation networks are based on traffic analysis zones and census tracts which are not at the level of detail required for the CAAA and conformity. Where additional processing is required of the transportation model output to provide input to such a photochemical grid model, assumptions and approximations in this additional processing will introduce error into the emissions modeling.

- Historically, transportation planning models did not validate link speeds. These were used as interim variables only to produce link volumes. In fact, once traffic assignment was completed, the model travel speeds were often found to be significantly different from the actual speeds. Now, however, accurate representation of speeds is needed to properly forecast emissions. In addition, accurate speeds are needed to account for the effects of congestion. If the speeds in the model are too high, for example, a congestion induced shift in mode cannot be adequately represented.[20]

- Although the CAAA requirements for attainment are driving the development of transportation plans and programs, the planning horizon and forecast years for the region often do not coincide with the required forecast years for the CAAA. Therefore, extrapolations or interpretations of the transportation forecasts are needed as input to the emissions models. These extrapolations or interpretations introduce assumptions and approximations that may not be appropriate.[21]

In addition to VMT, the number of trips, and particularly the number of trips taken in cold-start mode are critical for determining emissions estimates. *Trip chaining (e.g., home to day-care to work) is a growing phenomenon due partly to growth in two-worker families.* Trip chaining affects the number of trips, trip length, and the fraction of trips made in cold start mode. Models do not represent trip chaining, and therefore may over-estimate the effect of employer based TCMs to reduce the use of single occupancy vehicles by workers, for example.[22]

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[20] Maren L. Outwater and William Loudon, "Travel Demand Forecasting Guidelines for the Federal and California Clean Air Act," a paper prepared for presentation at the Transportation Research Board, Annual Meeting, June 1994.

[21] Greig Harvey & Elizabeth Deakin, "Toward Improved Regional Transportation Modeling Practice (Revised), December 1991, p. 49.

[22] Michael Replogle, "Improving Transportation Modeling for Air Quality and Long-Range Planning," Environmental Defense Fund, prepared for presentation to the Transportation Research Board 1993 Annual Meeting, p. 6.

The CAAA also require the adoption of TCMs in some cases where they are needed to meet the NAAQS. These TCMs must be analyzed for their potential to reduce VMT and emissions. However, the typical four-step modeling process is not sensitive to many of the TCMs listed in Section 108(f) of the CAAA.

- As mentioned above, time of day situations are not well represented in the models. But, the models need to analyze TCMs sensitive to time of day, such as programs to limit or restrict vehicle use in downtown areas during peak periods, or employer based programs to reduce single occupancy vehicles and permit flexible work schedules.

- Several TCMs emphasize walking and biking. However, most transportation models are concerned with vehicle trips rather than person trips, and thus ignore the non-motorized modes. This problem is more important for short trips, which have the most potential to switch to walking or biking. In addition, trip generation and distribution models do not typically include information on the attractiveness of the walking and biking environment or the proximity of housing and jobs or shopping which can affect the modal split for these modes. Also, the models cannot handle changes in destinations which may result when there are mode shifts to non-motorized modes or when there are restrictions on vehicle access to points of the urbanized areas.

- Several TCMs emphasize mass transit, and model shortcomings with respect to transit are similar to those for non-motorized modes. Trip generation and distribution models do not typically include information on transit accessibility or levels of service. Instead, highway travel times are used to estimate trip distribution. Transit use, however, depends upon urban structure (such as the density of development, the degree to which land uses are mixed, the connectivity of the roadways, and the proximity and levels of service of transit). Transit use also depends upon the level of impedance to automobile travel (which can be affected by parking costs or limitations, or restrictions to automobile use in general), however the transportation models typically do not account for such variables. Also, the share of trips made by park-and-ride and kiss-and-ride are not sensitive to factors such as changes in the proximity of jobs and housing to transit stops, changes in pedestrian and/or bicycle access, or park-and-ride lot expansion.

- Mode choice models are not usually sensitive to factors related to auto occupancy, such as auto ownership. Auto occupancy is an important factor related to several of the TCMs specified in the CAAA.

3.1.2 Model Shortcomings in Meeting the Requirements of the ISTEA

While the CAAA require the transportation modeling process to produce much more detail than in the past, ISTEA requires that the process consider many more factors than in the past. The 15 factors to be considered for the metropolitan transportation plan and the 23 factors to be considered for the state transportation plan have implications for the transportation planning models:

- ISTEA mandates the reflection of a metropolitan area's comprehensive long range land use plan and metropolitan development objectives in the transportation plan. Further, ISTEA mandates the consideration of the effect and consistency of transportation policy decisions on land use and development. This implies the need to have transportation sensitive land use models, however, few such models are in use, and feedback from the transportation modeling process to land use models is typically not done. Also, trip generation models tend to be insensitive to the jobs/housing balance which directly affects trip productions and attractions due to changes in residences and employment sites. The current methods of computing trip productions and attractions can lead to underestimations and future year emissions and traffic congestion.

- Mass transit, walking, and biking are to be emphasized. As discussed above, the transportation modeling process does not usually handle these modes well.

- The social and economic effects of transportation decisions are to be considered. This implies that the transportation modeling process should be more sensitive to demographics and social structure. However, trip generation models are often not sensitive to alternative trip-making patterns due to variations in auto ownership, income, age of community, household size, and so forth.

The planning requirements for the Congestion Management System and the Traffic Management system also place requirements on the transportation models:

- Traffic congestion greatly influences emissions. However, in many transportation planning models, congestion has no effect on population distribution and employment forecasts due to the restricted sensitivity and lack of feedback between traffic assignment and land use modeling and trip generation. In addition, the capacity constraints used in most models do not adequately degrade speeds at high levels of congestion, so that congested highway travel times are not considered in the mode choice part of the modeling process.

- Strategies such as rideshare matching, telecommuting, and parking management are to be considered, but the models are typically not sensitive to policies which would encourage these options.

- As mentioned previously, mode choice models are not usually sensitive to factors related to auto occupancy, such as auto ownership. Auto occupancy is an important factor related to several of the congestion management strategies that must be considered in the development of a metropolitan transportation plan.

- Congestion pricing is to be considered. However, models sensitive only to time will not be sensitive to this option.

- IVHS technologies, such as motorist and transit information systems are to be considered. The four-step modeling structure is not sensitive to a policy which would provide real-time information on traffic conditions to the traveler.

3.1.3 Model Shortcomings in Meeting the Requirements of Conformity

The conformity regulations recognize some of the typical shortcomings of the transportation modeling process. As stated previously, these regulations require improved internal consistency in the modeling process. For example, free flow speeds in the models are to be based on empirical observations. Trip distribution times are to be consistent with travel times resulting from traffic assignment. Trip distribution and mode choice must be sensitive to pricing, where pricing is an important factor. The regulations require that the land-use and transportation system interaction be considered, but do not require formal transportation sensitive land-use models or the use of accessibility measures for trip generation or regional growth.

3.2 Model Modifications

For the existing set of transportation planning models to be responsive to the new federally-mandated requirements, many changes will have to be made to each element of the process. The *Manual of Regional Transportation Modeling Practice for Air Quality Analysis*,[23] sponsored by the National Association of Regional Councils, provides guidance to MPOs for meeting the requirements of the new legislation. The degree of sophistication of the transportation planning process differs from MPO to MPO, and there is a need to improve many existing models in use around the country to the level of the state-of-the-art.

However, it is important to note that even if the individual elements of the modeling process are significantly modified to respond to the newly-mandated planning requirements, there may still be problems in the overall modeling framework that cannot be solved unless the whole process and/or modeling structure is modified. Such problems result from attempting to handle such complicated processes as time-of-day modeling, trip chaining, and a higher level of detail (e.g., grid-based modeling) within the traditional four-step process.

The shortcomings of the existing models relative to the newly-legislated requirements indicate that significant changes are needed in the models and potentially in the model structure to accurately address these requirements. The needed model modifications are as follows:

- *Time of day modeling* which adequately represents transit trips, traffic factors such as the length of the am peak and pm peak, and TCMs such as flexible work hours, must be included in the models. This may require the development of time of day trip tables

[23] ***Manual of Regional Transportation Modeling Practice for Air Quality Analysis***, NARC, July 1993.

immediately after trip generation, prior to the first use of any network-derived data.[24] Another approach might be to add a time of day model as a fifth model in the process.

- *Representation of trip-chaining* behavior must be included in the models. Harvey and Deakin[25] suggest that proper representation of trip chaining requires an accessibility variable for the home zone.

- *The transportation network must be represented in sufficient detail to allow network-based models to assist in determining conformity, particularly for CO. In addition, the network must provide VMT for grid-based models to determine NAAQS attainment.* The use of GIS, in which a network can be described at a very detailed level[26] using common geographic coordinates, could be helpful in fulfilling the requirements of the CAAA and the conformity regulations.

- *The models must be designed to accurately represent speeds on links.* And, as required by the conformity regulation, travel times used for trip distribution are to be consistent with travel times resulting from traffic assignment. If recycling of travel times between network assignment and trip distribution is performed, the forecasts of trip destinations and modes can be made sensitive to levels of congestion, and trips will be shifted between transit/ high-occupancy vehicles and single-occupant vehicles.

- *Travel costs should be included in the models.* In particular, parking costs, which may include both tangible cost and other factors such as parking capacity/accessibility should be included, since they can all be factors in mode choice.

- *Household income and other travel-sensitive variables such as household structure must be included in the models.* Demographic variables such as income significantly influence travel behavior and are needed to understand the socio-economic effects of transportation.

- *Bicycle and walk trips should be represented in the network and in mode choice models.* These modes could be easily added to the mode choice models, but the difficulty would be in the network representation, which would have to be quite detailed in order to accurately measure times and distances for walking and bicycle trips.

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[24] Peter R. Stopher, "Deficiencies in Travel Forecasting Procedures Relative to the 1990 Clean Air Act Amendment Requirements," op. cit., p. 23.

[25] Greig Harvey and Elizabeth Deakin, "Toward Improved Regional Transportation Modeling Practice," op. cit., pp. 27-28.

[26] The term "very detailed level" refers to a level of detail necessary to model non-motorized travel, such as bicycling or walking.

- *Automobile ownership modeling which is sensitive to work mode choice must be added to the models.* Automobile ownership is a major factor in mode choice and trip-making, but it is currently treated as an exogenous input which is often based on trend analysis. Automobile forecasting models should be sensitive to the potential of increases in transit, walk, and bicycle accessibility on household automobile ownership.

- *Transportation-sensitive land use models should be incorporated in the models.* Land use impacts on transportation have been difficult to quantify, primarily because issues such as the maturity of a particular region, and the balance of jobs and housing have not been represented in the models. Land use models need to contain measures of accessibility for analysis zones which adequately reflect highway congestion, proximity to transit and transit level of service, and the environment for biking and walking. In addition, the transportation models need to be sensitive to development issues.

4 CONCLUSIONS

The landmark pieces of legislation discussed in this report provide an opportunity for the linkage of the transportation and air quality planning to evaluate NAAQS attainment and also promote intermodalism and cost-effectiveness. As discussed in Section 3, these laws and rules will require significant modifications to the transportation planning models, not only to fulfill the planning requirements of ISTEA, but to provide input to emissions modeling required by the CAAA and conformity regulations.

The CAAA mandates SIP revisions which include emissions estimates for current and future years, annual VMT reports and forecasts based on transportation network models, demonstration of attainment of the NAAQS, and the implementation of TCMs when milestones are not met.

Recent implementing regulations for ISTEA set forth requirements for both statewide and metropolitan area planning. In addition to requiring coordination of planning activities between environmental agencies, transportation agencies, and other interested parties, the regulations require an extensive public process. The metropolitan planning process must consider 15 different factors, and the statewide process must consider 23 different factors. These factors include the interaction between land use and development and transportation; the need to relieve congestion; utilization of the management and monitoring systems to identify transportation needs; the overall social, economic, energy, and environmental effects of transportation; methods to increase transit use; methods to increase the use of walking and bicycles; and TSM and other investment strategies to make the most efficient use of existing transportation facilities.

Other implementing regulations for ISTEA provide for the establishment of six management and monitoring systems, which together with a traffic monitoring system will provide better information on the condition and use of existing transportation facilities. The congestion management system (CMS), in particular, requires the identification and evaluation of strategies to improve transportation system performance and reduce single-occupant vehicle travel.

Conformity regulations link the transportation planning requirements of ISTEA with the requirements of the CAAA. These regulations require that a transportation plan and transportation improvement program (TIP) conform to a state implementation plan's air quality objectives. These objectives specifically address the severity and number of NAAQS violations, and the achievement of NAAQS attainment as soon as possible. Existing transportation planning models will have to be significantly modified to satisfy the requirements of the conformity regulations.

This report identifies the shortcomings of the existing set of transportation planning models in terms of their ability to fulfill the new requirements. The four-step transportation modeling process has been under development for four decades, but retains essentially the same structure. This process was established to evaluate new regional transportation facilities,

however, the new planning requirements emphasize strategies which promote more efficient use of the existing transportation facilities. These include strategies such as intermodalism; congestion management; and various TCMs such as improved public transit, trip reduction ordinances, traffic flow improvements, encouragement of non-motorized uses, employer-based programs, etc. Conformity determinations include requirements that plans or projects provide for timely implementation of TCMs, reduce localized CO violations, and not contribute to new violations.

The degree of sophistication of the transportation planning process differs from MPO to MPO, and there is a need to improve many existing models to the level of the state-of-the-art. The conformity regulations set forth minimum standards, which include requirements that travel times be recycled between traffic assignment and trip distribution, that model speeds be based upon empirical observations, that travel be sensitive to pricing, and that peak and off-peak travel times be provided.

While improvements in the four-step transportation modeling process can accommodate some of the new requirements, other requirements point our the need for alternative approaches or model structures. For example, the modeling process needs to be modified to provide information on tripmaking by time of day, and to be sensitive to transportation policies which may alter the time that tripmaking occurs. Trip-chaining behavior, along with its effect on work and non-work tripmaking, VMT, and modal split must be also represented in the models. In addition, the level of detail represented by the models must be increased in order to provide information on CO hot spots, and VMT, trips, and speeds by small geographic areas. The models need to include variables relevant to tripmaking such as demographic variables, urban design variables, and accessibility measures. Methods for accounting for walking and bicycling need to be incorporated into the models.

The planning and data collection requirements of the CAAA and ISTEA therefore reinforce the approach being undertaken by the Travel Model Improvement Program. Work needs to be done to bring current practice to the state-of-the-art as well as to advance the state of the art with research into new model structures and approaches.

APPENDIX A - HISTORICAL SUMMARY OF TRANSPORTATION PLANNING

Urban transportation planning was first mandated by the Federal-Aid Highway Act of 1962. This act established the "3C" planning process - comprehensive, cooperative and continuing-, and required this type of planning as a condition for receiving Federal funds in urbanized areas. Further, it officially introduced the idea of integrating land use with transportation, and declared that planning be intermodal.

Currently, Federal legislation has mandated specific metropolitan and statewide transportation planning requirements, has required the establishment of six management systems to collect, maintain and analyze transportation-related data, and has introduced strict air quality planning and compliance requirements. Even though the planning requirements have changed significantly since 1962, the transportation planning models have not changed that much. In order to recognize the impact of thirty years of changes to the planning requirements on the adequacy of the models, the following subsections will briefly outline the history of transportation planning in terms of Federal legislation.

A-1 Brief History of Transportation Planning

The history of transportation planning has been well documented, particularly by Edward Weiner[27]. A brief summary of the history, presented below, highlights the legislation that has changed the planning requirements over time. A more detailed summary can be found in the following table.

Although urban transportation planning was not mandated as part of Federal funding requirements until the Federal-Aid Highway Act of 1962, there were several pieces of legislation before that which established key planning organizations and programs. Between 1916 and 1961, the following activities led up to the creation of the 3C transportation planning process:

- 1916: Bureau of Public Roads (BPR) created.
- 1921: Federal-aid Highway System established, state highway departments organized, and state matching of Federal assistance required.
- 1934: Discretionary highway planning and research program established.
- 1944: Federal assistance for secondary and urban extension roads initiated and national system of interstate highways designated.
- 1953: First funding provided for the U.S. Interstate Highway System.

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[27] Edward Weiner, ***Urban Transportation Planning in the United States: An Historical Overview***, Office of Economics, Office of the Assistant Secretary for Policy and International Affairs, Office of the Secretary of Transportation, Revised Edition, November 1992, DOT-T-93-02.

- 1956: Funding created for national system of interstate and defense highways.

- 1961: Program of loans and demonstrations for the construction of transit facilities and purchase of capital equipment created.

- 1961: Use of Housing and Home Finance Agency comprehensive planning funds authorized for urban transportation planning.

Between 1962 and 1972, transportation planning requirements were established through several pieces of legislation, were expanded to include transit planning, guidance for planning was first issued, and the integration of transportation planning and other planning (environmental, land use, and air quality) was defined. The following list summarizes the legislative activities between 1962 and 1972:

- 1962: 3C urban transportation planning process mandated for receiving Federal funds.

- 1963: 3C planning process guidelines issued by the BPR (see discussion following these bullets). Ten elements of the planning process were defined.

- 1964: The Urban Mass Transportation Act created transit capital grants to public agencies, and the first national research and development program for transit was established.

- 1965: Grants for comprehensive planning authorized to regional planning agencies (RPAs) and councils of government (COGs). Department of Housing and Urban Development (HUD) created.

- 1966: U.S. Department of Transportation (DOT) created, with the FHWA and the Federal Aviation Administration (FAA) as subordinate organizations.

- 1966: The Metropolitan Development and Demonstration Cities Act required an areawide planning and review process for various Federal assistance programs, such as water and sewer grants, transit and highway assistance, urban renewal, etc.

- 1967: FHWA consolidated previous urban transportation planning guidance in a Policy and Procedure Memorandum (PPM-50-9).

- 1968: The Urban Mass Transportation Administration (UMTA) was transferred from HUD to DOT.

- 1968: FHWA issued an Instructional Memorandum (IM 50-4-68), "Operations Plans for Continuing Urban Transportation Planning," which maintained the responsiveness of planning to the needs of local areas. Five elements were identified for a continued planning process: surveillance, reappraisal, service, procedural development and an annual report.

- 1968: The Intergovernmental Cooperation Act required the coordination of Federal programs with local governments, generally acting through RPAs or COGs.

- 1969: The National Environmental Policy Act required a systematic interdisciplinary approach to planning as part of an environmental impact statement (EIS) process.

- 1970: The CAAA of 1970 focused on traffic management as a remedy for air pollution control. They also established the Environmental Protection Agency (EPA), specified emission standards, required the establishment of ambient air quality standards, and required State Implementation Plans (SIPs) and Transportation Control Plans (TCPs).

- 1972: UMTA issued an External Operating Manual which included planning requirements for planning projects. Appendix 2 of the Manual was entitled "Urban Mass Transportation Planning Requirements Guide," (UMTA Order 1000.2, dated August 22, 1972) which set forth the areawide planning requirements for the transit program. These requirements were designed to be consistent with the 3C planning process.

The most significant documentation during this ten-year time frame was the ***Highway Planning Program Manual*** (HPPM), originally issued by the BPR and later updated by the FHWA. Prior to the UMTA External Operating Manual, the HPPM was the only technical documentation and guidance available on the urban transportation planning process. Volume 8 of the HPPM was entitled "Urban Transportation Planning," and contained the following chapters:

I. General - Organization
II. Use of Computers
III. Origin-Destination Surveys
IV. Population Studies
V. Economic Studies
VI. Land Use
VII. Classification of Existing Street Use and Street Inventory
VIII. Development of Standards and Evaluation of Existing Traffic Services
IX. Traffic Engineering Studies
X. Public Transportation
XI. Terminal Facilities
XII. Travel Forecasting (Trip Generation and Distribution)
XIII. Traffic Assignment
XIV. Developing the Transportation Plan
XV. Plan Implementation
XVI. The Continuing Planning Process

Each chapter in the HPPM was originally written and updated between September 1965 and August 1973.

In 1975, UMTA and FHWA issued joint highway and transit planning regulations that "unified the individual planning requirements of FHWA and UMTA and superseded the operating procedures"[28] mentioned previously. These regulations were the precursor to the current requirements for metropolitan and statewide planning (to be discussed in section 2.2). They included:

- The development of a unified planning work program (UPWP) which describes all urban transportation and transportation-related planning activities anticipated during the next one- to two-year period;

- The development of a transportation plan, consisting of specific elements (Chapter I of title 23 and Chapter VI of title 49 of the Code of Federal Regulations (CFR), Part 450, Subpart A), including a long-range and transportation system management (TSM) elements;and

- The development of a transportation improvement program (TIP).

Between 1977 and 1980, the following significant legislation related to transportation planning requirements occurred:

- 1977: The CAAA required that transportation plans, programs and projects funded under title 23 or title 49 conform with State or Federal air quality implementation plans.

- 1978: The Surface Transportation Assistance Act added energy conservation as a goal in the planning process.

- 1978: Regulations integrating air quality planning and 3C planning were issued.

- 1980: Joint FHWA/UMTA Environmental Regulations were issued that required a single set of environmental procedures for highway and transit projects in order to produce a single EIS and Alternatives Analysis document.

In 1981 and 1982, two Executive Orders (EOs) were issued by President Reagan which reflected a national concern for the complexity and burdensome nature of requirements and regulations[29]. Decentralization and intergovernmental coordination were the themes in these two EOs (12291 and 12372). EO 12291 "established procedures for reviewing existing regulations and evaluating new ones. It required that a regulation have greater benefits to

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[28] "Planning Assistance and Standards: Urban Transportation Planning; Final Rule," 40 FR 42976 (September 17, 1975).

[29] Edward Weiner, ***Urban Transportation Planning in the United States: An Historical Overview***, op. cit., p. 171.

society than costs and that the approach used must maximize those benefits. All regulatory actions were to be based on a regulatory impact analysis that assessed the benefits and costs. The objectives of EO 12372 were to foster an intergovernmental partnership and strengthen federalism by relying on state and local processes for intergovernmental coordination and review of Federal financial assistance and direct Federal development."[30]

The impact of these EOs marked a turning point in the way requirements and regulations were promulgated. For transportation planning, the first set of regulations that reflected this change to more general requirements was issued in 1983. Joint FHWA/UMTA urban transportation planning regulations were revised to reflect the reduction in the Federal government's involvement in urban transportation planning. These revised regulations "stated the product or end that was required but left the details of the process to the state and local agencies, so the regulations no longer contained the elements of the process nor factors to consider in conducting the process."[31]

Between this legislation and the present, all transportation planning regulations and requirements continued to reflect a less-specific nature, as follows:

- 1987: The Surface Transportation and Uniform Relocation Assistance Act added a requirement to the planning process that involved the development of long-term financial plans for regional urban mass transit improvements.

- 1987: Joint FHWA/UMTA Environmental Regulations were revised to provide more flexibility in the requirements for comprehensive environmental assessments.

Since 1990, there have been several significant pieces of legislation and implementing regulations which mandate a new set of planning and data collection requirements. The legislation includes the Clean Air Act Amendments of 1990 and the Intermodal Surface Transportation Efficiency Act of 1991. Detailed descriptions of these requirements are included as Appendix B.

A-2 Tabular Summary of Transportation Planning History

A tabular summary of transportation planning history follows:

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[30] Ibid, p. 171 and 174.

[31] Ibid, p. 185.

SUMMARY OF TRANSPORTATION PLANNING HISTORY

REF. NO.	YEAR	MAJOR TOPIC	SUB-TOPIC	STATUTORY REFERENCE	DESCRIPTION
1	1916	1934 Federal-Aid Road Act	Federal highway program		The Federal-Aid Road Act of 1916 was the beginning of the federal-aid highway program. It created the Bureau of Public Roads.
2	1921	1921 Federal Highway Act	Federal highway program		The Federal Highway Act of 1921 established the federal-aid highway system, required that states organize state highway departments, provided contract authority (between the US and states for aid), and required state matching of Federal assistance.
3	1934	1934 Federal-Aid Highway Act	Federal highway planning		The 1934 Federal-Aid Highway Act established a discretionary highway planning and research (HP&R) program that was authorized at 1 1/2 percent of [the capital expenditures for highway construction].
4	1944	1944 Federal-Aid Highway Act	Federal highway program		The 1944 Federal-Aid Highway Act initiated Federal assistance for a Secondary and Urban Extensions Program in addition to the Federal-aid highway system originally established in 1921. It also directed the designation of a 40,000 mile national system of Interstate highways by provided no funding.
5	1947	1947 Housing Act	Federal housing program	1947 Housing Act	The 1947 Housing Act created the (US) Housing and Home Finance Agency.
6	1953	1953 Federal-Aid Highway Act	Federal highway program		The 1953 Federal-Aid Highway Act provided the first funding for the US Interstate Highway System.
7	1954	1954 Housing Act	Comprehensive Planning Program		Section 701 of the 1954 Housing Act established a program of grants to assist local governments in conducting "comprehensive" planning programs.
8	1956	1956 Federal-Aid Highway Act	Interstate and Defense Highway System		The 1956 Federal-Aid Highway Act created funding for a National System of Interstate and Defense Highways.
9	1956	1956 Highway Revenue Act	Federal Highway Trust Fund		The 1956 Federal Revenue Act established the Highway Trust Fund which provided a 90% federal share for eligible highway construction.
10	1961	1961 Housing Act	Urban transit loans and demos.		The 1961 Housing Act created a program of loans and demonstrations for the construction of transit facilities and purchase of capital equipment.
11	1961	1961 Housing Act	Urban transportation studies	1961 Housing Act	The 1961 Housing Act authorized the use of HHFA comprehensive planning funds (Section 701 of the 1954 Housing Act) to be used for urban transportation planning.

REF. NO.	YEAR	MAJOR TOPIC	SUB-TOPIC	STATUTORY REFERENCE	DESCRIPTION
12	1962	1962 Federal-Aid Highway Act	"3C" urban transportation Planning	23 USC Sec. 134	The 1962 Federal-Aid Highway Act mandated a "comprehensive, cooperative and continuing" urban transportation planning process. It became known as the "3C" planning process. The Act was the first Federal law to require urban transportation planning as a condition for receiving federal funds in urbanized areas. It asserted that urban transportation was to be integrated with land development and that transportation planning would be intermodal. "It is declared to be in the national interest to encourage and promote the development of transportation systems embracing various modes of transport in a manner that will serve the states and local communities efficiently and effectively." Further, the Secretary of Commerce was directed to cooperate with the states "...in the development of long-range highway plans and programs which are properly coordinated with plans for improvements in other affected forms of transportation and which are formulated with due consideration to their probable effect on the future development of the urban area. . . " "After July 1, 1965, the Secretary shall not approve under section 105 of this title any programs for projects in any urban area of more than fifty thousand population unless he finds that such projects are based on a continuing, comprehensive transportation planning process carried out cooperatively by states and local communities in conformance with the objectives stated in this section" (23 USC Section 134) The Act also required that 1 1/2 % of the [highway construction funds] be made available for highway planning and research (HP&R). An additional 1/2 percentum was optional.

REF. NO.	YEAR	MAJOR TOPIC	SUB-TOPIC	STATUTORY REFERENCE	DESCRIPTION
13	1963	Federal Highway Planning Guideline	Guidelines for 3C Planning Process	IM 50-2-63	In March of 1963, the Bureau of Public Roads issued guidelines defining the 3C planning process(IM 50-2-63). "Cooperative" was defined to include not only cooperation between the Federal, state, and local levels of government but also among the various agencies within the same level of government. "Continuing" referred to the need to periodically re-evaluate and update a transportation plan. "Comprehensive" was defined to include the basic ten elements of a 3C planning process for which inventories and analyses were required. These ten elements are: 1. Economic factors affecting development 2. Population 3. Land Use 4. Transportation facilities, including those for mass transportation 5. Travel patterns 6. Terminal and transfer facilities 7. Traffic control features 8. Zoning ordinances, subdivision regulations, building codes, etc. 9. Financial resources 10. Social and community-value factors, such as preservation of open space, parks and recreational facilities; preservation of historical sites and buildings;environmental amenities; and aesthetics. "The planning process consisted of: establishing an organization to carry out the planning process; development of local goals and objectives; surveys and inventories of existing conditions and facilities; analyses of current conditions and calibration of forecasting techniques; forecasting of future activity and travel; evaluation of alternative transportation networks resulting in a recommended transportation plan; staging of the transportation plan; and identification of resources to implement it." (Wiener 1992) By the legislated deadline of July 1, 1965, all 224 existing urbanized areas which fell under the 1962 Act had an urban transportation planning process underway (Holmes, 1973) ties;
14	1964	Urban Mass Transportation Act	Urban transit capital grants	1964 UMT Act	The 1964 Urban Mass Transportation Act created transit capital grants to public bodies with a maximum Federal share of 66 2/3 percentum.
15	1964	Urban Mass Transportation Act	Research and Development Program	1964 UMT Act	The 1964 Urban Mass Transportation Act established the first national research and development program for transit.
16	1965	Housing and Urban Develop. Act	Regional planning grants from S.701	1965 HUD Act	In addition to creating HUD, the 1965 Housing and Urban Development Act authorized grants for comprehensive planning to regional planning agencies (RPAs) and councils of governments (COGs) from 701 funds (S. 701, Housing Act of 1954, as amended).
17	1966	Dept. of Transportation Act	US DOT established	1966 DOT Act	The 1966 Department of Transportation Act created the U.S. Department of Transportation bringing the independent Federal Highway Administration and the Federal Aviation Administration under the DOT umbrella.

REF. NO.	YEAR	MAJOR TOPIC	SUB-TOPIC	STATUTORY REFERENCE	DESCRIPTION
18	1966	UMT Act Amendments	Transit Technical Studies Program	1966 UMT Amend. Act	The 1966 Urban Mass Transportation Amendments Act amended the 1964 UMT Act to add a transit technical studies program (Section 9, UMT Act of 1964) to [. . purposes. . .]. Other amendments added a management training program and a New Systems study.
19	1966	Demo Cities and Metro Develop. Act	S. 204 Areawide Planning	S.204, MD&DC Act of 1966	The 1966 Metropolitan Development and Demonstration Cities Act provided in Section 204 that an areawide planning and review process would be a requirement for federal assistance for various grant programs (e.g water and sewer grants, transit and highway assistance, urban renewal etc.). "Section 204 asserted the federal interest improving the coordination of public facility construction projects to obtain maximum effectiveness of federal spending and to relate such projects to areawide development plans. . . Section 204 required that all applications for planning and construction of facilities be submitted to an areawide planning agency for review and comment. The areawide agency was required to be composed of local elected officials. . . Procedures to implement this act were issued by the Bureau of the Budget in Circular No. A-82. . . ." (Wiener)
20	1966	National Traffic and Motor Safety Act	Highway safety programs		The 1966 National Traffic and Motor Vehicle Safety Act created the National Traffic Safety Agency, established minimum safety standards for motor vehicles and equipment, and expanded the National Driver Register.
21	1966	National Safety Act	Highway safety programs		The 1966 Highway Safety Act created the National Highway Safety Agency, required states to establish highway safety programs, made matching Federal funds (75/25%) available to States allocated by population and highway mileage (S.402).
22	1966	National Historic Preservation Act	Historic preservation requirements		The 1966 National Historical Preservation Act created the Advisory Council on Historic Preservation and required Federal agencies to take account of and protect historic properties (S.106).
23	1967	Urban Transportation Planning Guide	Consolidated Urban Transp. Guideline	PMM 50-9	The [Federal Highway Administration] consolidated previous guidance in a 1966 Policy and Procedure Memorandum. (PPM-50-9)
24	1967	National Highway Safety Bureau	Consolidation of safety agencies	Exec Order 11357	In 1967, President Johnson issued Executive Order 11357, which combined the National Traffic Safety Agency and the National Highway Safety Agency into the National Highway Safety Bureau in the US Department of Transportation.
25	1968	Federal-Aid Highway Act	TOPICS, environment, public hearings	*	The 1968 Federal-Aid Highway Act created the TOPICS Program (Traffic Operations Program to Improve Capacity and Safety), prohibited takings of parks, wetlands or wildlife refuge; and required public hearings.
27	1968	Intergovernmental Cooperation Act	Federal/Local government coordination	1968 IC Act	In 1968, the Intergovernmental Cooperation Act required the coordination or Federal programs with local governments, generally acting through areawide planning organizations or councils of governments (COGs).

REF. NO.	YEAR	MAJOR TOPIC	SUB-TOPIC	STATUTORY REFERENCE	DESCRIPTION
28	1968	FHWA Operations Plans	Plans for "Continuing" UTP	IM 50-4-68	In 1968, as most urbanized areas were well along on their 3C planning, FHWA issued an Instructional Memorandum (IM 50-4-68) entitled "Operations Plans for 'Continuing' Urban Transportation Planning" to maintain the responsiveness of planning to the needs of local areas and to potential changes. The operations plans were to address the various items needed to perform continuing planning, including: the organizational structure; scope of activities and the agencies that were responsible, a description of the surveillance methodology to identify changes in land development and travel demand, a description of land use and travel forecasting procedures, and work remaining on the ten basic elements of the 3C planning process. The Guidelines identified five essential elements for a continued planning process: surveillance, reappraisal, service, procedural development and annual report. The "surveillance" element focused on monitoring changes in the area in development, sociodemographic characteristics, and travel. "Reappraisal" dealt with three levels of review of the transportation forecasts and plan to determine if they were still valid. Every five years the plan and forecast were to be updated to retain a 20-year time horizon. The "service" element was to assist agencies in the implementation of the plan. The "procedural development" element emphasized the need to upgrade analysis techniques. Lastly, the publication of an "annual report" on these activities was required as a means of communicating with local officials and citizens. (U.S. DOT 1968)
29	1969	National Environmental Policy Act	NEPA planning requirements	1969 NEPA	The 1969 National Environmental Policy Act (NEPA) required a systematic interdisciplinary approach to planning and decisionmaking as a part of an environmental impact statement (EIS) process for project covered by the Act. It also established the Council on Environmental Quality (CEQ)
30	1969	OMB Circular A-95	Areawide Proj. Notification/Review	OMB Circular A-95	In 1969, the Office of Management and Budget issued Circular A-95 which required that areawide planning agencies comment on federally-aided projects.
31	1969	FHWA PPM on Two Hearing Process	Full consideration of proj impacts	PPM 20-8	In 1969, the [FHWA] issued a Policy and Procedure Memorandum on the "Two Hearing Process" which required full consideration of social, economic and environmental impacts [in the Federal highway construction process].
32	1969	Environmental Quality Improvement Act	Office of Environmental Quality	1969 EQ	The 1969 Environmental Quality Improvement Act established the Office of Environmental Quality.
33	1970	UMT Assistance Act	Long-term commitment to transit	1970 UMT Assistance Act	The 1970 Urban Mass Transportation Assistance Act established a long-term commitment to transit funding -- $10 billion over a twelve year period. The Act also added [Section 16 to the UMT Act of 1964] which provided requirements concerning the elderly and persons with disabilities.

REF. NO.	YEAR	MAJOR TOPIC	SUB-TOPIC	STATUTORY REFERENCE	DESCRIPTION
34	1970	Clean Air Act Amendments	EPA, emission stand, SIPs, TCPs	1970 CAA Amendments	The 1970 Clean Air Act Amendments created the EPA, specified emission standards, required the establishment of ambient air quality standards, required State Implementation Plans (SIPs) and [Transportation Control Plans] (TCPs) and focus on traffic management as a remedy for air pollution control.
35	1970	Federal Highway Planning Guideline	Annual certification of 3C Process	IM 50-3-71	In 1971, the Federal Highway Administration issued an Instructional Memorandum that established annual certification of the 3C urban transportation planning process.
36	1972	FHWA Process Guidelines for Highways	PPM for processing highway projects	PPM 90-4	In 1972, the Federal Highway Administration issued a Policy and Procedure Memorandum which established process guidelines for highway projects.

REF. NO.	YEAR	MAJOR TOPIC	SUB-TOPIC	STATUTORY REFERENCE	DESCRIPTION
37	1972	UMTA External Operating Manual	Planning requirements for transit proj.	UMTA Circ. 1000.2	In August of 1972, UMTA issued an External Operating Manual which as its first consolidated guidance for project management also described the planning requirements for transit projects. Appendix 2 of the Manual was entitled the "Urban Mass Transportation Planning Requirements Guide" which set forth the areawide planning requirements for the transit program designed to be consistent with the 3C planning process. An urban area needed to have: a legally established planning agency representing local units of government; a comprehensive, continuing areawide planning process; and a land use plan to serve as the basis for determining travel demand. "The transportation planning requirements, which were certified by UMTA, included: a long-range transportation planning process, a 5-10 year transit development program, and a shot-range program. The agency conducting the transportation planning was to be, wherever possible, the agency carrying out the comprehensive planning. (Weiner) The planning requirements contained in the Manual were superseded by the joint FHWA/UMTA Urban Transportation Planning regulations (US DOT 1975). Operating Manual which as its first consolidated guidance for project management also described the planning requirements for transit projects. Appendix 2 of the Manual was entitled the "Urban Mass Transportation Planning Requirements Guide" which set forth the areawide planning requirements for the transit program designed to be consistent with the 3C planning process. An urban area needed to have: a legally established planning agency representing local units of government; a comprehensive, continuing areawide planning process; and a land use plan to serve as the basis for determining travel demand. "The transportation planning requirements, which were certified by UMTA, included: a long-range transportation planning process, a 5-10 year transit development program, and a shot-range program. The agency conducting the transportation planning was to be, wherever possible, the agency carrying out the comprehensive planning. (Weiner) The planning requirements contained in the Manual were superseded by the joint FHWA/UMTA Urban Transportation Planning regulations (US DOT 1975).
38	1973	Federal-Aid Highway Act	Highway to transit fund	1973 F-A Highway Act transfer	The 1973 Federal-Aid Highway Act allowed Federal Aid Urban System and Interstate funds to be transferred to transit projects.
39	1973	Rehabilitation Act [Amendment]	Program access for handicapped	S.504 Rehab Act of 1973	In 1973 the Rehabilitation Act [was amended to] added Section 504 which provided that Federally funded programs had to provide access to handicapped persons.

REF. NO.	YEAR	MAJOR TOPIC	SUB-TOPIC	STATUTORY REFERENCE	DESCRIPTION
40	1973	CEQ Guidelines on EIS preparation			In 1973 the Council on Environmental Quality issued guidelines on the preparation of Environmental Impact Statements.
42	1974	Emergency Highway Energy Consv. Act	55 mph speed limit	1974 EHEC Act	In 1974 the Emergency Highway Energy Conservation Act established a 55 mile per hour speed limit on Federal [Interstate] highways.
43	1974	Energy Policy and Conservation Act	CAFE standards	1975 EPC Act	The 1974 Energy Policy and Conservation Act established corporate average fuel economy (CAFE) standards for automobile manufacturers.

REF. NO.	YEAR	MAJOR TOPIC	SUB-TOPIC	STATUTORY REFERENCE	DESCRIPTION
44	1975	Joint FHWA/UMTA Planning Requirements	MPO, prospectus, UPWP, TIP, AE, TSM		"In 1975, FHWA and UMTA issued final joint highway and transit planning regulations in the Federal Register entitled, "Planning Assistance and Standards". The regulations provided for the joint designation of MPO's to carry out planning and required agreements on the division of responsibility where the MPO's and A-95 agencies were different. A multiyear prospectus and annual unified work program had to be submitted specifying all transportation-related planning activities for an urban area as a condition for receiving federal planning funds." "The urban transportation planning process was required to produce a long-range transportation plan, which had to be reviewed annually to confirm its validity. The transportation plan had to contain a long-range element and a shorter-range "transportation systems management element" (TSME) for improving the operation of existing transportation systems without new facilities. "A multiyear "transportation improvement program" (TIP) also had to be developed consistent with the transportation plan. The TIP had to include all highway and transit projects to be implemented within the coming five years. It thereby became the linkage between the planning and programming of urban transportation projects. It also brought together all highway and transit projects into a single document that could be reviewed and approved by decision makers. The TIP had to contain an "annual element" that would be the basis for the federal funding decisions on projects for the coming year." "The regulations provided for a joint annual certification of the planning process. This certification was required as a condition for receiving federal funds for projects. The regulations incorporated previously legislated requirements related to social, economic, and environmental impact analysis, air quality planning, and the elderly and handicapped." "These joint regulations applied to all urban highway and transit programs including those for transit operating assistance. They represented the most important action up to that time to bring about multimodal urban transportation planning and programming of projects. They changed the emphasis from long-term planning to shorter range transportation system management, and provided a stronger linkage between planning and programming. These regulations were another turning point in the evolution of urban transportation planning that set the tone for the next several years." (Weiner)
45	1976	Federal-Aid Highway Act	Interstate transfers, 3R program	1973 F-A Hwy Act	The 1976 Federal-Aid Highway Act provided for transfer of funds from Interstate projects to other highways and busways, established the "3R" Program (for resurfacing, restoration, and rehabilitation).

REF. NO.	YEAR	MAJOR TOPIC	SUB-TOPIC	STATUTORY REFERENCE	DESCRIPTION
46	1976	USDOT S. 504 Regulations	non-discrimination/disabled persons		The US DOT issued regulations implementing S.504 of the Rehabilitation Act of 1973 to prohibit discrimination against persons with disabilities in Federally-assisted programs and projects.
47	1977	Clean Air Act Amendments	deadline extension,	1977 CA Act Amendments	The 1977 Clean Air Act amendments extended the attainment deadline [for ambient air quality?], and required "conformance" [to what?] or imposed "sanctions" [what? on whom?].
48	1977	Dept of Energy Organization Act	Creation of DOE	1977 DEO Act	The 1977 Department of Energy Organization Act created the Department of Energy.
49	1977	Natl. Urban Dev. and New Comm. Dev.	Natl policy report on growth		The 1977 National Urban Development and New Communities Development Act required a national policy report rather than a report on growth.
50	1978 Surface Transportation Assist. Act	Same Plng Rqmnts Transit & Hwy		1978 STA Act	The Surface Transportation Act of 1978 required the same planning requirements for highways and transit. [Also, deadline for Interstate completion by 1990, created bridge R&R program, transit Section 5 program expanded to four tiers, added Section 18 (Rural) transit program to UMT Act, Buy America requirement.
51	1978	National Energy Act	Energy conservation		The 1978 National Energy Act established energy conservation as a goal and promoted carpools and vanpools.
52	1978	Council on Environmental Quality Regs	"scoping and tiering"		
53	1978	Transp. and Air Qual. Guidelines	Integration 3C and AQ planning		In 1978 regulations were promulgated that integrated air quality planning and the 3C transportation planning process.
54	1979	Urban Initiatives Program Guideline	Joint Dvlpmnt,leverage, econ.stim		[1978 promulgation of Urban Initiative Program guidelines: joint development, leveraging federal investments, stimulate economic development.]
55	1979	S. 504 Regulations	Transit accessibility		In 1979, the US DOT issued regulations implementing Section 504 of the Rehabilitation Act of 1973 for federally-assisted transit programs.
56	1979	National Transportation Policy	Final Report National Study Comm.		In 1980, a joint FHWA/UMTA environmental regulation was issued which required a single set of environmental procedures for highway and transit projects and a single Environmental Impact Statement and Alternatives Analysis document.

REF. NO.	YEAR	MAJOR TOPIC	SUB-TOPIC	STATUTORY REFERENCE	DESCRIPTION
57	1980	Joint FHWA/UMTA Environmental Regs	Single Env. Procedures, EIS/AA		In 1980, a joint FHWA/UMTA environmental regulation was issued which required a single set of environmental procedures for highway and transit projects and a single Environmental Impact Statement and Alternatives Analysis document.
58	1981	Federal-Aid Highway Act	Creation of 4R program at 90/10	1981 F-A Hwy Act	The Federal-Aid Highway Act of 1981 created a 4R program (Resurfacing, Restoration, Rehabilitation, and Reconstruction) at 90% Federal/10% state matching ratio. It also redefined eligible items to complete the Interstate system.
59	1981	E.O. 12291	Regulation Evaluation Procedures		Executive Order 12291, issued by President Reagan in 1981, provided procedures for evaluating regulations. it further provided that the benefits must exceed costs [what?].
60	1981	Interim Section 504 Regulations	Certification of Special Efforts		
61	1982	Surface Transportation Assist. Act	Inc. Gas tax, Transit Acct, Sec. 9	1982 STA Act	[1982 Surface Transportation Assistance Act: 5-cent increase in gas tax (4-cents to highways for Interstate completion and expanded highway and bridge rehabilitation; 1-cent to Mass Transit Account of Highway Trust Fund for Discretionary Grants only for capital projects at 75% federal share), new Section 9 Formula Grant for capital and operating projects (with ops cap).
62	1982	Intergovernmental Review of Federal Proj.	OMB Circular A-95 Replacement	E.O. 12372	The 1982 Executive Order 12372, Intergovernmental Review of Federal Programs, replace OMB Circular A-95. It provided that states would establish their own review process, and that the Federal government must "accommodate" or "explain" projects. It also provided for a "single point of contact" [for intergovernmental review].
63	1982	Federal Paratransit Policy	Supplement/Substitute Paratransit		
64	1983	Revised Urban Transp. Plng Regs	Removal of Reg. Requirements		[1982 Revised Urban Transportation Planning Regulations -- removed all items not actually required, increased state and local flexibility.]
65	1983	Section 504 Regulations (NPRM)	S. 504 DOT-wide, detailed criteria		
66	1986	Charter Bus Regulation (NPRM)	Prohibit charter by public transit		
67	1986	Sec. 504 Regulations	S.504 six transit service criteria		

REF. NO.	YEAR	MAJOR TOPIC	SUB-TOPIC	STATUTORY REFERENCE	DESCRIPTION
68	1987	Surface Trans and Uniform Reloc.AA		1987 STURA Act	[1987 Surface Transportation and Uniform Relocation Assistance Act - $87.6 billion for 1987-91 for highway, safety, and transit programs; funds for 152 special highway projects; permitted states to raise the speed limit on rural Interstates from 55 mph to 65 mph, removed Federal regulation of bridge tolls, established Strategic Highway Research Program (SHRP); specified split of Section 3 transit funds, fixed guideway grant criteria, advanced construction approval, Section 9 funds for leasing arrangements, new Section 9B formula grants for capital projects, new bus testing facility, testing of all new bus models, increased Buy America threshold and project cost differential, required development of financial plan for transit improvements; increased eligibility and relocation payments due to construction projects; extended Highway Trust Funds to June 30, 1993.]

APPENDIX B - DETAILED DESCRIPTION OF METROPOLITAN AND STATE TRANSPORTATION STRATEGIES AND DATA COLLECTION REQUIREMENTS

In order to identify the specific transportation planning and data collection requirements from recent federal legislation, it was necessary to perform in-depth research into all the pertinent regulations, NPRMs, and guideline documents that were written regarding the legislation. A complete list of references that were consulted to prepare this report is shown in Appendix E.

A framework was developed in order to assess how the current set of transportation planning models addresses the new requirements. The framework consists of the following information:

- Dates of major planning requirements or documents;
- Description of the legislative requirements for these documents;
- Document required/document contents - this information describes the required document and its contents;
- Planning Requirements - this information contains the planning that is accomplished in the preparation of the required document; and
- Data Requirements - this information contains the data to be collected in the preparation of the required document to support the planning requirements.

Tables representing the framework for each required document are included in Appendix C. Following are detailed descriptions of the transportation planning and data collection requirements of current legislation and the implementing regulations.

B-1 Clean Air Act Amendments of 1990 (CAAA)

The CAAA of 1990 define different categories of NAA for different air pollutants, depending upon the severity by which the NAAQS are exceeded. The CAAA then sets up different schedules and requirements for the various NAA categories. The worse the air pollution, the longer a region has to comply with the NAAQS. Also, the worse the air pollution, the more stringent are the planning requirements and measures mandated for compliance. While there are NAAQS for many different air pollutants, the ones most relevant to transportation planning are those for ozone, and CO. Particulates (PM_{10}) are also relevant for a limited number of areas, but planning requirements and models for these are much less well defined. NO_2 is also a transportation-related pollutant, although California's South Coast is the only NO_2 NAA. Both ozone and PM_{10} have precursors (volatile organic compounds and nitrogen oxides) which must be considered for the purposes of SIP planning and conformity.

The following table shows the schedule for compliance for NAA for ozone, CO, and PM_{10}.

Pollutant	Severity	Design Value parts per million (ppm)	NAAQS Attainment Date
Ozone	Marginal	0.121 up to 0.138 over 1 hour	Nov 15, 1993
	Moderate	0.138 up to 0.160 over 1 hour	Nov 15, 1996
	Serious	0.160 up to 0.180 over 1 hour	Nov 15, 1999
	Severe (1)	0.180 up to 0.190 over 1 hour	Nov 15, 2005
	Severe (2)	0.190 up to 0.280 over 1 hour	Nov 15, 2007
	Extreme	0.280 and above over 1 hour	Nov 15, 2010
CO	Moderate (1)	9.1 to 12.7 over 8 hours	Dec 31, 1995
	Moderate (2)	12.7 through 16.4 over 8 hours	Dec 31, 1995
	Serious	16.5 and above over 8 hours	Dec 31, 2000
PM_{10}	Moderate	150 $\mu g/m^3$ over 24 hours or 50 $\mu g/m^3$ over a year	Dec 31, 1994
	Serious	If fail to reach attainment	10 years after reclassification

The CAAA of 1990 set forth major transportation planning requirements for the development of the SIPs and for Conformity determinations. The SIPs must show how NAA will meet the NAAQS by the attainment deadline, and adequate real progress in intermediate future years. Conformity determinations are required to show that the Transportation plans, Transportation Improvement Programs, and transportation projects are in line with the SIPs. Conformity requirements will be addressed in Section B-3.

The SIP revisions required by the CAAA include:

- Estimates of emissions for current years and forecasted years;
- Annual VMT forecasts and reports;
- Demonstration of attainment of the NAAQS;
- Milestone compliance and reasonable further progress (RFP);
- Special programs, including TCMs as needed to meet the NAAQS; and
- Contingency measures when milestones are not met.

The requirements listed above and the timing depend upon the type of pollutant and the particular category of the NAA. These items are discussed in more detail below.

B-1.1 Base Emissions Inventory, Periodic Inventories, and Projected Inventories

Base Emissions Inventories: All ozone NAA and CO NAA were required to submit by November 15, 1992, base emissions inventories of 1990 emissions from point, area, and mobile sources. The contribution of mobile sources to pollution in 1990 are determined by estimating VMT in 1990, and applying emissions factors from the EPA MOBILE model. MOBILE estimates emissions levels based upon the calendar year, ambient temperatures during the peak ozone or CO season, fleet mix and year, and several other factors. A more detailed discussion of VMT estimating is included in Section B-1.2 below, and will not be repeated here.

Transportation related inputs to the MOBILE model include[32]:

- VMT by 8 vehicle types;
- Annual mileage accumulation rate by 8 vehicle types;
- Vehicle registration distribution by vehicle type and 25 vehicle age categories;
- Trip length distributions;
- VMT by speed class (or by 12 roadway functional classes as a minimum -- six functional classes for rural and for urban areas);
- VMT by time of day (as characterized by average speeds for the time period) by functional class. Note that hourly VMT may be required for photochemical or other models;
- VMT by the above categories by grid square for photochemical modeling purposes; and
- Seasonal variation in VMT, vehicle mix, etc.

If data are not available on these factors, MOBILE contains national default values. However, for areas in Moderate and above NAA, EPA expects states to develop and use their own specific estimates of VMT by vehicle type and highway functional/volume classes.

Periodic Inventories: In addition to the base emission inventories, areas are required to submit updated inventories every 3 years until the area reaches attainment. The first periodic inventories, due in 1995, cover actual emissions for the 1993 time period. VMT estimates for these inventories would be computed in the same way as for the base inventory, except that

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[32] "Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources," U.S. EPA, EPA-450/4-81-026d (Revised), 1992, pp. 13-61, and Peter R. Stopher, "Deficiencies in Travel Forecasting Procedures Relative to the 1990 Clean Air Act Amendment Requirement," prepared for Conference Session on Implications of the 1990 Clean Air Act Amendments on Travel Demand Forecasting Techniques, 1992 TRB Annual Meeting, December 1991, p. 8.

the Highway Performance Monitoring System (HPMS) system must be used for 1993 and later VMT (see discussion under VMT below).

Adjusted Base Year Inventories and Target Level Inventories: For all ozone NAA which are classified as Moderate or higher, the November 15, 1992 SIP revision must contain adjusted base year emissions inventories and target emissions inventories for 1996. These inventories are computed for 1996, but are based on the 1990 VMT estimates and MOBILE emissions factors for 1996. The target inventories are set at 85 percent of the adjusted base inventories less various correction factors. The target inventories are important, because control strategies must then be developed so that actual emissions will meet the target levels. The target levels already account for tailpipe emissions improvements, so that mobile source emissions reductions must come from VMT reductions, trip reductions, or other means.

For all Serious or higher ozone NAA, the November 15, 1994 SIP revision should contain adjusted base year inventories and target level inventories for each three year period from 1996 until the attainment date. Target level inventories would then be due in 1999, 2002, 2005, and 2008. Again, the adjusted base year inventories are based upon 1990 VMT, but use the target year emissions factors from MOBILE. Target inventories are set at levels which are the previous milestone target less 9 percent of the adjusted base year inventories (3 percent reduction per year for 3 years) less a correction factor for fleet turnover. Working backwards from the target emissions inventories, the mobile portion of the inventory can be determined along with VMT targets for each milestone year.

The CAAA also calls for annual targets for emissions reductions for volatile organic compounds (VOCs) and NO_x. These must be submitted as part of the 1993 SIP revision for Moderate or higher ozone NAA.

B-1.2 VMT Estimates

Annual actual VMT estimates and forecasts are required for all CO NAA classified as Moderate, but with CO concentrations above 12.7 ppm. In addition, VMT estimates and forecasts are required to develop the emissions inventories both for ozone and CO as covered above. EPA has provided a guidance document for developing the VMT estimates.[33]

The first VMT forecast and report was due November 15, 1992 for CO NAA with the 1992 SIP revision. Estimates of actual VMT were to be produced for 1990, and forecasts of VMT were to be produced for 1993 and each year thereafter prior to the attainment year.

Estimates of Actual VMT: EPA specifies that estimates of actual VMT for the NAA will be based upon the FHWA HPMS. The 1992 SIP is supposed to contain a commitment by the state to sample each HPMS facility class/volume group for VMT tracking purposes as of June 1, 1993.

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[33] "Section 187 VMT Forecasting and Tracking Guidance," U.S. EPA, January 1992.

The HPMS requires taking traffic counts for a sample of roadways by facility type and volume group. Five urban highway facility types are used, and 13 different volume classes.[34] These counts consist of 24 or 48 hour counts on each sample segment. These are then adjusted to annual averages based on day-of-week and seasonal adjustment factors. System mileage is computed depending upon the sample segment length, the average daily traffic, and the expansion factor for the segment type.

Note that in developing VMT for the emissions inventories, a reverse process is required to provide VMT estimates for the peak ozone or CO seasons, and for weekday hourly periods. These estimates should use similar factors and assumptions as used to expand daily counts to yearly VMT estimates for the HPMS.

One difficulty is that the HPMS system is set up to monitor the Federal Aid Urbanized Area (FAUA), while VMT estimates for the SIP may include areas outside the FAUA. In addition, the SIP VMT estimates should include local roadways. Therefore, states need to develop similar methods to HPMS to measure VMT information for these areas. Serious CO areas need to obtain EPA approval for such "count-based" methods by June 30, 1994, and they must start using these methods by January 1, 1995.

Annual VMT Forecasts: In addition to the estimates of actual VMT, forecasts are required of annual VMT from 1993 up until the year of attainment. All Serious CO NAA should use a network based travel demand modeling process.[35] Moderate CO areas above 12.7 ppm are encouraged to use a travel demand modeling process, but also may base VMT forecasts on historical trends. All Serious or higher ozone NAA can use the guidance specified for Moderate CO NAA for forecasts to 1996. After 1996, the network based travel demand modeling process must be used.

The requirements for the network based models are as follows[36]:

- They should be validated against recent (1985 or later) ground counts for the region;
- Forecasts with these models should be based upon forecasts of demographics, land-use, and transportation system characteristics. Interpolation can be used to obtain values for future model target years, but these items should be forecast for at least 1 year within 5

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[34] "Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources," op. cit., p. 64.

[35] The travel demand modeling process refers to the traditional four-step process which has been developed over four decades. See Peter R. Stopher and Arnim H. Meyburg, ***Urban Transportation Modeling and Planning***, Lexington, MA: Lexington Books, D.C. Heath and Co., 1975.

[36] "Section 187 VMT Forecasting and Tracking Guidance," op. cit., pp. 20-21.

years of the model target year. Also, the latest forecast year should be no earlier than the latest model target year;

- The models should be in equilibrium on each link, so that no link is loaded beyond its reasonable capacity;
- The models should distinguish peak and off-peak travel times;
- The models should recycle travel times as inputs until a self-consistent trip assignment among zones is achieved; and
- The models should consider transit, where it is relevant.

Data requirements for the network based models are not discussed further in the VMT guidance. However, since output from the models may well become the subject of litigation, considerable effort should be expended to provide recent and accurate data for the models[37]. Also EPA has specified more modeling requirements as part of the conformity regulation to be discussed in Section B-3.

B-1.3 Demonstration of Attainment of NAAQS

The SIP revisions must demonstrate attainment of the NAAQS with a schedule which depends upon the NAA category. Demonstrating attainment requires photochemical grid modeling for ozone NAAs which are serious or worse, with inputs which include the projected emissions inventories as described above. An attainment demonstration with photochemical grid modeling also provides target emissions levels required for attainment and target VMT levels. NAA which are moderate are permitted to use the empirical model, city-specific Empirical Kinetic Modeling Approach (EKMA).

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[37] Although extensive direction has not been provided by EPA in this guidance, EPA may have many suggestions for planning models. For example, Harvey and Deakin describe the EPA interaction with the Metropolitan Transportation Commission (MTC) in conformity findings: "EPA Region IX has closely scrutinized the technical basis for MTC's (and others') conformity findings, but has shown a willingness to tolerate, for the near term, what are perceived as deficiencies in return for promises of future improvement in modeling runs. For example, the Southern California Association of Governments (SCAG) could not respond to most of EPA's analysis requests in the first interim conformity analyses, but did include: (1) feeding back speeds through the trip distribution and mode split steps until equilibrium was reached, (2) adding arterials to the network, and (3) carrying out limited analyses of the effects of employment and residence locations. SCAG also agreed that future conformity analyses will include: (1) incorporating the most recent O/D survey and census data and projections, (2) addressing the emission consequences of speeds above 55 M.P.H. in base and forecast years, (3) assessing pricing measures - particularly toll roads, (4) more comprehensive and consistent assessment of land use interactions, (5) feedback of speeds through the trip generation step, (6) improved TCM specification and quantification, and (7) analysis of PM_{10}." [From Greig Harvey and Elizabeth Deakin, "Toward Improved Regional Transportation Modeling Practice," (Revised), December 1991, p. 33.]

For CO NAA with values greater than 12.7 ppm, the 1992 SIP revision was required to contain a demonstration of attainment by December 31, 1995 for Moderate NAA and by December 31, 2000 for Serious NAA.

In the 1993 SIP revision, Moderate ozone NAA must demonstrate attainment with the NAAQS by 1996. There is also a 15 percent reduction in emissions required for Moderate areas by 1996, which is discussed below. The 15 percent reduction for Moderate areas is expected to be approximately what is required for attainment. If more reduction is required, Moderate areas are still required to meet the NAAQS. Serious or higher ozone NAA must demonstrate attainment of the NAAQS in their 1994 SIP revision.

Photochemical grid modeling requires input on emissions for each grid represented in the model. These grids are typically 2km or 5km square. This implies the need for VMT forecasts in the detailed VMT categories required for the MOBILE model for each grid square represented in the dispersion model.

An attainment demonstration by December 31, 1994 for PM_{10} NAA was due with the 1991 SIP revision. This demonstration was to include air quality modeling, but a revised model was not available as of July 1992.

B-1.4 Milestone Compliance and Reasonable Further Progress (RFP)

The CAAA set forth a series of intermediate milestones to be met by NAA, with a schedule depending upon the pollutant and the non-attainment category. In the case of ozone NAA, the milestones are specific emission reduction targets. In the case of CO NAA, the milestones are VMT targets.

All Moderate and higher ozone NAA must demonstrate in the 1993 SIP revision a 15 percent reduction in emissions by 1996. The target levels are set by the target emissions inventories submitted with the 1992 SIP revision as discussed above. This reduction is in addition to any emissions reductions already mandated at the time of the CAAA with improved mobile source emissions reduction technology. Therefore, this demonstration requires other reductions and transportation control measures, which can become quite stringent where VMT is growing.

In addition to the 1996 15 percent reduction, Serious or higher ozone NAA must submit with the 1994 SIP revision a "rate of progress demonstration." This is a demonstration of a 3 percent reduction in emissions on the average per year over each 3 year period until attainment. The milestone years are set every three years from 1996 to the attainment date. Target emissions inventories are set as described above. Special measures must be included to bring mobile vehicle emissions into line with the emissions inventory targets.

All CO NAA with values greater than 12.7 ppm were required to submit with the 1992 SIP revision plans which contain forecasts of VMT for each year before the year in which attainment is projected. These forecasts of VMT then serve as yearly VMT milestones.

For PM_{10} NAA, the 1991 SIP revision was supposed to contain quantitative milestones for emissions reductions which must be achieved every 3 years. If the demonstration of attainment by 1994 is impracticable, the plan must provide for expeditious alternatives.

In addition to the specific milestone requirements for different pollutants, the CAAA specify a general requirement for "reasonable further progress" (RFP). Section 171 of the Clean Air Act defines RFP as such annual incremental reductions in emissions of the relevant air pollutant as are required by this part or may reasonably be required by the Administrator for the purpose of ensuring attainment of the applicable NAAQS. Section 172 of the Clean Air Act then states that SIP provisions shall require RFP. However, rather than make additional requirements for NAA for RFP, EPA has decided to rely on existing requirements such as the periodic inventories and other reports and certifications[38]

B-1.5 Transportation Control Measures (TCMs) as Needed to Meet the Milestones and NAAQS

The SIP revisions must contain TCMs as required to allow the NAA to meet the milestones and NAAQS. The schedule and types of requirements depend upon the category of the NAA. The worse the NAA, the earlier the requirements for TCMs.

For PM_{10} NAA, transportation planning activities should include measures to reduce PM_{10} in order to facilitate attainment of the NAAQS.

Data requirements for PM_{10} analysis include:

- Data on dust from paved and unpaved surfaces;
- Data on motor vehicle exhaust from highway and off-highway sources;
- Diesel vehicle exhaust and bus terminals; and
- Re-entrained materials from traveled surfaces primarily paved and unpaved roads and open areas like parking lots.

Severe or higher ozone NAA must include in their 1992 SIP revisions, TCMs to offset growth in emissions from growth in VMT [Clean Air Act Section 182(d)(1)(A)]. Such areas should choose and implement such measures as are specified in section 108(f) to the extent needed to demonstrate attainment. In addition, these areas are required to submit a program for employer trip reduction to reduce work trip VMT.

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[38] "State Implementation Plans; General Preamble for the Implementation of Title I of the CAAA of 1990; Proposed Rule," 57 FR 13512 (April 16, 1992).

Serious CO NAA must also include TCMs for the purpose of reducing CO emissions. These areas must explain why any 108(f) measure was not adopted. The 108(f) measures are listed below[39]:

1. Programs for improved public transit;

2. Restriction of certain roads or lanes to, or construction of such roads;

3. Employer-based transportation management plans, including incentives;

4. Trip-reduction ordinances;

5. Traffic flow improvement programs that achieve emission reductions;

6. Fringe and transportation corridor parking facilities serving multiple occupancy vehicle programs or transit service;

7. Programs to limit or restrict vehicle use in downtown areas or other areas of emission concentration particularly during periods of peak use;

8. Programs for the provision of all forms of high-occupancy, shared-ride services;

9. Programs to limit portions of road surfaces or certain sections of the metropolitan area to the use of non-motorized vehicles or pedestrian use, both as to time and place;

10. Programs for secure bicycle storage facilities and other facilities, including bicycle lanes, for the convenience and protection of bicyclists, in both public and private areas;

11. Programs to control extended idling of vehicles;

12. Programs to reduce motor vehicle emissions, consistent with Title II, which are caused by extreme cold start conditions;

13. Employer-sponsored programs to permit flexible work schedules;

14. Programs and ordinances to facilitate non-automobile travel, provision and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts of a locality, including programs and ordinances applicable to new shopping centers, special events, and other centers of vehicle activity;

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[39] Clean Air Act Amendments of 1990, Section 108(b), November 15, 1990.

15. Programs for new construction and major reconstructions of paths, tracks or areas solely for the use by pedestrian or other non-motorized means of transportation when economically feasible and in the public interest, and

16. Programs to encourage the voluntary removal from use and the marketplace of pre-1980 model year light duty vehicles and pre-1980 model light duty trucks.

The 1993 SIP revision must contain TCMs and other measures as necessary for Moderate or higher ozone NAA to achieve the 15 percent emissions reduction required by 1996.

The 1994 SIP revision must contain TCMs as required for Serious or higher areas to achieve the 3 percent reduction in emissions per year for each year following 1996 until attainment. This SIP must contain annual projections of TCM implementation and emissions reductions. Severe or higher ozone areas must submit their employer compliance programs for employers of over 100 employees. Extreme ozone areas may submit TCM's applicable during periods of heavy traffic that reduce the use of high polluting or heavy-duty vehicles.

The 1996 SIP revision and each revision in 3 year intervals following must contain a demonstration that "current aggregate vehicle mileage, aggregate vehicle emissions, congestion levels, and other relevant parameters are consistent with those used for the area's demonstration of attainment."[40] If not, the state has 18 months to submit a SIP revision which must include 108(f) measures to bring projected emission levels into attainment.

These SIP requirements have implications for transportation planning. VMT projections must be undertaken as previously described. Then TCM's need to be analyzed for their potential for reducing VMT and emissions. The SIP revisions must provide evidence of adequate financial and human resources for each TCM, and must describe the process of implementation, enforcement, monitoring and maintenance, where applicable[41]. Where state regulations or laws are required for TCM implementation, these should be submitted as part of the SIP.

A difficulty for transportation planning is that the standard transportation demand modeling process is not sensitive to many of the TCMs. Without improvements to the transportation modeling process, many TCMs must be analyzed "off-line". For example, MPOs might estimate the effect of a program to create bicycle lanes by assuming similar vehicle trip reductions to those experienced in other regions. The trip reductions could then be factored

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[40] "State Implementation Plans; General Preamble for the Implementation of Title I of the CAAA of 1990; Proposed Rule," 57 FR 13520 (April 16, 1993).

[41] Cambridge Systematics, Inc., ***Transportation Control Measure Information Documents***, op. cit.

into the transportation modeling process. Current EPA guidance provides excellent examples of TCM programs which could be used for such an "off-line" approach.[42]

Although not spelled out in the TCM guidance, the data needs for TCM analysis are extensive. The following table lists TCM data requirements as developed by Fleet, et.al. These data need to be developed for each location of interest, for example central city, suburbs, grid square, highway, intersection, transit route, or whatever is appropriate for the analysis.

System Data	Demand Data	Time or Cost Data
Highway System: Lane miles Lane miles of HOV Capacity Functional Class Portion of system congested Nature & location of const. Location/duration of incidents Incident management system Transit System: Vehicle hours Vehicle miles Routes Riders Garages Park & ride lots Transfer stations Other: Truck freight facilities Employment sites by size	No. vehicles using HOV lanes No. of persons using HOV lanes Duration of peak period VMT distribution by trip length % VMT by operating mode % VMT by vehicle class Number of trips: starts & parks Park duration VMT by hour Number of vehicles by class Age distribution of vehicle fleet Trips by vehicle class Increase in trips of one purpose as a result of a TCM Amount of vehicle idling time Bus ridership Rail ridership Trips: VMT, DVMT PMT ADT Congested or Delayed: Percent of travel Percent of travellers Percent of vehicles	Person hours of delay Vehicle hours of delay Average Speed Peak period speed Average travel time: Peak and off peak % of travel congested/ delayed Parking cost Running speeds by hour of day, area type and facility type Travel time Travel time by trip purpose Trip length by trip purpose Trip cost by trip purpose

[42] Cambridge Systematics, Inc., ***Transportation Control Measure Information Documents***, op. cit.

B-1.6 Contingency Measures When Milestones Are Not Met

The CAAA have many requirements for contingency measures should milestones not be achieved in the case of ozone NAA, or VMT targets not be achieved for CO NAA. These measures are supposed to be planned in advance, and submitted in implementable form in the SIP revisions. These measures are in addition to those required to show compliance with the milestones.

Contingency measures for ozone NAA are due with the 1992 or the 1993 SIP revision. Moderate or above areas should submit contingency plans which will provide additional emissions reductions of up to 3 percent of the adjusted base year inventory.[43] In addition, the CAAA amendments suggest that Serious or Severe areas may adopt economic incentive programs in the 1993 or 1994 SIP revisions where needed to meet the 15 percent emissions reduction target in 1996.

When Serious or Severe areas fail to meet milestones, they have the option of implementing economic incentive programs. Extreme ozone NAA with milestone failures, or which fail to submit demonstrations are required to submit plan revisions with economic incentive programs within 9 months of the failures.

CO NAA must provide contingency measures when actual VMT exceeds forecasted VMT, or when updated forecasts of VMT exceed prior forecasts. For CO areas with design values above 12.7 ppm, these contingency measures are due with the 1992 SIP revision. Measures needed for other Moderate CO areas to insure that the NAAQS are achieved are due by November 15, 1993. Contingency measures must be adopted and enforceable. These measures should be designed to counteract the effect of 1 year's growth in VMT.[44]

The transportation planning implications of these contingency measures are the same as those for the TCMs described above.

B-2 Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA)

B-2.1 Metropolitan Planning

The final rule for Metropolitan Planning was issued on October 28, 1993 and combined with Statewide Planning. The rule defines the metropolitan transportation plan as the "official intermodal transportation plan that is developed and adopted through the metropolitan transportation planning process for the metropolitan planning area"[45]. All MPOs serving an

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[43] "State Implementation Plans; General Preamble for the Implementation of Title I of the CAAA of 1990; Proposed Rule," 57 FR 13511 (April 16, 1992).

[44] Ibid, p. 13532.

[45] "Statewide Planning; Metropolitan Planning; Rule" 58 FR 58065 (October 28, 1993).

urbanized area of at least 50,000 are required to submit a metropolitan transportation plan and a TIP that satisfy both FHWA (23 CFR Part 450) and FTA (49 CAR Part 613) requirements. Further, these plans and TIPs must conform to SIPs per EPA regulations (40 CAR Part 51)[46].

Before describing the actual planning and data requirements for the metropolitan plan, it is important to understand the content of the plan. The plan must have a 20-year horizon. Also, it must "include both long- and short-range strategies/actions that lead to the development of an integrated intermodal metropolitan transportation system that facilitates the efficient movement of people and goods."[47]

There are several considerations that must be included in the plan:

- The identification of transportation demand of persons and goods;
- The identification of adopted congestion management strategies that demonstrate a systematic approach in addressing current and future transportation demand. These strategies may include:
  - Traffic operations
  - Freight movement options
  - High occupancy vehicle (HOV) treatments
  - Public transportation improvements;
  - Ridesharing
  - Pedestrian and bicycle facilities
  - Alternative work schedules
  - Telecommuting
- The identification of pedestrian walkway and bicycle transportation facilities;
- The reflection of the results of the management systems, particularly the congestion management system (CMS);
- The assessment of capital investment and other measures to preserve and most efficiently use the existing transportation system;
- The description of existing and proposed transportation facilities in NAA to permit conformity determinations;
- The multimodal evaluation of the transportation, socioeconomic, environmental, and financial impact of the overall plan;

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[46] "Air Quality: Transportation Plans, Programs, and Projects; Federal or State Implementation Plan Conformity; Rule", 58 FR 62188-62253 (November 24, 1993).

[47] "Statewide Planning; Metropolitan Planning; Rule," 58 FR 58075 (October 28, 1993).

- The reflection of the area's comprehensive long-range land use plan, metropolitan development objectives; and other local, state, or national goals including housing, employment, environmental, and energy goals and objectives.

- The identification of proposed transportation enhancements;

- The presentation of a financial plan that demonstrates the consistency of proposed transportation investments with known and project sources of revenue;

The planning requirements set forth in the Rule in order to prepare a plan with the aforementioned considerations are not specific in terms of the model(s) that should be used, or the data required. However, the elements of the planning process are discussed and can be summarized as follows:

- The consideration of the following 15 factors:

  - Preservation of existing transportation facilities.

  - The consistency of transportation planning with applicable Federal, State, and local energy conservation programs, goals, and objectives.

  - The need to relieve congestion and prevent congestion from occurring where it does not yet occur. This includes a CMS in TMAs.

  - The effect of transportation policy decisions and consistency with land use and development plans.

  - The programming of expenditure on transportation enhancement activities as required in 23 USC 133.

  - The effects of all transportation projects to be undertaken within the metropolitan area.

  - International border crossings and access to ports, airports, intermodal transportation facilities, etc.

  - The need for connectivity of roads within the metropolitan area with roads outside the metropolitan area.

  - The transportation needs identified through use of the management systems required by 23 USC 303.

  - Preservation of rights-of-way.

  - Methods to enhance the efficient movement of freight.

- Life-cycle cost in the design and engineering of bridges, tunnels, or pavement.

- Overall social, economic, energy, and environmental. effects of transportation. decisions.

- Methods to expand and enhance transit services and to increase the use of such services.

- Capital investments that would result in increased security in transit systems;

- Early and continuing public involvement;
- Consistency with Title VI of the Civil Rights Act;
- The identification of actions necessary to comply with the Americans with Disabilities Act;
- Involvement by related and interested agencies and authorities; and
- Involvement of local, state, and federal environment resource and permit agencies.

The majority of the data required to support the planning requirements for development of the transportation plan will eventually come from the management systems that are required to be implemented by fiscal year 1995. Out of the six systems required, three have a direct relationship to the planning process: CMS, Public Transportation Facilities and Equipment Management System (PTMS), and Intermodal Facilities and Systems Management System (IMS). These will be discussed in more detail in Section B-2.3.

The development of the metropolitan TIP has a different focus than the plan. "The TIP must serve as the mechanism that focuses and prioritizes the projects, establishes the relationship among projects and notifies the public of project status for the metropolitan area."[48] The TIP is developed by the MPO in cooperation with the state and public transit operators. There must be reasonable opportunity for public comment on the TIP.

The TIP covers a three-year period (at a minimum), and must be updated every two years. It contains the following:

- All transportation projects within the metropolitan planning area proposed for funding under title 23 and the Federal Transit Act;

- Only projects that are consistent with the transportation plan;

- All regionally significant transportation[49] projects for which FHWA or FTA approval is

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[48] "Statewide Planning; Metropolitan Planning; Rule," 58 FR 58061 (October 28, 1993).

[49] Regionally significant, in the case of transportation facilities, means any facility with an arterial or higher functional classification, plus any other facility that serves regional travel needs (such as access to and from the area outside of the region, to major activity centers in the region, or to transportation

required whether or not the projects are to be funded with title 23 or Federal Transit Act funds; and

- For informational purposes and air quality analysis in NAA and maintenance areas, all regionally significant projects to be funded with non-Federal funds.

For each project consistent with the aforementioned requirements, the following data must be included in the TIP:

- Sufficient descriptive material to identify the project or project phase (in NAA and maintenance areas, enough detail must be included to allow air quality analysis in accordance with conformity requirements);
- Estimated total cost;
- The amount of Federal funds proposed to be obligated during each program year;
- Proposed source of Federal and non-Federal funds;
- Identification of the recipient/subrecipient and State and local agencies responsible for carrying out the project; and
- In NAA and maintenance areas, identification of those projects which are TCMs.
- Identification of projects to implement ADA required paratransit and key station plans.

As with the Metropolitan Plan, the planning requirements for the TIP are not explicitly stated. However, the process which is required to produce the TIP is specified as having the following steps:

- Identify the criteria and process for prioritizing the implementation of transportation plan elements within the TIP;
- Identify any changes in priorities from previous TIPs;
- Identify those projects from a previous TIP that were implemented;
- Identify those projects which experienced a significant delay in planned implementation;
- In NAA and maintenance areas, describe the progress in implementing any required TCMs, including the reasons for any significant delays in the planned implementation; and

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terminals) and would normally be included in the modeling for the transportation network.

- In NAA and maintenance areas, list projects from a previous TIP that were found to conform, and are now part of the base case for the purpose of conformity analysis.

B-2.2 Statewide Transportation Planning

As mentioned previously, the requirements for statewide transportation planning are new with the ISTEA. The Rule defines a five step process as follows:

1. Data collection and analysis.

2. Consideration of the following factors:

   - Results of the management systems required by 23 USC 303

   - Federal, State or local energy use goals, objectives, programs, or requirements

   - Strategies to incorporate bicycle transportation facilities and pedestrian walkways

   - International border crossings and access to ports, airports, intermodal transportation facilities, etc.

   - Transportation needs of areas outside of metropolitan planning areas

   - Any metropolitan area plan

   - Connectivity between metropolitan planning areas within the State and within metropolitan planning areas in other States

   - Recreational travel and tourism

   - Any State plan developed pursuant to the Federal Water Pollution Control Act

   - TSM and investment strategies to make most efficient use of existing transportation facilities

   - Overall social, economic, energy, and environmental effects of transportation decisions

   - Methods to reduce congestion and prevent congestion from occurring where it does not yet occur

   - Methods to expand and enhance transit services

   - Effect of transportation decisions on land use and land development

- Strategies for identifying and implementing transportation enhancements where appropriate throughout the state

- Use of innovative financing mechanisms

- Preservation of rights-of-way

- Long-range needs of the State transportation system for movement of persons and goods

- Methods to enhance the efficient movement of commercial motor vehicles

- Life-cycle costing in the design and engineering of bridges, tunnels, or pavements

- Coordination of metropolitan transportation plans and programs

- Investment strategies to improve adjoining State and local roads

- Concerns of Indian tribal governments

3. Coordination of all planning activities relating to the development of the state transportation plan. The regulation specifies 13 areas for coordination

4. The development of a State transportation plan.

5. The development of a State transportation improvement program (STIP).

The statewide transportation plan is due on January 1, 1995. The plan will be developed cooperatively with the MPOs (consistent with the metropolitan plans) and with Indian tribal government and the Secretary of the Interior, if there is such an area in the State. The following requirements are presented in the regulation as to the contents of the plan:

- The plan must be intermodal and statewide in scope;

- The plan must cover a period of at least 20 years;

- The plan will contain a plan for bicycle transportation and pedestrian walkways in appropriate areas which are interconnected with other modes;

- The plan shall be coordinated with the metropolitan transportation plan.

- The plan will contain short-range planning studies, strategic planning and/or policy studies; and

- The plan will contain information on the availability of financial and other resources needed to carry out the plan.

Furthermore, the regulations specify that there shall be a proactive public involvement process in the development of the plan and STIP.

The data required to support the planning process includes:

- Data from traffic data analysis including data from HPMS and the Traffic Monitoring System (TMS).
- Data resulting from the management systems identifying statewide transportation needs. These data are described in the section on the management systems, and include data on physical facilities and system performance.
- Data on bicycle and pedestrian tripmaking
- Data on recreational travel and tourism
- Data on the social, economic, energy, and environmental effects of transportation decisions
- Land use projection data including economic, demographic, environmental, growth management, and land use activities
- Financial data for plans and programs
- Data on existing and potential rights-of-ways for future transportation
- Data on commercial motor vehicle efficiency

In addition to the statewide transportation plan, each state must develop a statewide transportation improvement program (STIP). Requirements for the STIP are very similar to those for the TIP. The contents of the STIP are specified as follows:

- A priority list of transportation projects to be carried out in the first three years of the STIP must be included. Metropolitan planning area TIPs must be included without modification after being approved by the MPO and the Governor, and being found to conform by FHWA and FTA.
- The STIP must contain only projects consistent with the statewide plan.
- In NAA and maintenance areas, the STIP will contain only those transportation projects found to conform, or from programs that conform, to the conformity regulations.

- The STIP must be financially constrained and must include information to demonstrate that funds can reasonably be expected to be available to implement the projects.

- The STIP must contain all capital and non-capital transportation projects.

- The STIP must contain all regionally significant transportation projects, even if not funded by FHWA or FTA.

For each project within a STIP, the following data are required:

- Sufficient descriptive material to identify the project or phase;
- Estimated total cost;
- The amount of Federal funds proposed to be obligated during each program year;
- Proposed category of Federal funds and source(s) of non-Federal funds; and
- Identification of the agencies responsible for carrying out the project.

B-2.3 Management and Monitoring Systems[50]

Section 1034 of the ISTEA amended title 23 USC, Highways by adding new section 303, Management Systems which requires the issuance of regulations for State development, establishment, and implementation of a system for managing each of the following:

- Highway pavement of Federal-aid highways;
- Bridges on and off Federal -aid highways;
- Highway safety;
- CMS;
- PTMS; and
- IMS.

The systems must be developed and implemented in cooperation with MPOs in metropolitan areas, with local officials in non-metropolitan areas, with affected agencies receiving assistance under the Federal Transit Act, and other agencies with responsibility for the operation of affected transportation systems or facilities. States must be implementing each management system beginning in Federal fiscal year 1995. The FHWA and FTA agree that the metropolitan and statewide transportation planning processes are the appropriate forums for coordinating the outputs of the management systems, as well as other transportation needs, particularly since the legislation specifically requires the outputs of the systems to be considered in these planning processes. In addition, it is proposed that, as appropriate, the CMS, PTMS, and IMS be part of the transportation planning processes in all metropolitan planning areas. The CMS shall be part of the metropolitan planning process in Transportation Management Areas (TMAs).

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[50] "Management and Monitoring Systems; Interim Final Rule," 58 FR 63442-63485 (December 1, 1993).

Each of the management systems will require data to define and monitor the magnitude of the problems, identify needs, analyze alternative solutions, and measure the effectiveness of the implemented actions. Some data needs, such as traffic volumes or travel demand, may be common to all systems while other data will be unique to the particular system. The Interim Final Rule (IFR) indicates the traffic monitoring system required by the legislation, the FHWA's HPMS, and the data required by section 15 of the Federal Transit Act will be used by the FHWA and FTA to the extent possible to meet their needs.

B-2.3.1 Pavement Management System (PMS)

Each State's PMS for the National Highway System (NHS) should be based on AASHTO's ***Guidelines for Pavement Management Systems***. The analyses to be performed in the PMS include:

- Condition analysis (includes ride, distress, rutting and surface friction);
- Performance analysis (includes pavement performance analysis and an estimate of the remaining service life);
- Investment analysis (includes an estimate of total costs for present and projected conditions at the network-level and the development of project-level investment strategies with prioritized projects and preservation strategies using life-cycle costs);
- Engineering analysis (includes the evaluation of design, construction, rehabilitation, materials, mix designs, and preventative maintenance as they relate to the performance of pavements); and
- Update (includes the annual evaluation and updating as necessary of the PMS based on the agency's current policies, engineering criteria, practices, and experience).

Data required by the PMS are:

- Inventory - the physical pavement features, including the number of lanes, length, width, surface, type, functional classification, and shoulder information;
- History - The project dates and types of construction, reconstruction, rehabilitation, and preventative maintenance;
- Condition survey - the ride, distress, rutting, and surface friction;
- Traffic volumes, vehicle classification, and load data; and
- Database - the linking of all data files used in the PMS. The database will also be the source for reporting pavement related information to FHWA for the HPMS.

B-2.3.2 Bridge Management System (BMS)

The BMS is considered to be a decision support system that performs analysis using mathematical models to predict deterioration and to recommend alternative actions. The BMS must be capable of performing network level analysis and optimization, and will include the following procedures to:

- Predict the deterioration of bridge elements with and without intervening actions;
- Identify feasible actions to improve bridge condition, safety, and serviceability;
- Estimate the cost of actions;
- Estimate expected user cost savings for safety and serviceability improvements;
- Determine least-cost maintenance, repair, and rehabilitation strategies for bridge elements using life cycle cost analysis or a comparable procedure;
- Perform multiperiod optimization;
- Use feedback from actions taken to update prediction and cost models; and
- Generate summaries and reports as needed for the planning and programming processes.

The BMS must contain a database and an ongoing program to collect the data needed to support the BMS. Data required to support this analysis are:

- Bridge inventory data
- Bridge inspection data
- Cost data
- Supplemental data to support the analysis requirements of BMS (for example user costs including travel time, motor vehicle operating, and accident costs measured on site or estimated using models).

B-2.3.3 Highway Safety Management System (SMS)

The primary purpose of the SMS is to reduce the number and severity of traffic crashes by ensuring that all opportunities to improve highway safety are identified, implemented as appropriate, and evaluated.

The five major planning areas to be addressed in the SMS are:

- Coordination and integration of broad base safety programs such as motor carrier, corridor, and community-based traffic safety activities into a comprehensive management approach for highway safety;

- Identification and investigation of hazardous and potentially hazardous highway safety problems, roadway locations and features, including railroad-highway grade crossings, and the establishment of countermeasures and setting priorities to correct the identified hazards or potential hazards;

- Insurance that safety in all highway transportation programs and projects is considered early;

- Identification of safety needs of special user groups such as older drivers, pedestrians, bicyclists, motorcyclists, commercial motor carriers, and hazardous material carriers, in the planning, design, construction and operation of highway systems; and

- Routine maintenance and upgrade of safety hardware, highway elements and operational features.

The following issues must be addressed as appropriate for the five major areas in the SMS:

- The establishment of long and short term highway safety goals;

- Identification and definition of the safety responsibilities;

- Identification of disciplines involved in highway safety at the State and local level;

- Assessment of multi-agency responsibilities and accountability;

- Establishment of coordination, cooperation, and communication mechanism;

- Data collection, maintenance and dissemination for identifying problems and determining improvement needs;

- Analysis of available data and operational investigations, and comparisons of existing conditions and current standards to assess highway safety needs, select countermeasures, and set priorities;

- Evaluation of the effectiveness of activities that relate to highway safety performance;

- Development and implementation of public information and educational activities;

- Identification of skills and resources needed to implement the State's highway safety activities and programs;

- Identification of current and future training needs; and

- Development of methods for monitoring and disseminating new technology and incorporating effective results.

The data required by the SMS includes information pertaining to:

- Crashes
- Traffic (including number of trains at highway-rail crossings)
- Pedestrians
- Enforcement
- Vehicles
- Bicyclists
- Drivers
- Highways
- Medical services

B-2.3.4 Traffic Congestion Management System (CMS)

Perhaps most closely related to the metropolitan and statewide transportation planning processes, the CMS identifies and assesses transportation system congestion. The CMS will identify and monitor areas within the State (metropolitan and rural) where congestion is occurring or where there is potential for congestion, and will determine the level of congestion. The perception of congestion is based on performance measures established cooperatively by the state and affected MPOs, local agencies and operators of major modes of transportation. The CMS will be capable of assessing the effects of physical improvements and/or areawide transportation policy decisions on system performance. It will also be capable of providing an appropriate analysis of all reasonable travel demand reduction and operational management strategies for corridors where projects will significantly increase capacity for SOVs.

The planning requirements for the CMS involve:

- Identification and evaluation of strategies to improve transportation system performance. (There is an emphasis on strategies that reduce single-occupant vehicle travel.) These strategies would include, but not be limited to:

  - TDM measures, including carpooling, vanpooling, alternative work hours, telecommuting, and parking management

  - Traffic operations improvements, including intersection and roadway widening, channelization, traffic surveillance and control systems, motorist information systems, ramp metering, traffic control centers, and computerized signal systems

  - Measures to encourage HOV use, including public transit improvements, HOV lanes, HOV ramp bypass lanes, guaranteed ride home programs, and employer trip reduction ordinances

  - Public transit capital improvements, such as, exclusive rights-of-way, bus bypass ramps, park and ride, and mode change facilities, and paratransit services.

- Public transit operational improvements, such as, service enhancements or expansion, traffic signal preemption, fare reduction, and transit information systems

- Measures to encourage modes such as facilities for bicycles, pedestrians, and ferry service

- Congestion pricing

- Growth management and activity center strategies

- Access management techniques

- Incident management

- Application of IVHS technologies and advanced public transportation system technologies

- The addition of general purpose lanes

- For strategy implementation, identification of the schedule, responsibilities, and probable funding sources; and

- Evaluation of the effectiveness of implemented strategies.

The data requirements for the CMS, although not specific, focus on the continuous data collection and monitoring in order to determine the duration and magnitude of congestion. The actual data to be collected will be based on the performance measures that are selected to assess the congestion and estimate the change in congestion when proposed strategies are implemented. The table on page 53 showing data needs for TCMs can also be used to describe the data needed for the CMS.

B-2.3.5 Public Transportation Facilities and Equipment Management System (PTMS)

The PTMS is a systematic process for collecting and analyzing information on the condition and cost of transportation facilities, equipment and rolling stock (referred to hereafter as transit assets). PTMS will be capable of identifying and evaluating strategies that impact current and future deficiencies.

The planning requirements of the PTMS include:

- The identification and evaluation of proposed strategies and projects based upon the PTMS data collection and monitoring activities. This effort should produce schedules for major maintenance or replacement, and estimated replacement costs.

- The identification of costs, funding sources, and priorities of proposed strategies and projects.

The data requirements for the PTMS are:

- Base-year comprehensive inventory of transit assets, including age, condition, remaining useful life, and replacement cost;

- Number of vehicles and ridership data for dedicated transit rights-of-way at maximum load points in the peak direction and for the daily time period;

B-2.3.6 Intermodal Facilities and Systems Management System (IMS)

The IMS is a systematic process for identifying intermodal facilities, defining strategies to improve performance, and the evaluation and implementation of these strategies. Volume and patterns of goods and people carried by intermodal transportation will be collected and monitored.

The planning requirements of the IMS include:

- The identification of intermodal facilities

- The identification of performance measures to measure the efficiency of the facilities and systems in moving people and goods. Measures could include travel time, cost, volumes, origins and destinations, capacity, accidents, accessibility, perceived quantity, and transfer time.

- Data collection and system monitoring

The data collection and monitoring in the IMS will include:

- A base year inventory of physical and operating characteristics of intermodal facilities (operational characteristics include time, cost, capacity, and usage).

- Survey of operational and physical characteristics of such facilities based upon performance measures established at the state and local level.

B-2.3.7 Traffic Monitoring System (TMS)

Even though it is not one of the six management systems, the TMS is specified in the regulation to support the data required by the six management systems. The data from the

TMS will be consistent with the Highway Performance Monitoring System (HPMS)[51], and based on the American Association of State Highway and Transportation Officials (AASHTO) ***Guidelines for Traffic Data Programs***[52] and FHWA's ***Traffic Monitoring Guide***[53]. These two guides suggest that the data to be included in the TMS will result from continuous traffic counts, short-term traffic monitoring, and vehicle occupancy monitoring. Typical data elements regarding traffic volume include, but are not limited to:

- Annual average daily traffic
- Design hourly volume
- Peak hour traffic percentage
- Directional split
- Peak period volume
- Diurnal distribution
- Turning movements
- Vehicle miles of travel

The TMS must address the following elements:

- Data precision to meet the needs of the data users;
- Continuous counting operations to collect traffic volumes, vehicle classification, and vehicle weight;
- Short-term traffic monitoring:
  - Count data on traffic volumes, vehicle classification and vehicle weight must be adjusted to reflect annual average conditions; and
  - Vehicle classification activities on the National Highway System (NHS) shall ensure that no greater than every three years, every major system segment will be monitored to provide information on the numbers of trucks, buses, and total number of vehicles operating on an average day.
- Vehicle occupancy monitoring, with data updated at a minimum of three years;
- Field operations must include:
  - Testing of data collection equipment
  - Documentation of field operations

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[51] FHWA, ***Highway Performance Monitoring System Field Manual***, Office of Highway Information Management, December 1987 updated through April 20, 1990, FHWA Order M5600.1A, OMB No. 2125-0028, p. 1-2.

[52] ***AASHTO Guidelines for Traffic Data Programs***, 1992, ISBN 1-56051-054-4.

[53] FHWA, ***Traffic Monitoring Guide***, Office of Highway Information Management, October 1992, FHWA-PL-92-017.

- Source data retention, including the following data for each data collection session:

  - Each value or values as collected during the session;
  - Date on which each count was made;
  - Hours during which the count took place;

- Office factoring procedures, including:

  - Functional class-specific factors used to adjust data from short term monitoring sessions to estimates of average daily conditions shall be used to adjust for month, day of week, axle correction, and growth, and such factors shall be reviewed annually and updated at least every 3 years;

  - Document editing and adjusting procedures used by a State.

B-3 Conformity of Transportation Plans and Programs to Air Quality Implementation Plans

The Clean Air Act [(Section 176(c)(4)(c)] requires each State to submit an implementation plan revision which includes criteria and procedures for assessing conformity. "Conformity to an implementation plan is defined in the Clean Air Act as conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards and achieving expeditious attainment of such standards".[54]

Conformity is defined in Parts 51 and 93 of the CAR. Part 51 sets the conformity related requirements for the revision of the SIP. This revision is due by November 25, 1994. Part 93 is very similar and provides the conformity requirements for Federal agencies effective as of December 27, 1993. Conformity of existing transportation plans must be re-determined within 18 months of the final rule or by May 25, 1994 if not sooner.

The on-going schedule for conformity determinations is at least every three years. However, conformity determinations are triggered by other events: when changes to transportation plans, and/or TIPs are made; and when revisions to an implementation plan are submitted (e.g., changes to a transportation-related emissions budget, or changes to TCMs). In the first case, changes to transportation plans will require not only a new conformity determination, but also a new conformity determination for the TIP. EPA is requiring that within six months of a transportation plan amendment, the TIP be revised and a conformity determination made. In the second case, EPA is requiring that a new conformity determination on the transportation plan be made in 18 months after changes to an implementation plan. In addition, FHWA and FTA projects must also be found to conform before being approved or funded.

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[54] "Air Quality Transportation Plans, Programs, and Projects; Federal or State Implementation Plan Conformity; Rule," FR 58 62188 (November 24, 1993).

The final rule requires consultation in the development of transportation plans and programs and of SIPs. Consultation is required among transportation and air quality agencies. In addition, a proactive public process is required. The following organizations are to consult with each other during the plan development process:

- MPOs;
- State and local air quality planning agencies;
- State and local transportation agencies;
- Other organizations with responsibilities for developing, submitting, or implementing provision of an implementation plan required by the Clean Air Act;
- Local or regional offices of the EPA;
- Local or regional offices of the FHWA; and
- Local or regional offices of the FTA.

The consultation procedures are to cover many transportation planning processes, and specifically must include the process for evaluating and choosing a model and methods to be used for hot spot and regional emissions analysis. In addition, the procedures are to include a process for consulting on the design, schedule, and funding of research and data collection efforts and transportation model development by the MPO.

The final rule sets forth requirements for the content of the transportation plan. Transportation plans adopted after January 1, 1995 in serious, severe, or extreme ozone NAA and in serious CO NAA must describe the transportation system envisioned for future years called horizon years. For the horizon years, the plan must:

- quantify and document the demographic and employment factors, including land use forecasts influencing expected transportation demand.
- describe the regionally significant additions to the highway and transit network in sufficient detail to allow modeling of transit ridership and travel times under various volumes. Also, be specific enough to show a relationship between land use and the transportation system.
- describe future transportation policies, requirements, services, and activities, including intermodal activities.

The final rule specifies the criteria for conformity which differ by time period, by type of pollutant, and by the level of non-attainment. The following table shows the time periods mentioned in the rule.

TIME PERIOD	BEGINS ON	LASTS UNTIL
Interim Period - Phase I	Time prior to effective date of final rule	Effective date of the final rule
Interim Period - Phase II	Effective date of the final rule	Submission to EPA of the control strategy SIP revision
Transitional Period	Submission to EPA of the control strategy SIP revision	EPA takes final approval or disapproval action on the SIP revision
Control Strategy Period	EPA approves control strategy SIP revision	The area is redesignated as an attainment area
Maintenance Period	The area is redesignated as an attainment area	Lasting 20 years

The interim period has different conformity criteria and procedures for regional and project-level analysis than those during the control strategy and maintenance periods. The control strategy and maintenance periods have the same criteria and procedures. The transition period includes the requirements of the interim period and the requirements of the control strategy and maintenance periods. The specific criteria can be summarized as follows:

- In the interim and transition period, each FHWA/FTA project must eliminate or reduce the severity and number of localized CO violations in CO NAA.

- In the interim and transition periods the transportation plan TIP, and projects not from a conforming transportation plan and TIP must contribute to emissions reductions in ozone and CO NAA. They must not increase emissions in PM_{10} or NO_2 NAA. Regional emissions analysis is required to show that these conditions are met.

- In the transition, control strategy, and maintenance periods, regional transportation emissions from plans and TIPs need to be consistent with the SIP's transportation emissions budgets. Likewise, a project not from a conforming transportation plan and TIP must be consistent with the motor vehicle emissions budgets.

In addition to the criteria for conformity, the final rule establishes a number of other criteria. These are:

- Use of the latest planning assumptions- These include the latest assumptions for current and future population, employment, travel, congestion, and background concentration of pollutants. There is a requirement to discuss how transit operating policies have changed since the previous conformity determination, and there is a requirement to use reasonable assumptions about transit service, fares, and road and bridge tolls over time. The conformity determination must use the latest information about TCM effectiveness.

- Use of the latest emissions model.

- The transportation plan, TIP, and projects which are not from a conforming plan or TIP must provide for the timely implementation of TCMs.

Lastly, the final rule establishes detailed criteria for determining regional transportation-related emissions. These include very specific modeling requirements after January 1, 1995 for serious, severe, and extreme ozone NAA and serious CO NAA. The modeling requirements follow:[55]

- The network-based model must be validated against ground counts for a base year that is not more than 10 years prior to the date of the conformity determination.

- For peak-hour or peak-period traffic assignments, a capacity sensitive assignment methodology must be used;

- Zone-to-zone travel times used to distribute trips between origin and destination pairs must be in reasonable agreement with the travel times resulting from the assignment of trips to network links. These times should also be used for modeling mode splits if transit use is anticipated to be a significant factor;

- Free-flow speeds on network links must be based on empirical observations;

- Peak and off-peak travel demand and travel times must be provided;

- Trip distribution and mode choice must be sensitive to pricing, where pricing is a significant factor;

- The model must utilize and document a logical correspondence between the assumed scenario of land development and use, and the future transportation system for which emissions are being estimated, but reliance on a formal land-use model is not specifically required;

- A dependence of trip generation on the accessibility of destinations via the transportation system is not specifically required, unless the network model is capable of such determinations and the necessary information is available;

- A dependence of regional economic and population growth on the accessibility of destinations via the transportation system is not specifically required, unless the network model is capable of such determinations and the necessary information is available; and

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[55] IBID, p.62230-62231.

- Consideration of emissions increases from construction-related congestion is not specifically required.

Additional requirements of the emissions analysis are:

- HPMS estimates of VMT shall be considered the primary measure of VMT. A factor or factors shall be develop to reconcile and calibrate the network-based model estimates of VMT in the base year of its validation to the HPMS estimates for the same period, and these factors shall be applied to model estimates of future VMT. Departure from these procedures is permitted with the concurrence of DOT and EPA.

- Reasonable methods shall be used to estimate NAA vehicle travel on off-network roadways within the urban transportation planning area, and on roadways outside the urban transportation planning area;

- Reasonable methods in accordance with good practice must be used to estimate traffic speeds and delays in a manner that is sensitive to the estimated volume of travel on each roadway segment represented in network model; and

- Ambient temperatures shall be consistent with those used to establish the emissions budget in the applicable implementation plan. Factors other than temperatures, for example the fraction of travel in a hot stabilized engine mode, may be modified after interagency consultation if the newer estimates incorporate additional or more geographically specific information or represent a logically estimated trend in such factors beyond the period considered in the applicable implementation plan.

For areas that are not subject to the use of network models, procedures that extrapolate historical VMT or may project future VMT by considering growth in population and historical growth trends for VMT per person can be used. These procedures must also consider future economic activity, transit alternatives, and transportation system policies.

In terms of the CO hot-spot requirements, the analysis must be based on the applicable air quality models, data bases and other requirements specified in 40 CAR Part 51, Appendix W, "Guidelines on Air Quality Models (Revised)" (1988), Supplement A (1987) and Supplement B (1993), EPA publication No. 450/2-78-027R. Assumptions used in hot-spot analysis must be consistent with the assumptions used in the regional emission analysis for those inputs that are required for both analyses. Requirements for PM_{10} hot spot analyses have not yet been specified. For construction-related activities that cause temporary or self-correcting increases in emissions, CO and PM_{10} hot-spot analyses are not required.

The data requirements to support the conformity process is extensive. The data for the transportation plan and TIP includes:

- Estimates of current and future land use patterns, population, demographics, and employment.

- Estimates of background levels of pollutants.
- Transit fares, service levels, and ridership.
- Regionally significant highway and transit facilities, services and activities;
- On-going TDM or TSM activities;
- Regionally significant projects which are currently under construction;
- TCMs and regionally significant facilities, services, and activities which will be operational or in effect in the horizon years;
- Fully-adopted and/or funded non-Federal TCMs;
- Incremental effects of any non-Federal TCMs known to the MPO; and
- Regionally significant non-FHWA/FTA highway and transit projects that will be implemented and completed by the horizon year.

The data required to support the transportation network modeling include:

- Transportation analysis zones
- Highway and transit networks
- Ground counts for a recent base year
- Empirical observations of free flow speeds
- Zone to zone modal split
- Peak and offpeak travel times and travel demand
- Travel cost information including auto operating costs, parking costs, transit fares, and tolls
- Origin-destination and trip length information
- Vehicle occupancy

Other data required to support the emissions analysis are:

- HPMS estimates of VMT, and reasonable estimates of VMT where HPMS estimates are not available.
- Ambient temperature assumptions as used for the emissions budget in the SIP.

APPENDIX C - SUMMARY TABLES OF CURRENT PLANNING REQUIREMENTS

SUMMARY OF PLANNING REQUIREMENTS RELATED TO THE CAAA, NPRMs, AND GUIDANCES

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Nov 15, 1991, or 18 months after new designation or re-classification. Serious areas have 4 years after designation	[Section 189 CAA] Moderate PM-10 non-attainment areas (NAA): submit plan revision to provide for attainment by Dec 31, 1993, & provisions of RACMs implemented by Dec 10, 1993. See subparts 1 and 4 of Title I of the CAA. (& ref 4)	**1991 SIP Revision** Demonstration of attainment, or demonstration that attainment by attainment date is impracticable. In this case a demo that plan provides expeditious alternatives. Quantitative milestones for emissions reduction which must be achieved every 3 years. Provisions to guarantee that RACM are implemented.	Transportation planning activities should include measures to reduce PM-10 in order to facilitate attainment of the NAAQS. Demonstration of attainment is to include air quality modeling. (Revised model not available as of July 1992)	Data on: ▪ dust from paved and unpaved surfaces ▪ motor vehicle exhaust from highway and off-highway sources ▪ diesel vehicle exhaust and bus terminals ▪ re-entrained materials from traveled surfaces primarily paved and unpaved roads and open areas like parking lots.
Nov 15, 1992. (Draft due Jan-Mar 1992.) Updates every 3 years starting Sept 30, 1995	[Setion 182(a) CAA] For Marginal+ ozone NAA, and [Section 187(a) CAA] for Moderate+ CO NAA: provide 1990 emissions inventories. (ref. 4, 6, 9, and 19)	**1992 SIP Revision** **Base Emissions Inventory & Periodic Inventories, and Projected Inventories:** ▪ Inventories of 1990 emissions from point, area, and mobile sources. Includes sources of VOC, NOx, and CO in the peak ozone season and CO in the peak CO season. ▪ Complete documentation of the VMT Tracking Area and the VMT estimating and forecasting methods used. ▪ For Moderate+ ozone areas adjusted base year inventory and 1996 target inventory (based upon 1990 VMT and the 1996 MOBILE emissions factor).	Determine current projected mobile source contribution to total emissions. Use VMT estimates based upon HPMS system where possible. Since guidance is for annual VMT, adjustments must be consistent with method to adjust ground counts to average daily counts for HPMS. Estimates are needed for areas outside the Federal Aid Urbanized Area (FAUA) which are inside the VMT tracking area. Estimates are also needed for the local network. Optional use of network models if HPMS data aren't adequate for 1990. HPMS must be used for 1993 and later VMT. Network models should be used to get link-specific speeds, spacial, and temporal VMT distributions. Photochemical grid modeling requirements will help define the inventory area. Must account for fleet turnover, new highway sections, and speed limit changes. Inventories for the base year are determined using 1990 VMT and MOBILE emissions estimates. The formula for the 1996 target level of emissions is: BE96 = 1990 Baseline emissions = 1990 Nonmotor vehicle emissions + (1990 VMT X hypothetical 1996 MOBILE emissions factor) 1996 target emissions = BE96 X 0.85 - (corrections due to RACT rules and I/M program)	▪ 1990 VMT estimates for FAUA based upon sampling according to FHWA Field Manual and Traffic Monitoring Guide. Estimates for each functional class/volume group. ▪ 1990 VMT estimates for the local network and areas outside FAUA which are in the 1990 VMT tracking area. ▪ 1990 VMT by functional class to distinguish speeds, by peak and off-peak, by month, day of week, hour of day. ▪ The % of VMT for different speed bands, hot starts, cold starts, and hot stabilized driving modes. ▪ Fleet mix and input into MOBILE.

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Nov 15, 1992	[Section 182(c)(9) CAA] for Serious+ ozone NAA, provide contingency provisions. [Section 182(d)(1) CAA] for Severe+ ozone NAA SIP revision that offsets emissions due to VMT or vehicle trip growth. [Section 182(d)(1)(B) CAA] Severe+ ozone NAA: Employer Trip Reduction Program. [Section 176(c) CAA] Marginal+ ozone areas include conformity requirements. (ref 4,6,9,17,18,& 19)	**1992 SIP Revision (cont.)** **Contingency Measures in Ozone NAA:** ▪ For Serious + ozone NAA, contingency measures to be undertaken if an area fails to make reasonable further progress or to attain the air quality standards by the applicable attainment date. **Measures for Reducing VMT and Consideration of TCMs in Ozone NAA:** ▪ For Severe+ ozone NAA, identification and adoption of TCMs to offset growth in emissions from growth in VMT or vehicle trips. ▪ For Severe+ ozone NAA, consideration of 108(f) measures. ▪ Air quality analyses that include a demonstration that adequate controls are in place to meet the requirements for attainment of the NAAQS, for reasonable further progress (RFP), and to insure that VOC emissions will never be higher than for the ozone season of the previous year. **Requirement for Employer Trip Reduction for Severe+ Ozone NAA:** Submit a program for employer trip reduction to reduce work trip VMT. **Conformity Requirements for all NAA Areas:** (delayed pending EPA rulemaking)	Estimate VMT & trip growth, and determine emissions to be offset due to VMT/trip growth. Determine potential TCM contribution to attainment. For Serious+ ozone NAA, give consideration to the 108(f) measures. Ensure adequate access to downtown, other commercial, and residential areas and avoid measures that increase or relocate emissions and congestion rather than reduce them. Commit to adopt TCMs needed to achieve offset/contribution. Insure needed TCMs are planned and implemented on schedule. The design process needs to consider: Issues of equity; providing area-wide measures such as transportation management associations that can reinforce more localized measures such as employer-based trip reduction targets; enhancing the supply of transit, ridesharing, bicycling, and walking options rather than just restricting or discouraging the use of drive alone travel; incorporating elements of pricing and market-based incentives, with particular attention paid to the distribution of public and private travel subsidies; including marketing, education, and public awareness as well as more traditional technical activities; incorporating longer range, permanent measures as well as short run measures that are capable of being quickly implemented and producing immediate impacts but which also may be more temporary in character; and assuring adequate intergovernmental involvement, cooperation and commitment. A carefully designed, inter-related program may include 15 to 20 individual measures and be three to four times as effective as any of the measures taken individually. (Note that in ref 9, the Preamble for the Implementation of Title I of the CAAA, explains that it is sufficient to show "committal SIP revisions," for the 1992 SIP, and provide measures in "specific and enforceable form" in further revisions.) Determine Employer Trip Reduction Programs and get approval through legislature if necessary and establish area AVO. A 25% vehicle occupancy rate reduction is needed.	▪ VMT estimates and projections. ▪ Transportation demand modeling inputs such as population and economic forecasts, land use forecasts, cordon or screen counts, home interview data, mode split data, level of service and trip time information. ▪ Number of employers with >100 employees in NAA. Number of employees and existing and forecasted trips, modes, and VMT. ▪ Data for TCM analyses.

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Nov 15, 1992	[Section 187(a)(7) CAA] Attainment demonstration for Moderate CO NAA. [Section 187(a)(2) CAA] Annual VMT forecasts. [Section 187(a)(3) CAA] Contingency measures for Moderate+ CO NAA. [Section 187(b)(2) CAA] For Serious CO NAA: SIP revision that offsets emissions due to VMT or vehicle trip growth. (ref. 4, 9, and 17)	**1992 SIP Revision (cont.):** **CO Attainment Demonstration:** For Moderate+ CO NAA >12.7ppm, attainment demonstration with annual emissions reductions for CO attainment by 12/31/95 for Moderate areas and 12/31/2000 for serious areas. **CO Contingency Measures:** For Moderate+ CO NAA >12.7ppm, provide contingency measures to be implemented if VMT forecasts are exceeded by a actual VMT or subsequent VMT forecasts. **CO TCMs:** For Serious CO NAA, include TCMs for the purpose of reducing CO emissions. Explain why any 108(f) measure was not adopted. **Annual Forecast:** For Moderate+ CO areas >12.7ppm submit annual VMT forecast for tracking purposes up to the year before attainment. **Other:** For CO NAA >12.7ppm, commitment to sample each HPMS facility class/volume group for VMT tracking purposes as of June 1, 1993. Serious areas may submit long term measures and "backstop" measures should long term measures fail to be implemented.	Determine in preparing 1992 SIP revision, if TCMs are needed for annual emission reduction attainment. Insure needed TCMs are planned and implemented on schedule. Show that given assumptions about population growth, economic growth, and growth in VMT, SIP control measures will result in the attainment of the NAAQS by the relevant deadline. Provide annual forecast for tracking purposes. Develop/evaluate contingency measures assessing VMT/emissions impacts. Adopt contingency measure for implementation if forecasted VMT is exceeded or attainment missed. Contingency measures should be capable of countering the effect of 1 years growth in VMT.	▪ VMT estimates and projections. ▪ Transportation demand modeling input such as population and economic forecast, land use, cordon or screen counts, home interview data, mode data, level of service and trip time information.

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Nov 15, 1992; (First forecast due with 1992 SIP revision. First annual report due Sept. 1994).	[Section 187(a)&(b) CAA] Moderate+ CO NAA above 12.7ppm: forecast of VMT for each year before attainment year. (ref. 6)	**1992 SIP Revision (cont.)** **Annual VMT Forecasts and Reports** General Content: history of VMT forecasts and actual VMT. Changes in urbanized area boundaries and improvements to HPMS. For Moderate+ CO NAA **HPMS Base Yr and Tracking VMT** (annual VMT): (a) Statistical precision (b) Adjustments and expansions used (c) VMT on each functional group except local (d) VMT for local (e) VMT for outside FAUA. **Network-Based Travel Demand Model Process** (changes from SIP): (a) model accuracy and confidence (b) model inputs including socio-economic data, network, and domain. (c) model outputs including trip distribution, trip generation, mode split, traffic assignment. (d) local system VMT growth. (e) Growth outside the model domain or outside the FAUA. **HPMS Forecasts:** Historical VMT growth regression equation, local VMT and methodology, and outside VMT and methodology.	▪ Use HPMS guidance for VMT estimates. Develop similar methodologies for areas outside FAUA and for local areas. ▪ By June 30, 1994 Serious areas must obtain EPA approval for count-based method to estimate VMT for areas outside FAUA and for local facilities. Start using as of Jan 1, 1995. ▪ States with Serious CO should forecast VMT by applying growth factors based on validated network-based travel demand modeling process to 1990 actual VMT estimate. All Moderate+ NAA should do same if a model is available. Models should be in equilibrium on each link, distinguish peak and off-peak travel times, and consider transit, where relevant. ▪ Validate model against recent (1985+) ground counts. ▪ States must forecast demographic, land-use, and transportation system projects for at least one year with 5 years of each VMT forecast year.	▪ VMT estimates based upon HPMS field manual for each facility/class/volume group in the FAUA. ▪ VMT estimates by peak/off-peak, by month, by day of week, and hour of day. ▪ VMT for local system. ▪ VMT for area outside FAUA but inside VMT tracking area. ▪ Existing data and forecasts for the urban transportation demand forecasting process. This includes socio-economic data, land use, trip purposes, trip rates, modal splits, cordon and screenline counts, traffic counts, and level of service data.

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Nov 15, 1993	[Section 182(b)(1) CAA] Moderate+ ozone NAA: 15% VOC reduction by '96. Moderate areas must demonstrate attainment of the NAAQS by 1996. (ref. 4 and ref. 9)	**1993 SIP Revision (the 15% SIP)** ▪ Demonstration of 15% reduction from the 1990 baseline of weekday VOC by 1996. ▪ Moderate areas demonstrate attainment of the NAAQS by 1996. ▪ Moderate+ areas include control strategies along with associated regulations to achieve 15% reduction. ▪ Moderate+ areas include targets for annual reductions in emissions of VOCs and NOx. ▪ Moderate+ areas include contingency measures. ▪ Serious or severe areas may adopt economic incentive program. Include an enforceable commitment to submit to an annual tracking program which includes extra steps to make up for shortfalls.	Determine TCMs to be implemented, appropriate schedules, and expected emissions reductions to demonstrate 15% reduction or attainment by 1996. Develop annual emissions reduction targets. Develop implementable control strategies as needed to meet the targets. Determine the role TCMs play for meeting the 15% reduction. Develop contingency procedures to provide additional 3% reductions for any year when there is failure in achieving the NAAQS or reasonable further progress (RFP). Attainment is demonstrated with the Urban Airshed Model, or the Kinetic Modeling Approach. (Note that if moderate areas are using the regional airshed modeling, they have until Nov. 1994 to meet this requirement - ref 20.) VMT projections for attainment follow the EPA VMT guidance (ref 6).	▪ Fleet mix and input to MOBILE ▪ 1990 VMT ▪ VMT growth as forecast using the EPA VMT tracking and forecasting tracking guidance (see above or ref 6) ▪ Data or elasticity of demand for TCPs. ▪ Existing data and forecasts for the urban travel demand process. ▪ Weekday hourly VMT during the peak ozone season.

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Nov 15, 1994	[Section 182(c)(1) CAA] Serious+ ozone NAA measures for improved air quality monitoring. [Section 182(c)(2)(A) CAA] Serious+ ozone NAA: Attainment demonstration. [Section 182(c)(2)(B) CAA] Serious+ ozone NAA show ave. annual VOC reduction of 3% over 3 yr periods after 1996. [Section 182(d)(1)(B) CAA] & [Section 182(g) CAA] Severe+ ozone NAA: Employer compliance plans. [Section 182(e)(4) CAA] Extreme ozone NAA: TCMs for heavy duty vehicles/heavy traffic hours. [Section 182(e)(5) CAA] Extreme ozone NAA: New technologies.	<u>1994 SIP Revision</u> Serious+ ozone NAA submit a program of measures designed to enhance and improve air quality monitoring and emissions monitoring (awaits EPA rulemaking). Adjusted base year inventory and attainment year projection inventory. Serious+ areas submit a control strategy and associated regs to meet the following: ▪ Serious areas demonstrate attainment of the NAAQS by 1999. ▪ Serious+ areas demonstrate 3% red. in emissions on the average/year over each 3 year period until attainment. Set target levels of emissions for milestone yrs. Serious+ ozone NAA submit annual projections of TCM implementation and emissions reductions from 1996 to attainment. Severe+ ozone NAA submit employer compliance programs for employers of over 100 employees. Serious or Severe ozone NAA may optionally adopt economic incentive programs. Extreme areas may submit TCMs for heavy traffic hours. Serious+ ozone NAA submit contingency provisions, long term measures, and backstop measures. Extreme areas may assume new technologies.	Compute adjusted baseline and target emissions for each milestone year between 1996 and the attainment date. Determine the mobile portion of the inventory. Determine VMT targets and control strategies to meet targets. For VMT projections to 1996, use VMT forecasting and tracking methodology as specified for CO moderate areas (ref 6). A model is not required for this. After 1996, use VMT forecasting and tracking methodology for severe CO NAA. A network model is required in this case. Use photochemical grid modeling to demonstrate attainment. Submit employer compliance plans for employer trip reduction programs as committed in the 1992 SIP. Contingency measures should provide 3% annual reduction in addition to those measures needed to make RFP or attainment. If needed, submit plans for long-term measures which cannot be fully developed for this SIP. There must be commitment to develop these measures, and other "backstop" measures to be implemented should there be failure in implementing long term measures. Backstop measures should be fully adopted.	▪ Fleet mix and input to MOBILE ▪ 1990 VMT ▪ VMT growth as forecast using the EPA VMT tracking and forecasting tracking guidance (see above or ref 6). ▪ Data or elasticity of demand for TCPs. ▪ Existing data and forecasts for the urban travel demand process. ▪ Weekday hourly VMT during the peak ozone season. ▪ Data on employer plans, number of employees, mode split changes.

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Mar 31, 1996	[Section 187(d)(1) CAA] For Serious CO NAA: Show emission reductions required by 12/31/95. If not, a SIP revision with economic incentives and TCM program is due in 9 months. (ref. 4, ref. 6, and ref. 17)	**Milestone Demonstration for CO**	Demonstrate reductions required by 12/31/95 and TCM contributions.	VMT Projections of link loadings, speeds, trip ends, hot and cold starts.
Nov 15, 1996 and every 3 years following	[Section 182(c)(5) CAA] Demonstration of consistency for Serious+ ozone NAA. [Section 182(g) CAA] For Serious+ ozone NAA: demonstrations that milestones have been met. (ref. 4,6,17,&19)	**Demonstration of Consistency and Compliance Demonstration for Milestones for VOC Reductions** Submit a demonstration that the VMT, vehicle emissions, and congestion levels are consistent with attainment. Submit a demonstration that the milestones have been achieved for VOC reductions of 15% by 1996 and 3% annual average every 3 years. Submit an inventory of actual emissions 90 days after each milestone.	The VMT consistency demonstration can be based on annual VMT reports and periodic inventories. Verify consistency of VMT levels with the attainment demonstration. If this demonstration fails, the state has 18 months to submit a SIP revision which includes 108(f) and other measures. Insure TCMs selected to contribute to 15% and 3% reductions are planned and implemented on schedule. Possible implementation of Contingency Plan or Economic Incentive and Transportation Control Program if milestones are missed. Extreme areas missing milestones must implement economic incentives within 9 months. The compliance demonstration with milestones can be satisfied by an early submittal of the 2nd periodic emissions inventory.	(see emissions inventories and annual VMT reports)
Dec 31, 1996	[Section 187(d)(3) CAA] for Serious CO areas: failure to meet milestone. (ref. 4 and ref. 17)	**SIP Revision** **Failure to Meet CO Milestone:** Serious CO areas provide a SIP revision to implement economic incentive and Transportation Control Programs.	Develop/adopt economic incentive TCM program for 12/31/96 implementation. This can include accelerated retirement of old vehicles.	Vehicle age estimates for retirement program.
Within 18 months of failure to meet milestones (9 months for extreme areas).	[Section 182(c)(5)(A) CAA] Serious+ ozone NAA: revised SIP with TCMs. [Section 182(g) CAA] Extreme ozone NAA submit economic incentive programs. (ref. 4 and ref. 17)	**SIP Revision** TCMs for Serious+ ozone NAA economic incentive programs required for extreme areas	Develop TCMs for SIP revision to reduce excess emissions. Develop economic incentive programs for Extreme areas.	Fleet mix and input to MOBILE VMT + VMT growth. Land use existing and projected, trips, trip purposes, modes, trip distribution, and link loadings.

SUMMARY OF PLANNING REQUIREMENTS RELATED TO THE ISTEA, NPRMs, AND GUIDANCES

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Oct. 1, 1994 for NAA requiring TCMs as part of Nov. 1993 SIPs. Other areas have until Dec. 18, 1994. Updated every 3 yrs in NAA and maint. areas; every 5 yrs in attainment areas	Development of a transportation plan addressing at least a 20-yr planning horizon Sections 1024 and 3012 of ISTEA, §134 of title 23, USC (23 CFR Part 450 and 49 CFR Part 613) and Section 8 of the Federal Transit Act:	**Metropolitan Transportation Plan** §450.322: ▪ Include long- and short-range strategies/actions for integrated, intermodal metropolitan transportation system ▪ In NAA and maint. areas, FHWA and FTA, as well as the MPO must make conformity determinations with the CAA and the EPA conformity regs. ▪ The plan shall: 1. ID near-term transp. demand of persons & goods in metropolitan planning area 2 ID adopted congestion mgmt strategies that address current & future transp. demand 3 ID pedestrian walkway & bicycle transp. facilities 4 Consideration of results of mgmt systems 5. Assess capital investment & other measures necessary to preserve existing metropolitan transp. system 6 Include design concept & scope descriptions of existing/proposed transp. facilities in NAA & maint. areas to permit conformity under the US EPA conformity regs 7 Reflect multimodal evaluation of transp, socioeconomic, environmental and financial impact of the overall plan 8 Same as 6., but for major transp. investments for which analyses are not complete 9 Reflect consideration of the area's comprehensive long-range land use plan and metropolitan development objectives, environmental resource plans of local, State and Fed agencies, etc. 10 Indicate proposed transp. enhancement activities 11 Include a financial plan that demonstrates the consistency of proposed transp. investments with known and projected sources of revenue	§450.316: The planning process shall involve public participation; consistency with Civil Rights Act of 1964; ID actions necessary to comply with ADA; and involvement of various transp. agencies and environmental agencies 15 factors must be considered as part of the planning process: 1. Preservation of existing transportation facilities 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 effect and consistency of transportation policy decisions on land use and development 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 7. International border crossings and access to ports, airports, intermodal transportation facilities, etc. 8. The need for connectivity of roads within the metropolitan area with roads outside the metropolitan area. 9. The transportation needs identified through use of the management systems required by section 303 of this title. 10. Preservation of rights-of-way 11. Methods to enhance the efficient movement of freight 12. Life-cycle cost in the design and engineering of bridges, tunnels, or pavement. 13. Overall social, economic, energy, and environ. effects of transp. decisions 14. Methods to expand & enhance transit services & to increase the use of such services. 15. Capital investments that would result in increased security in transit systems.	Data required for the planning will come mostly from the management systems (see data requirements under PMS, BMS, SMS, CMS, PTMS, TMS/H and IMS). Data can be categorized as follows: ▪ System data ▪ Usage of the system or demand ▪ Time or cost to use the system ▪ Location of interest The potential sources of these data are: ▪ Traffic counting programs ▪ Travel time surveys ▪ Home interview surveys ▪ Employer surveys ▪ Vehicle occupancy counts ▪ Screen line counts ▪ Cordon surveys ▪ Surveys at activity centers ▪ Parking inventories ▪ Site impact studies ▪ Computerized signal systems ▪ On-board transit surveys ▪ Travel behavior studies

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Updated every 2 yrs	Development of a TIP by the MPO in cooperation with the State & public transit operators. Covers a period of not less than 3 yrs Sections 1024 and 3012 of ISTEA, §134 of title 23, USC (23 CFR Part 450 and 49 CFR Part 613) and Section 8 of the Federal Transit Act	**Metropolitan Transportation Improvement Program** §450.324(f) plan contents: 1. All transp. projects w/in the metropolitan planning area proposed for funding under title 23 and the Federal Transit Act 2. Only projects that are consistent w/the transp. plan 3. All projects for which FHWA or FTA approval is req'd 4. All transp. projects proposed to be funded w/Fed. funds 5. All regionally significant projects to be funded w/non-Fed. funds	§450.324(n) As a management tool for monitoring progress in implementing the plan, the TIP should: 1. ID criteria & process for prioritizing implementation of transp. plan elements w/in TIP & any changes in priorities from previous TIPs 2. Major projects from previous TIP that were implemented & ID significant delays in the planned implementation of major projects 3. In NAA & maint. areas, describe progress in implementing any req'd TCMs 4. In NAA & maint. areas, list projects found to conform in a previous TIP & are now part of the base case for the purpose of air quality conformity analyses. 5. In NAA & maint. areas, the TIP shall give priority to TCMs identified in the SIP.	§450.324(g) Each project shall include: a. Sufficient descriptive material (and in NAA and maint. areas, sufficient detail to permit conformity analysis) b. Estimated total cost c. Amount of Fed. funds proposed to be obligated during each program yr d. Proposed source of Fed and non-Fed. funds e. ID of recipient and State & local agencies responsible for carrying out the project f. In NAA and maint. areas, ID of projects which are TCMs g. ID of projects to meet requirements of the ADA paratransit and key station plans.

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Jan. 1, 1995	Development of a statewide transportation plan for all areas of the State Sec. 1025 of ISTEA, and §135 of title 23, USC (23 CFR Part 450 and 49 CFR Part 613)	**Statewide Transportation Plan** §450.214: The plan shall: 1. Be intermodal and statewide in scope 2. Cover a period of at least 20 years 3. Contain a plan for bicycle transp. and pedestrian walkways which is appropriately interconnected with other modes 4. Be coordinated with the metropolitan transportation plan. 5. Contain short-range planning studies, strategic planning and/or policy studies, etc. 6. Contain info on the availability of financial and other resources needed to carry out the plan	§450.206: Statewide planning process shall include: 1. Data collection & analysis 2. Consideration of factors in §450.208 3. Coordination of activities in §450.210 4. Development of a statewide transp. plan 5. Development of a STIP §450.208: 23 factors must be considered as part of the planning process: 1 Results of mgmt systems req'd by 23 USC 303 2 Fed, State or local energy use goals, objectives, programs, or rqmts 3 Strategies to incorporate bicycle transp. facilities & pedestrian walkways 4 International border crossings and access to ports, airports, intermodal transportation facilities, etc. 5. Transp. needs of areas outside of metropolitan planning areas 6. Any metropolitan area plan developed pursuant to 23 USC 134 7 Connectivity between metropolitan planning areas w/in State and w/metropolitan planning areas in other States 8 Recreational travel & tourism 9 Any State plan developed pursuant to Fed. Water Pollution Control Act 10 TSM & investment strategies to make most efficient use of existing transp. facilities 11 Overall social, economic, energy and environ. effects of transp decisions 12 Methods to reduce congestion and prevent congestion from occurring where it does not yet occur. 13 Methods to expand & enhance transit services 14. Effect of transp. decisions on land use and land development 15. Strategies to ID & implement transportation enhancements 16. Use of innovative financing mechanisms 17. Preservation of rights-of-way 18 Long-range needs of the State transp. system 19. Methods to enhance the efficient movement of commercial motor vehicles 20. Life-cycle costing 21. Coordination of transp. plans & programs developed under 23 USC 134 and section 8 of the Federal Transit Act 22. Investment strategies to improve adjoining State & local roads 23. Concerns of Indian tribal governments	§450.210: Data-related coordination issues: 1. Data collection, analysis & evaluation of alternative transp. projects for a transit, highway, bikeway, etc. 2. Data analysis used in the development of plans & programs, (especially info resulting from traffic data analysis, housing, employment, and development) with land use projections, and with data from the management systems

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
	Development of a statewide transportation improvement program for all areas of the State. The portion of the STIP in a metropolitan planning area shall be developed in cooperation w/the MPO. Metropolitan TIPs in NAA and maint. areas are subject to FHWA and FTA conformity findings before their inclusion in the STIP. STIP shall cover a period of not less than 3 years. Sec. 1025 of ISTEA, and §135 of title 23, USC (23 CFR Part 450 and 49 CFR Part 613)	**Statewide Transportation Improvement Program (STIP)** §450.216: ▪ The STIP shall: 1. Include a priority list of transp. projects to be carried out in the first three years of the STIP. 2. Be consistent w/the plan developed in §450.214 3. In NAA and maint. areas, contain only transp. projects found to conform, or from programs that conform, to the rqmts contained in 40 CFR part 51. 4. Be financially constrained and include info to demonstrate that funds can reasonably be expected to be available to implement the projects. 5. Contain all capital & non-capital transp. projects.		For each project, the following data is required: i. Sufficient descriptive material to identify the project or phase ii. Estimated total cost iii. The amount of Fed. funds proposed to be obligated during each program yr iv. Proposed category of Fed. funds and source(s) of non-Fed. funds v. ID of agencies responsible for carrying out the project.
Oct. 1, 1995	State Development, establishment and implementation of system for managing highway pavement of Federal-aid highways Sec. 1034 of ISTEA, and §303 of title 23, USC (23 CFR Part 500 and 49 CFR Part 614)	**Pavement Management System (PMS)** §500.209: Each State highway agency's PMS based on AASHTO Guidelines for Pavement Mgmt Systems.	[§500.207]Analyses performed in a PMS: 1. Condition analysis 2. Performance analysis 3. Investment analysis 4. Engineering analysis 5. Update analysis to a yearly evaluation and update of the PMS	[§500.207] Essential components: 1. Inventory 2. History 3. Condition survey 4. Traffic - the volumes, classification, and load data 5. Database - source for reporting pavement-related info to FHWA for the Highway Performance Monitoring System (HPMS)

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Oct. 1, 1994 - BMS objectives are formally established Oct. 1, 1998 - State BMS shall be fully implemented	State Development, establishment and implementation of system for managing bridges on and off Federal-aid highways Sec. 1034 of ISTEA, and §303 of title 23, USC (23 CFR Part 500 and 49 CFR Part 614)	**Bridge Management System (BMS)** §500.307(b):	[§500.305] Network level analysis and optimization to the bridge inventory. The network model shall include procedures to: 1. Predict the deterioration of bridge elements with and without intervening actions 2. ID feasible actions to improve bridge condition, safety and serviceability 3. Estimate the cost of actions 4. Estimate the expected user cost savings for safety and serviceability improvements 5. Determine least-cost maintenance, repair, and rehabilitation strategies for bridge elements using lifecycle cost analysis or a comparable procedure 6. Perform multiperiod optimization 7. Feedback from actions to update models 8. Generate summaries and reports as needed for the planning and programming processes	Minimum BMS database shall include, or link: 1. Data req'd by 23 CFR 650.311, National Bridge Inspection Standards 2. Data characterizing the severity & extent of deterioration of bridge elements 3. Data for estimating the cost of actions 4. Traffic and accident statistics to support estimates of user cost savings 5. A history on conditions and actions taken on each bridge, excluding minor or incidental maintenance

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Oct. 1, 1994, develop a work plan Oct. 1, 1996, SMS must be fully operational	State Development, establishment and implementation of system for managing highway safety Sec. 1034 of ISTEA, and §303 of title 23, USC (23 CFR Part 500 and 49 CFR Part 614)	**Highway Safety Management System (SMS)** §500.407(a) : 1. Establishment of long and short term highway safety goals 2. Establishment of accountability by identifying and defining the safety responsibilities of units and positions 3. Recognition of institutional and organizational initiatives through identification of disciplines involved in highway safety at the State and local level, assessment of multi-agency responsibilities and accountability, and establishment of coordination 4. Collection, maintenance and dissemination of data necessary for problem identification and determining improvement needs 5. Analysis of available data, multi-disciplinary and operational investigations, and comparisons of existing conditions and current standards to assess highway safety needs, select countermeasures, and set priorities 6. Evaluation of the effectiveness of all activities that relate to highway safety performance. 7. Development & implementation of public info and education activities 8. ID of skills and resources needed to implement the State's activities and programs affecting highway safety, ID of current and future training needs, development of a program to carry out necessary training, development of methods for monitoring and disseminating new technology and incorporating effective results	[§500.407(b)] 1. Coordinating & integrating broad base safety programs such as motor carrier, corridor, and community-based traffic safety activities into a comprehensive mgmt approach for highway safety 2. IDing and investigating hazardous & potentially hazardous highway safety problems... 3. Ensuring early consideration of safety in all highway transp. programs and projects 4. IDing safety needs of special user groups such as older drivers,...in the planning, design, construction and operation of highway systems 5. Routinely maintaining and upgrading safety hardware, highway elements and operational features	▪ Collection, maintenance and dissemination of data necessary for problem identification and determining improvement needs ▪ Analysis of available data, multi-disciplinary and operational investigations, and comparisons of existing conditions and current standards to assess highway safety needs, select countermeasures, and set priorities

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Oct. 1, 1994 - work program Oct. 1, 1995 - fully operational in NAA TMS Oct. 1, 1996 - fully operational in all areas	State Development, establishment and implementation of system for managing traffic congestion Sec. 1034 of ISTEA, and §303 of title 23, USC (23 CFR Part 500 and 49 CFR Part 614)	**Traffic Congestion Management System (CMS)** §500.507: a. Performance measures	[§500.507] c. ID and evaluation of proposed strategies: 1. TDM measures 2. Traffic operations improvements 3. Measures to encourage HOVs 4. Public transit capital improvements 5. Public transit operational improvements 6. Other modes like bicycles & pedestrians 7. Congestion pricing 8. Growth mgmt and activity center strategies 9. Access mgmt techniques 10. Incident mgmt 11. Application of IVHS technology 12. Addition of gen'l purpose lanes d. Implementation of strategies - implementation responsibilities, time frame for implementation and probable funding sources e. Evaluation of the effectiveness of implemented strategies	[§500.507] b. Data collection and system monitoring: continuous program of data collection & monitoring established so that the duration and magnitude of congestion can be determined & monitored. To the extent possible, existing sources such as HPMS and FTA Section 15 should be used.
Oct. 1, 1994 - work plan Oct. 1, 1996 - fully operational	State Development, establishment and implementation of system for managing public transportation facilities and equipment Sec. 1034 of ISTEA, and §303 of title 23, USC (23 CFR Part 500 and 49 CFR Part 614)	**Public Transportation Facilities and Equipment Management System (PTMS)** §500.609: a. ID of condition measures	[§500.609] c. Strategy and action identification and evaluation d. Implementation of strategies and projects	[§500.609] b. Data collection and system monitoring: 1. Base-yr comprehensive inventory 2. Highway transit vehicles & ridership data collected as part of the TMS/H. No. vehicles and ridership data for dedicated transit right-of-ways collected as part of PTMS at a minimum at the maximum load points for the peak period in the peak direction and for the daily time period

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Oct. 1, 1994 - work plan Oct. 1, 1996 - fully operational	State Development, establishment and implementation of system for managing intermodal transportation facilities and equipment Sec. 1034 of ISTEA, and §303 of title 23, USC (23 CFR Part 500 and 49 CFR Part 614)	**Intermodal Facilities and Systems Management System (IMS)** Intermodal needs addressed by a process that considers: connections, choices, and coordination & cooperation §500.707: a. ID of intermodal facilities h. ID of efficiency measures and performance standards	[§500.707] d. System and facility performance evaluation e. Strategy and action identification and evaluation	[§500.707] c. Data collection and system monitoring: surveys of operational & physical characteristics of facilities (including time, cost, capacity, and usage)

DATES	DESCRIPTION OF LEGISLATIVE REQUIREMENTS	DOCUMENT REQUIRED AND DOCUMENT CONTENTS	PLANNING REQUIREMENTS	DATA REQUIREMENTS
Oct. 1, 1994 - work plan Oct. 1, 1995 - fully operational for NHS Oct. 1, 1996 - fully operational for all public highways	State Development, establishment and implementation of system for monitoring traffic Sec. 1034 of ISTEA, and §303 of title 23, USC (23 CFR Part 500 and 49 CFR Part 614)	**Traffic Monitoring System (TMS/H)** §500.209: Each State highway agency's TMS/H based on AASHTO Guidelines for Traffic Data Programs, as augmented by FHWA's Traffic Monitoring Guide, in conformance with the HPMS Field Manual Elements: 1. Precision of reported data 2. Continuous counter operations 3. Short term traffic monitoring: 4. Vehicle occupancy monitoring 5. Field operations: i. Equipment testing ii. Documentation of field operations 6. Source data retention: i. Data available in formats that conform to those in the version of the Traffic Monitoring Guide current at the time of data collection 7. Office factoring procedures		For short term traffic monitoring: i. Count data for traffic volumes, vehicle classification & vehicle weight shall be adjusted to reflect annual average conditions ii. Veh. classification activities on the Nat'l Hwy System (NHS) shall be sufficient to ensure that, on a cycle of no greater than 3 yrs, every major rural system segment will be monitored to provide info on the no. of single-trailer combination trucks, multiple-trailer combination trucks, 2-axle, 4-tire vehicles, buses and the total no. of vehicles operating on an average day. Following data will be available for each hwy traffic data collection session: A. each value/values as collected during the session B. Date on which each count was made C. Location of the counting session D. Hours during which the count took place E. The type/model of machine used F. Machine serial no. G. Date of last successful test of the machine used H. If human observers are used, the names of the observers
Jan. 26, 1992 Initially Annual updates due Jan. 26 from 1993 through 1997	49 CFR Part 37 [§37.139(d)(1)]	**ADA Complementary Paratransit Plan** 1. Description of fixed-route service 2. Description of paratransit service 3. Plan and milestones to meet 6 service criteria 4. Eligibility process 5. Public participation process 6. Certification	1. Survey of existing services 2. Public process & involvement of persons with disabilities in plan development	▪ Area population ▪ Paratransit operating costs ▪ ADA population estimate ▪ ADA ridership estimate
Jan. 26, 1992	49 CFR Part 37 [§37.47, 37.51]	**ADA Key Station Plan** 1. ID of key stations 2. Milestones for achievement of accessibility 3. Extension requests with cost justification	A public process is required for plan development. This includes consultation with persons with disabilities and at least one public hearing	Data requirements include: 1. Costs for achieving accessibility when extensions are needed 2. Data on ridership and land uses to identify key stations

APPENDIX D - GIS & IVHS AS MODELING TOOLS

The planning requirements presented in this report demand specific modeling needs as well as specific data collection activities that are not currently available. One way to improve the existing models and their associated data collection activities is the application of advanced technologies such as GIS and IVHS. GIS can provide detailed geographic specificity in the models, and IVHS can provide real-time data collection and analysis.

GIS is already being used for a variety of planning activities in State DOTs, transit agencies and MPOs[56]. In terms of transportation planning models, GIS could be used in the following ways[57,58]:

- To better estimate the share of jobs and households within various access distances of transit;
- To better represent traffic analysis zones focused on transit nodes or major bus corridors, rather than on roadways;
- To collect inventory data on urban and transportation infrastructure, such as transit stop location, sidewalk location, bicycle facilities, etc.;
- To facilitate the identification and analysis of congestion;
- To monitor land development and growth patterns, and their effect on transportation;
- To provide the framework for the management systems discussed in Section 2.2.3; and
- To provide consistency in the method and storage for metropolitan and statewide data collection efforts.

Fleet, et al discuss the implications for GIS-T as follows[59]:

- This is a time of changing views on types of data needed and the methods and technology available to collect it;
- The institutional structure of the planning/programming/implementation process is changing and many new players (implementing agencies) now have more active roles in the planning and decision making process;

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[56] Carol L. Schweiger, ***Current Use of Geographic Information Systems in Transit Planning***, prepared for UMTA Office of Grants Management, Final Report, August 1991, DOT-T-92-02.

[57] Michael Replogle, "Improving Transportation Modeling for Air Quality and Long-Range Planning," op. cit., p. 18.

[58] Christopher Fleet, Charles Goodman and Ron Giguere, "Travel Data Needs to Respond Effectively to Congestion Management and Air Quality Planning," op. cit., pp. 4-5.

[59] Ibid, p. 11.

- There is a need to develop more of a "following" among the MPOs to implement GIS; and

- This is a time when the technology of GIS that may offer significant help as a planning tool is itself changing so dramatically and rapidly.

There is potential for IVHS technologies to greatly improve the data collection and analysis, particularly through advanced traffic management systems (ATMS), and commercial vehicle operations (CVO) systems. The following primary characteristics of ATMS[60] relate specifically to the planning and data collection requirements discussed in this report:

- Collection of real-time traffic data;

- Reaction to changes in traffic flow with timely traffic strategies - predicting when and where congestion will occur based on real-time information, providing routing information to motorists, and making appropriate adjustments to control devices; and

- Area-wide surveillance and detection systems.

"In order to implement ATMS, real-time traffic monitoring and data management capabilities must be developed, including advanced detection technologies such as image processing systems, automated vehicle location and identification techniques, and the use of vehicles themselves as traffic probes."[61] Currently, there are only a few examples of ATMS that include real-time traffic monitoring.

CVO systems will also provide real-time data collection through the use of technologies such as automated vehicle identification, automated vehicle classification, automated vehicle location and weigh-in-motion systems. Unfortunately, as with ATMS, there are not many actual implementations of CVO technologies currently.

Even though many of the applicable IVHS technologies have not been fully deployed, they still provide promise with respect to future data collection techniques to fulfill the requirements discussed in this report.

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[60] IVHS America, ***Strategic Plan for Intelligent Vehicle-Highway Systems in the United States***, May 20, 1992, Report No. IVHS-AMER-92-3, p. III-9.

[61] Ibid, pp. III-9 through III-10.

APPENDIX E - LIST OF REFERENCES

LIST OF REFERENCES

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NOTICE

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TECHNOLOGY SHARING

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