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# A Review of Metropolitan Area Early Deployment Plans and Congestion Management Systems for the Development of Intelligent Transportation Systems

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16. Abstract

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This report documents a study of the relationships among early deployment plans(EDPs), CMS, and regional frameworks. There were four principal objectives of the study:

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Review the relationship between the development processes for EDPs and CMS.

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John A. Volpe
National Transportation
Systems Center

# A REVIEW OF METROPOLITAN AREA EARLY DEPLOYMENT PLANS AND CONGESTION MANAGEMENT SYSTEMS FOR THE DEVELOPMENT OF INTELLIGENT TRANSPORTATION SYSTEMS

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# FOREWORD

This report was prepared by the U.S. Department of Transportation's (U.S. DOT) John A. Volpe National Transportation Systems Center (Volpe Center) for the U.S. DOT's Joint Program Office for Intelligent Transportation Systems (ITS). The Volpe Center study team consisted of Allan J. DeBlasio, the project manager, and Tai-Kuo Liu from the Economic Analysis Division; Melissa M. Laube from the Service Assessment Division; Albert R. Skane from the Information Systems Division; and Howard M. Eichenbaum from EG&G Dynatrend. Mac Lister was the JPO manager of the review.

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## EXECUTIVE SUMMARY


Integration of intelligent transportation systems (ITS) within a metropolitan area is crucial for effective deployment. The Early Deployment Planning (EDP) Process is one tool that allows transportation officials to plan for and implement ITS technologies as part of an integrated transportation system. Congestion management systems (CMS), which are in place or under development in most major metropolitan areas, provide an important mechanism for establishing the linkage between the development of ITS products and services and the metropolitan planning process. These two activities will aid in the development of a regional framework, which defines a systems architecture and a planning and deployment process needed to support this integration.

This report documents a study of the relationships among early deployment plans (EDPs), CMS, and regional frameworks. There were four principal objectives of the study:

- Report on the status of EDPs conducted in metropolitan areas throughout the U.S.
- Review the role of the EDP process in establishing a regional framework
- Report on the status of CMS development
- Review the relationship between the development processes for EDPs and CMS.

The review of EDPs also addressed one specific question:

- Are EDPs defining or leading to the establishment of regional frameworks?

Three principal findings emerged in response to this question:

- **Most EDPs do not define a clear regional framework.** Only a few EDPs presented systems that map to the national architecture and most completed EDPs define their systems or structure at a conceptual level, without clear definition of the interrelationships between subsystems and information flows.

- **Many of the EDPs currently in progress may give increased consideration to systems integration at the regional** level. Many EDPs were completed before the National ITS Architecture was developed and early guidance documents provide only general direction in developing system architectures or regional frameworks. Most of the staff of on-going EDP

development efforts reported that they planned to model their EDPs on the National ITS Architecture.

- **Institutional coordination and technical integration is being emphasized in areas where many ITS projects are underway and an ITS infrastructure exists.** Integration of the development of EDPs within the metropolitan planning process, however, has been minimal.

The review of CMS addressed three key questions:

. Do CMS consider ITS strategies as solutions to system deficiencies and opportunities for enhancing mobility?

. Is the development of CMS being coordinated with the development of EDPs?

. Are the ITS strategies proposed in CMS compatible with regional ITS frameworks?

Three major findings resulted from the CMS review:

- **CMS consider ITS alternatives but not in the context of the EDP or a regional framework.** ITS generally is treated in terms of individual applications within specific corridors. These applications are usually confined to limited access highways.

- **Better coordination is needed within and among agencies in developing CMS and ITS.** State departments of transportation (DOTs) have generally been the lead agencies for EDPs and regional frameworks while metropolitan planning organizations have lead responsibility for developing CMS. Coordination between CMS and EDP development has been weak, but is improving in some metropolitan areas.

- **While CMS potentially can be an effective mechanism for incorporating ITS in the metropolitan planning process, broader integration also is needed through other planning activities and products.** The metropolitan area's transportation plan can provide a long-range vision for ITS, and the development of the transportation plan and the transportation improvement program represent important opportunities for developing and implementing ITS within a regional framework.

# A REVIEW OF METROPOLITAN AREA EARLY DEPLOYMENT PLANS AND CONGESTION MANAGEMENT SYSTEMS FOR THE DEVELOPMENT OF INTELLIGENT TRANSPORTATION SYSTEMS

## 1. INTRODUCTION

Intelligent transportation systems (ITS) can play a crucial role in increasing the efficiency and safety of regional transportation systems, contributing toward the accomplishment of a major goal of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). ITS planning through early deployment plans (EDPs) has advanced to the stage where many metropolitan areas and states are ready for implementation. Whether or not this next critical stage produces deployments that realize the full potential benefits of the technology depends to a significant degree on the effective integration of ITS applications to form a cohesive regional system.

Federally funded EDPs have been completed or are underway in most of the 75 largest metropolitan areas. The EDPs are intended to serve as a tool that allows local and state agencies to systematically plan and implement ITS technologies as part of an integrated transportation system. EDPs should lead to a regional framework for each of the metropolitan areas in which they are developed. Also, the National Architecture for ITS, which will aid the integration of system components and the development of regional ITS frameworks, was completed in 1996.

Integration of technology applications within a regional framework is only one aspect of the coordination effort necessary to implement ITS successfully. The metropolitan planning process is the forum where potential transportation system improvements are planned and evaluated as prospective public investments. In the past, the process has emphasized planning for capital improvements, rather than investments in operational improvements that can enhance system performance. Congestion management systems (CMS), which were introduced as a requirement in ISTEA, have broadened the perspective of planning agencies to link potential improvements with well-defined operational needs and objectives. CMS can provide a means for identifying opportunities for ITS deployment within the planning process and incorporating the regional frameworks developed through EDPs.

This study addressed the role of EDPs in defining regional ITS frameworks and the extent of integration of ITS and regional frameworks within CMS. There were four principal objectives of the study:

- Report on the status of EDPs conducted in metropolitan areas throughout the U.S.
- Review the role of the EDP process in establishing a regional framework
- Report on the status of CMS development
- Review the relationship between the development processes for EDPs and CMS.

The study is intended to address four key questions:

- Are EDPs defining regional frameworks for ITS?
- To what extent do CMS consider ITS strategies as solutions to system deficiencies and opportunities for enhancing mobility?
- Is the development of CMS being coordinated with the development of EDPs?
- Are the ITS strategies proposed in CMS compatible with regional ITS frameworks?

The remainder of the study report is organized into three major sections. Section 2 summarizes two reviews of the development of EDPs, Section 3 reports on the review of the development of CMS, Section 4 presents the conclusions of the study. A list of acronyms and abbreviations is contained in Appendix L.

# 2. REVIEWS OF EARLY DEPLOYMENT PLANS

Developing a regional vision for ITS is a challenging undertaking. ITS initiatives involve rapidly changing technology, new institutional arrangements, and significant operations and maintenance considerations. The EDP process and funding were designed to help state and local officials develop such regional visions for the use of ITS technologies in meeting transportation needs and to guide the decision-making related to the selection, design, and implementation of ITS products and services. During the past year, Volpe Center staff conducted two reviews of the EDP process and the products of completed EDP studies.

## 2.1 Initial Review

The Volpe Center staff conducted an initial EDP review in 1996. The documents reviewed included 15 EDPs and three priority corridor plans. There were four principal objectives of this review:

- Identify transportation problems cited in the plans
- Identify ITS infrastructure elements that address local and regional transportation problems
- Identify the main technologies to be applied within each of the recommended ITS elements
- Identify the estimated costs associated with each element.

### 2.1.1 Study Approach

The Volpe Center study team gathered 15 EDPs from state and county departments of transportation (DOTs) and priority corridor plans from three corridor coalitions. (Appendix A is a list these 18 documents and the date of publication for each.) These EDPs were reviewed to determine the transportation needs of the area or corridor and the solutions proposed to address these needs. This review of completed EDPs and corridor plans was followed by a series of telephone interviews with transportation officials involved with developing the plans to determine the extent of ITS activity since the plans were completed. Solutions and activities were usually identified as one or more of the seven metropolitan ITS (core) infrastructure elements that were defined at the time the EDP studies were being conducted:

- RMTIC regional multi-modal traveler information center
- FMS freeway management systems
- IMS incident management systems
- T M S transit management systems

- TSCS traffic signal control systems
- ETC electronic toll collection
- EFP electronic fare payment

### 2.1.2 Review of EDP Documentation

The review of the completed EDPs resulted in four principal findings.

### Principal Findings

**Most problems cited in the EDPs were generally associated with either increasing traffic delays and air pollution or declining safety on the highways.** A principal cause of these conditions was identified as traffic congestion, to which the following were most often mentioned as contributing factors:

- Increasing traffic (more vehicles, more trips, and greater distances traveled)
- Incidents and accidents (along with time consuming detection, verification, and response)
- Roadway construction
- Special events
- Lack of motorist information and guidance
- Lack of roadway capacity
- Lack of cooperation and coordination among different traffic management groups and systems in an area
- Financial, social, and environmental constraints to continued expansion of roadway systems
- Unwillingness or inability of more of the commuting public to share rides or use public transportation.

**Among the many recommended solutions to the identified transportation problems, five were cited most frequently:**

- Improved freeway and arterial management systems with more video surveillance for verification purposes and more loop detector coverage for better congestion measurement, incident detection, ramp metering, and traffic signal system controls. Specific ITS elements cited include RMTIC, FMS, IMS, and TSCS.
- Improved motorist information and guidance with highway advisory radio systems, and changeable message signs. (RMTIC)

- Improved coordination and cooperation of traffic managers and participating support elements with more and better integrated traveler information centers and transportation management centers covering broader areas. (RMTIC, FMS, IMS, TSCS, and TMS)
- Improved communication capabilities in support of transportation system operators and users with communications fiber optic backbone networks. (RMTIC, FMS, IMS, TSCS, TMS, EFP)
- Increased on-highway assistance to motorists with additional and more functional motorist assistance patrols. (FMS, IMS)

**The estimated investment necessary to support the required deployments identified in the 18 plans totals approximately $3.14 billion.** The time period over which this investment is spread varies among individual plans, ranging from 2 to 20 years and, in one case, even beyond.

The estimated costs for individual plans (excluding Piedmont, which did not supply estimates) averaged $184 million, ranging from $2.6 million (less than .0l% of the total) for Greenville/Spartanburg to $18 18 million (or almost 58% of the total) for Seattle/Portland. (Cost information for individual plans is summarized in Appendix B.)

**The EDPs provide for significant investment in six ITS elements (RMTIC, FMS, IMS, TSCS, TMS, and EFP).** FMS captures the largest portion, $1.85 billion (59%) of the total required investment, with the other five elements ranging roughly between $140 million and $190 million. RMTIC, FMS, IMS, and TSCS show varying degrees of near-term investment loading, while TMS investment is more often planned to occur at a later time period and EFP investment is evenly distributed over time. (Total estimated deployment investment by element aggregated for all 17 EDPs is presented in Appendix C.)

## Additional Observations

The following observations were gathered from this review of the 18 plans and are intended to offer further perspective on the nature and range of information provided in the plans.

**Cost schedules are inconsistent from plan to plan.**

- Six of the 18 plans associate the estimated costs of recommended initiatives with periods of specific calendar years (i.e., 1995-99, etc.): Boston, Charlotte, Detroit, Omaha, Portland, and the I-95 Corridor.
- Ten associate the costs with periods of numbered years(i.e., years l-5, etc.) with no reference to calendar years.

  One (Greenville/Spartanburg) associates its estimated costs with a general time frame i.e., short term).
- One (Piedmont Triad) associates neither schedule nor costs with its discussion of ITS initiatives.

**Most plans use and identify an advisory committee.** Sixteen of the 18 plans identify one or more committees established to advise, oversee, and guide the planning efforts. In each case, the plan identifies committee members and the organizations they represent.

**Plans lack complete descriptions of current transportation system status.** Many of the area planning organizations engaged in the ITS planning activities discussed here are also engaged, and have been for some time, in projects that are to some degree ITS-related. These organizations have already made some ITS infrastructure investments to which some plans make reference but with varying degrees of completeness. Lack of information on these previous investments could distort the reader's sense of an area's needs, accomplishments, and of the relative priorities among plans.

**State DOTs lead most planning initiatives:**

- Each of the 18 planning initiatives appears to be led by a state DOT, with one exception: the Maricopa County, Arizona initiative led by the County DOT.
- Eight of the planning initiatives involve more than one state:
  1. Charlotte — North Carolina and two counties in South Carolina.
  2. GCM Corridor — Indiana, Illinois, and Wisconsin
  3. I-65 Corridor — Kentucky and Indiana.
  4. I-95 Corridor — Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia.
  5. Omaha — Nebraska and Iowa.
  6. Portland — Oregon and Washington.
  7. St. Louis — Missouri and Illinois.
  8. Seattle/Portland — Washington and Oregon.

**Most of the studies are performed by private sector firms:**

- Fourteen of the 18 planning studies were performed by private sector firms (consultants, etc.).
- The two North Carolina studies (Charlotte and Piedmont) were conducted by the North Carolina DOT.
- The Omaha and Tampa studies were each conducted by universities in the area being studied.

### 2.1.3 Telephone Interviews

During September 1996, Volpe Center staff made a series of phone calls to many of the staffs that had previously submitted plans and to staffs from areas that had completed an EDP but had not finished the formal documentation. The purpose of these contacts was to determine what ITS

project activities had occurred since completion of the EDP. Twelve of the 18 staffs that had provided plans plus four others whose documented plans had not been available provided input.

### Principal Finding

**Thirty-three projects were identified as having progressed through the EDP process.** These projects would require a one-time cost of about $286 million and continuing costs of $4.45 million per year. The large majority of the projects involve FMS or IMS elements or a combination of the two. As of June 1996, eight of these projects have been or were about to be operational. Six were or would soon be under construction. Eight were or would soon be in the design phase. Two were awaiting legislative approval and were not yet in their state's transportation improvement program (TIP). Three more projects recommended in EDPs were not yet in their state's TIP and another two had their designs completed but were not yet undertaken. (Appendix D contains more detailed information on the projects.)

## 2.2 Second Review

The initial EDP review, which focused on the identification of individual ITS proposed as solutions to area and corridor transportation problems, was followed by a two-month review concluding in June 1997. This recent review was designed to serve two objectives:

- report the status of EDPs
- determine the role of the EDP process in establishing regional frameworks.

### 2.2.1 Study Approach

Information on the status of EDPs was collected for the 75 largest metropolitan areas in the U.S. To supplement information obtained from completed EDPs, telephone interviews were conducted with key technical personnel participating in EDP studies that were in progress at the time of the study. The status of the EDPs was determined by reviewing the U.S. DOT's ITS Project Book and by contacting the areas involved in EDP studies. (Appendix E contains the status of EDPs as of June 1997.) Completed EDPs were then reviewed to judge if they were establishing regional frameworks.

### Regional Frameworks

A regional framework for ITS planning and deployment comprises a regional ITS system architecture, which shows ITS components and data flows between subsystems and the operational institutions using them, and a planning and deployment process. An established regional framework, with a clear structure and logic, helps participant organizations and the general public to understand the ITS and reach consensus in defining a system that addresses the

region's transportation problems and needs. The framework provides criteria against which projects can be evaluated for selection and implementation, and standards, which guide the assessment of technologies, system performance, operations, and maintenance. Deployment strategies can also be established within the framework.

The National ITS Architecture has been designed to aid the development of regional ITS frameworks. Specifications of critical characteristics of hardware, software, communication, data, security, and performance are provided to ensure that interrelated systems are designed to be interoperable and support deployment economies of scale.

The National ITS Architecture identified two technical layers, a *Transportation* layer and a *Communication* layer, both of which must operate in the context of an *Institutional* layer. The *Transportation* layer contains the transportation systems aggregated into four systems and 19 subsystems. The *Communications* layer provides the interconnections among the subsystems described in the *Transportation* layer and data and information transmitting among functional components. The relationship between the *Transportation* and *Communications* layers can be represented by a "sausage diagram" (Figure 1.), which was introduced in the National ITS Architecture to illustrate National ITS Architecture subsystems and the communications systems that link them together.

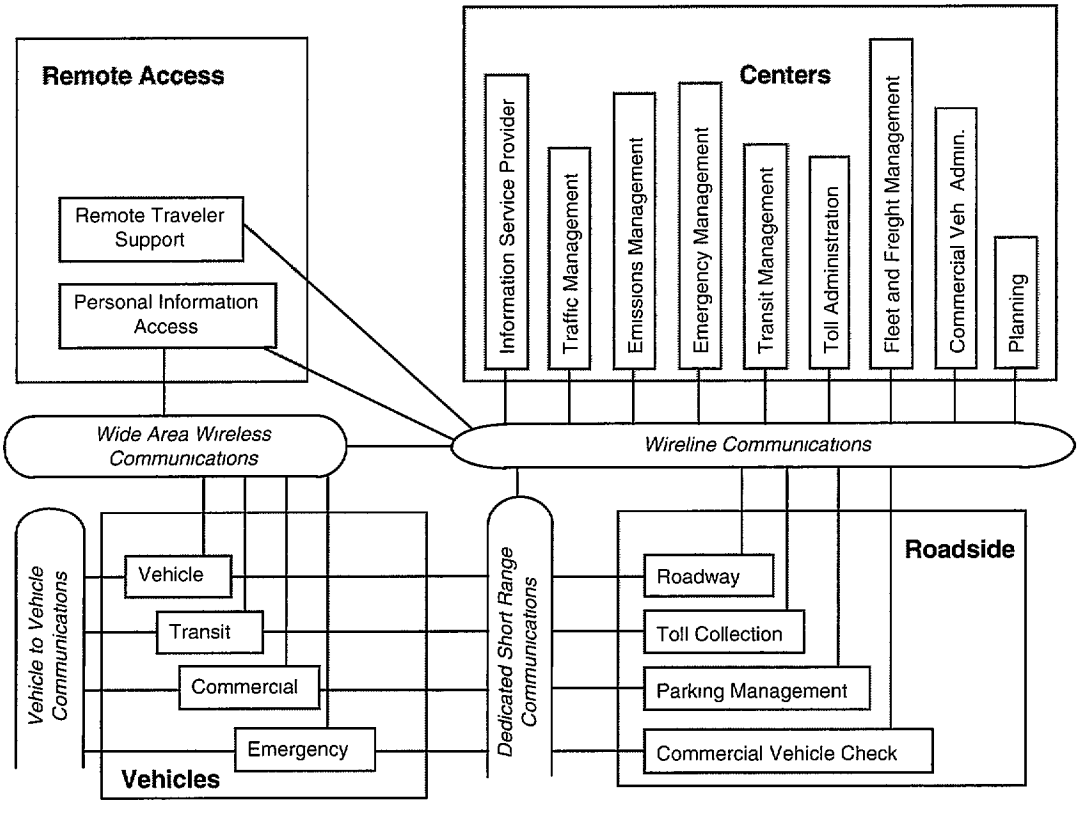


**Figure 1. "Sausage Diagram"**

*Reference: National ITS Architecture - Implementation Strategy*

The *Institutional* layer can be described as a framework defining the policies, funding incentives, organizational responsibilities, working arrangements, and jurisdictional structure that support the technical *(Transportation* and *Communications)* layers of the architecture. A level of multi-modal, multi-jurisdictional cooperation and coordination is emphasized in the development of a structure of institutional relationships as part of the regional framework. This requires broad consensus and cooperation among affected constituencies regarding common goals and shared missions.

## Review Criteria

At the time of the review, however, all of the components that would be required in a regional framework were not fully defined. Therefore the study team reviewed guidance provided to the developers of EDPs and other documentation that discussed creating systems architectures:

- *IVHS Planning and Project Deployment Process* (FHWA, 1993)
- *ITS Strategic Assessments* (FHWA, 1996)
- *National ITS Architecture - Executive Summary* (JAT, 1997)
- *National ITS Architecture - Implementation Strategy* (JAT, 1996)
- *Deploying the ITS Infrastructure: Putting the National ITS Architecture to Work,* (draft, Mitretek, 1997).

Based on the review of these guidance documents, the team identified nine steps that would be involved in developing a regional framework. These nine steps were the criteria against which the EDPs were evaluated to determine if they were defining a regional framework:

- Map existing systems to a framework
- Define the functional components
- Identify how these components will be interconnected
- Identify basic subsystems
- Define required interaction between the subsystems and with other systems
- Define flows of information and the interfaces between subsystems
- Identify data that must be transferred between subsystems
- Identify how regional organizations will work together
- Identify integration opportunities

These criteria emphasized the logical steps and key components recommended to support effective ITS deployment. (Appendix F provides more detailed documentation of the review of this guidance.)

### 2.2.2 Review of EDP Documentation and Telephone Interviews

Among the 75 largest metropolitan areas, 64 areas were found to have undertaken EDP studies. As of June 1997, there are 34 completed EDPs and 30 in progress. Of the 34 completed EDPs, 20 final reports and 3 executive summaries were received by the study team, 16 of which were reviewed for this report. Staff from 21 of the 30 areas with on-going EDPs were contacted by telephone. (Appendix G is a summary of the review of completed EDPs and Appendix H is a summary of the review of on-going EDPs Appendix I contains the list of questions asked in the interviews.)

### Principal Findings

Review findings and observations reflect application of the nine criteria for development of a regional framework.

**Map existing systems to a framework.** Of the 16 EDPs reviewed, four showed existing systems to map with the proposed ITS systems infrastructure, while only one mapped the existing system using a physical ("sausage") diagram. The San Francisco area used the existing metropolitan transportation system as its framework in designing the ITS and sub-components.

The staff responsible for many of the on-going EDP efforts that were started recently indicated that they want to use the National ITS Architecture as a reference in defining regional system architecture.

**Define the functional components.** Most of the completed EDPs identified and prioritized a list of ITS user services presented as a requirement in the IVHS Planning and Project Deployment Process. User services were used in many EDPs as the basis to define the proposed system functions and system components. Market packages, defined as a collection of equipment capabilities likely to be deployed as a group, will complement or replace user services in on-going EDPs.

FMS, TSCS, IMS, and emergency management services (EMS) were the ITS elements most often cited or proposed as high priority items in completed EDPs. FMS and TSCS can be viewed as the base ITS infrastructure or the building blocks for more sophisticated ITS systems. The review suggests that IMS and EMS are regarded as having great potential for the enhancement of safety and mobility.

**Identify basic subsystems and interconnections.** Although the transportation layer in a regional system can be strictly defined using subsystems groupings and functional components as described in the "sausage diagram," few completed EDPs have taken this approach in defining subsystems and their interconnections. The majority of the completed EDPs define their transportation systems or structure at a conceptual level; subsystems were often not clearly

defined. The interrelationships between subsystems and information flows are not clearly defined and often are inconsistent.

There is a common element concerning subsystem interconnections found in many of the EDPs. An operations environment with multiple and distributed traffic operations centers (TOCs) is favored as a short-term solution while a central transportation information center (TIC) is viewed as an ideal long-term option. This finding reflects a preference for maintaining elements of existing traffic management systems while leaving the door open for future improvements when financial and technological situations may change.

For on-going EDPs, and especially for the start-ups, the National ITS Architecture is frequently mentioned as a reference or model for the development of a regional architecture. Staff contacted by telephone in at least twelve of the metropolitan areas with on-going EDP development efforts indicated that they would definitely address the National ITS Architecture in their EDPs. A learning period may be needed to allow more regions and participants to fully comprehend the National ITS Architecture before they are ready to design the logical and physical structures of the system architecture accordingly. The National ITS Architecture also will evolve and mature into a complete ITS system architecture that more fully defines communications and data standards.

**Identify information and data flows**. Standardized communications and information protocols are regarded by many as critical for information and regional architecture development. Only high-level information flows are shown in some of the reviewed EDPs. Very few provide a detailed data flow diagram. One EDP includes inconsistent technical frameworks for exchanging information between agencies.

**Identify institutional coordination.** An institutional framework is established to resolve technical and non-technical issues, define policies, and support program implementation. Most of the EDPs identify an advisory committee or management team as having responsibility for overseeing EDP development. Some provide for focus groups or working groups to formulate cooperative agreements and determine agency responsibilities, which may include development and distribution of memorandums of understanding (MOUs) or manuals for system construction, operations, and maintenance.

Two EDPs designated a deployment committee with responsibility for overseeing the implementation activities under each working group. Deployment schedules (usually divided into short-, mid-, and long-term) and costs are usually listed by projects. Multi-agency, collaborative projects are differentiated from single agency projects. Some EDPs also include potential showcase projects.

The staff of only a few on-going EDPs were reluctant to identify an institutional layer. In some cases, they indicated that the definition of an institutional framework had been deferred.

**Identify integration opportunities.** An ITS regional framework provides a foundation for institutional coordination and technical integration among the components of a regional

transportation system. Many interviewees recognized ITS as a source of more and better transportation data. One EDP recommended, and several interviewees agreed, that ITS projects should be incorporated in the metropolitan transportation planning process, where appropriate, in order to gain local and state funding support.

The development of EDPs and CMS was not closely coordinated in the earliest completed EDPs. However, staff of six on-going EDPs indicated they are coordinating with the developers of the CMS or plan to do so. Coordination is evident among the deployment activities in priority corridors. There also are opportunities for integration with other ISTEA management systems, especially intermodal and safety management.

Opportunities are commonly identified throughout the EDPs for more direct and effective coordination among local agencies, state police, local police, and transit agencies. Organizational assignments and cooperative agreements for IMS and EMS are required to provide clear definitions of implementation responsibilities among police and other local agencies. Another typical example of the need for physical integration and institutional coordination relates to the design and operation of timing plans for route diversions that involve an interface between freeway systems and local arterial streets.

## Additional Observations

**Among the 23 metropolitan areas for which completed EDP reports were received, 19 state DOTs were identified as the lead agencies responsible for project direction and contracting activities.** One county DOT (Maricopa County DOT, Arizona) and three MPOs served as lead agencies. Among the 21 on-going EDPs, 13 state DOTs and 8 MPOs were identified as the lead agencies. These results suggest a trend of MPOs becoming more involved in the ITS planning process as knowledge of ITS becomes more widespread and implementation advances.

**Most of the completed EDPs were performed by private consulting firms under contract.** Of the 23 EDPs received, 16 were performed by single or joint consulting companies, while 3 were completed by area universities, 2 by state DOTs, and 2 by the staffs of MPOs. Among the 21 metropolitan areas contacted that have on-going EDPs, at least 11 of the EDPs were being prepared by consultants.

# 3. REVIEW OF CONGESTION MANAGEMENT SYSTEMS

Congestion management systems (CMS) provide for comprehensive monitoring, evaluation, and enhancement of multi-modal transportation system performance. Federal regulations require CMS in transportation management areas (TMAs), which are metropolitan areas with populations of 200,000 or more residents, when the TMAs are designated as being in non-attainment of carbon monoxide or ozone standards. As the primary mechanism through which operational issues are integrated into the transportation planning processes of many metropolitan areas and states, CMS are logical channels for incorporating potential ITS strategies in the analysis supporting transportation investment decisions.

There are five basic functions of CMS:

- measurement of the quality of performance of the entire transportation system, through such indicators as the extent of congestion and the quality of mobility
- identification of the causes of deficiencies in performance, such as congestion
- identification and evaluation of alternative actions that will contribute to the more efficient use of existing and future transportation facilities and networks, based on established performance measures
- development of information supporting the implementation of actions
- evaluation of the efficiency and effectiveness of implemented actions.

The potential solutions and improvements identified through CMS can include technologies that provide for better travel management and safety. In metropolitan areas, ITS can then be further integrated in the planning process through the development of the region's transportation plan and the investment decisions incorporated in the TIP.

CMS generally build a region-wide analytical framework from the "bottom up," integrating data and analysis of traffic conditions in individual corridors and locations. Most traffic problems and their solutions can be related to constraints or deficiencies that are specific to individual corridors or locations. As a result, CMS may consider individual ITS measures or sets of measures, without necessarily addressing ITS on a region-wide basis. A regional ITS framework requires relating location-specific problems to a regional solution. Integrating local conditions within a regional framework is also necessary to the development of a multi-modal network that enhances mobility options.

## 3.1 Study Approach

In determining the extent to which CMS has been used to link ITS and the planning process of metropolitan areas and states, this study considered information collected from two sources:

- CMS documentation was obtained from metropolitan areas across the country and the documents were reviewed to determine whether and how ITS was treated as an opportunity to improve the performance of the transportation system.
- Staff of metropolitan planning organizations (MPOs) were interviewed to determine the types and levels of coordination that have occurred in developing EDPs, CMS, and regional ITS frameworks in metropolitan areas where there has been significant progress toward completing both an EDP and a CMS.

As in the case of the EDPs, the review of CMS focused on the largest 75 metropolitan areas across the country. Information on the status of CMS was collected through telephone and e-mail contacts with the staffs of the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) regional offices and MPOs. An initial level of screening was conducted to identify those metropolitan areas in which an interim or fully operational CMS had been completed. The study staff received status reports for 44 metropolitan areas, 16 of which had completed fully operational CMS and 12 of which had interim CMS in place, as of June 1997. It was further determined through comparison of information collected on the status of EDPs that 9 of the areas contacted had both fully operational CMS and completed EDPs, while 7 areas had interim CMS and completed EDPs. MPOs in all of these areas were contacted to obtain information on coordination that may have occurred during the development of the CMS and the EDP. Among these 16 MPOs, 10 responded by participating in structured interviews with study staff. (Appendix E contains the status of CMS as of June 1997; Appendix J is a list of MPOs participating in the telephone interviews.)

## 3.2 Review of CMS Documentation

The study team received documentation for 16 fully operational and 12 interim CMS. This material was reviewed to determine the potential role of ITS in terms of two specific functions:

- enhancement of transportation system performance through operational improvements
- collection and transmission of data to monitor system performance.

Two types of ITS applications were considered for both functions:

- individual ITS strategies
- ITS regional frameworks, in which individual ITS strategies are coordinated through a region-wide system or plan.

### Principal Findings

**Most of the CMS identify ITS as a potential strategy for improving system operations.** In many cases, however, the CMS does not reflect serious consideration of how ITS would be applied to relieve congestion or improve mobility. For example, there is frequently no attempt to relate ITS strategies to actual or projected operating conditions. This is particularly true of interim CMS and fully operational CMS completed several years ago.

**Several CMS provide analytic support for ITS solutions.** CMS for Boston, Harrisburg, Hampton Roads, Philadelphia, Pittsburgh, and Scranton establish a connection between ITS and the operational characteristics of the transportation system. This linkage helps to define the role of ITS in improving system performance, which supports evaluation of ITS as a potential investment.

**Only a few CMS refer to a regional ITS plan.** Boston and Hampton Roads reflect some recognition of region-wide ITS coordination. Most often, ITS improvements or strategies are considered on an individual basis as a transportation system management measure to reduce highway congestion in a specific corridor.

**Few CMS consider ITS as a source of information for monitoring system performance,** The CMS focus on ITS as a performance improvement strategy, rather than as a source of data to be used in continuing applications of the CMS or other mechanisms for performance monitoring. The CMS development program for Seattle notes plans to use advanced traffic management systems and automatic vehicle identification technologies for data gathering in development of the region's fully operational CMS.

## 3.3 Telephone Interviews

Telephone interviews were conducted with MPO staff members who have responsibility for CMS. The interviews consisted of 17 questions that explored four topics:

- organizational structures and institutional roles associated with the development of each region's CMS, EDP, and ITS regional framework, including the channels of communication through which these different products have been coordinated;
- mechanisms for integration within the CMS of the EDP, ITS regional frameworks, or individual ITS strategies;
- linkage between ITS and the planning process, beyond the development of the CMS;.
- use of ITS as a tool for data collection and performance monitoring in the CMS.

A copy of the list of questions asked in these interviews is provided in Appendix K.

## Principal Findings

**The state DOT usually leads the EDP study, while the MPO leads the development of the CMS.** As a result, specific efforts to coordinate the two efforts are necessary to achieve integration. Moreover, the EDP and CMS typically reflect the differing perspectives and concerns of the two lead agencies, sometimes producing inconsistency in approach and outcomes.

**Coordination between EDP and CMS development is limited.** Most of the those interviewed reported that the EDP and CMS for their metropolitan areas had been developed independently from one another. While most MPOs have an advisory role in the EDP process, usually different staff members within each agency were involved in the development of the EDP and CMS, with little or no sharing of information among these staff. Typically, those responsible for the CMS had little knowledge of the EDP or regional ITS framework for their metropolitan area. In some cases, a contributing factor to the lack of coordination was that the CMS and EDP were developed at different times.

**Many metropolitan areas have considered ITS strategies to improve traffic management through monitoring, controls, and traveler information systems.** These improvements, however, generally are treated as independent projects. Consistent with the results of the documentation review, only one of the interview participants reported consideration of a regional ITS framework or plan.

**ITS applications are frequently perceived only in terms of limited access highways.** ITS is viewed as being limited to such measures as traffic surveillance and control systems, changeable message signs, incident detection and management systems, and motorist information systems and then are conceived only in terms of highway applications. ITS rarely is considered in a multi-modal context.

**Only two respondents reported that ITS was being used to collect data required for CMS.** While even these efforts -- in New Jersey and Charlotte, North Carolina -- were limited, future application of ITS technology for data collection was reported to be under consideration in several additional metropolitan areas.

**Few EDP committees continue to function past EDP development.** Therefore, the committees do not provide continuing leadership in updating, modifying, or implementing ITS plans through coordination within the metropolitan planning process.

# 4. SUMMARY

This study has provided for the collection and analysis of information on the status of ITS planning and regional coordination in metropolitan areas throughout the U.S. The review of EDPs and CMS conducted for the study shows that there has been significant progress by state and local transportation agencies in planning for ITS, but that regional systems integration and linkage to the metropolitan planning process generally are not well advanced. A synthesis of the findings from the review of EDPs and CMS support these findings.

## 4.1 Reviews of Early Deployment Plans

EDPs are completed or in progress for most major metropolitan areas. While most of the completed EDPs identify priorities for implementation of ITS user services, few have approached ITS development in terms of an integrated regional architecture or framework. However, there are indications that current EDP development efforts reflect familiarity with the National ITS Architecture and that increased consideration is being given to the integration and connection of system components at the regional level. While the lead agencies for the EDPs are usually state DOTs, interagency committees generally serve in an advisory role in developing EDPs.

The reviews produced five principal findings regarding the development of regional frameworks through EDPs:

- **Most EDPs do not define a clear regional framework.** Only a few EDPs presented systems that map to the proposed ITS systems infrastructure. Most completed EDPs define their systems or structure at a conceptual level, without clear definition of the interrelationships between subsystems and information flows. Some EDPs contain very general transportation, communication, or institutional frameworks.
- **Early guidance documents provided only general direction in developing system architectures or regional frameworks.** Many EDPs were completed before the National ITS Architecture was fully developed. Most of the staff interviewed from on-going EDP development efforts were familiar with the National ITS Architecture and reported that they planned to model their EDPs on the National ITS Architecture.
- **Data issues present a dilemma.** Everyone desires more and better data, but in practice, no single source or system can collect and deliver all the data that are needed. Data collection, processing, and information dissemination remain a complex problem in transportation operations and user applications. The implementation of ITS presents an important opportunity to fundamentally change the handling and use of data.
- **Communications standards and protocols are considered critical to the selection, implementation, and maintenance of ITS components.** They are key factors that support the interoperability and compatibility of regional ITS elements.

. **Institutional coordination and technical integration are broadly recognized as being important for successful EDP development and ITS implementation.** Cooperative development of EDPs within the metropolitan planning process, however, has been minimal.

## 4.2 Review of Congestion Management Systems

CMS can play an important role in linking ITS to the metropolitan planning process. This integration, however, currently is in a preliminary stage. CMS are still a relatively new concept and most MPOs have either only recently completed development of their first fully operational CMS or are still working to meet the federal October 1997 deadline for CMS completion. The knowledge of ITS among MPO staff working on CMS is limited, particularly as it concerns EDPs and ITS regional frameworks. This lack of information reflects the fact that state DOTs have generally been the lead agencies for EDPs and regional frameworks while coordination between CMS and EDP development has been weak. Nevertheless, coordination in some areas is improving and knowledge of ITS is increasing among MPO staff.

There are three major conclusions of this study concerning integration of CMS and ITS:

- **Better coordination is needed within and among agencies in developing CMS and ITS.** The CMS developed to date do not reflect the level of ITS planning underway by state DOTs and other transportation agencies in metropolitan areas.
- **CMS consider ITS alternatives but not in the context of the EDP or a regional framework.** ITS is generally treated in terms of individual applications within specific corridors, without reference to a regional framework. Moreover, ITS applications are usually confined to limited access highways rather than the entire roadway network. Transit and inter-modal considerations are negligible.
- **While CMS potentially can be an effective mechanism for incorporating ITS in the metropolitan planning process, broader integration also is needed through other planning activities and products.** The transportation plan, for example, which presents a 20-year vision of the regional transportation system, provides the opportunity to develop a region-wide, multi-modal context for ITS development. This perspective can then be carried forward through the development of the TIP, which provides for the investments necessary to implement the transportation plan.

# APPENDIX A
# LIST OF INITIAL ITS PLANS REVIEWED AND COMPLETION DATES

1. Birmingham, AL., Congestion Management/IVHS Program Study (4/95)
2. Metropolitan Boston, MA., IVHS Strategic Deployment Plan (l/94)
3. Charlotte, NC., IVHS Area-wide Plan - An Early Deployment Study (3/93)
4. Denver, CO., Metro Area IVHS Master Plan (2/94)
5. Metropolitan Detroit, MI., Early Deployment of ATMS/ATIS (2/94)
6. GCM (Gary*Chicago*Milwaukee) ITS Priority Corridor, Initial Program Plan (6/95)
7. Metro Grand Rapids, MI., Strategic Deployment Plan, Early Deployment Study for ITS (5/96)
8. Greenville/Spartanburg, SC., Congestion Management Study and Design Project Report (3/96)
9. Hampton Roads, VA. Region, Strategic ITS Deployment Plan (10/95)
10. I-65 (Louisville, KY./IN.) Freeway Incident Management Study (8/94)
11. I-95 Corridor Coalition Business Plan (6/95)
12. Maricopa County, AZ., ITS Strategic Plan - Early Deployment of ITS (10/95)
13. Omaha, NB. Metro Area, Strategic Deployment Plan - ITS Early Deployment Planning Study (12/95)
14. Piedmont Triad, NC., Advanced Transportation System Improvements Report - An IVHS Area-wide/Corridor Plan (8/94)
15. Portland, OR. Region-wide Advanced Traffic Management System Plan, Executive Summary (10/93)
16. Bi-State St. Louis, MO. Area IVHS Planning Study (4/94)
17. Seattle to Portland Inter-City ITS Corridor Study and Communications Plan (3/96)
18. Tampa, FL. Bay Area Integrated Transportation Information System Report (9/93)

# APPENDIX B
# PLAN RECOMMENDATIONS FOR DEPLOYMENT INVESTMENT BY PLAN PHASE

(Figures Represent $ in Millions)

| PLAN (time frame) | First Five Years | Second Five Years | Beyond Ten Yrs | TOTAL |
|---|---|---|---|---|
| Birmingham (O-20 yrs) | 48.98 | 98.12 | 27.95 | 175.05 |
| Boston (1994-2000) | 91.54 (1st 7 yrs) | - | | 91.54 |
| Charlotte (1992-2013+) | 32.42 | 28.23 | 81.16 | 141.81 |
| Denver (0-ll+) | 58.95 | 29.56 | 6.09 | 94.60 |
| Detroit (5/94- 1 0/02) | 85.65 | 75.58 | | 161.23 |
| GCM Corridor (O-2) | 32.60 (1st 2 yrs) | - | | 32.60 |
| Grand Rapids (0- 1 1 +) | 19.50 | 19.09 | 26.21 | 64.80 |
| Greenvle/Spartan ("Short term") | 2.58 | | | 2.58 (<0.1%) |
| Hampton Roads (0- 10) | 39.55 | 18.82 | | 58.37 |
| I-65 Corridor (O-6+) | 5.03 | 13.53 | | 18.56 |
| I-95 Corridor (1993-97) | 46.75 (1 st 5 yrs) | - | | 46.75 |
| Maricopa County (O-l 5) | 118.21 | 13.03 | 0.71 | 131.95 |
| Omaha (1995-2015) | 17.39 | 25.15 | 69.25 | 111.79 |
| Piedmont Triad ---- | No costs or time frames were developed by the report | | | |
| Portland (1994-99) | 25.50 (1st 6 yrs) | - | | 25.50 |
| St. Louis (O-l l+) | 77.06 | 32.54 | 32.09 | 141.69 |
| Seattle/Portland Corridor (O-20) | 669.33 | 555.37 | 593.11 | 1817.81 (58%) |
| Tampa Bay (O-4) | 18.85(lst 4yrs) | - | | 18.85 |
| TOTALS | 1389.89 | 909.02 | 836.57 | 3135.48 (100%) |
| | (44.3%) | (29.0%) | (26.7%) | (100%) |
| | | | average (excluding Piedmont) = | 184.44 |
| | | | average (excluding Piedmont, Seattle/Portland, & Greenvle/Spartan.) = | 87.67 |

# APPENDIX C
# PLAN RECOMMENDATIONS FOR DEPLOYMENT INVESTMENT BY ITS ELEMENT

(Figures represent $ in millions followed by % of column total in parenthesis)

| ITS Element | First Five Years (%) | Second Five Years (%) | Beyond Ten Yrs (%) | TOTAL (%) |
|---|---|---|---|---|
| RMTIC | 87.55 (6.3) | 35.56 (3.9) | 23.62 (2.8) | 146.73 (4.7) |
| FMS | 765.48 (55.1) | 525.14 (57.8) | 559.38 (66.9) | 1850.00 (59.0) |
| IMS | 93.75 (6.7) | 56.51 (6.2) | 0.58 (0.1) | 150.84 (4.8) |
| TSCS | 73.59 (5.3) | 51.26 (5.6) | 41.49 (5.0) | 166.34 (5.3) |
| TMS | 35.77 (2.6) | 70.01 (7.7) | 86.09 (10.3) | 191.87 (6.1) |
| EFP | 50.60 (3.6) | 43.78 (4.8) | 46.00 (5.5) | 140.38 (4.5) |
| EMS | 1.12 (0.1) | – | – | 1.12 (0.0) |
| ETC | 0.10 (0.0) | – | – | 0.10 (0.0) |
| RRX | – | – | – | 0 |
| OTHER: | | | | |
| c v o | 1.29 (0.1) | 10.15 (1.1) | – | 11.44 (0.4) |
| COMM | 80.74 (5.8) | 42.57 (4.7) | 16.08 (1.9) | 139.39 (4.5) |
| Computer/Software | 4.12 (0.3) | 3.84 (0.4) | 9.20 (1.1) | 17.16 (0.6) |
| Overhead/Development | 195.78 (14.1) | 70.20 (7.7) | 54.13 (6.5) | 320.11 (10.2) |
| TOTALS | 1389.89 (100) | 909.02 (100) | 836.57 (100) | 3135.48 (100) |
| | (44.3%) | (29.0%) | (26.7%) | (100%) |

# APPENDIX D
# ITS ACTIVITY SINCE PUBLICATION OF PLANS

| AREA/CORRIDOR: PROJECTS | STATUS | COST($) | ITS ELEMENTS |
|---|---|---|---|
| Boston: | | | |
| Communication reqs study | Completed | 200K | FMS,IM,TSCS, EMS,RMTIC |
| HOV lane/SE Xpressway | In operation | 1.0 mil 950K/yr | FMS |
| Incident management program | In operation | 575K | IM, EMS |
| Motorist assistance program | In operation | 1.8mil/yr | IM, EMS |
| SmartRoute system/ATIS | In operation | 1 .5mil/yr | FMS, IMS, RMTIC |
| Regional traffic operations center | Construction in FY97/98 | 3.0 mil | FMS, IMS, TSCS, EMS, RMTIC |
| I-93 Integrated corridor | In design phase | 3.7 mil | FMS, IMS, TSCS, EMS, RMTIC |
| I-95/Rte 128/Arterials | Construction in FY97/98 | 10.0 mil | FMS, IMS, EMS, RMTIC |
| Charlotte: | | | |
| Congestion avoidance and reduction for autos and trucks (CARAT) | Under construction | 13.7 mil | FMS, IMS |
| Dallas: | | | |
| US75,IH635,IH35E/Loop12,SH183 | Being added to TIP | 40.0 mil | FMS, IMS |
| Denver: | | | |
| Traffic management center | In design phase | 5.0 mil | FMS, IMS, RMTIC |
| Detroit: | | | |
| ATMS/ATIS expansion | In design & construction | 33.0 mil | FMS,IM,EMS,RMTIC |
| Grand Rapids: | | | |
| No projects due to EDP | | | |
| Greensboro: | | | |
| I-85 Loop detection/ramp metering | In design phase | 3.5 mil | FMS, IMS |
| Greenville/Spartanburg: | | | |
| I-85 State hiway emergency patrol | On-road in Oct96 | 200IUyr | FMS, IMS |
| Spartanburg ground mounted VMS | In stand-by operation | 40K | FMS, IMS |
| Greenville HAR/VMS/expanded State hiway emergency patrol | In design phase | 400K | FMS, IMS |
| Hampton Roads: | | | |
| Freeway traffic management system | Under construction | 1 lmil | FMS, IMS, EMS |
| I-65 (Louisville): | | | |
| I-65 Freeway incident mgnt system | In design phase | 5 mil | FMS,IMS,TSCS, EMS |
| I-70 (Denver): | | | |
| ITS improvements | ? | 1.7 mil | FMS, IMS, RMTIC |
| Kansas City: | | | |
| Freeway management system | Letting design contract 1 /97 | 28 mil | FMS |
| Omaha: | | | |
| Traveler information system | Plan recommended/not yet in TIP | 2.7 mil | FMS, IMS |
| Upgrades to hdwre and traffic signals | " " " " " " | 2.4 mil | TSCS |
| Pittsburgh: | | | |
| Penn Lincoln Pkwy | In final design /let | 6 mil | FMS, IMS, EMS |
| Pkwy patrol system | In operation contract 12/97 | 250K | IMS |

# APPENDIX D
# ITS ACTIVITY SINCE PUBLICATION OF PLANS
## (continued)

| AREA/CORRIDOR: PROJECTS | STATUS | COST($) | ITS ELEMENTS |
|---|---|---|---|
| Seattle/Portland corridor: | | | |
| I-5 corridor ITS/CVO initiative | Pending legislative approval | 23 mil | FMS |
| Vancouver, WA TMCS | " " " | 35 mil | FMS, IMS |
| St. Louis: | | | |
| IM project | Under construction | 4 mil | IMS |
| Cameras/detection equipment/VMS | Soon to be in design phase | 7.5 mil | FMS |
| Tampa: | | | |
| Surveillance system | Design completed/not yet undertaken | 1.2 mil | IM |
| Tampa computerized signal system | " " " " " | 4.5 mil | TSCS |
| TOTALS | | 286.325 mil<br>plus 4.45 mil/yr | |

# APPENDIX E
# STATUS OF EDPs AND CMS
# as of June 1997

| Metropolitan Area | State | Reg. | EDPs | | CMS | |
|---|---|---|---|---|---|---|
| | | | Due Date | Report | Status | Report |
| | | | | | | |
| Hartford, New Britain, Middletown | CT | 1 | done | July | | |
| New Haven, Meriden | CT | 1 | **Sep-97** | Jan-98 | | |
| Boston, Lawrence, Salem | MA | 1 | **done** | X | **final** | X |
| Springfield | MA | 1 | **Jul-97** | | | |
| Albany, Schenectady, Troy | NY | 1 | | Dec | | |
| Buffalo, Niagara Falls | NY | 1 | **Mar-97** | final stage | | |
| NY, No. NJ, LI - EDP | NY | 1 | **Mar-97** | Sept | --- | --- |
| New York, Long Island - CMS | NY | 1 | **---** | --- | | |
| Northern New Jersey - CMS | NJ | 1 | **---** | --- | interim | X |
| Rochester | NY | 1 | done | X | | |
| Syracuse | NY | 1 | **Jul-98** | | | |
| Providence, Pawtucket, Fall River | RI | 1 | done | requested | | |
| | | | | | | |
| Washington | DC | 3 | **done** | X | **fnl strat** | X |
| Baltimore | MD | 3 | **Oct-97** | | interim | X |
| Allentown, Bethlehem, Easton | PA | 3 | **May-98** | | final? | |
| Harrisburg, Lebanon, Carlisle | PA | 3 | **May-98** | | final | X |
| Philadelphia, Wilmington, Trenton | PA | 3 | pending | | final | X |
| Pittsburgh, Beaver Valley | PA | 3 | **done** | requested | **final** | X |
| Scranton, Wilkes-Barre | PA | 3 | **Apr-97** | July | **final** | X |
| Norfolk, Virginia Beach, Newport News | VA | 3 | | | interim | X |
| Richmond, St. Petersburg | VA | 3 | **done** | | **interim** | under dev |
| | | | | | | |
| Birmingham | AL | 4 | done | X | under dev | study |
| Jacksonville | FL | 4 | **Jul-97** | | interim | |
| Miami, Fort Lauderdale | FL | 4 | | | final | |
| Orlando | FL | 4 | **Jul-97** | Dec | final | adopt pnd |
| Tampa, St. Petersburg, Clearwater | FL | 4 | done | X | | |
| West Palm Beach, Boca Raton, Delray | FL | 4 | | | under dev | |
| Atlanta | GA | 4 | **Jan-97** | June | **interim** | |
| Louisville | KY | 4 | done | X | not req. | n/a |
| Charlotte, Gastonia, Rock Hill | NC | 4 | done | X | | |
| Greensboro, Winston-Salem, High Point | NC | 4 | done | X | | |
| Raleigh-Durham | NC | 4 | done | X | | |
| Charleston | SC | 4 | **Jan-97** | Oct | | |
| Greenville, Spartanburg | SC | 4 | done | X | | |
| Knoxville | TN | 4 | **Mar-98** | | partial | |
| Memphis | TN | 4 | **Oct-97** | | partial | |
| Nashville | TN | 4 | **done** | requested | **final** | |

X in "Report" column indicates report received at the Volpe Center
Shaded cells indicate metropolitan areas with a completed EDP and an interim or final CMS

# APPENDIX E
# STATUS OF EDPs AND CMS
# as of June 1997
## (continued)

| Metropolitan Area | State | Reg. | EDPs | | CMS | |
|---|---|---|---|---|---|---|
| | | | Due Date | Report | Status | Report |
| | | | | | | |
| Chicago, Gary, Lake County | IL | 5 | **Feb-98** | Jul-98 | interim | **X** |
| Indianapolis | IN | 5 | **done** | X | **final** | |
| Detroit, Ann Arbor | MI | 5 | done | X | under dev | |
| Grand Rapids | MI | 5 | done | X | under dev | |
| Minneapolis, St. Paul | MN | 5 | | | final | X |
| Cincinnati, Hamilton | OH | 5 | | | under dev | requested |
| Cleveland, Akron, Lorain | OH | 5 | done | exec sum | under dev | under dev |
| Columbus | OH | 5 | **Feb-97** | | under dev | under dev |
| Dayton, Springfield | OH | 5 | **Oct-97** | | under dev | under dev |
| Toledo | OH | 5 | pending | | | requested |
| Youngstown, Warren | OH | 5 | pending | May-99 | | requested |
| Milwaukee, Racine | WI | 5 | | | final | X |
| | | | | | | |
| Little Rock, North Little Rock | AK | 6 | | | | ? |
| Baton Rouge | LA | 6 | | | | **?** |
| New Orleans | LA | 6 | **done** | requested | **interim** | **under dev** |
| Oklahoma City | OK | 6 | **Oct-98** | | | |
| Tulsa | OK | 6 | | | | |
| Austin | TX | 6 | done | July | | |
| Dallas, Fort. Worth | TX | 6 | **done** | requested | **final** | requested |
| El Paso | TX | 6 | **Apr-98** | | | |
| Houston, Galveston, Brazoria | TX | 6 | Pri. Corridor | requested | | |
| San Antonio | TX | 6 | **Apr-98** | | | |
| | | | | | | |
| Wichita | KS | 7 | pending | | | |
| St. Louis | MO | 7 | **done** | X | **interim** | **under dev** |
| Kansas City | MO | 7 | **done** | X | **interim** | **under dev** |
| Omaha | NB | 7 | done | X | under dev | under dev |
| | | | | | | |
| Denver, Boulder | CO | 8 | **done** | X | **interim** | x |
| Salt Lake City, Ogden | UT | 8 | **Jan-97** | requested | **final** | **X** |

# APPENDIX E
# STATUS OF EDPs AND CMS
# as of June 1997
## (continued)

| Metropolitan Area | State | Reg. | EDPs | | CMS | |
|---|---|---|---|---|---|---|
| | | | Due Date | Report | Status | Report |
| | | | | | | |
| Phoenix | AZ | 9 | done | X | final | X |
| Tucson | AZ | 9 | done | X | | |
| Bakersfield | CA | 9 | | | | |
| Fresno | CA | 9 | Mar-98 | | | |
| Los Angeles, Anaheim, Riverside | CA | 9 | Dec-97 | | strategies | status rpt |
| Sacramento | CA | 9 | done | X | | |
| San Diego | CA | 9 | Jun-97 | | | |
| San Francisco, Oakland, San Jose | CA | 9 | done | X | | |
| Honolulu | HI | 9 | Apr-97 | requested | under dev | under dev |
| Las Vegas | NV | 9 | done | X | | |
| | | | | | | |
| Portland, Vancouver | OR | 10 | done | exec sum | interim | X |
| Seattle, Tacoma | WA | 10 | done | X | under dev | X |

# APPENDIX F
# REVIEW OF GUIDANCE PROVIDED TO EDP PARTICIPANTS

This appendix presents a review of the documents produced by the Department to identify guidance in developing regional frameworks that was presented to participants in the EDP Process .

**IVHS Planning and Project Deployment Process - April 1, 1993**

This document was the first one circulated to the EDP participants. It provides very general guidance on the construction of a system architecture. Because it preceded the National ITS Architecture, it provides no assistance for designing a regional framework consistent with a national architecture. The document states that a system architecture provides the framework around which detailed functions, technologies, and interfaces are defined and lists a few general concepts needed to produce the architecture:

- group resources and required activities and resources to various subsystems
- define required interaction among the subsystems and with other systems
- develop a high-level flow chart.

The document states that the development of a systems architecture is done concurrently with the definition of the functional requirements to support the required user services and that these two processes are iterative.

The document also discusses, in general terms, the relationships between system architectures and the concept of ITS user services and functions. It defines the concept of user services and identifies six user service areas (now called bundles): Traveler Information, Freight and Fleet Management, Emergency Vehicle Management, Traffic Management, Public Transport, and Additional Services. (It references the Working Paper on IVHS User Services and Functions if additional information is sought.) The document also lists seven system functions: Surveillance, Traveler Interface, Navigation/Guidance, In-vehicle Sensors, Communications, Control Strategies, and Data Processing

**ITS Strategic Assessments - October 28, 1996**

This document was released about the time the last group was selected to participate in the EDP Process. It contains definitions of market and equipment packages as well as a section that provides general direction for defining a regional architecture. The document states that a regional architecture is a framework for delivery of the selected market packages and lists the purpose of a regional architecture:

- allocates the desired functional capabilities, or equipment packages, to subsystems
- defines flows of information and the interfaces between subsystems
- identifies how regional organizations may work together to deliver market packages
- helps identify integration opportunities.

This document proposes that regional ITS elements be mapped into the physical aspect of the National ITS Architecture (a combination of the Transportation Layer and Communications Layer). These regional elements should then be mapped into the National ITS Architecture subsystems, and equipment packages assigned to the subsystems. An example is shown of the Dallas architecture, which uses the physical aspect of the National ITS Architecture. The document refers potential regional architects to the *National ITS Architecture Implementation Strategy* document for further guidance.

**National ITS Architecture Executive Summary - January 1997**

(This document was not referenced by either of the two previously mentioned documents, but was reviewed to gain insight into the National ITS Architecture and the documents defining it.)

This document provides the layout for the logical and physical aspects of the National ITS Architecture. This Architecture has been constructed to implement the 29 user services. The physical aspect of the National ITS Architecture, also known as the “sausage diagram,” contains four systems (Traveler, Center, Roadside and Vehicle) and 19 subsystems connected with communications technologies. The systems, subsystems, and communications are described in detail. The document asserts that the logical and physical aspects of the National ITS Architecture should be used when constructing a regional framework.

The document also lists several market packages that can be deployed early due to their low-risk implementation characteristics: Surface Street Control, Freeway Control, Dynamic Toll Management, Transit Vehicle Tracking, Transit Operations, and Electronic Clearance.

The Executive Summary refers any potential implementor of a regional framework to the document *National ITS Architecture Implementation Strategy* for further guidance.

**National ITS Architecture Implementation Strategy -June 1996**

This document was referenced by the *ITS Strategic Assessment* document and the *National ITS Architecture Executive Summary.* It provides detailed information on how to implement a regional architecture using the National ITS Architecture. It states that a regional architecture is defined when communications choices, technology choices, and the allocation of information management and control processing capabilities within the regional transportation system are developed. It also discusses the process of defining a regional architecture:

- map existing systems to the National ITS Architecture framework
- assess existing system national compatibility
- determine cost and benefits of achieving compatibility.

The document lists the three layers necessary in implementation: Communications, Transportation, and Institutional. The document also describes the "sausage diagram," a diagram of the National ITS Architecture subsystems and the communication systems that link them. This "sausage diagram" contains the Transportation Layer and its interface with the Communications Layer.

This document discusses how the "sausage diagram" can be used as part of the architecture for implementation of a regional framework. The document describes the National ITS Architecture subsystems, equipment packages, and market packages as well as providing tables that show the relationship between the subsystems and packages. The document also shows the relationship between market packages and user services. The document explains how, through the use of the "sausage diagram," equipment and market packages chosen by regional designers can be implemented in a regional framework in accordance with the National ITS Architecture.

This document also describes the relationship between the National ITS Architecture and the Intelligent Transportation Infrastructure (ITI) (now called the metropolitan ITS Infrastructure) and lists the nine ITI components:

- Regional Multimodal Traveler Information System
- Traffic Signal Control System
- Freeway Management System
- Transit Management System
- Incident management Programs
- Electronic Fare payment System
- Electronic Toll Collection System
- Highway-Rail Crossing Protection
- Emergency Management Services.

The document provides a table listing the relationship between ITI components and National ITS Architecture market packages. Using this table, the document lists the market packages which support the ITI and shows the necessary subsystems and communications in the "sausage diagram" to support ITI.

The document also discusses the Institutional Layer, which it defines as introducing the policies, funding incentives, working arrangements, and jurisdictional structure that support the technical (Transportation and Communications) layers of the architecture. This layer provides the basis for understanding who the implementors will be and the roles these implementors could take in implementing architecture-based ITS systems. The document provides a diagram of the Institutional Layer which consist of five groupings: Federal, Non-Profit/Advisory, Private Sector, Local Government, and General Public (Users). The document also contains tables which list, by National ITS Architecture subsystem, the responsible organizations for production, operations, usage, funding, etc.

This document discusses the development of a the Market Package Plan, which will identify the market packages that satisfy the needs of the region. This Plan will be influenced by many sources including the existing system inventory, the ITI, and cost analysis.

This document also provides more information about the "Define Regional Architecture" step of the ITS Planning Process. The first step in defining the regional architecture is to map existing and currently programmed transportation systems into the subsystems defined by the National ITS Architecture. This step will be done using the "sausage diagram." The end result of this step is a regional architecture that includes existing systems and reflects necessary extensions to these systems and their interfaces to support the new transportation services that are planned for the region.

Once the transportation system in the regional architecture has been defined, the communications architecture that will integrate the system must be defined. This step is the development of the Communications Layer. The Communications Layer shows how various communications technologies can be used to support the communications requirements for ITS. This layer includes a description of the general communications services that connect the transportation subsystems in the Transportation Layer. Once determined, the information from the Communications Layer will be applied to the regional framework as found in the "sausage diagram." The Communications Layer allows broad choices to the implementor; data flows defined in the Transportation Layer can be supported in different ways by the Communications Layer.

The combination of the Transportation and Communications Layer will create a regional architecture. This defined regional architecture will be combined with the identified market packages and general strategies to develop a Strategic Deployment Plan.

**Deploying the ITS Infrastructure: Putting the National ITS Architecture to Work - draft**

This document was reviewed to gain insight on defining the need for a regional framework to conform to the National ITS Architecture. The document discusses the purpose of the National ITS Architecture:

- identifies basic subsystems
- defines functions performed by each subsystem
- identifies data that must be transferred between them.

It also discusses three questions that an architecture must address:

- What will the system do?
- What are its functional components?
- How will these components be interconnected?

It then defines the components of the National ITS Architecture:

- Functions - activities that an ITS would carry out
- Sub-functions, etc. - further definition of functions
- Subsystems - components to which functions are assigned
- Interfaces between subsystems - data flows.

The document states that there are two aspects to the architecture: logical and physical. The logical architecture answers the question, what has to be done? and defines the data flow diagrams and process specifications (P-specs). The physical architecture addresses the question, how should it be done (functions)? It defines the subsystems, assigns P-specs to them, and documents data-flow interfaces between the subsystems.

This document goes on to say that a subsystem or device is in conformance if four conditions are met:

1. supports some subset of functions for that subsystem in the National ITS Architecture (and that rationale is provided for any functions that have been excluded), corresponding to the requirements of the deployment.
2. allocates the proper function to the proper subsystem
3. supports the data flows relevant to the included functions defined for that subsystem in the National ITS Architecture
4. uses open system interface standards wherever they exist, but not to the exclusion of proprietary interfaces or communication protocols between subsystems when appropriate.

The document suggests that in the near term, to be in conformance, a regional framework should identify which subsystems should be included in the transportation system and which subsystems should interface to which other subsystems. In the long term, the regional framework should be

more specific, including identifying which standards must be used in interfaces between subsystems.

**Summary**

The documents reviewed list several activities required to develop a regional framework:

- identify what the system will do
- map existing systems to the National ITS Architecture framework
- assess existing system national compatibility
- define the functional components
- identify how these components will be interconnected
- identify basic subsystems
- define functions performed by each subsystem
- define required interaction among the subsystems and with other systems
- define flows of information and the interfaces between subsystems
- identify data that must be transferred between subsystems
- group resources and required activities and resources to various subsystems
- allocate the desired functional capabilities, or equipment packages, to subsystems
- identify how regional organizations may work together to deliver market packages
- identify integration opportunities
- determine cost and benefits of achieving compatibility.
- develop a high-level flow chart

These documents also indicate that a regional framework can be represented in one of several ways or a combination of ways:

- user service plan
- market package plan
- transportation layer diagram
- communications layer diagram
- institutional layer diagram
- logical architecture (i.e., metropolitan ITS infrastructure)
- physical architecture (i.e., “sausage diagram”)

For the purpose of our review, we will focus on identifying specific components or activities:

- map existing systems to a framework
- define the functional components
- identify how these components will be interconnected
- identify basic subsystems
- define required interaction among the subsystems and with other systems
- define flows of information and the interfaces between subsystems
- identify data that must be transferred between subsystems
- identify how regional organizations will work together
- identify integration opportunities

We will look for user service plans and market package plans to identify the system functions. We also will look to the diagrams and explanatory text to identify if the other activities have been addressed.

## Definitions

Transportation Layer - The first of three layers found in the National ITS Architecture. This layer contains the transportation systems aggregated into four systems and 19 subsystems. Market packages will be entered into the subsystems of the Transportation Layer.

Communications Layer - The second of the three layers. This layer shows how various communications technologies can be used to support the communications requirements for ITS. This layer includes a description of the general communications services that connect the transportation subsystems in the Transportation Layer.

Institutional Layer - The third of the three layers. The Institutional Layer introduces the policies, funding incentives, working arrangements, and jurisdictional structure that support the technical (Transportation and Communications) layers of the architecture.

Sausage Diagram - Also referred to as the National ITS Physical Architecture. This diagram contains the Transportation Layer interfaced with the Communications Layer.

Market Packages - A collection of equipment capabilities which satisfy a market need and are likely to be deployed as a group. These packages will be implemented into the Physical Architecture as part of the Strategic Deployment Plan.

# APPENDIX G
# SUMMARY OF COMPLETED EDPs

| EDP | Comp. Date | Map Existing Systems | Functional Components | Subsystems | Subsystems Interconnections | Institutional | Integration |
|---|---|---|---|---|---|---|---|
| Charlotte | Mar-93 | NO | -IVHS Initiatives<br>-Projects<br>-No mention of User Services or Market Packages<br>-No Interconnections | None specified | None specified | None | Projects part of CARAT system |
| Tampa Bay | Sep-93 | Institutional & Communications Framework | -Does not define functional components other than Traffic vision Center<br>-No mention of User Services or Market Packages | -Communications layer defined<br>-No Transportation Layer | Hi-Level Communications | Institutional Layer | Traffic information in Tampa bay area through area TOCs |
| Boston | Jan-94 | Regional Architecture | -Priority IVHS functions<br>-Communications system<br>-No mention of User Services or Market Packages<br>-Regional architecture shows interconnections | Regional Architecture | -Regional TICC flows<br>Communications nehvork | Regional Architecture | Regional Architecture |
| Detroit | Feb-94 | Baseline Architecture | -Traffic Management Operations<br>-Traveler Information Management Operations<br>-System Performance Monitoring Operations<br>-Connected through DFOC | -3 subsystems Traffic Mgmt Ops. Traveler Info Mgmt Ops, System Performance Monitoring Ops<br>-No Framework | -Baseline Architecture<br>-Communications Node | -Regional organizations interconnected in MDTS<br>-Baseline Architecture | None specified |
| StLouis | Apr-94 | Institutional and Communications framework | -Proposed field system requirements and transportation mgmt requirements<br>-Communications network for field system requirements | -Roadside systems | -No Transportation Layer<br>-Communications Layer not clearly defined | -flows between TIC. agencies and technologies<br>-High-level Instltutional Layer | None specified |
| Piedmont | Jul-94 | NO | -6 high priority advanced transportation system initiatives<br>-Connections to TOC | 3 subsystems Travel & Traffic Mgmt, Public Transportation Mgmt. Emergency Mgmt | None specified | None specified | ATIS projects considered in MPO Planning Process |
| Louisville | Aug-94 | Communications network | -5 ITS projects for one User Service Incident Management<br>-no interconnections between projects<br>-Communications network | Incident Mgmt | -No Transportation Layer<br>-Communication flows | None specified | None specified |
| Phoenix | Oct-95 | Sausage Diagram | -User Services<br>-Projects<br>-No interconnections shown | Defines applicable subsystems of National ITS Architecture | -High-level Transportation Layer<br>-Communications Layer | High-level Institutional Layer | None specified |
| Omaha | Dec-95 | System Arch consistent with National ITS Arch and FHWA Core Infrastructure | -User Services<br>-Projects<br>-Interconnections through ATMIC | 5 subsystems Traffic Mgmt & Info Center, Traffic Signal Control. Freeway Mgmt, Transit Mgmt. Incident Mgmt | -Transportation layer<br>-Communications Layer<br>-Consistent with National Architecture | Institutional Layer | ITS projects incorporated into TIP process |
| Raleigh | Dee-95 | Transp Layer | -User Services<br>-7 high-priority projects<br>-Communications for projects listed<br>-System diagrams for individual projects | 5 subsystems Traffic Mgmt Center, Traffic Monitoring. CVO, Travel Services, Transit | -Transportation Layer<br>-Communications requirements by project not subsystem | Proposes 2 alternatives Centralized or Distributed | Short term plans integrated with 2001 NCDOT TIP |

# APPENDIX G
# SUMMARY OF COMPLETED EDPs
## (continued)

| EDP | Comp. Date | Map Existing Systems | Functional Components | Subsystems | Subsystems Interconnections | Institutional | Integration |
|---|---|---|---|---|---|---|---|
| Greenville/ Spartanburg | Mar-96 | Backbone Comm system | -4 initial functions of regional ATMS -components and interconnections for Spartanburg I-85 and Greenville ATIS/ATMS -Communications | ATMS | -Links to ATMS -Communicatons architecture | -Institutional framework for ATMS | None specified |
| Kansas City | Mar-96 | Communications Architecture Lists existing User Services | -Short, medium and long-term User Services Coordination through single TOC -Communications network | Freeway Mgmt System | Communications Network | -Interagency co-ordination and flow of Information -Institutional framework | k-state Incident Mgmt |
| Grand Rapids | May-36 | NO | -7 highest priority User Services -TOC will link to ITS functions | Didtributed System with 3 subsystems Traffic Mgmt, Transit Mgmt Emergency Mgmt | -No Transportation Layer -No Communications Layer -Generic National Architecture | Institutional Layer for FMS | None specified |
| Sacramento | Jun-96 | NO | -User Services -Framework for delivery of U s e r Services -Interconnection of functional components -Communications for each User Service | 6 subsystems Travel & Transportation Mgmt. Travel demand Mgmt. Public Transportation Ops. CVO. Emergency Mgmt, Advanced Vehicle Control s Safety | -No Transportation Layer -No Communications Layer | -Show how regional organizations will work together -Institutional framework | None specified |
| Indianapolis | Aug-96 | Reg framework | -12 highest priority User Services -Projects Interconnections between functional components | 5 subsystems Traveler Info. Freeway Mgmt. Traffic Signal Control. Incident Mgmt Transit Mgmt | -Links from TOC to subsystems Communications architecture | Institutional framework | None specified |
| San Francisco | Aug-96 | based on existing Metro Transp System | -User Services -Action Items chosen -Interconnections between action items | 5 subsystems Traveler Info. Roadway Mgmt, Transit & Rideshare, Emergency Response. Other | Project level Transportation framework | Project level Institutional framework | Integration of eight action items |

# APPENDIX H
# SUMMARY OF ON-GOING EDPs

| EDP | Expected Date | Status | Functional Components | National ITS Architecture | Regional Framework | Institutional Framework | Relationships to CMS |
|---|---|---|---|---|---|---|---|
| Salt Lake City. UT | May-97 | completed | Market Packages | | | stay within individual projects by agency, not much coordination | no, but believe it will generate a lot more data for CMS |
| Columbus, OH | Mar-97 | feasibility study rather than strategic plan | focus on Interface between FMS (non-existent) & the traffic control systems | not familiar with NIA | design modules only no data from freeway | City of Columbus owns TSCS & will be operator of FMS. institutional at conceptual level | |
| Austin. TX | Jul-97 | needs assessments | surveillance infra for traffic and transit operations | referenced | Focus on FMS | very rough conceptual framewk; mainly on IMS | |
| Dayton, OH | Nov-97 | just started | to be determined | | to be recommended | no integration/ implementation plan | |
| San Antonio. TX | Dec-97 MDI deploy-ments to be completed in Dec | EDP coordinated w/ MDI | All components except ETCS and EFP | followed national protocols | Regional system design developed 3 years ago | standard agreements sent to all agencies | not involved in CMS |
| LA/San Diego Corridor | Dec-97 | incorporated four regional plans | Every single system identified in the NIA | absolutely | A regional framwks , identified gaps/ recommendations, information/data flows developed; | Inst'l developed, multi-agency public. private partnership programs Identified good/poor interagency coordination | not addressed in corridor plan will benefit regional CMS |
| Chicago. IL | Jul-98 | kick-off in Feb | both user services & market packages | follows the priority corrido plan (w/ two other regional plans), consistent w/ NIA | integration is emphasized among manyongoing projects | City of Chicago heads the Advanced Technology Task F.. 2020 TP preceded IDP | interim CMS now will fully incorporate w/ final CMS |
| El Paso, TX | Oct-98 | just started | | yes | | | |
| Oklahoma City. OK | Oct-98 | will sign contract soon 1 year | wide open | yes, will follow NIA | | 1 billion roadway plan just approved, EDP needs to move fast in order to be incorporated into the roadway plan | yes |
| Youngstown. OH | May-99 | RFP is out 14 months contract period | most likely from market packages | yes, will base on NIA | | | |
| Fresno. CA | ? | RFP just out | | | | | |
| Nashville. TN | May-97 | completed | 16 applicable User service plans | Yes | logic layer/inf defined | recommend inst' l framework and management team to be established | yes. CMS will get funding easier if ITS included |
| New Haven, CT | Jan-38 | 1/3 of the way | market packages | Yes | not familiar | | |
| Hartford CT | Jul-97 | final stage | user services MS, FMS, transit/rideshare | yes | try to follow NIA. shows information flows | system organizations listed | |
| Memphrs, TN | Nov-97 | up to Task 3 | not familiar w/ functional comp's | yes | will do it | APO is taking the sad | coordinated |
| Springfield. MA | Dee-97 | | User service plans not fully defined | familiar with NIA | will develop it | EDP will go to TIP system implementation plan | |

# APPENDIX H
# SUMMARY OF COMPLETED EDPs
## (continued)

| EDP | Expected Date | Status | Functional Components | National ITS Architecture | Regional Framework | Institutional Framework | Relationships to CMS |
|---|---|---|---|---|---|---|---|
| Orlando, FL | Dec-97 | defining system arch | started user services now market package | yes | being developed | schematic | CMS is incorporated Into EDP |
| Philadelphla. PA | ? | defining problems | | | | | no |
| Jacksonville. FL | Jul-97 | Draft Task 9 Deployment Plan | Identified user services, seven functional areas | requirements for consultants | central TMC linked to subcenters; Integration between subsystems | developed coalition among all agencies | yes, EDP identifies CMS linkages. |
| Providence. RI | | completed | TOC, VMS, video detection, etc. | not familiar w/ NIA | not set-up regional framework, not show Interconnections | No | |
| Knoxville. TN | May-38 | RFP just out | will use market packages | | | | have CMS plan; will be used in EDP |

# APPENDIX I
# EDP TELEPHONE SURVEY QUESTIONS

EDP NAME:

EXPECTED COMPLETION DATE:

1) Where are you in the EDP Process?

2) Are you familiar with the National ITS Architecture and have you used it in developing your EDP?

3) Are you defining a regional architecture/framework in the EDP? If so, how are you showing the regional framework?

4) Have you defined an Institutional, Communications or Transportation Layer/Architecture in your EDP? Do you have diagrams of the Layers?

5) How are you defining the functional components of the EDP? Market Packages? User Service Plans? What are the functional components?

6) Do you define the basic subsystems in your EDP? What are the subsystems? (be ready to answer questions on what is a subsystem)

7) Are information flows shown between the subsystems? To what detail?

8) How does your EDP ensure the integration of the subsystems?

9) What does your EDP state about how regional organizations will work together in the implementation of the EDP?

10) Conclusions (to be filled out after survey is complete)

# APPENDIX J
# MPOs PARTICIPATING IN CMS TELEPHONE INTERVIEWS

| Metropolitan Area | CMS Status |
|---|---|
| Boston, MA | final |
| Buffalo, NY | interim |
| Charlotte, NC | final |
| New Orleans, LA | interim |
| Newark, NJ | interim |
| Pittsburgh, PA | final |
| Salt Lake, UT | final |
| Scranton, PA | final |
| Tampa, FL | interim |

# APPENDIX K
# CMS TELEPHONE SURVEY QUESTIONS

I'm *(name)* from the Volpe National Transportation Systems Center, which is a research agency within the U.S. DOT. We're working with the FHWA on a research study in which we're looking at interrelationships between CMS and ITS. In support of the study, we're calling MPOs that have fully operational *(optional: or interim)* CMS in place, to ask them about their experiences in developing CMS and planning for ITS. The questions will take about 10 minutes to answer. Is this a good time for you? *(If yes, proceed with questions, if not, arrange for questions to be administered at a more convenient time.)*

1. First, we'd like to confirm the status of the CMS for your metropolitan area. What is the stage of development of your CMS?

_____ fully operational
_____ interim
_____ other: describe _____

2. What type of organizational structure guided the development of the CMS?

_____ a committee of the MP0
_____ special task force
_____ other: describe _____

3. What agencies were involved?

____ MPO
____ state DOT
____ municipalities:
    ____ major city
    ____ others
____ transit operator(s)
____ economic development agency
____ federal DOT
____ other _____

4. Were any of the CMS committee members also involved in the development of the early deployment plan (EDP)?

____ MPO
____ state DOT
____ municipalities:
    ____ major city
    ____ others
____ transit operator(s)
    economic development agency
____ federal DOT
    other _____

5. To what extent has the development of the EDP been coordinated with the CMS development process? If there has been little or no coordination, probe deeper and ask for reasons?

6. What was the lead agency for the development of the EDP?

____ MPO
____ state DOT
____ municipalities:
    ____ major city
    ____ others
____ transit operator(s)
____ economic development agency
____ federal DOT
____ other _____
____ don't know

7. What other agencies were involved?

____ MPO
____ state DOT
____ municipalities:
    ____ major city
    ____ others
____ transit operator(s)
____ economic development agency
____ federal DOT
____ other _____

7a. Does the committee that was formed to develop the EDP continue to meet and guide the implementation of the plan?

_____ Yes _____ no _____ don't know

If yes, is it a stand-alone committee or part another structure, such as the MPO?
If no, who is responsible for implementing the recommendations of the EDP?

8. What was the role of the MPO in the development of the EDP?

_____ significant role in development
_____ advisory throughout process
_____ review of draft and final reports
_____ other
_____ no role

If there was a limited role or none at all, probe deeper and ask for reasons.

9. Has a regional ITS framework or architecture been developed for your metropolitan area?

_____ Yes _____ no _____ don't know

10. Has the EDP or the regional ITS framework been considered in the development of the CMS?

_____ direct integration: describe process:
_____ general consideration of ITS strategies/technologies: describe process:
_____ no direct coordination
_____ other describe process:

11. Are there specific functions or strategies identified in the EDP or the regional ITS framework that are also included in the CMS?

____ yes describe _____
____ no
____ don' t know

12. In what ways can the EDP and CMS processes be coordinated or consolidated to be more effective and efficient?

13. Have there been other paths (such as MIS) through which advanced technologies been included in the TIP or transportation plan for your region?

14. Do you have any additional comments?

# APPENDIX L
# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| CMS | congestion management systems |
| DOT | department of transportation |
| EDP | early deployment planning |
| EDPs | early deployment plans |
| EFP | electronic fare payment |
| EMS | emergency management services |
| ETC | electronic toll collection |
| FHWA | Federal Highway Administration |
| FMS | freeway management systems |
| FTA | Federal Transit Administration |
| IMS | incident management systems |
| ISTEA | Inter-modal Surface Transportation Efficiency Act of 199 1 |
| ITS | intelligent transportation systems |
| MOU | memorandum of understanding |
| MPO | metropolitan planning organization |
| RMTIC | regional multi-modal traveler information center |
| TIP | transportation improvement program |
| TMA | transportation management area |
| TMS | transit management systems |
| TSCS | traffic signal control systems |

# APPENDIX M
# REFERENCES

Federal Highway Administration and Federal Transit Administration, "ITS Strategic Assessments," Washington, D.C., October 1996.

Federal Highway Administration, "IVHS Planning and Project Deployment Process," Washington, D.C., April 1993.

Joint Architecture Team, Loral Federal Systems and Rockwell International, *National ITS Architecture - Executive Summary,* U.S. Department of Transportation, January 1997.

Joint Architecture Team, Loral Federal Systems and Rockwell International, *National ITS Architecture - Implementation Strategy,* U.S. Department of Transportation, June 1996.

Mitretek Systems, "Deploying the ITS Infrastructure: Putting the National ITS Architecture to Work," Washington, D.C., June 1997 (draft).

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